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INTERNATIONALISATION OF FIRMS ACCORDING TO OPEN INNOVATION PERSPECTIVE

DOCTORAL THESIS

Zagreb, 2015

Sveučilište u Zagrebu

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MEĐUNARODNE AKTIVNOSTI PODUZEĆA PUTEM OTVORENE SURADNJE I RAZMJENE INOVACIJA

DOKTORSKI RAD

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Professor Marina Dabić, Ph.D.

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Mentor:

prof. dr. sc. Marina Dabić

Zagreb, 2015.

Dedicated to my family,
my Mama and Deda.

ACKNOWLEDGEMENT

This thesis is written in partial fullfilment of the doctoral programme at the University of Zagreb, Faculty of Economics and Business. The work presented in the thesis is the result of the original independent research which has grown out of several projects, workshops and a research fellowship and which would not be possible without the support of the experienced researchers.

Special thanks goes to my supervisor, Professor Marina Dabić, Ph.D., University of Zagreb, Nottingham Trent University, who influenced my academic development and without whose guidance and advice this thesis would not be possible.

It has been my privilege to work with Professor Mile Terziovski, Ph.D., Curtin University, and Sarah Pearson, Ph.D., the Australian National University, CBR Innovation Network, during my time on the Australian Endeavour Research Fellowship. I am especially grateful to Ian Elsum, Ph.D., the Australian National University, for his comments and our valuable discussions. Their insights helped to shape the topic of the thesis. I have enjoyed the opportunity to learn from their knowledge and experience.

I am thankful to Professor Michael Dowling, Ph.D., University of Regensburg; Omar Bizri, Ph.D., SCITEH, World Bank; Professor Angeles Montoro-Sanchez, Ph.D., University Compultense de Madrid; Professor Miguel Gonzalez-Loureiro, Ph.D., University of Vigo; Professor Ljubo Jučić, Ph.D., University of Zagreb; Professor Darko Tipurić, Ph.D., University of Zagreb; Professor Gerald Steiner, Danube University and Harvard University; Professor Elias Carayannis, Ph.D., The George Washington University, and Professor Micheal Harvey, Ph.D., University of Arizona, for their time and comments on the performed research.

Last but not least, I thank my family and my closest friends who provided an enduring support during the thesis write-up, and encouraged and motivated me throughout my life.

Maja Bašić

Zagreb, 20 July 2015

Maja Bašić

STATEMENT ON ACADEMIC INTEGRITY

I hereby declare and confirm with my signature that the doctoral dissertation is exclusively the result of my own autonomous work based on my research and literature published, which is seen in the notes and bibliography used.

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ABSTRACT

The purpose of this thesis is to examine the potential of open innovation to unlock future gains in firms' innovation and internationalisation. Hence, the resulting knowledge encompassed recommendations for firms' strategies arising from the challenges of open innovation (OI) and internationalisation.

The empirical research was done in March and April 2014 on the entire population of the Republic of Croatia's telecommunications industry, which showcased a potentially successful innovative global industry in the setting of a transitional small open economy constrained by the institutional regulatory changes and a recent accession into the European Union. Structural equation modelling (SEM) was used for the data analysis purposes. The sample encompassed 88 firms, which were predominantly small and medium-sized.

Firms are offered an extensive overview of the relationships between four differing open innovation perspectives, innovation and internationalisation. The studied open innovation perspectives were: (1) the *readiness* of a business model to adopt OI practices, (2) the *accomplished inbound* OI, (3) the generic (market-oriented) and (4) *specific* (technically-oriented) identification of OI possibilities. The findings show a strong focus on a domestic market exercised by multinational companies' subsidiaries. Customer co-creation and contracted R&D services are the most utilised OI practices. Although patents are generally not used in innovation cooperation (innovation culture), formal modes of cooperation moderate the *specific* identification of open innovation possibilities' effect on the international commercialisation (performance and position) of the intellectual property. Neither teamwork skills, managerial skills nor international knowledge moderate the relationship between open innovation, innovation and internationalisation. Firms' competitiveness in the global market results in technologies that evolve incrementally, and marginally affect firms' abilities to profit from them. Institutional regulatory environment supports firms' international position through its influence on innovation. The results imply that firms approach open innovation and internationalisation from the behavioural and transaction costs perspective.

KEYWORDS: Open innovation, Internationalisation, International performance, International position, Innovation culture, Institutional regulatory environment, Telecommunications.

STRUCTURED (EXTENDED) SUMMARY IN ENGLISH

Firms in small open economies are limited by the small market size. In order to overcome this barrier, firms tailor products according to global market *niches* whose developments require insights into global market trends. European strategic framework Horizon 2020 highlights open innovation (OI) as a response to these limitations.

The purpose of this thesis was to constructively analyse the influence of OI on innovation and internationalisation. Four OI perspectives were depicted: (1) *readiness* of a business model to adopt OI practices, (2) *accomplished inbound* OI, and (3) the *generic* (market-oriented) and (4) *specific* (technically-oriented) identification of OI possibilities. Innovation performance was measured with five constructs: (1) innovation amount, (2) amount of intellectual property rights, (3) innovation revenue, (4) revenue from intellectual property rights and (5) innovation outcomes. Internationalisation was measured with four constructs: (1) international performance, (2) a firm's relative international financial position, (3) a firm's relative international financial growth and (4) a firm's relative international customer satisfaction. Innovation culture was studied through the firms' modes of innovation cooperation and the knowledge and skills of the project team members.

As a transitional small open economy, Croatia was impacted by the institutional regulatory changes coming from its recent accession into the European Union. Hence, Croatian telecommunications industry showcased a potentially successful innovative international industry. The empirical research was conducted in April and May 2014. The questionnaire survey served as a research instrument. 88 responses were gathered and analysed with structural equation models.

The findings show that: (1) Firms declaratively participate in inbound OI, and disregard collaborative and outbound OI. (2) Customers are the main sources of innovation. A strong focus on the domestic market is exercised by multinational companies' subsidiaries. Foreign customers' demands are not incorporated into a product or service and foreign customers do not benefit from the existing products or services tailored for a domestic consumer. (3) Firms perceive themselves as ready for OI but fail in successful global commercialisation of their innovations. (4) The intellectual property rights have a significant role in the commercialisation process. The OI perspectives affect the intellectual property rights, and the

formal cooperation moderates the relationship between the *specific* identification of OI possibilities and internationalisation in the presence of intellectual property rights.

(5) Information and communication technology, effective communication processes and joint project teams are predominantely used in innovation *cooperation*, while patents are generally not used. (6) The project team's knowledge and skills represent firms' internal capabilities to fight inertia. Technological skills are the most important skills for innovation. Conversely, neither teamwork skills, managerial skills, international knowledge nor radical innovation are statistically significant moderators of the depicted international commercialisation processes. Firms could benefit from better collaboration between the technical and marketing staff, and from a greater inclusion of the technical staff in the idea generation processes. Furthermore, the (international) cooperation of SMEs with R&D institutes (e.g., Institute Ruđer Bošković) and universities (e.g., University of Zagreb's Faculty of Electrical Engineering and Computing) could unlock the telecommunications industry's regional potential. (7) The firms' competitiveness in global markets results in technologies that evolve incrementally and marginally affect firms' chances of profiting from them. The lack of radical innovations might come from the fact that institutional processes hinder radical innovation; customer reactions are easily anticipated, and impede the flexibility, persistence and willingness to experiment. (8) Institutional influences on firms' international positions support firms' innovation through policies that lower the unit costs of production or incite new product development. Institutions are less powerful in regulating OI practices. A behavioural perspective should be taken to foster organisational flexibility with respect to innovation and internationalisation, and to overcome inertia and deficiencies in institutional regulatory environment. The absorption capacity grows when firms reduce the information asymmetry and invest into internal research capacities. In customising external ideas to internal processes and *gloCal* demands (Carayannis and Von Zedtwitz, 2005), firm should exercise exit and voice strategies (Hirschman, 1970). Thus, the thesis used the institutional entrepreneurship approach amalgamated with the transaction costs theory to explain open innovation and internationalisation.

The thesis depicted elements that facilitate firms' internationalisation through a model of successful appropriation of global markets returns from innovations on one side, and illustrated the role of institutional regulatory environment on the other side. This was the first study of this type done on the geographical setting of the Republic of Croatia, and the first

that described the relationship between the four differing OI perspectives, innovation and internationalisation. It enabled an extensive and comprehensive overview of the nature of OI and internationalisation in the Croatian telecommunications industry, thereby presenting its novel and scientific contribution.

Finally, future research should study the dynamics of the OI and internationalisation through a longitudinal and multi-sectoral approach that examine the relationships between the various open innovation perspectives, which would allow new insights and the generalisation of results.

STRUCTURED (EXTENDED) SUMMARY IN CROATIAN

Poduzeća malih otvorenih ekonomija su ograničena malom veličinom tržišta. Kako bi prevladala ovu prepreku, poduzeća trebaju prilagoditi svoje proizvode u skladu s globalnim tržišnim nišama, a što zahtijeva uvid u svjetske tržišne trendove. Europski strateški okvir Obzor 2020 promatra otvorenu suradnju i razmjenu inovacija (OI) kao odgovor na postavljena ograničenja.

Svrha ove disertacije je konstruktivna analiza utjecaja četiri perspektive OI-a na inovacije i međunarodne aktivnosti poduzeća. Perspektive OI-a uključuju: (1) *spremnost* poslovnog modela na prilagodbu različitim praksama OI-a, (2) *ostvarene* OI prema unutrašnjosti poduzeća, te (3) *generičke* (tržišno-orijentirane) i (4) *specifične* (tehnički-orijentirane) identifikacije mogućnosti za OI. Inovacijska uspješnost mjerena je putem pet konstrukata: (1) količina inovacija, (2) količina prava intelektualnog vlasništva, (3) prihod od inovacija, (4) prihod od prava intelektualnog vlasništva, i (5) rezultati inovacija. Međunarodna aktivnost poduzeća mjerena je putem četiri konstrukta: (1) međunarodna uspješnost, (2) relativni međunarodni financijski položaj poduzeća, (3) relativni međunarodni financijski rast poduzeća, i (4) relativno međunarodno zadovoljstvo kupaca. Inovacijska kultura promatrala se kroz načine suradnje poduzeća za inovacije, te znanja i vještina članova projektnog tima.

Telekomunikacijska industrija u Republici Hrvatskoj predstavlja potencijalno uspješnu inovativnu međunarodnu industriju malog otvorenog gospodarstva u tranziciji koju je obuhvatio niz institucionalnih regulatornih promjena povezanih s nedavnim ulaskom u Europsku uniju, te je kao takva dobar primjer za analizu odabrane tematike. Empirijska analiza provedena je u travnju i svibnju 2014. godine putem anketnog upitnika. Istraživanje je rezultiralo s 88 odgovora analiziranih modelima strukturnih jednadžbi.

Rezultati pokazuju kako: (1) Poduzeća deklarativno sudjelu u OI prema unutrašnjosti poduzeća, a zanemaruju suradnju i OI prema vanjskoj okolini. (2) Kupci su glavni izvori inovacija. Primjećuje se jak fokus podružnica multinacionalnih poduzeća na domaće tržište. Zahtjevi stranih kupaca nisu uključeni u dizajn proizvoda i usluga, a koji su kreirani za domaćeg potrošača. (3) Poduzeća se smatraju spremnima za OI-e, no ne uspijevaju komercijalizirati inovacije na međunarodnom tržištu. (4) Značajna je uloga intelektualnog vlasništva, osobito obzirom na utjecaj raznih prespektiva OI-a na intelektualno vlasništvo, i

moderirajući učinak formalne suradnje na odnos između *specifičnih* identifikacija mogućnosti za OI-e i međunarodnih aktivnosti poduzeća; (5) Informacijska i komunikacijska tehnologija, efektivni komunikacijski procesi i zajednički projektni timovi najučestalije se koriste u suradnji za razvoj inovacija, dok se patenti rijetko koriste. (6) Znanje i vještine projektnog tima predstavljaju unutarnje sposobnosti poduzeća da se odupre inerciji. Tehničke vještine su najvažnije vještine koje član projektnog tima treba posjedovati. Nasuprot tome, niti timski rad, menadžerske sposobnosti, međunarodna znanja ni radikalnost inovacija nisu statistički značajni moderatori opisanih međunarodnih procesa komercijalizacije. Poduzećima bi koristila bolja suradnja između zaposlenika tehničkih odjela i odjela marketinga, te bolja uključenost zaposlenika tehničkog odjela u proces stvaranja i oblikovanja ideja. Štoviše, (međunarodna) suradnja malih i srednjih poduzeća s istraživačko-razvojnim institutima (npr. Institut Ruđer Bošković i sveučilištima (npr.Sveučilište u Zagrebu, Fakultet elektrotehnike i računarstva) mogla bi otključati regionalni potencijal telekomunikacijske industrije. (7) Konkurentnost poduzeća na globalnom tržištu rezultira tehnologijom koja se inkrementalno razvija i marginalno utječe na vjerojatnost poduzeća da od nje ostvari financijsku dobit. Nedostatak radikalnih inovacija mogao bi biti rezultat institucionalnih procesa koji unazađuju radikalne inovacije; predvidljivih reakcija potrošača koje ometa fleksibilnost, ustrajnost i volju poduzeća za eksperimentiranjem. (8) Institutionalni utjecaj na poziciju poduzeća u međunarodnom okruženju podržava inovacijske napore poduzeća putem politike smanjenja jediničnih troškova proizvodnje i poticanja razvoja novih proizvoda i usluga. Institucije nisu toliko snažne u regulaciji praksi OI-a. Kako bi nadišla inerciju i nedostatke institucionalne regulatorne okoline, te omogućila organizacijsku fleksibilnost u odnosu na inovacije i internacionalizaciju, poduzeća bi trebala koristiti bihevioralnu perspektivu. Apsorpcijski kapacitet raste kada poduzeća smanjuju asimetriju informacija i ulažu u istraživačke kapacitete. Prilagođavajući vanjske ideje unutarnjim procesima i *gloCal*-noj potražnji (Carayannis and Von Zedtwitz, 2005), poduzeća mogu koristiti strategije *izlaska* (eng. *exit*) i *izražavanja stavova* (eng. *voice*) (Hirschman, 1970). Ova doktorska disertacija stoga ujedinjuje perspektivu institucionalnog poduzetništva s teorijom transakcijskih troškova kako bi objasnila otvorenu suradnju i razmjenu inovacija i međunarodne aktivnosti poduzeća.

Ova doktorska disertacija opisuje elemente koji omogućavaju uspješnije međunarodne aktivnosti poduzeća putem modela uspješnog globalnog iskorištavanja povrata na inovacije, s jedne strane, te ilustrira ulogu institucionalnog regulatornog okruženja s druge strane. Ovo je prvo ovakvo istraživanje provedeno na geografskom području Republike Hrvatske, a koje

opisuje odnos između četiri različite perspektive OI-a, inovacija i međunarodnih aktivnosti poduzeća, te omogućava opsežan i sveobuhvatan pregled prirode procesa OI-a i međunarodnih aktivnosti poduzeća u hrvatskoj telekomunikacijskoj industriji, time predstavljajući novost i znanstveni doprinos ovog rada.

Zaključno, buduća istraživanja trebala bi proučiti dinamiku otvorene suradnje i razmjene inovacija i internacionalizaciju putem longitudinalnog i multi-sektorskog pristupa koji ispituje odnos između raznih perspektiva otvorene suradnje i razmjene inovacije, a kojim bi se došlo do novih spoznaja i omogućila generalizacija rezultata.

KEYWORDS

Open innovation, Internationalisation, International performance, International position, Innovation culture, Institutional regulatory environment, Telecommunications.

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1. INTRODUCTION

1.1 Research area and research problem

High uncertainty, risk and competitiveness on global and local levels pressure firms to use various growth strategies (Hitt, Ireland and Hoskisson, 2014). Global product development and simultaneous sale on various international markets enable risk minimisation, increased efficiency and profit maximisation resulting from the customisation of products to local specificities (Lasserre, 2007, p. 279). Finding undiscovered global needs located in leading markets enables firms to profit and achieve their growth potential (Kalish, Mahajan and Muller, 1995; Kotabe and Helsen, 1998; Beise, 2004; Steenkamp, 2014).

Successful internationalisation is embodied in a firm's innovative capability and comes from a firm's relationship with other firms in the environment in which it operates and creates added value through incremental and radical innovation (Schumpeter, 1934; Kirzner, 1973; Chesbrough, 2011). According to Drucker (1985, p. 19), "*innovation is the specific tool of entrepreneurship, the means by which they exploit change as an opportunity for different business or different service. It is capable of being presented as a discipline, capable of being learned, capable of being predicted. Entrepreneurs need to search purposefully for the sources of innovation, the changes and their symptoms that indicate opportunities for successful innovation. And they need to know and to apply the principles of successful innovation*". This thesis uses Drucker's (1985) approach in viewing innovation as an entrepreneurial tool to achieve competitiveness. The competitiveness is achieved either by developing firms' internal capabilities or by acquiring them from the environment. A lack of innovation within a firm can be ameliorated if innovation is bought or adopted from the market and integrated into a new product or service (Chesbrough, 2003a). If a market is limited with many closed relationships that transfer knowledge[1], as are the markets of small open economies, a firm should seek innovation on the global market whereby geographic dispersion and information asymmetry (Beise, 2004) might restrict the process of innovation absorption making it dependent on the environment, networks, internal resources and capabilities.

[1] Knowledge transfer accroding to Kang, Kim and Bock (2010) can be: closed (one-to-one) or open (one-to-many).

Financial crisis combined with high indebtness limits a particular location's innovation capacity (Jurčić and Aralica, 2010). Hence, the industrial policy should accompany the rise in technology intensive industry to stimulate innovative activities (Jurčić and Aralica, 2009) in small countries attempting to increase their investment in knowledge, incite entrepreneurship and open the economy (Dabić and Potočan, 2012). Moreover, Croatian corporate governance system inadequately supports the development of a knowledge-based economy and its innovation activities (Račić, Cvijanović and Aralica, 2007). Therefore, the interrelationship between institutional conditions, corporate strategies and innovation that were studied in the Anglo-American and continental European literatures cannot be adequately applied to (post-) transition countries such as Croatia.

Growth in disparities in innovation performance between the European Union countries is described in the European Commission's (2013) Community Innovation Survey research report. Countries which are innovation leaders (Sweden, Germany, Denmark and Finland) move further ahead of the less innovative countries of the European South, wherein belongs the Republic of Croatia. Dabić, Kiessling and Andrijević-Matovac (2009) noticed that despite of the initial lack of innovation in the early 1990's and Croatia's growth of innovation that occurred during a transition, less than 25 per cent of firms are actually innovative. The authors noticed that innovation is used to increase efficiency and a product quality in larger firms. On the other hand, the lack of cooperative stakeholder relationships preclude risk sharing that would otherwise incite innovative projects with higher value added, readily hampering Croatia's innovative activities (Račić, Cvijanović and Aralica, 2007).

The majority of *Community Innovation Survey's* (CIS) indicators for the period 2001-2012 illustrate that Croatian firms perform worse in innovation and internationalisation compared to firms in the other European Union's countries (European Commission, 2013). The level of cooperation between Croatian and foreign scientists (the number of scientific co-publications per million population (388) is slightly larger than the EU27 average of 300), the number of innovative SMEs which cooperate with other firms (9.26% of all SMEs cooperate with others; the EU27 average is 11.69%), the amount of non-European Union doctoral students in Croatia (2.21% of all doctoral students in Croatia are from non-EU countries; the EU27 average is 20.02%) and the amount and the level of public and private R&D expenditures are among the worst indicators of the Croatian innovations (public R&D expenditure as percentage of GDP in Croatia is 0.42%, and the EU27 average of 0.75%; business R&D expenditure as

percentage of GDP is 0.34%, while the EU27 average business expenditure is 1.27%) (European Commission, 2013). The given indicators and studies signal the lack of exchange of innovations between Croatian and foreign firms which could be used to attain a synergy between the existing knowledge and skills possessed by employees and the added value of products or services which a firm offers. As Bečić and Dabić (2008) note, this is because the institutional framework for translation of R&D investments into commercialy viable products is still underdeveloped and business investment in R&D is low. Hence, I assume there the coordinated institutional support is necessary.

Although von Hippel (1988) recognised the importance of cooperation and exchange of innovation, Henry Chesbrough (2003a) was the first author to define cooperation and exchange of innovation as open innovation. According to Chesbrough (2003a, p. 1), open innovation (OI) is "*a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology.*" Later, Chesbrough, Vanhaverbeke and West (2006, p. vii) defined it as "*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology*". This is the definition used in this thesis. The idea of open innovation is portrayed on the continuum at whose ends stand closed and open innovation and which includes various levels and forms of openness (Chesbrough, Vanhaverbeke and West 2006). There are differences between inbound and outbound open innovation. Inbound open innovation includes the acquisition and adoption of competences, knowledge and technology, while outbound open innovation illustrates a process in which a firm sells ideas and resources on the market thereby selling licences or externalising its R&D activities which it finds no longer necessary, e.g., by forming spin-off firms (Carayannis et al., 1998; Dahlander and Gann, 2010). They are used in market-oriented activities such as improvement of products and services with respect to market requirements or for the purpose of sustaining a firm's competitiveness. Open innovation modes include: seeking innovation on the market, integrating innovation from the outside environment in the internal innovation processes, making the internally unused innovation available on the market to become further developed in the exchange for a fee given to a firm that created it (Gassman and Enkel, 2009).

Although the Chesbrough's (2003a) and Chesbrough, Vanhaverbeke and West's (2006) definitions present a foundation for the establishment and development of the concept of commercialisation of innovative ideas within and outside of a firm, various authors have touched upon the issues of open innovation. In order to review a literature gap, Dahlander and Gann (2010) analysed the most significant articles in the area of open innovation with respect to their research frameworks, samples, innovation paths and the resulting key findings. Zucchella and Siano (2014) noted that there exist differences in firms' approaches to open innovation and internationalisation, implying the position of the firm on the international market. The first research question follows: **What is the relationship between firms' open innovation and internationalisation?**

The role of innovative culture, knowledge and skills that a firm must possess is a key for enabling its international competitiveness (Knight and Cavusgil, 2004; Jones and Coviello, 2005, p. 295). A firms' ability to early internationalise and achieve international success is a function of a firm's internal capabilities (McDougall et al., 1994) whose significance is explained, among others, through institutional, evolutionary and network theory (Nelson and Winter, 1982; Wright and Dana, 2003). For instance, the supporters of resource-based, knowledge-based and evolutionary theories propose the existence of a firm's particular capability which enables innovation through the creation of new knowledge that incites internationalisation (Nelson and Winter, 1982; Knight and Cavusgil, 2004). However, the firms' reliance on the environment in which it develops innovation is the least understandable area of open innovation (Huizingh, 2011). This observation extends to the influence of open innovation on internationalisation. Although Kyläheiko et al.'s (2011) research contributed to the theory of internationalisation with respect to innovation, there is a need to analyse characteristics of firms' internal and external environment which influence the effectiveness of their innovation and internationalisation. Thus, the second research question: **How does the institutional environment influence the relationship between open innovation and internationalisation?**

For a firm to become a successful international innovator, its business model needs to interact with international stakeholders, ranging from customers to distributors and international innovation partners. A decrease in a firm's competitiveness can be a result of inertia embodied in the institutionalisation of existing processes or a firm's lack of determination to adapt its business model and open innovation to new market demands (Christensen and

Lundvall, 2004; Verbeke and Yuan, 2007; Chesbrough, 2011; Hamel, 2011). Due to institutionalisation of the existing business model, this sort of inertia usually originates from the top management who neglect the introduction of alterations that would consequently lead to better responses to the market conditions (Hamel, 2011). Thus, a third research question points towards internal institutionalisation of relationships in order to give an insight into the instruments that are used to overcome institutional inertia: **How do firms manage different open innovation perspectives in cases of institutional inertia? How can a firm overcome institutional inertia?**

Given the aforementioned, this thesis is named: "Internationalisation of firms according to open innovation perspective".

1.2. Research purpose, aims and hypothesis

The main research goal of this doctoral thesis is the identification of the level of open innovation which is obtained by firms with a higher level of internationalisation. Additional scientific research goals are the following: (1) to illustrate available knowledge and critically analyse scientific literature in the field of open innovation and internationalisation, (2) to examine the common characteristics of internationalisation and open innovation, (3) to establish the significance of open innovation activities for firms' international performance, (4) to analyse trends, potentials and limitations of open innovation practices of Croatian firms' in the telecommunication industry, (5) to give recommendation for the improvement of open innovation perspectives of Croatian firms in the telecommunication industry, (6) to explore the capability of open innovation perspectives to influence the international position of Croatian firms in the telecommunication industry, (7) to identify the characteristics of firms in the telecommunication industry with similar open innovation practices, (8) to analyse the structure and dynamics of open innovation perspectives of Croatian firms in the telecommunication industry, (9) to analyse the factors and processes which determine the influence of the environment on implementation of firms' open innovation and internationalisation.

The stated goals are contemporary in the international scientific community and their identification is essential for strengthening of the innovative performance of Croatian firms in the telecommunication industry. Additionally, the goals are associated with the concept of smart specialisation which is, jointly with open innovation, one of the priorities of the European economic strategy and as such specified in the Horizon 2020. Smart specialisation is a public policy used by the European Union to prioritise knowledge-based investment and establish the synergies between public and private innovations to be achieved through mapping, benchmarking and clustering industries and their key players, thereby avoiding duplication of policies and focusing on activities or technologies, rather than industrial sectors (OECD, 2013). The analysis of open innovation perspectives is an under-researched area. Its international positioning and perspectives in the Croatian telecommunication industry could enhance the Croatian firms' inclusion in global processes. Hence, this research enables the comparisons and conclusions regarding international competitiveness of Croatian firms in the telecommunication industry.

The following hypotheses and methods are used to examine the research goals:

Hypothesis 1. The level of open innovation undertaken by a firm positively influences the firms' internationalisation.

Hypothesis 1a. A more active open innovation positively influences the firms' innovation performance.

Hypothesis 1b. A more active open innovation positively influences the firms' international position.

Hypothesis 1c. A more active open innovation positively influences the firms' international success.

Hypothesis 2. A higher rate of formal cooperation between firms moderates the relationship between open innovation and internationalisation through the firms' innovation performance.

Hypothesis 3. Knowledge and skills of the project team moderate the relationship between open innovation and internationalisation through the firms' innovation performance.

Hypothesis 4. Innovation which is new to the market moderates the relationship between the firm's innovation performance and internationalisation more than the innovation which is new to the firm.

Hypothesis 5. The institutional environment affects the firms' innovation performance.

Hypothesis 5a. *The effect of the institutional environment on the firms' innovation performance is mediated by open innovation.*

Hypothesis 5b. *The effect of the institutional environment on the firms' international performance is mediated by the firms' innovation performance.*

Hypothesis 5c. *The effect of the institutional environment on the firms' international position is mediated by the firms' innovation performance.*

Chapter 5 provides a detailed explanation of the stated hypothesis.

1.3. Sources of data and research methodology

The theoretical part of this thesis was based on research methods that help in examining the given constructs with respect to the relevant domestic and foreign scientific and professional literature (scientific databases: Web of Science, Scopus, ScienceDirect, statistical yearbooks, international studies and doctoral thesis) on firms' open innovation, international performance and international position. Following the analysis of the available literature, a synthesis of the key findings was made. The methods of description, analysis, synthesis, generalisation, induction, deduction, classification, comparative analysis, concretisation and compilation were used.

The empirical research examined the telecommunications industry comprised of 347 firms in the Republic of Croatia (Orbis, 2013). The telecommunications industry contains among other activities, the activities in which more than fifty per cent of added value comes from:

- high-technology manufacturing industries: manufacturing of communication equipment (NACE statistical classification: 26.3 and 26.4),
- and knowledge-based services: telecommunication services (NACE statistical classification: 61) (Eurostat, 2008).

The high-technology manufacturing and knowledge-based services can often be found in a single firm. As manufacturers and service providers intertwine, the distinction between them was difficult. Hence, this thesis used the term "telecommunications industry" to refer to the above mentioned telecommunication activities. Data on telecommunications industry were partially gathered from publicly available sources such as the yearly reports available from the Croatian Registrar of the publicly available financial data, and the yearly reports given in the Orbis and Amadeus databases. Orbis and Amadeus databases collect firm-level financial data for European companies.

The primary research was conducted after gathering and analysing secondary sources of information in the framework of the Erasmus Network "Open innovation" project (OI-NET 542203-LLP-1-2013-1-FI-ERASMUS-ENW) financed by the European Commission (2013-2016). For the purpose of the research, the method of examination was used. The empirical research was based on the structured questionnaire survey which served as a research

instrument. The survey was conducted on the members of the project teams who were able to provide information on firm's internationalisation. The respondents were identified and contacted over the phone before they were asked to fill in the survey. The respondents who could not be personally interviewed received the survey by post, and later per email. The structured questionnaire survey was conducted on the deliberate sample aiming to incorporate approximately a similar amount of exporting and non-exporting firms, with different levels of intangible assets in their portfolios which would further provide an insight into the structure of firms' open innovation and internationalisation practices. Out of the total number of firms in the telecommunications industry, 334 are small and medium-sized (96.25%), and approximately 110 different firms reported exports in the period between 2003-2012 (e.g., 26 telecommunications firms reported exports in 2003, 41 in 2007 and 55 in 2012) (Orbis, 2013). In order to gather sufficient amount of data for the statistical analysis, the population encompassed all the firms in the telecommunications industry. The sample managed to incorporate 88 firms, which corresponds to the 26% response rate.

1.4. Structure of the thesis

The proposed structure of this doctoral thesis is divided into seven thematically connected chapters.

The research problem and area are defined in this **introductory chapter**. Herein, the purpose of the research is purported to align it with the research goals and hypotheses. This chapter describes sources of data, doctoral thesis' research methods, the methods of the empirical research, and a thorough overview of the dissertation's structure and expected scientific contribution.

The **second chapter** exposes theoretical underpinnings of the interwoveness of firms' internationalisation and open innovation. The review of the most important theories is given within four subheadings that are comprised of internationalisation and open innovation, and describe the typology of innovative and international environment, the sources of firms' innovation and internationalisation, and firms' social capital mechanisms.

The third chapter provides a review of firms' internationalisation with respect to firms' attitudes towards and approaches to internationalisation, and gives an overview of typology and indicators of internationalisation.

The specificities of open innovation are depicted in the **fourth chapter**. The model that preceded the open innovation perspective includes a systematic and concise review of economics of innovation theories, used indicators of innovation performance, critical evaluation of drivers and limitations of firms' innovation performance. Subsequently, an insight is given into the conceptual development and challenges to open innovation.

The **fifth chapter** gives an overview of open innovation and internationalisation model in the telecommunications industry. It explains the reasons for choosing the telecommunication industry as a sample of empirical research and illustrates the history and significance of the telecommunications industry globally and specifically in the Republic of Croatia. It shows some basic telecommunication indicators. The Republic of Croatia's telecommunications industry provided an interesting research sample because its development is in line with the policies of the European Union. Croatian telecommunications firms are owned by their

European Union's counterparts. Moreover, the Republic of Croatia's recent accession into the European Union in July 2013 forms an interesting case study of the sector impacted by the recent accession. An explanation of the conceptual model, research limitations, the model's variables and the expected scientific and practical contribution of the empirical research are also explained in this chapter.

The results of the empirical analysis of internationalisation through open innovation perspective are illustrated **in the sixth chapter**. An explanation and presentation of the empirical research results, the evaluation of the scope and quality of the model follows the methodological framework in line with the future research recommendations.

The last chapter describes the main results of the theoretical and empirical research and concludes the topic of this doctoral thesis.

1.5. Expected scientific contribution

The influence of open innovation on the internationalisation of medium-sized and large firms was mainly studied in developed or large economies, thereby neglecting their importance for the countries in transition that changed or are in the process of changing their institutional environments. The Republic of Croatia is an example of such an environment.

The literature lacks a comprehensive comparison of open innovation and internationalisation perspectives, especially in the geographic area covered by this thesis. The expected academic contribution of the thesis encompasses a systematic and comprehensive review of domestic and foreign literature and a critical analysis of the named research areas. Academic contribution of the thesis is supported by the development of scientific thought on various open innovation perspectives that facilitate the firms' internationalisation. The scientific contribution was accomplished through the empirical research that tested the conceptual open innovation and internationalisation model. From the available research on open innovation in firms of various sizes, only a few of them described motives, barriers and types of open innovation. The research results accentuated the importance and the roles of differing open innovation perspectives on internationalisation of Croatian firms and the need to use a theorietical and constructive approach in firms' internationalisation.

There exists a need for a greater coordination of open innovation for a firm's international success. Hence, the applicative contribution of the thesis aimed to understand how differing open innovation perspectives are implemented and how they affect firms' innovation and internationalisation performance. The applicative contribution encompassed a model of open innovation perspectives' influence on innovation and internationalisation to identify the efficiencies of various open innovation perspectives. An insight was given into the state and structure of the internationalisation of firms in the telecommunications industry in the Republic of Croatia, their differing open innovation perspectives and institutional limitations of the domestic market whose goal is to support internationalisation of innovative firms. Thus, this thesis sets the foundation for the identification of appropriate strategies responding to the internationalisation and open innovation challenges in both domestic and international market.

This topic is important in the scientific and professional community as the thesis contributes to the Republic of Croatia's open innovation and internationalisation analysis. There is a need for its consequent implementation into the existing national strategic frameworks. Following a top-down approach, and going beyond the limitations of domestic market and Croatia's recent accession into the European Union, Croatian firms should pursue international cooperation for innovations, especially within the European strategic framework Horizon 2020. With this in mind, the empirical research pointed to the open innovation perspectives that were used by successful internationalised firms and found the gaps in open innovation practices that could be utilised for firms' innovative and internationally competitive potentials.

2. THEORETICAL FRAMEWORK OF INTERDEPENDENCIES BETWEEN OPEN INNOVATION AND INTERNATIONALISATION

2.1. Contribution to the development of the theoretical framework of interdependencies between innovation and internationalisation

In order to comprehend the interwoveness of firms' internationalisation and open innovation, this chapter summarises the fundamental theories that support internationalisation and open innovation processes. It illustrates firm characteristics within open innovation and internationalisation perspectives and relates them to the proposed hypothesis.

Although some studies debate whether innovation and internationalisation are complementary or substitutive strategies (Kyläheiko et al., 2011: Table 2.1.), this thesis perceives them to mutually enforce firms' competitiveness.

Table 2. 1. Alternative growth strategies with respect to innovation and internationalisation

Growth strategies	Without internationalisation	Internationalisation
Innovation	Domestic innovator	International innovator
Without innovation, i.e. pure replication	Domestic replicator	International replicator

Source: Kyläheiko, K., Jantunen, A., Puumalainen, K., and Saarenketo, S. (2011), Innovation and internationalization as growth strategies: The role of technological capabilities and appropriability. *International Business Review*, Vol. 20, pp. 508-520, p. 511.

Key contributions to the innovation theory are found in the evolutionary, institutional, long-run perspectives, dynamic capabilities theory, the combination of theories and the new product development theory (Dabić, Cvijanović and Gonzalez-Loureiro, 2012). These theories explain open innovation's influence on internationalisation through industry-based, resource-based, and institution-based dimensions (Yamakawa, Peng and Deeds, 2008). Institutions are significant factors of a dynamic and transitional environment (Alhstrom and Bruton, 2010) due to the entrepreneurial characteristics (Nasra and Dacin, 2009) inherent in the human and social capital, and the social capital mechanisms that depict differences in the

processes of open innovation and internationalisation. Hence, they are summarised in this chapter.

2.1.1. Differences in firms' innovative activities according to the institutional theory

Porter's (1990) model of national competitive advantage illustrated the importance of institutional analysis with respect to the firms' international engagement. Contemporary literature, both resource-based and evolutionary, is based on the identification and transformation of firms' unique characteristics into products and services (Dunning, 2000, p. 180). It allows the institution-based view to be amalgamated with contemporary views (e.g., resource-based and evolutionary) to depict the motives backing firms' international strategy and performance (Peng, Wang and Jiang, 2008).

Institutions are defined as "*multifaceted, durable social structures, made up of symbolic elements, social activities, and material resources*" (Scott, 2001, p. 49) or "*sets of common habits, routines, established practices, rules, or laws that regulate the interaction between individuals and groups*" (Edquist and Johnson, 1997, p. 60). By applying these definitions to the notions of institutional isomorphism (Meyer and Rowan, 1977; Johnson and Greenwood, 2007) organisations conform to norms and expectations, coordinate economic resources (Powell and DiMaggio 1991; Meyer and Rowan 1991), and form the environment within which innovation is to be undertaken (Narula, 2002, p. 797). This environment is often characterised by long-term actions, *limited rationality*, *satisfying* and *local search* (Ketokivi and Schroeder, 2004) that causes organisational inertia (Johnson and Greenwood, 2007), and limits firms' innovative and international activities.

Although internal practices and structures (key capabilities, competition, corporate strategy and strategic decisions) are institutionalised, their change is inevitable and occurs with path dependency and networking from inside and outside of an organisation (Brousseau and Raynaud, 2011). Technological replacements occur only with shocks because it is the only way for a path dependency to change (Khalil, 2013). Namely, incremental changes are more frequent and reasonable at times of uncertainty and ambiguity and radical changes depend on the organisational dynamics. On the other hand, internationalisation is depicted through

external influences that act to enable internal changes and become a way an organisation operates, and minimises the risk of the lock-in in the idiosyncratic environment (Beise, 2004).

"Institutional entrepreneurship", as a managerial reaction to social pressures (Johnson and Greenwood, 2007), explains how enacted changes incite innovative structures and systems that grow outside of the institutional and geographical boundaries. The change of institutional environment encompasses *(1) a pre-institutionalisation phase* of experimentation, *(2) a semi-institutionalisation phase* of purposeful incorporation of new practices and innovations with the existing ones, and (*3) a phase of complete institutionalisation* in which actions become a norm (Tolbert and Zucker, 1983; Johnson and Greenwood, 2007).

This thesis takes the institutional entrepreneurship approach with respect to open innovations in the telecommunications industry. Moreover, the institutional theory helps in comprehending Hypothesis 1 and Hypothesis 5. Hypothesis 1 examines different stages of institutionalisation of firms' open innovation perspectives with respect to the resulting innovation and internationalisation performance. The examined open innovation perspectives include the responsiveness of the firms' business model to open innovation, and firms' way of learning about open innovation and identifying open innovation possibilities and the accomplished open innovation practices. Each of the three open innovation perspectives has different levels of institutionalisation and, therefore, portrays differing results with respect to innovation and internationalisation performance. Hypothesis 5 deals with the effect of the country's regulatory environment on open innovation perspectives and internationalisation thereby inspecting the highest attainable degree of institutional support for innovative practices.

2.1.2. Function of innovation in the evolutionary theory

Evolutionary theory is used to examine innovation, and includes various aspects of a firm entry, performance, growth and exit from the market (Ettlie, 2006, p. 74). It emerged because the neoclassical economic theory lacked clarification of the concepts of uncertainty, information asymmetry, bounded rationality, opportunism, and asset specificity (Rumelt,

Schendel and Teece, 1991). Since these concepts are tightly bound to the challenges of open innovation, the key concepts of evolutionary theory are explained in this section.

Evolutionary theory originates from Schumpeter's (1934) theory of technological change. As change is Darwinian in nature, incremental innovations, imitation and progressive adoptions gradually lead to institutional changes allowing evolution to occur slowly and endogenously through alteration of tacit knowledge, routines and competitive dynamics (Ettlie, 2006, p. 71; Brousseau, Garrouste, and Raynaud, 2011; Brousseau and Raynaud, 2011; Polanyi, 1967; Nelson and Winter, 1982, p. 402; Teece, 1987; Ettlie, 2006; Teles, 2009). There are two aspects of evolutionary theory: the developmental evolution and the socioeconomic evolution (Hodgson, 1994). This thesis refers to the socioeconomic evolution.

As the socio-economic evolutionary theory is holistic (Rumelt, Schendel and Teece, 1991), it regards a firm as "*a set of capabilities, procedures and decision rules that perform under a set of external conditions*" (Ettlie, 2006, p. 70) that are in the locus of production and regarded as "*an open system that survives through some form of exchange with the environment*" (Nelson and Winter, 1982, p. 113). Organisational routine, "search" processes and the selection environment are its key concepts (Nelson and Winter, 1982).

Their functioning of *routines* in the evolutionary theory is explained through the role of *individual skills* that are composed of tacit knowledge (Nelson and Winter, 1982, p. 73). Nelson and Winter (1982, p. 399) define routines as a "*set of ways of doing things and ways of determining what to do*". Routines here range from capabilities (techniques that firms use) and choices (behaviours that can be optimised). Although the flexibility of routinised behaviour is limited, routines change with the changing environments. The concept of routines and skills enables our understanding of the readiness of a firm for open innovation as well as the main internal determinants for its enhancement or deprivation.

Evaluation of a current routine might lead to its change or replacement through the *search* process (Nelson and Winter, 1982, p. 399). Although *search* activities are partly routinised and predictable, they enable changes. Therefore, understanding the "*search*" concept is important for comprehension of the way firms learn about or identify open innovation possibilities.

"S*election environment*" of an organisation is determined by conditions and characteristics of firms within the industry sector as well as product demand and factor supply (Nelson and Winter, 1982, p. 399). The selection environment refers to the importance of institutional environment.

Herein innovation is regarded as a change in routines, i.e., it is enabled through the routines' anomalies and their recombinations (Nelson and Winter, 1982, p. 128-129). Routine recombination is unpredictable, uncertain and can result in organisational *activity* directed at innovation (or problem-solving) and the innovative activities themselves (Nelson and Winter, 1982, p. 132-134). However, knowledge inherent in communication channels and various networking strategies minimises the uncertainty through learning, adapting and using external information to develop internal processes (Cohendet and Llerenna, 1998; Teles, 2009). Consequently, a new value is created either through R&D or by imitating best practices, investing, entering new markets, or adapting to new labour market conditions (Ettlie, 2006, p. 70).

Following the Schumpeter's (1942) notion that innovation increases with the size of a firm, the studies found that firms with innovative R&D are outperformed by their aggressive imitators thereby eliminating small firms from an industry. On the other hand, when R&D is not profitable, and market is not competitive, R&D intensive firms are predominately small (Nelson and Winter, 1982, p. 350, Ettlie, 2006, p. 71). With respect to the global environment, internationally competitive innovations replace a design currently preferred by users (Beise, 2004, p. 997), making ways for new organisational routines in the preferred selection environments. The examples include: the Internet, which superseded fax machines, or GSM networks in Europe (Beise, 2004, p. 997).

Evolutionary theory helps in understanding the role of the readiness of the business model for open innovation given in Hypothesis 1; Hypothesis 3 in which the role of an individual's teamwork, managerial skills and international knowledge is important to comprehend the way organisations function, i.e., their organisational routines; and Hypothesis 4 dealing with radical innovation in the telecommunication industry. It explains why larger firms tend to have more innovations, while technologies that evolve incrementally can be disrupted in a way that increases or decreases the industry's existing firms' chances of survival.

2.1.3. Explaining open innovation through the network theory

Contemporary studies integrate various theories (e.g., entrepreneurship, institutional and network theories) to illustrate how localised social capital is nested in partnerships with various stakeholders (Webb et al., 2010). Both informal and formal networks are important constituents of open innovation (Ibert and Müller, 2014). Hence, this section explains the network theory with respect to the given notions.

Barnes (1954, p. 44) was the first to define social networks as "*a system of ties between pairs of persons who regard each other as approximate social equals*". When the interpretation of social networks is extended to organisations, resources may be found outside of a firm, in resources and routines that emerge with firms' joint learning and recombination of complementary resources and capabilities (Dyer and Singh, 1998, p. 662).

Firms differ with respect to the size of the network, the number of mutual relations, the possibilities of new relationships and the difference between the core and peripheral businesses (Svejenova and Alvarez, 2007). The network relationships vary in strength, stability, intent and nature (Snow et al., 1992) making way for various combinations of exploration, exploitation or mixed relationship (March, 1991; Koza and Lewin, 2000).

The network theory analyses the impact of the network structure on the performance of the firm, the types of network relationships, and the ways of cooperation responsible for the tasks execution (Svejenova and Alvarez, 2007). They are measured by *social capital*, a value derived from the *relational* approach to a social network (Wasserman and Faust, 1994).

Understanding innovation diffusion in the international context depends on the firm's position in the network, its capacity to manage and benefit from network relationships, and communication intensity between the markets (Takada and Jain, 1991; Beise, 2004), this section portrayed some of the characteristics of the network theory for understanding open innovation (e.g., in Mortara and Minshall, 2011). Namely, the network theory is not only significant with respect to the prevailing relationships with various stakeholders but also for understanding the ways firms' communication patterns help them achieve their innovation goals.

According to the *network theory* global inter-organisational R&D is tied to the effective network structures (Cornell, 2012). These networks often change over time as a project matures from knowledge creation to innovation exploitation (commercialisation). Harryson (2008 in Cornell, 2012) claims that the most effective innovation network is open and formed with a variety of relationships. As an invention becomes commercialised, a firm decreases the number of relationships and develops closer ties fostered by trust in order to minimise transaction costs, enhance the governance system, increase production efficiency and speed up the commercialisation process (e.g., Fukuyama, 1995; North, 1990, in Dyer and Singh, 1998, p. 673-676). Complexity of innovations and flexibility of relationships are also important aspects of firms' network structures because they enable more dynamic partnerships (Harryson, 2008; in Cornall, 2012, p. 186).

Network theory is important for the evaluation of Hypothesis 2 that explains the differences between formal and informal cooperation through social information processing (Burkhardt, 1994; Meyer, 1994; Pollock, Whitbred and Contractor, 2000). This thesis focuses on the third aspect of network analysis, i.e., the ways of cooperation responsible for the task's execution. The third hypothesis studies formal ways of cooperation that moderate the relationships between the ways firms learn about or identify open innovation possibilities, and the resulting amounts of intellectual property rights and international performance.

2.2. Characteristics of international innovative environment

A firm's understanding of diverse sets of economic and socio-cultural resources improves the possibility of its success when making strategic decisions about internationalisation. The internationalisation decisions are tied to different institutional settings (Terjesen and Elam, 2009; Nasra and Dacin, 2009; Deligonul et al., 2013; Mohamad, 2014). Institutions stand out as the most durable social structures framed by the regulative, normative and cultural-cognitive pillars (Table 2.2, Scott, 2001) that reflect idiosyncratic cultural norms, values, traditions and institutions (Manalova, Eunni and Gyoshev, 2007).

Table 2. 2. Institutional pillars and carriers

	Pillars of Institutions		
Carriers	**Regulative**	**Normative**	**Cultural-Cognitive**
Symbolic systems	Rules, laws	Values, expectations	Categories, typifications, shemes
Relational systems	Governance systems, Power systems	Regimes, authority systems	Structural isomorphism, identities
Routines	Protocols, standard operating procedures	Jobs, roles, obedience to duty	Scripts
Artifacts	Objects complying with mandated specifications	Objects meeting conventions, standards	Objects possessing symbolic value

Source: Scott, W. R. (2001), *Institutions and Organizations*. Thousand Oaks: Sage, p. 77.

As a framework for organising the institutional theory data, Scott (2001) identifies and describes the institutional carriers that encompass both macro and microlevels. Busenitz, Gomez and Spencer (2000) examined the cross-country entrepreneurial advantage according to the three institutional pillars. These pillars are interwoven and represent a continuum (Scott, 2001; Hoffman 1997, p. 36) through which institutions such as government agencies and professional institutes institutionalise certain behaviours through (1) *coercive (forced) isomorphism* from government agencies or regulatory bodies, (2) *mimetic isomorphism* from managers replicating more successful organisations, and (3) *normative isomorphism* from imposed professional norms (e.g., code of conduct) (DiMaggio and Powel, 1983).

2.2.1. Regulatory framework and international innovative activities

The national legal system is one of the basic institutions of the market economy (Niskanen, 1991, p. 234). It enables easier establishment of firm and better protection for investors (Busenitz, Gomez and Spencer, 2000, p. 995; Yang et al., 2013) through government-sponsored programs (Rondinelli & Kasarda, 1992). Government-sponsored programs are part of the regulatory institutional pillar in which rules and regulations are enforced either by interacting or by enforcing parties (Scott, 2001; Lu et al., 2014) through the inducements or rewards for compliance (Niskanen, 1991, p. 234).

Explicit regulatory guidelines, procedures, rules or laws are parts of a regulatory system used by Busenitz, Gomez and Spencer (2000) in their empirical analysis of the regulatory environment's effect on innovation and internationalisation. With respect to innovation, Busenitz, Gomez and Spencer's (2000) regulatory framework based on the legal system, is portrayed in their characteristics of intellectual property rights' exclusiveness, saleability, separability, and uniqueness. These characteristics allow the avoidance of the property abuse and the exchange of the intellectual property rights on the market (Niskanen, 1991). Their significance for the international environment is illustrated in the example of Marocni's patent protections described in Chapter 5. Busenitz, Gomez and Spencer's (2000) scale (composed of the five statements) examines how governments assist individuals, SMEs and intermediary organisations in *new business development, risks minimisation and entrepreneurial efforts* (Busenitz, Gomez and Spencer, 2000, p. 995). Their scale is used in the analysis of Hypothesis 5.

Apart from the regulation, the normative and cognitive characteristics also influence the international innovative environment.

2.2.2. The role of cognitive attributes in the international innovative environment

Behavioural factors are the responses to social interactions (Scott, 2001). They are important for firms' internationalisation (Tan et al., 2014; Segaro, Larimo and Jones, 2014).

The cognitive dimension in the international environment refers to a "*set of institutionalised and shared knowledge and skills that are owned by entrepreneurs in a particular country"* (Busenitz, Gomez and Spencer, 2000, p. 995). The cognitive attributes explain how firms or their managers approach internationalisation and innovation, whether they are prone to take risks, adapt to the international environment and whether they have the knowledge and skills necessary for international success. In that way they relate to behaviour factors.

2.2.3. The influence of norms on international innovative performance

The last pillar of institutional environment relates to norms. A definition of norms within the international innovative environment corresponds to "*a degree to which a country's residents admire entrepreneurial activity and value creative and innovative thinking*" (Busenitz, Gomez and Spencer, 2000, p. 995).

Norms create isomorphism that enables professionalisation between organisations (Scott, 2001). Professionalisation occurs as firms develop similar preferences or adapt their behaviour to existing preferences (Brousseau, Garrouste, and Raynaud, 2011). Therefore, norms shape firms' innovative and international behaviour by creating role expectations. If entrepreneurship, with respect to the innovative and international strategy, is admired in the country and becomes a norm according to which businesses operate, the propensities of businesses' internationalisation and innovativeness will be higher than if the opposite were the case.

2.3. Sources of firms' innovative and international performance

The fundamental premises of the resource-based approach stem from Selznik's (1957) theory of distinctive competences and Penrose's (1959) knowledge-based theory. The two theories explain organisational success in terms of organisational idiosyncratic and often implicit (tacit) resources (Tipurić, 2014, p. 169-175). According to the resource- and knowledge-based view, an organisation achieves a sustainable competitive advantage by creating and recombining its valuable, rare, inimitable and non-substitutable resources (VRIN) (Barney, 1991; Teece, Pisano and Shuen, 1997).

The creation of organisational core competences (Prahalad and Hamel, 1990) stems from the availability, heterogeneity and immobility of scarce and intangible resources which explains how organisations achieve and maintain competitive advantage (Benevene and Cortini, 2010; Tipurić, 2014, p. 176; Bakar and Ahmad, 2010; Lin, Lin and Lin, 2010; Branstetter et al., 2011). Therefore, these resources and capabilities, which form firms' social capital, are dependent on the political and social contexts (Auh and Menguc, 2009) and influence organisational performance (Felicio, Couto and Caiado, 2014). The re-invention, transformation and utilisation of "sticky" and imperfectly mobile resources is difficult to imitate (Reed and DeFillippi, 1990) and detach from an organisation.

As the resource effectiveness is prolonged and obsolescence prevented (Barney, 1991, p. 101; in Auh and Menguc, 2009) through organisational learning capability (Hsu and Fang, 2009), this section expands institutional, evolutionary and network theory with the resource- and knowledge-based views to review the resources firms need to successfully and efficiently operate in the international markets.

2.3.1. Human capital as a foundation of innovative performance

Human capital is a signicant determinant of a firm's performance (Shipton et al., 2006; Crook et al., 2011). It is "*a unit-level resource that is created from the emergence of individuals' knowledge, skills, abilities, or other characteristics"* (Ployhart and Moliterno, 2011, p. 127). Previous research found that international characteristics of top managers contribute to firm

performance (Schmid and sDauth, 2014), and that human capital moderates the internationalisation and performance relationship (Hitt et al., 2006). This section depicts characteristics of human capital that affect internationalisation. The soft skills and international experience of managers and employees enable greater insights into customer demands through international innovative opportunities.

2.3.1.1. Soft skills of managers and employees

Global companies have flexible systems that encourage the work of resourceful and creative managers (Ghoshal and Bartlett, 1997; Harvey, Fisher, McPhail and Moeller, 2013). In line with the social and political environment, managerial skills facilitate or hamper institutional influences on a firm's performance (Auh and Menguc, 2009). Skills that improve global managers' effectiveness in implementation of the effective local strategies and global coordination include: "*tacit knowledge, experience, learning, unlearning, intuition, self-confidence, flexibility, prioritization of problems, working under pressure, tolerance for ambiguity*" (Griffith and Hoppner, 2013; Harvey and Novicevic, 2002; Jones and Coviello, 2005, p. 296), the perception of risk, risk tolerance, entrepreneurial and managerial competence (Jones and Coviello, 2005, p. 296), training (Kiessling and Harvey, 2014), induction, team working and appraisal (Shipton et al., 2006).

Burgess (2013, p. 198) argues that "*leadership and communication skills enable effective global and corporate entrepreneurship"* by reducing a penalty for failure and facilitating organisational learning. Leadership skills encourage project team members to identify innovative opportunities, and communication skills enable innovative ideas at various organisational levels. A global manager is an innovator, risk taker and facilitator of organisational learning whose team management skills encompass the ability to understand the behavioural characteristics of his or her team members, to lead and influence others, to show concern for others, to manage conflicts and to be culturally aware (Fisher, 2011, p. 1000). Nonetheless, manager need to posses technological skills and distinctive competencies necessary for organisational innovation (Martin-Rojas, Garcia-Morales and Bolivar-Ramos, 2013, p. 418).

2.3.1.2. International experience of managers and employees

Cross-cultural knowledge integration (Gupta & Govindarajan, 2002) implies cultural sensitivity and cultural intelligence (Holzmuller and Stottinger, 2001). Age, education, background, global vision (Hou, Li and Priem, 2013; Zahra and George, 2002; Table 2.3), skills, environmental perspective and management know-how (Ruzzier, Hisrich and Antoncic, 2006) add to the managers' cross-cultural integration and international experience.

Table 2. 3. Influence of organisational factors on internationalisation

Variable	Dimension	Findings
Top Management Team	Foreign work experience	"New ventures led by managers with foreign work experience internationalise more quickly and successfully." (Oviatt and McDougall, 1995)
		"Top management teams with international experience are more likely to choose full-control entry modes over shared-control entry mode." (Nielsen and Nielsen, 2011)
		"Global work experiences positively relates to their strategic thinking competence." (Dragoni et al., 2014)
	Education abroad	"A higher percentage of managers of firms that internationalised received education abroad than those of startups that did not internationalise." (Burgel and Murray, 1998).
		"Born globals' managers are more likely to have been educated abroad than those of traditional exporters." (Evangelista, 2005)
	Background	"Firms with principal founders drawn managerial parental background were significantly more likely to export than firms with other types of founders." (Westhead et al., 1998)
	Global vision	"Oviatt and McDougall's (1995) study found that new ventures led by managers with global vision were able to internationalise more quickly and successfully."

Source: Expanded and adapted from Zahra, S. A., and George, G. (2002), International Entrepreneurship: The current status of the field and future research agends. *International Entrepreneurship*, pp. 255-288, p. 266.

A significant role of managers' international experience (Oviatt and McDougall, 1994; Jones and Coviello, 2005; Ruzzier, Hisrich and Antoncic, 2006; Sapienza et al., 2006; Hou, Li and Priem, 2013; Harvey, Napier and Moeller, 2011; Dabić and Harvey, 2011; Harvey et al.,

2012) is evident in terms of situation assessment, their personal contacts, verbal communication, leadership, motivation, cooperation, planning, and decision-making (Holzmuller and Stottinger, 2001, p. 600).

Pološki Vokić, Marić and Hernaus' (2007) study concluded that the characteristics of Croatian top managers measured by nationality, international experience and international education do not influence the firms' global characteristics. The time span and recent accession of Croatia into the European Union call for a re-examination of the given hypothesis with respect to their innovative behaviour. Hypothesis 3 tests its significance.

2.3.2. Forms of structural actualisation of international innovative performance

Structural capital includes processes and databases that enable the functioning of human capital in an organisation (Maddocks and Beaney, 2002). As a supportive element of organisational infrastructure that facilitates an innovative organisational environment (Burgees, 2013), structural capital's components are decomposed into: (1) organisational capital, (2) process capital, and (3) innovation capital (Maddocks and Beaney, 2002).

Organisational structures such as learning, amoeba or bonsai organisation need to support and adapt to innovation at different skill levels, tasks, contexts, organisational co-competencies and learning changes (Terziovski, 2010). In that way organisational structure allows enough flexibility to overcome organisational inertia. Hence, the following section illustrates the importance of organisational flexibility and describes capabilities necessary for the successful execution of organisations' innovation goals.

2.3.2.1. Flexibility of the organisational structure

Structured organisations are environments in which uncertainty and constraints create homogeneous structures, cultures and results, but do not necessarily imply organisational efficiency (DiMaggio and Powell, 1983). If firms want to efficiently adapt to external dynamics, they need to allow a certain amount of strategic flexibility to respond and adapt to environmental challenges (Cingoz and Asuman Akdogan, 2013).

Strategic flexibility can be achieved more or less formally (Terziovski, 2010). Flexibility can lead to negative project planning effects and positive product specifications effects (Candi, van den Ende and Gemser, 2013). Technologies require hierarchical processes (Aoki, 1986) with higher formality. Formality that is achieved through the greater work rules, regulations, policies and procedures (Hernaus, Aleksić and Klindžić, 2013, p. 27) encourages employee commitment and organisational effectiveness (Patel, 2005; Prakash and Gupta, 2008 in Terziovski, 2010, p. 893).

On the other hand, capability development requires horizontal processes (Aoki, 1986). Herein, a cross-functional structure favours radical innovations, while the functional structures are more suitable for incremental processes (de Visser et al., 2010, p. 293).

2.3.2.2. Organisational capabilities

The shift in the importance from tangible to intangible organisational resources (Tsai, Li and Yen, 2012; Greco, Cricelli and Grimaldi, 2013) happened simultaneously with the firms' needs to raise productivity and competitiveness in an international environment (Jiang et al., 2011).

Intangible resources are tacit and require demanding ways of codification (Kogut and Zander, 1993; Conner and Prahalad, 1996), acquisition, development, imitation (Winter, 1987), trade and stickiness (Ghemawat, 1991; Villalonga, 2004). Intangible assets are strategically important as they incrementally adjust to the environment (Arikan and McGahan, 2010; Kogut and Zander, 1993; Grant, 1996) and enable value creation. Their adaptation to the environment occurs through network relationships (Rindova and Kotha, 2001; Kale & Singh, 2007; Capaldo and Messeni Petruzzelli, 2011). Intangible assets are now being denoted as dynamic capabilities (Teece, Pisano and Shuen, 1997; O'Reilly and Tushman, 2004; Tipurić, 2014, p. 184). Dynamic capabilities are defined as "*skills, procedures, organisational structures, and decision rules that firms utilise to create and capture value*" and with which "*managers must be able to sense opportunities, craft a business model to capitalise on them, and reconfigure their organizations, and sometimes their industries, as the business environment and technology shift facilitated by limited hierarchy, flexible teams, and performance-based incentives"* (Teece, 2010a, p. 679).

In line with the evolutionary theory (Nelson & Winter, 1982), capabilities are composed of routines (Winter, 2003, Teece 2007) which can be either formal or informal (Becker, Lazaric, Nelson, & Winter, 2005). Building of capabilities is a gradual process (Foss, Heimeriks, Winter, & Zollo, 2012) which requires the analysis of organisational resources, their complementarities and routines. The following section defines organisational social capital through the perspective of organisational routines.

2.3.3. Role of social capital and social network in open innovation

2.3.3.1. Definitions and types of social capital

Social capital refers to the quality of relationships and the advantages individuals extract from social networks (Burt, 1997, Nahapiet and Ghoshal, 1998; both in Baron 2007). Three social capital dimensions are: structural, relational and cognitive (Tsai and Ghoshal, 1998; Gubbins and Dooley, 2014). Structural and relational capital describe the strategic side of social relationships, while the relational capital points to the information and knowledge sharing side of the social relationships (Lehtimaki and Karintaus, 2012). The previous section has described structural capital and this section illustrates relational and cognitive elements that positively influence firm performance (Andrews, 2010).

Embedded social capital can result in complex policies that initiate, accelerate and stabilise coordination, cooperation (Elsner, Heinrich and Schwardt, 2015) and firm performance (Terziovski, 2003). Social relations can either be direct or indirect, widened by a good reputation, and placed in an established, continuing relationships (Baron, 2007, p. 173). Flexible strategies (Buganza, Dell'Era and Verganti, 2009) are usually applied in good social relationships. However, in transitional environments of the Croatian telecommunications industry, the risk and uncertainty should be decreased by communication, informal contacts (Jones and Coviello, 2005, p. 296) and appropriate formal (e.g., private property) and informal institutional structures (e.g., trust) (Puffer, McCarthy and Boisot, 2009).

2.3.3.2. Depth and spread of a business' social network

The number and quality of social ties define the size and scope of social networks (Baron, 2007). Social networks are institutionally limited (Patel and Conklin, 2009) in the ways firms create and protect value from their innovations (Srivastava and Gnyawali, 2011).

The firms' propensity to innovate and internationalise (Andersson and Wictor, 2003; Senik et al., 2011; Torkelli et al., 2012) is affected by the mobilisation, assimilation and the use of resources, i.e., knowledge transfer within and between organisations (Maurer, Bartsch and Ebers, 2011). Different knowledge transfer modes are applicable to different depths and spreads of business networks and the network effect on innovation is deepened by knowledge sharing (Hu and Randel, 2014) within a particular culture (Nachum, 2010; Ibert and Muller, 2014). The effect of business network on innovation increases the intellectual capital and the relational embeddedness, i.e. the quality of networks (Nahapiet and Ghoshal, 1998; Moran, 2005).

Network depth depends on: (1) the relationship characteristics; (2) the relationship dynamics; (3) the institutional environment; and, (4) the reasons and types of social ties (Azarian, 2010, p. 323). Trust is often used as a proxy for relational dimension of social capital and as an indicator of the depth of network relationships. Its effect on product innovation (Tsai and Ghoshal, 1998) comes from the organisation's ability to share knowledge and merge complementary resources (Dyer and Singh, 1998).

The varieties of actors, to whom firms are exposed, create innovation opportunities. The number of ties can serve as an indicator of business network spread. The ties indicate the propensity of a firm to access up-to-date information impacting their innovation efforts. Innovation is created through access to up-to-date information (Kang, Kim and Bock, 2010) from the related domestic industries and foreign clients (Lamin and Dunlap, 2011). Hence, a good network quality is a predisposition for successful innovation in the international arena. It can result in different knowledge transfer modes aligned with the effect of various open innovation perspectives on innovation and internationalisation.

2.4. Mechanisms to approach social capital

2.4.1. Overview of the various cooperation mechanisms

Social capital is located in firms' formal and informal (behavioural) relationships. If a firm is dissatisfied with its environment, it needs to change its relationships with other organisations. Hirschman (1970) observed how businesses react to detriments in conditions and quality within different environments and relationships. He defined three responses to dissatisfactory differences coming from the environment or existing relationships. Exit (a withdrawal from a relationship), voice (an attempt to improve the relationship) and loyalty (the lack of change) to an existing relationship (Hirschman, 1970) are augmented with neglect (Farrell, 1983), and lack of reaction (Kolarska and Aldrich, 1980). Although loyalty, neglect and the lack of reactions are passive reactions according to Hirschman's typology, Oliver's (1991) strategic reactions to institutional pressures state that tacit approval is the only passive strategy. The tacit approval is to be applied when the objectives of the organisational and institutional expectations collide. Furrer, Tjemkes and Henseler (2012) deepen the understanding of the relational characteristics based on Hirschman's (1970) typology. Their model includes the *active-passive* and *constructive-destructive* dimensions that differentiate between seven behavioural mechanisms to dissatisfactory relationships: *exit, creative, aggressive, opportunistic, patience and creative voice and understanding voice* (Furrer, Tjemkes and Henseler, 2012).

Organisational responses to organisational inertia are necessary to foster innovation. Narula (2002) adopts Hirschman's (1970) voice, exit and loyalty strategies in explaining how to overcome inertia in innovation. According to Narula's (2002, p. 800) explanation, the 'voice' strategy is used when firms change actions, the 'loyalty' when they take advantage of the change in the environment or other firms, and the 'exit' strategy when they take advantage of different environments.

The 'voice' and the 'exit' strategies tend to be pursued simultaneously (Hirschman, 1970) and sometimes it might be beneficial for firms to observe actions of other firms by using the strategy of loyalty. Firms are often reluctant to use the 'exit' strategy because of: (1) the time and the effort needed to invest in new relationships, (2) the necessary tacit knowledge and (3) the linkages between research communities (Narula, 2002). The role of institutions is evident

in institutional pressures that can lead to inertia in cases when the 'loyalty' strategy is pursued. In these cases firms should use the available cooperation mechanisms to overcome inertia and be more innovative in the international environment, i.e., to pursue the 'exit' strategy.

Cooperation with other firms in the industry implies that firms are less likely to be actively involved in strategies of avoidance and defiance (Clemens and Douglas, 2005). Hence, Narula (2002, p. 801) states that the 'exit' strategy is important for the innovating firm.

The following section describes behavioural and constitutive mechanisms as the ways firms can internally incite the 'exit' strategy.

2.4.2. Particularities of behavioural and constitutive cooperation mechanisms

Global network actors comply to the accepted norms of behaviour and operate within the rules and boundaries of their gloCal environments (Carayannis and Von Zedtwitz, 2005) and industrial relationships. Deligonul et al. (2013) study how firms align to their global supplier networks that are integrated with their institutional environments (Figure 2.1.).

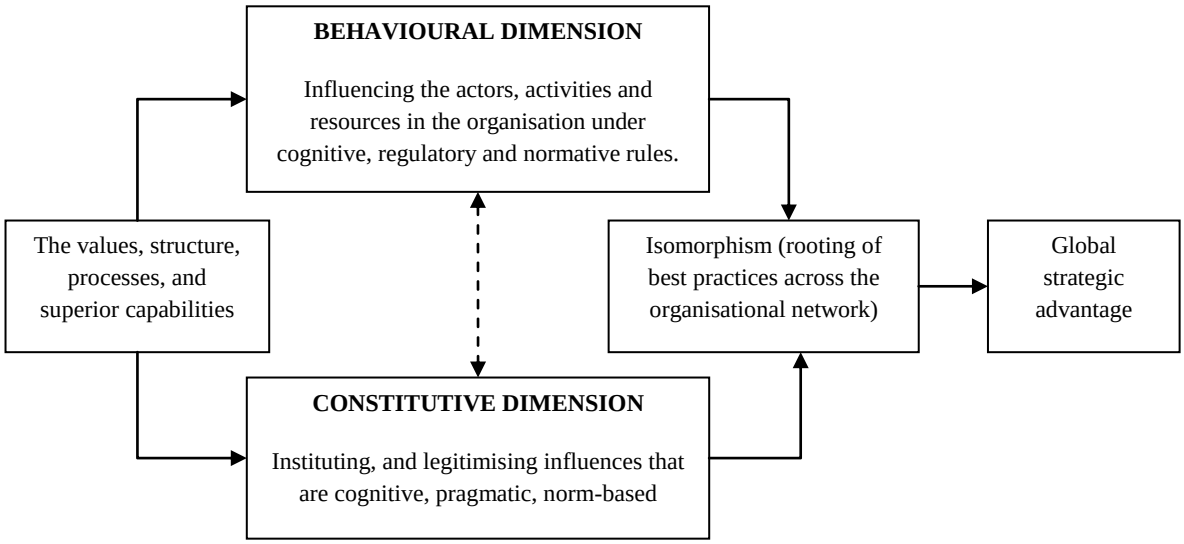


Figure 2. 1. An institutional perspective on the development of supplier relationships

Source: Deligonul, S., Elg, U., Cavusgil, E. and Ghauri, P. N. (2013) Developing strategic supplier networks: An institutional perspective. *Journal of Business Research*. Vol. 66, No. 4, pp. 506-515, p. 510.

Deligonul et al.'s (2013) model shows institutionalisation as a long-term process. Supplier relationships can be managed analytically. The analytical management eases the transformation of relationships into strategic assets. Given the behavioural and constitutive cooperation mechanism depicted by institutional theory's process of isomorphism, the model explains how enhanced performance comes from the established and functional institutional base that needs to be adjusted.

The behavioural dimension involves managing the individuals, firms and relationships on one side and activities and resources on the other side (Deligonul et al., 2013). The purpose of the bihevioural dimension is the transformation of the social capital into a competitive advantage given the firms' resources necessary for successful innovative and international performance. This can be achieved through: (a) *personal bonding*, (b) *horizontal value and resource sharing*, (c) *affinity*, (d) *goal alignment*, (e) *transparency*, (f) *sensitivity to local values*, (g) *forward-looking strategies*, and (h) *education and training* (Deligonul et al., 2013).

The constitutive dimension shapes firms' "*institutional structures with respect to rules, norms, and standards"* (Deligonul et al., 2013). It relates to a formal way of institutionalisation. Streeck and Thelen (2005, p. 16) state that the institutionalisation occurs continuously and is *"recreated by a great number of actors with divergent interests, varying normative commitments, different powers, and limited cognition*." The cognition is formed by compeling the obedience to rules and preventing illegitimate actions (Streeck and Thelen, 2005). The regulatory influence concerns setting up a dominant governance (e.g., the code of conduct). Finally, the normative influence enhances social interactions through the *commitment to efficiency, foreign market development, asset deployment efficacy and the value chain restructuring* (Deligonul et al., 2013).

Both behavioural and constitutive aspects of institutionalisation's cooperation mechanisms should be used to facilitate internationalisation of innovative businesses. In line with Deligonul et al. (2013) this thesis is inclined towards fostering greater organisational flexibility that enables businesses to overcome institutional inertia based on domestic market conditions. Herein, behavioural or less formal international engagement should be established first. A business should set up the international social ties. After the ties are formed, more formal cooperation should be put in place so that firms can appropriate value from their

innovative outputs. Subsequently, informal mechanisms can be applied to relationships that are nurtured with trust and transparency.

The next chapters explain internationalisation and innovation necessary for the comprehension of a firm’s global success.

3. FEATURES OF FIRMS' INNOVATIVE ACTIVITIES IN THE INTERNATIONAL ENVIRONMENT

3.1. Firms' attitudes towards internationalisation

The process of internationalisation and the specificities of open innovation require the understanding of institutional, evolutionary and network theories, which are described in the previous chapter. If a firm wants to successfully internationalise, its human, structural and social capital should address various institutional characteristics and environments that increase a firm's probability of survival (Puig, Gonzalez-Loureiro and Ghauri, 2014) and growth (Lu and Beamish, 2001, p. 565).

Johanson and Vahlne (1990, p. 11) refer to internationalisation as "*a process in which the enterprise gradually increases its international involvement"*. This definition implies an evolutionary process (Gonzalez and da Cuhna, 2012) and is used in this thesis to depict the internationalisation process. The dynamic capabilities, innovation (Dabić et al., 2012), and managerial experience (Sapienza et al., 2006) facilitate the internationalisation process that occurs through the international networks that offset the reduction of costs, and economies of scope (Zahra, Ireland and Hitt, 2000). In order to understand these processes, this chapter describes internationalisation theories based on the trade theories of a firm (Ruzzier, Hisrich and Antoncic, 2006, p. 480) and the international business and entrepreneurship's behavioural theory (Cyert and March, 1963). These theories jointly explain the rationale behind and the consequences of internationalisation.

Challenges to internationalisation

Firms face a variety of challenges that impede their internationalisation processes. The costs of R&D and market research, specific and specialised intangible managerial knowledge (Narula, 2002, p. 801), the liability of foreignness and newness, and the political and operational risks (Lu and Beamish, 2001) increase the costs of the final product. On the other hand, the product over-standardisation raises concerns about the appropriate level of integration into interational markets (Zahra, Ireland and Hitt, 2000; Reuber and Fischer, 2011).

The international strategy that is backed by intangible assets eases the international integration process (Autio, George and Alexy, 2011). Having a well though off international strategy enables minimisation of challenges by overcoming inertia and establishing the routines of foreign collaboration (Narula, 2002).

Forms of internationalisation

When a strong brand does not exit or a product or a service is of poor quality, consumers can easily switch between alternatives and the global competition threatens firms' domestic positions (Ruzzier, Hisrich and Antoncic, 2006). On the other hand, increased global competition on a domestic market can provide opportunities (Griffith, Kiessling and Dabić, 2005) for innovation collaboration in terms of a product and service development or a new market entrance.

The three forms of internationalisation include: *inward*, *outward* and *cooperative* internationalisation (Ruzzier, Hisrich and Antoncic, 2006). The inward internationalisation refers to a foreign purchase of a product or a service. *Innovation, capacity utilisation, skill development and business performance improvement* are often the outcomes of the outward internationalisation (Morgan and Katsikeas, 1997 in Ruzzier, Hisrich and Antoncic, 2006). The outward internationalisation is crucial for firms' survival, profitability and growth, and refers to international sale of products or services.

Internationalisation stages and strategies

The internationalisation process is divided into several stages which increase our understanding of the relationships between open innovation and the internationalisation process.

The internationalisation processes can be studied from *the market (the large firms' diversification strategies), firm (the stage models of internationalisation)* and *entrepreneurship perspective* (Ahokangas, 1998, in Ruzzier, Hisrich and Antoncic, 2006). The differing objects of the internationalisation studies explain the interchanging definitions of internationalisation stages and strategies. Lu and Beamish (2001) refer to the foreign direct

investment, exporting and strategic alliances as internationalisation strategies, while Oviatt and McDougall (1994) view them as stages of the internationalisation process.

At a firm level internationalisation usually begins with foreign orders, proceeds with exports and sometimes progresses towards the creation of international divisions. The alliances with foreign partners benefit firms' access to the local knowledge. Some firms perceive alliances safer than exports because of the greater foreign market survival (Zahra, Ireland and Hitt, 2000). Foreign direct investments and the firms' export capabilities are achieved by active foreign market expansion opportunities (Franco, 2013). Finally, an integrated global enterprise with strong organisational coalitions and knowledge about foreign markets forms the last organisational stage (Czinkota and Johnston, 1981; in Oviatt and McDougall, 1994, p. 50).

This chapter depicts the international entrepreneurship due to its ability to merge the theoretical aspects of innovation and internationalisation. The corporate entrepreneurship extended the theoretical arguments into the international business field. Hence, this chapter illustrates several key theories that apply to the firms' innovative behaviours within the internationalisation process.

3.1.1. Nature and value of international entrepreneurship

3.1.1.1. Entrepreneurship and international context

Successful international competitiveness is achieved through entrepreneurship that is based on the sound engineering and technical abilities, infrastructure, economic policies, low corruption rates, and the lack of bureaucratic impediments (Contractor and Kundu, 2004).

In the Theory of Economic Development (1934), Joseph Schumpeter describes destructive creation wherein an entrepreneur as an innovator disturbs economic equilibrium by creating new opportunities for the socioeconomic development in times of uncertainty, change and technological upheaval. Kondradieff waves (Das and Kapil, 2015) describe innovation cycles in which a firm should be dedicated to innovation in order to capitalise on perceived opportunities. Innovation explains entrepreneurship (Hitt et al., 2001) as it occurs when a firm

or an individual "*revolutionise or reform the pattern of production, exploit an innovation or an untried technology for producing a new commodity, produce an old product in a new way, open a new source of supply of materials, or a new outlet for products, or reorganise the industry"* (Schumpeter, 1942). Innovations open new markets thereby seizing temporary monopoly profits that change business cycles (Schumpeter 1934; de Jong and Marsili, 2010).

A somewhat different understanding to Schumpeter's definition of entrepreneurship comes from Kirzner (1997) according to whom entrepreneurship happens because of the knowledge and information gaps. An arbitrage in the marketplace occurs as firms capitalise on knowledge and information asymmetries. Both definitions give a valid explanation of the nature of entrepreneurship which exists in small and large firms (Acs, Morck and Yeung, 2001).

The entrepreneurial process is continuous and influenced by behavioural and cognitive individual, group and societal factors (Baron, 2007, 2008). The differences in resource combinations that result from the entrepreneurial process' innovation, proactiveness and venturing, cause some firms to be more globally successful than others (Zahra, Ireland and Hitt, 2001; Glavas and Mathews, 2014). The international opportunities come from recognition and commitment to the various internationalisation strategies (Kirzner, 1973). The entrepreneurial internationalisation strategies strengthen the absorptive capacity and incorporate external innovations to firms' internal developments (Javalgi, Hall and Cavusgil, 2014). These actions are operationalised through the individual and firm network relationships (Ciravegna, Lopez and Kundu, 2014).

3.1.1.2. Defining International Entrepreneurship

International entrepreneurship is explained through the lens of the internationalisation theories ranging from the resource-based view, the organisational learning theory, the network theory, the transaction costs theory and the eclectic paradigm (Keupp and Gassman, 2009a). The key definitions of international entrepreneurship are displayed in Table 3.1.

Table 3.1. Definitions of International entrepreneurship

Authors	Definition
McDougall (1989)	"*International entrepreneurship is the development of international new ventures or start-ups that, from their inception, engage in international business, thus viewing their operating domain as international from the initial states of the firm's operation.*"
Oviatt and McDougall (1995)	*"International entrepreneurship is the discovery, enactment, evaluation, and exploitation of opportunities – across national borders- to create future goods and services."*
McDougall and Oviatt (2000, p. 903)	International entrepreneurship is *"a combination of innovative, risk-seeking behaviour that crosses national borders and is intended to create value in organisation."*
Shane and Venkatarman (2000, p.18)	*"International entrepreneurial dynamics is the scholary examination of how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated and exploited."*
Oviatt and McDougall (2005, p. 54)	International entrepreneurship is *"the discovery, enactment, evaluation, and exploitation of opportunities—across national borders—to create future goods and services."*

Source: Author's representation.

The numerous definitions of international entrepreneurship displayed in Table 3.1. describe international entrepreneurship as a process of discovery of valuable innovations and their successfully introduction to global markets (Reid, 1981; Acs, Morck and Yeung, 2001).

3.1.1.3. Review of International entrepreneurship research area

International entrepreneurship studies began in 1988 with Morrow's article that accentuated the role of the SMEs' technological advances and cultural awareness in opening previously untapped foreign markets (Oviatt and McDougall, 2005). It grew out of McDougall and Oviatt's (1994) seminal article. International entrepreneurship studies small and young firms' internationalisation process, the differences between exporters and non-exporters and similarities and differences of entrepreneurship in different countries and cultures (Oviatt and McDougall, 1994, p. 47; Keupp and Gassman, 2009a). Moreover, it differentiates between: *international new ventures* or *internationalisation of already established small firms* (McDougall and Oviatt, 2000; Lu and Beamish, 2001; Andersson, 2011), thereby allowing

entrepreneurial activity across borders to take effect through intrapreneurial acts of corporate entrepreneurship (Zahra, Ireland and Hitt, 2000; Zahra and George, 2002; Oviatt and McDougall, 2005; all in Hornsby et al., 2013). Hence, this thesis takes the view that the process of entering new geographic markets is an act of entrepreneurship (Lu and Beamish, 2001, p. 565).

With respect to the SME internationalisation, the international entrepreneurship suplements the internationalisation theories (Ripolles, Blesa and Monferrer, 2012). It is traditionally studied from the entrepreneurship and international business perspective (Barlett and Ghoshal, 1989; McDougall and Oviatt, 2000; Antoncic and Hisrich, 2003; Keupp and Gassman, 2009a; Kiss, Danis and Cavusgil, 2012). Although implying the strategic fit between entrepreneurship and internationalisation, (Hitt et al., 2001), different entrepreneurial cultures (Dimitratos et al., 2012) can cause an "unplanned" internationalisation to occur in highly innovative SMEs (Kalinic, Sarasvathy and Forza, 2014). Therefore, Jones, Coviello and Tang (2011, p. 633) grouped international entrepreneurship research into three categories: "*(1) entrepreneurial internationalisation (venture type, internationalisation, networks and social capital, organisational issues and entrepreneurship), (2) international comparisons of entrepreneurship (cross-country and cross-cultural comparisons of entrepreneurship), and (3) comparative entrepreneurial internationalisation (comparing entrepreneurial internationalisation across countries and cultures).*"

3.1.1.4. The process of International Entrepreneurship

Mtigwe's (2005) research shows that 86% of the studied firms' internationalisations started with exporting to the geographically close markets firms (Figure 3.1.).

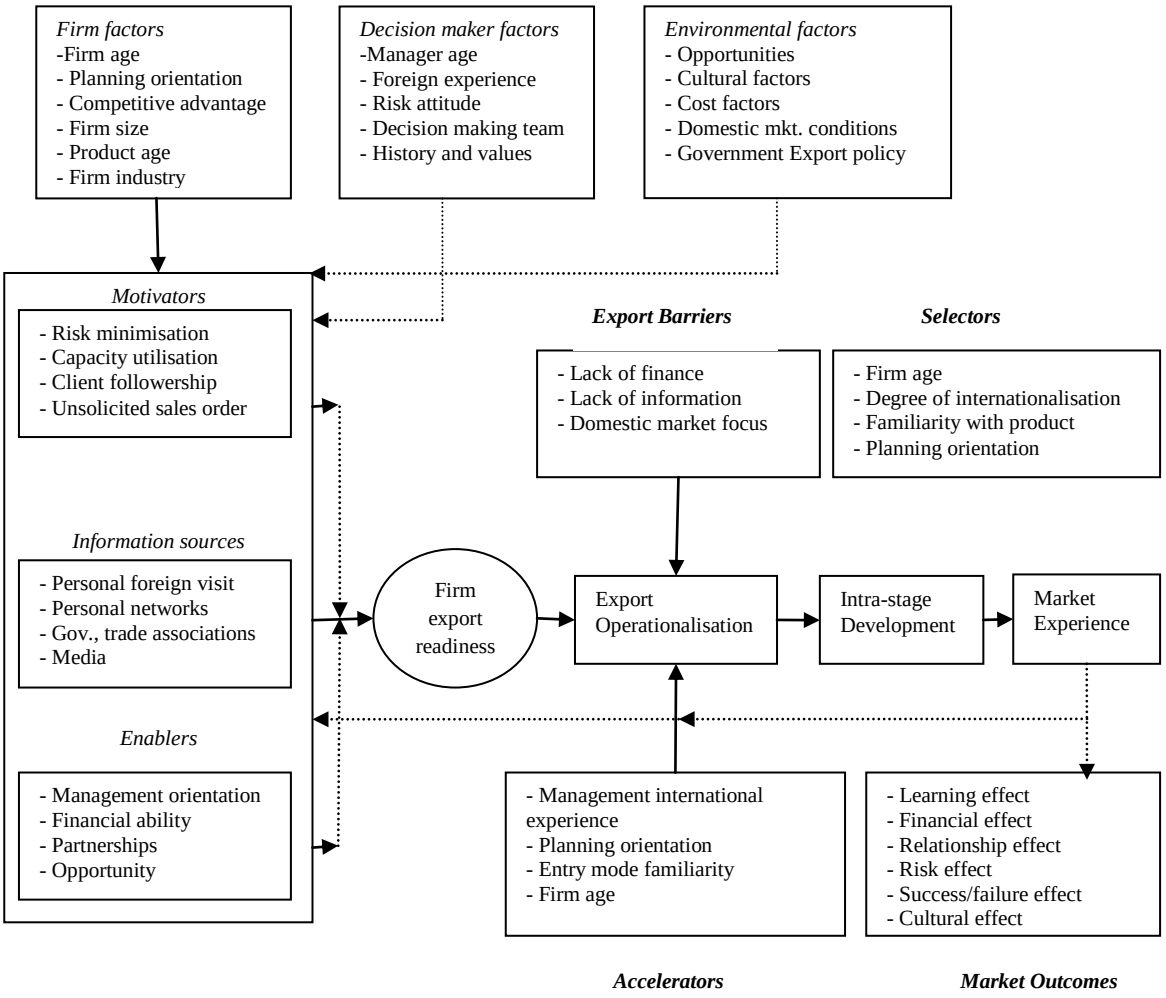


Figure 3. 1. The internationalisation process of SMEs

Source: Mtigwe, B. (2005) The entrepreneurial firm internationalization process in the Southern African context: A comparative approach. *International Journal of Entrepreneurial Behavior & Research*, Vol. 11, No. 5, pp. 358 – 377, p. 367.

Mtigwe (2005) identified four micro-processes that shape the South African SMEs' internationalisation process: *accelerators, export barriers, selectors of intra-stage foreign market development and foreign market outcomes* (Figure 3.1.). Accelerators that incite internationalisation include: management international experience, planning, familiarity with the entry mode used, and firm age. Export barriers are faced by all firms. Barriers to SME exports are inherent in their domestic and foreign markets and include the lack of finance and information. The internationalisation processes are also influenced by internal factors such as financial ability, adequacy of information sources, motivation, costs, and environmental

factors such as the culture and the government support policies. These factors determine the firms' international market outcomes such as their ability to learn and succeed.

These barriers affect the speed of internationalisation which subsequently influences SME growth (Autio, Sapienza and Almeida, 2000). The speed of internationalisation depends on: "*(1) the time between the discovery or enactment of an opportunity and its first foreign market entry, (2) the speed with which country scope is increased, i.e. how rapidly entries into foreign markets accumulate and the speed with which the countries are entered that are psychically distant from the entrepreneur's home country, and (3) the speed of international commitment, i.e. how quickly does the percentage of foreign revenue increase*" (Oviatt and McDougall, 2005, p. 541).

The understanding of the process of entrepreneurship in the international environment is important because it helps to explain the processes the telecommunications industry firms go through with respect to their innovation opportunities in different environments.

3.1.2. Role of born global firms in the international setting

An increase in the number of born-globals portrays the consequence of an earlier firm internationalisation (Shrader, Oviatt and McDougall, 2000). Born globals have the ability to leverage a distinctive mix of strategies for a global success (Knight and Cavusgil, 2004; Jantunen et al., 2008). They were firstly noted in the advanced technology industries compliant to the communication technologies advancement and the spread of the global networks (Oviatt and McDougall, 1994, p. 48; Knight and Cavusgil, 1996). The easier access to capital funding, technologies (fax, satellite communications and Internet), transport (freight containers, lower travel prices), lower trade barriers (Oviatt and McDougall, 1994, p. 46), and the co-operation with local network partners (Andersson, 2011) facilitated firm internationalisation, and made way for the born-global phenomena.

The lack of resources and the presence of the foreign market entry risk present a challenge and opportunity for the born globals (Autio, Sapienza and Almeida, 2000; Oviatt and McDougall, 2005; Keupp and Gassman, 2009). Born globals strongly rely on the past

international experience of their founders' specialisation, market orientation, quality, innovation, skills, and global partnerships (Madsen and Servais, 1997; Gerschewski, Rose and Lindsay, 2014).

In spite of Crick's (2009) note that international new ventures have a regional focus as opposed to born-globals who have a global focus, in this thesis the notions of born-globals and international new ventures are used interchangeably. Born-globals are defined as the "*business organisations that from inception, seek to derive significant competitive advantage from the use of resources and the sale of outputs in multiple countries*" (Oviatt and McDougall, 1994, p. 49). Although some of their international activities began pior to their foundation (Hewerdine and Welch, 2013); Andersson and Wictor, (2003) define them as firms whose foreign sales are at least twentyfive percent (25%) of their total revenue three years after their foundation.

The important feature of born globals is their young age, the added value they derive from their international operations, and the large share of resources (materials, people, finances and time) attributed to several international markets, which are not necessarily owned by a venture (Oviatt and McDougall, 1994, p. 60).

Rasmussen and Madsen (2002) summarised the definitions of born globals and the similar concepts in Table 3.2.

Table 3.2. Born globals and similar concepts

Authors	Background	Conclusion/result
Hedlund and Kverneland (1985)	'Leapfrogging' Firms that jumps over stages in the traditional models.	More and more homogeneous export-markets. Internationalisation as a part of the firm strategy.
Young (1987)	Theoretical discussion of the results from Hedlund and Kverneland (1985)	Agrees in the conclusion regarding leapfrogging, but only for high-tech firms.
Ganitsky (1989)	Innate exporters. 18 exporters from Israel which are Born International.	Firms which are Born Globals adapt to a high degree their strategy to the foreign markets. Lack of resources and experience.
Jolly et al. (1992)	High Technology Start-Ups. Four case studies of high-tech start-ups.	From the start these firm have their strategy pointed towards the global niche markets. Founder with an international experience.
McKinsey and Co. (1993)	Born Global. Survey among 310 production firms with a new export.	25% of the firms had an intensive export within the first two years after the foundation of the firm. Export in average 75% of their sales.
Cavusgil (1994)	Born Global. Interpretation of McKinsey and Co. (1993)	Small is beautiful. Gradual internationalisation is dead.
McDougall et al. (1994)	International New Ventures. 24 case studies.	A strategy from the birth directed towards the international markets. The stage models are not usable any longer.
Oviatt and McDougall (1994)	12 case studies – same as in McDougall et al. (1994). Firms with a proactive international strategy.	An INV is a business organisation that from inception, seeks to derive significant competitive advantage from the use of resources and the sale of outputs in multiple countries.
Bell (1995)	Small producers of computer software. Most of them have to be international from the start.	'Psychic distance' is no longer usable. No support for the stage models.
Bloodgood et al. (1996)	Firms with a 'high potential' for growth.	Internationalisation depends on the international experience of the founder. Even small firms in the USA have the possibility of being international from birth.
Knight and Cavusgil (1996)	Born Global. Summary of existing research plus articles from newspapers. Firms with an export of 25% or more within the first 3-6 years.	Factors that lead to the existence of Born Globals: Growing number of niche markets all over the world. Changes in production and communication technology. Growing number of international network.
Madsen and Servais (1997)	Born Global. Summary of existing research plus a number of Danish case studies.	The classical stage models are valid for the Born Globals if the founder's experience and the internationalisation of the markets is taken into consideration.
Jones (1999)	International Entrepreneurs. Firms with a large international network at the foundation. Questionnaire amongst high-tech firm in England.	Internationalisation of the firms often starts with networks, which does not have anything to do with sales. Many different roads to the internationalisation of these firsm.

Source: Rasmussen, E.S., and Madsen, T.K. (2002), The Born Global Concept. *Paper proposed to be presented in the 28th EIBA Conference 2002, in the special session "SME internationalization and born globals - different European views and evidence"*, 27 pages, p. 13.

Four elements of born globals' (international new ventures') existence are illustrated in the Figure 3.2. and include: (1) the organisational formation through internalisation of some transactions, (2) the strong reliance on alternative governance structures to access resources, (3) the establishment of foreign location advantages, and (4) the control over unique resources (Oviatt and McDougall, 1994, p. 54).

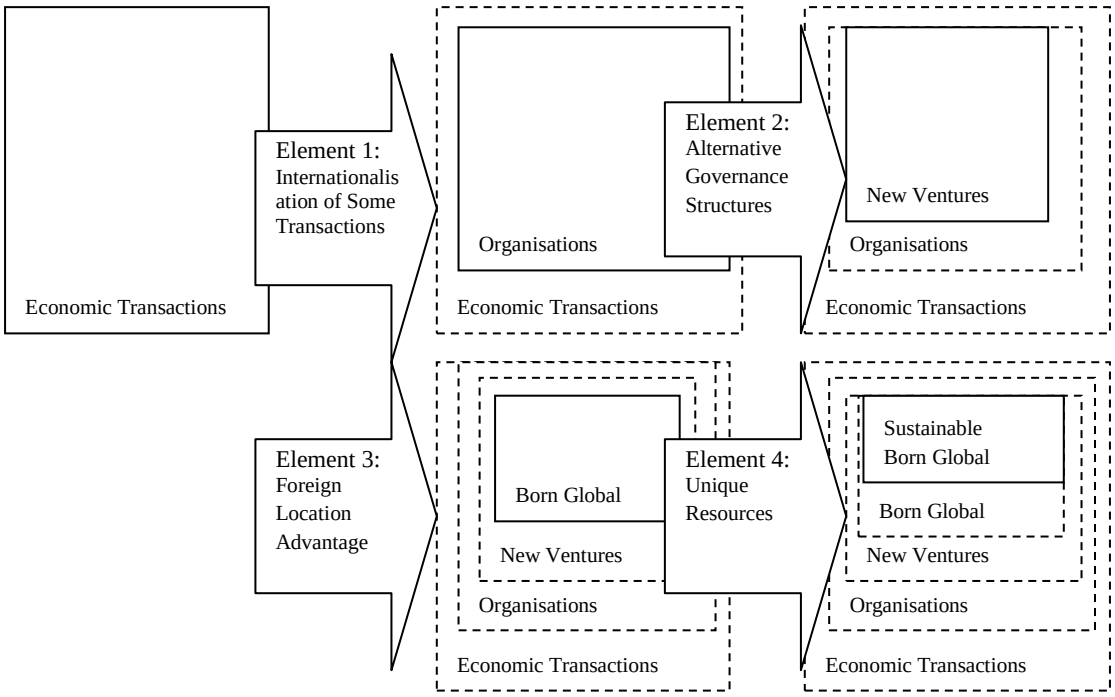


Figure 3.2. Necessary and sufficient elements for sustainable international new venture

Source: Oviatt, B.M., and McDougall, P.P. (1994), Toward a theory of international new ventures, *Journal of International Business Studies*, Vol. 25, No. 1, pp. 45-64, p. 54.

Figure 3.2. depicts the economic transactions which create the necessary and sufficient elements for the creation of a sustainable born global (international new venture). The internalisation theory explains why organisations emerge in cases of inefficient management of economic transactions (Williamson, 1985). New ventures exploit foreign market advantages by internalising only a small portion of resources of larger and mature organisations. Herein, the mobile resources (raw material, knowledge, intermediate products) are merged with location specific resources (Dunning, 2000) in which unique knowledge must be international from inception. Hence, the elements of internalisation of some transactions, the existence of alternative governance structures and a foreign location

advantage explain the emergance of born globals (international new ventures) (Dunning, 2000). The sufficient condition for the existence of sustainable born globals (international new venures) concerns the uniqueness of resources (Barney, 1991). The unique resources such as the appropriation of knowledge as described in Section 3.2.1

3.1.2.1. Types of born-global firms

The time of internationalisation matters with respect to the born globals' learning abilities (Trudgen and Freeman, 2014). Early internationalising firms benefit from learning from others, while the firms that internationalise late benefit from learning from experience (Schwens and Kabst, 2009). The early internationalisation positively affects sales, but can result in deteriorated innovation and profitability (Zhou and Wu, 2014).

Oviatt and McDougall (1994) described four types of born-globals based on firms' amount of value chain activities and foreign countries' presence (Figure 3.3.). Their typology originates from Porter's (1985, 1990) value chain analysis and multinational corporations' international strategy. Their framework is based on the asset control which impacts the foreign market commitment (Ripolles, Blesa and Monferrer, 2012).

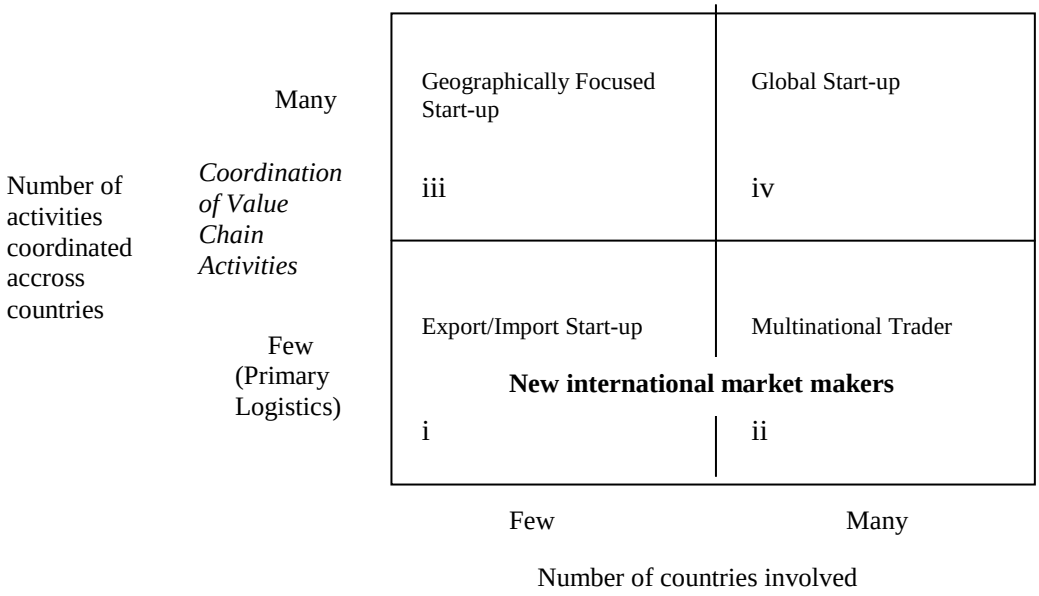


Figure 3. 3. Types of born-global firms

Source: Oviatt, B.M., and McDougall, P.P. (1994), Toward a theory of international new ventures, *Journal of International Business Studies*, Vol. 25, No. 1, pp. 45-64, p. 59.

Figure 3.3. shows an export/import start-up and a multinational trader as older firms in the market that notice imbalances in foreign markets before their competitors do. Geographically focused start-ups usually use foreign traders to handle international networks. Finally, global start-ups coordinate many value-chain activities in the global network as they possess the necessary skills to attain sustainable advantage from the increased global interactions (Oviatt and McDougall, 1994).

3.1.2.2. Other types of born globals

Hagen et al. (2012) identified four strategic SME types: (1) an entrepreneurial/growth-oriented SME, (2) a customer-oriented SME, (3) a product/inward-oriented SME, and (4) SMEs that lack strategic orientation.

Dimitratos et al.'s (2014) study found that international entrepreneurship increases the smaller firm's opportunity to become multinational corporations. Subsequently, they defined micro-multinational enterprises (mMNEs) which are smaller firms that show a propensity to become multinationals (Dimitratos et al., 2014).

Andersson and Evangelista's study (2004) takes the individual approach to international entrepreneurship and differentiates between two types of born-global entrepreneurs: (1) an experienced employee in a large organisation in which his or her potential could not be achieved, (2) and the younger, inexperienced but ambitious entrepreneur.

3.1.2.3. Internationalisation of born globals

The stages of internationalisation approach portray the born globals' internationalisation process from the venture creation to the international growth stage (Trudgen and Freeman, 2014). They depict ways innovative firms can use open innovation in different foreign markets.

When examining the growth paths of successful born globals, Almor (2013) suggests three growth directions: customer-based, country-based, and product-based. Their internationalisation process occurs through exports to psychically close foreign markets. Establishing subsidiaries and entering psychically distant foreign markets occurs thereafter (Hashai and Almor, 2004). Each growth path is implemented differently. The customer

growth is backed by 48reenfield marketing strategies, the country growth direction by networks, and the product growth direction by subsidiaries (Almor, 2013).

3.1.3. Influence of corporate entrepreneurship on innovations within international environment

3.1.3.1. Definition of corporate entrepreneurship

Entrepreneurial behaviour in an existing organisation incorporates intentions and behaviours aimed to find and attract new customers (Antoncic and Hisrich, 2003). It is used to prevent financial losses and to introduce new strategies (Kuratko, Montagno and Hornsby, 1990), and achieved through the firms' internal and external resource recombinations (Burgelman, 1984).

Corporate entrepreneurship, corporate venturing (Vesper, 1990) or intrapreneurship (Pinchot, 1985) imply strategic organisational activities that include *new business venturing* within an existing businesses (Guth and Ginsberg, 1990; Zahra, 1991; Sharma and Chrisman, 1999; in Hartmann, 2014, p. 20). *Risk-taking*, *proactiveness* and *competitive aggressiveness* (Antoncic and Prodan, 2008, p. 258) facilitated with managerial support, work autonomy, rewards, time availability, organisational boundaries (Kuratko, Hornsby and Covin, 2014) and absorptive capacity (Zahra, Filatotchev and Wright, 2009) allow the occurrence of product, process or organisational innovations (Ireland, Kuratko and Morris, 2006; Sharma and Chrisman, 1999).

In order to define a ''new business'' within an organisation, Kuratko, Covin and Garrett (2009) designed the framework based on the four strategies of the product and market growth matrix. Their framework depicts several stages of market and product "newness". In order to achieve "newness" and develop a new business, firms can develop new products, new markets or both (Figure 3.4.).

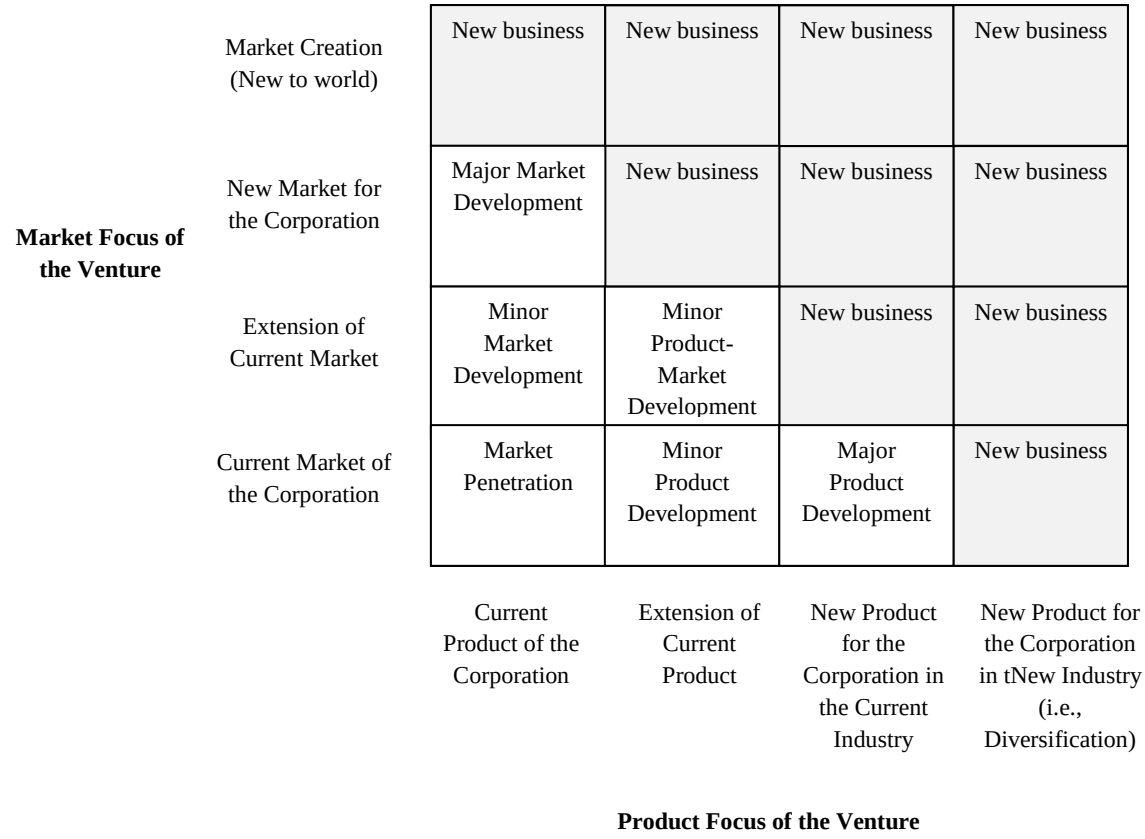


Figure 3. 4. Defining what constitutes a new business

Source: Morris, M.H., Kuratko, D.F., and Covin, J.G. (2008) Corporate entrepreneurship and innovation. Mason, OH: Cengage/South Western Publishers, p. 83. In: Kuratko, D.F., Covin, J.G., and Garrett, R.P. (2009) Corporate venturing: Insights from actual performance. Vol. 52, pp. 459-467, p. 460.

The ownership of a new business and new business concepts implies different ways firms perceive corporate entrepreneurship (Wolcott and Lippitz, 2007) and manage challenges with respect to the different types of innovation, various managerial roles, the individual training and operating controls (Kuratko, Covin and Hornsby, 2014). Firms like Apple, IBM, 3M, Procter & Gamble, and Google understand the significance and challenges of corporate entrepreneurship to their internal environments (Kuratko, Hornsby and Covin, 2014). Therefore, corporate entrepreneurship is an internal organisational dimension that promotes and supports an environment for innovation (Garcia-Morales, Bolivar-Ramos and Martin-Rojas, 2014; Kuratko, Hornsby and Covin, 2014).

3.1.3.2. Types of entrepreneurial activities within corporate entrepreneurship

Corporate entrepreneurship contains intrapreneurial and extrapreneurial activities (Christensen, 2004) that employ firms' internal and external sources (Zahra and Covin, 1995; Zahra and Nielsen, 2002; Antoncic and Prodan, 2008; Simon et al., 2011; Laplume and Dass, 2014). Graph 3.5. depicts the complementary perspectives of corporate venturing, internal resources, internationalisation and firms' external networks within the corporate entrepreneurship domain (Christensen, 2004).

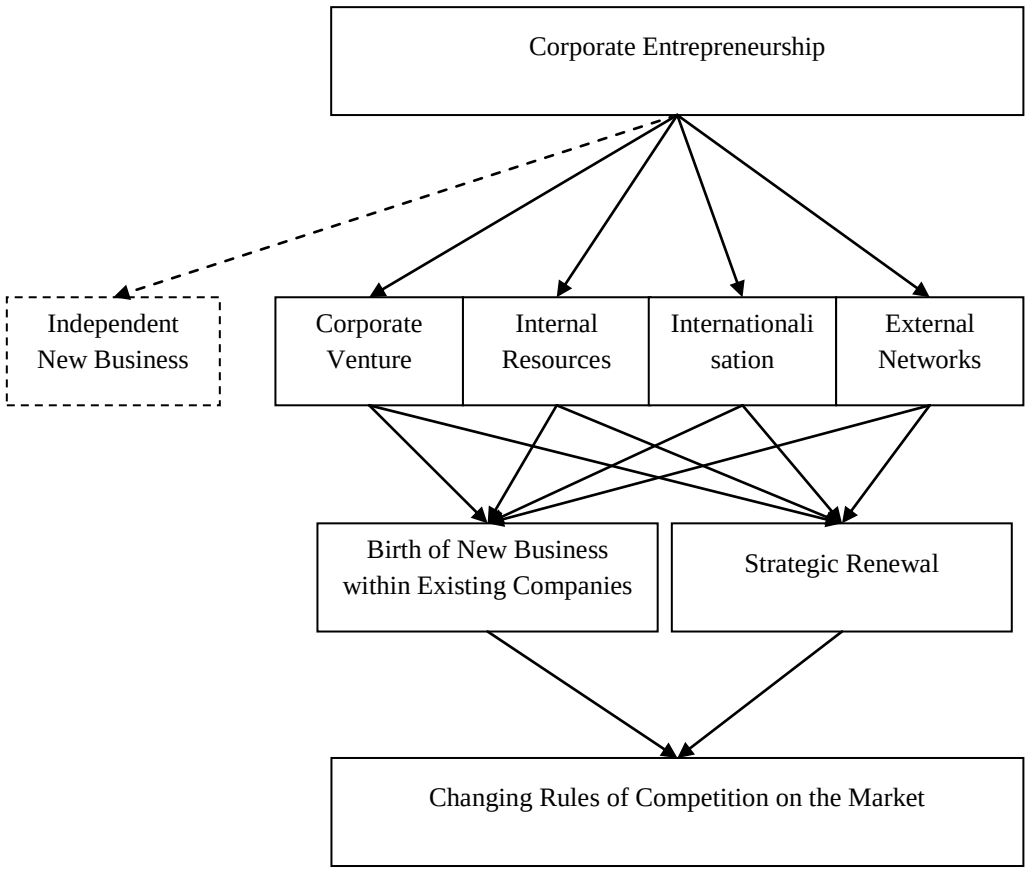


Figure 3. 5. The proposed framework for corporate entrepreneurship

Source: Christensen, K.S. (2004), A classification of the corporate entrepreneurship umbrella: labels and perspectives. *International Journal of Management Enterprise Development*, Vol. 1, No. 4, pp. 301 – 315, p. 310.

Corporate entrepreneurship is composed of internal and external activities (Figure 3.5.). The independent units are designed to internally test markets and expand product, process, and organisational innovations. When externally testing the market, firms use the resources

dispersed in the environment (Zahra, 1991; Ferreira, 2002; Burgers and Covin, 2014). In open innovation complementary resources are indispensable part of the innovation process in which internal and external activities are merged to form a new product, service or a process.

3.1.3.3. Organisational forms of corporate entrepreneurship

Following from the Morris, Kuratko and Covin's (2008) depiction of corporate entrepreneurship, Burgelman's (1984) organisational forms of corporate entrepreneurship encompass: direct integration, new product business department, special business units, micro new ventures department, new venture division, independent business units, nurturing and contracting, contracting and complete spin-offs (Burgelman, 1985, p. 98; Figure 3.6.). These organisational designs relate to open innovation and internationalisation in their ability to support innovation within a firm.

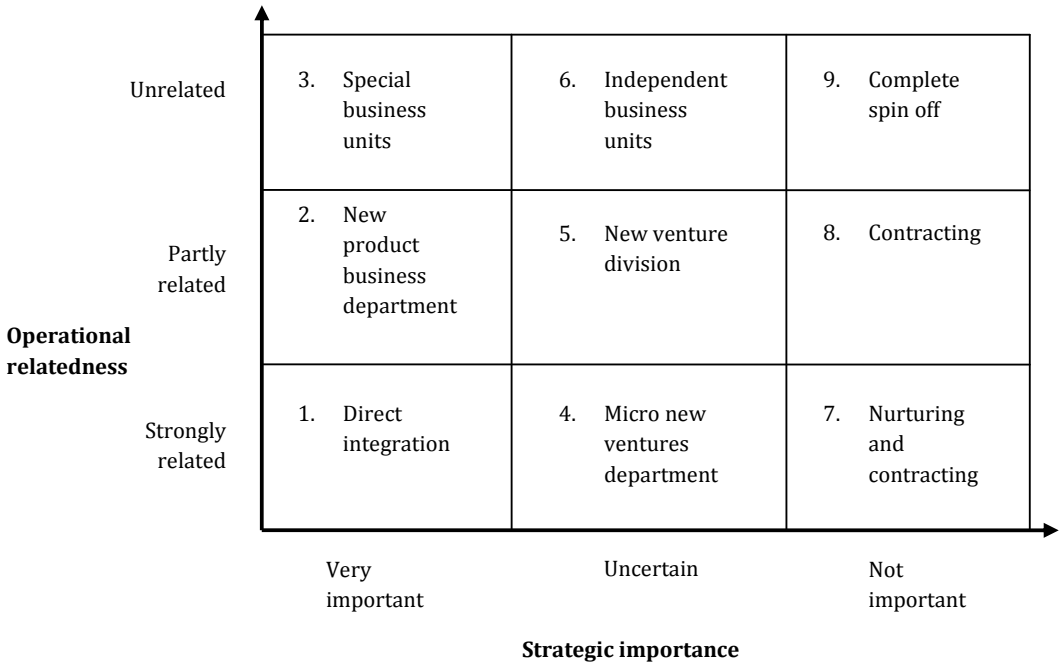


Figure 3. 6. Organisation designs for corporate entrepreneurship

Source: Burgelman, R.A. (1984) Designs for Corporate Entrepreneurship in Established firms. *California Management Review*. In Burgelman, R.A. (1985) Managing Corporate Entrepreneruship: New structures for implementing technological innovation. *Technology in Society*, Vol. 71, pp. 91-103, p. 98.

The firms' flexibility and knowledge are dependent on networks (Stuart, Hoang, and Hybels, 1999; Dubini and Aldrich, 1991; Hitt, Ireland and Lee, 2000; Hitt, Hoskisson and Kim, 1997; Benn, Dunphy and Griffiths, 2014). Hence, successful innovation and internationalisation should be supported by firms' networks (Hornsby et al., 2013).

3.1.3.4. The role of corporate entrepreneurship in innovative international environment

Organisational proceses are shaped by the institutional changes (Ferreira, 2002). The corporate's entrepreneurial orientation is influenced by the country's normative and cognitive dimension (Gomez-Haro, Aragon-Correa and Cordon-Pozo, 2011). Moreover, the regulatory dimension limits or directs the type of internationalisation and innovation firms are carrying out (Hitt, Hoskisson and Kim, 1997; Gomez-Haro, Aragon-Correa and Cordon-Pozo, 2011). This is, subsequently, portrayed in the type of corporate entrepreneurship that firms are undertaking.

3.2. Typology of internationalisation

Croatia is a transitional economy that joined the European Union in 2013. The gaps in standards, managerial overconfidence and inability to identify or capitalise on a firm's global potential comprise some of the transitional economy's challenges (Bartlett and Ghoshal, 2000). Firms can respond to these challenges by developing corporate strategies that incite innovation (Cuhna et al., 2014; Meyer and Su, 2015) and internationalisation (Dabić, Gonzalez-Loureriro and Furrer, 2014).

The theoretical foundation of internationalisation is found in firms' innovative behaviour which states that firms gradually build capabilities to disrupt and extract profits from international markets. Internationalisation is explained through the knowledge-based theory, the resource-based theory (Buckley and Casson, 1976, 2009; Kogut and Zander, 1992, 1993; Li et al., 2010, Rugman et al., 2011), the internalisation theory's transaction cost economics (Bartlett and Ghoshal, 1989; Rugman and Verbeke, 1992) and the Upsalla and the Innovation models (Anderson, 1993; Johanson and Vahlne, 2007; Cassiman and Golovko, 2011).

This section reviews major theories of internationalisation which interpret firms' innovative activities in the international environment and help in understanding internationalisation according to open innovation.

3.2.1. Model of knowledge-based internationalisation

The knowledge-based internationalisation can be viewed from the individual, firm and network levels (Casillas et al., 2009). The individual level internationalisation relates to the entrepreneurial behaviour; the firm level draws on the firms' ability to learn about the international markets; and the network internationalisation is based on the transfer of the individual or firm knowledge about institutions (*international institutional knowledge*), and customer, supplier and competitor relationships (*market knowledge*) (Johanson and Vahlne, 2007; Casillas et al., 2009, p. 312; Hohenthal, Johanson and Johanson, 2014).

Firms' boundaries are not only determined by market failure but by complementary capabilities between the creator and the user of knowledge (Kogut and Zander, 1992). The

differences exist between the organisational internal and the external knowledge transfer. Internal knowledge transfers are self-perpetuating (Kogut and Zander, 1993, p. 639) and follow a sequential path that builds on the firm's prior knowledge, the acquisition of new knowledge, knowledge integration, action and feedback (in Figure 3.7. Casillas et al., 2009).

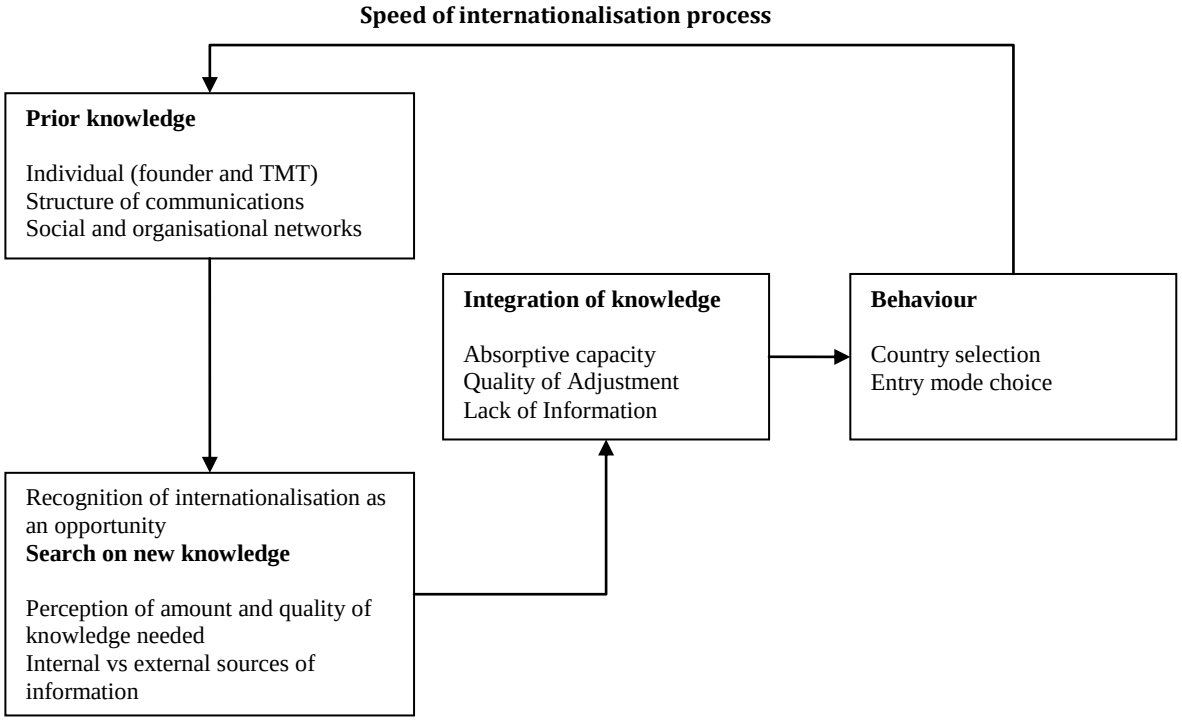


Figure 3. 7. A model of the influence of knowledge on the internationalisation process

Source: Casillas, J.C., Moreno, A.M., Acedo, F.J., Gallego, M.A., and Ramos, E. (2009) An integrative model of the role of knowledge in the internationalization process. *Journal of World Business*, Vol. 44, pp. 311-322, p. 314.

Internalisation theory considers knowledge to be a public good, easily transferred and difficult to protect (Buckley and Casson, 1976). Teece (1977) opposes that view and states that the cost of knowledge transfers can be calculated. The transfer of novel, difficult to codify and idiosyncratic knowledge affects firms' international expansion (Kogut and Zander, 1993; Teece and Pisano, 2004). Even if knowledge was a public good, the opportunistic behaviour (e.g., legal fees that prevent replication) could approximate its international transfer costs (Kogut and Zander, 1993). Hence, markets for knowledge are imperfect (Fletcher and Harris, 2012).

Tacit knowledge is obtained from technology, production and marketing. It impedes imitations, thereby increasing the costs of imitation and decreasing the speed of transfer (Kogut and Zander, 1993, p. 637).). Tacit knowledge affects firms' choices of international expansion, the entry timing and internationalisation strategy (Tuppura et al., 2008). Moreover, it decreases the possible knowledge transfer opportunism in cases of uncertainty, asset specificity and knowledge appropriability (Saarenketo et al., 2008

Figure 3.7. clarifies why some firms follow a sequential process of internationalisation explained by the Uppsala model (Bilkey and Tesar, 1977; Johanson and Vahlne, 1977), while others internationalise immediately after or during their inception (Oviatt and McDougall, 1994). As internationalisation begins with the initial stock of knowledge, it is increased by learning, making the process of internationalisation dependent on various network actors that aid or inhibit the process. The country selection and the entry choice mode are dependent on the prior international knowledge, communication structures and networks (Casillas, Barbero and Sapienza, 2015). Firms gradually expand into physically or psychologically close markets (Johanson and Vahlne, 1977; Johanson and Wiedersheim-Paul, 1975, in Casillas et al., 2009). The search for new knowledge enables knowledge integration into firms' internal processes, thereby inciting innovation and internationalisation (Cassillas et al., 2009). With this in mind, the knowledge-based internationalisation provides a foundation for Upsalla and Innovation model of internationalisation as the most popular theories of international entrepreneurship (Seno-Alday, 2010, p. 18).

3.2.2. Upsalla model of firms' innovative internationalisation

Upsalla's internationalisation model is based on the behavioural theory of the firm (Cyert and March, 1963), the bounded rationality, the uncertainty avoidance (Blankenburg Holm et al., 2009) and Penrose's (1959) theory of the firm's growth.

Upsalla model portrays internationalisation as the causal cycle in which firms' international activities intensify as firms gradually commit more resources to foreign markets, thereby acquiring more foreign markets knowledge (Johanson and Vahlne, 1990, p. 11; Casillas, Barbero and Sapienza, 2015; Figure 3.8.).

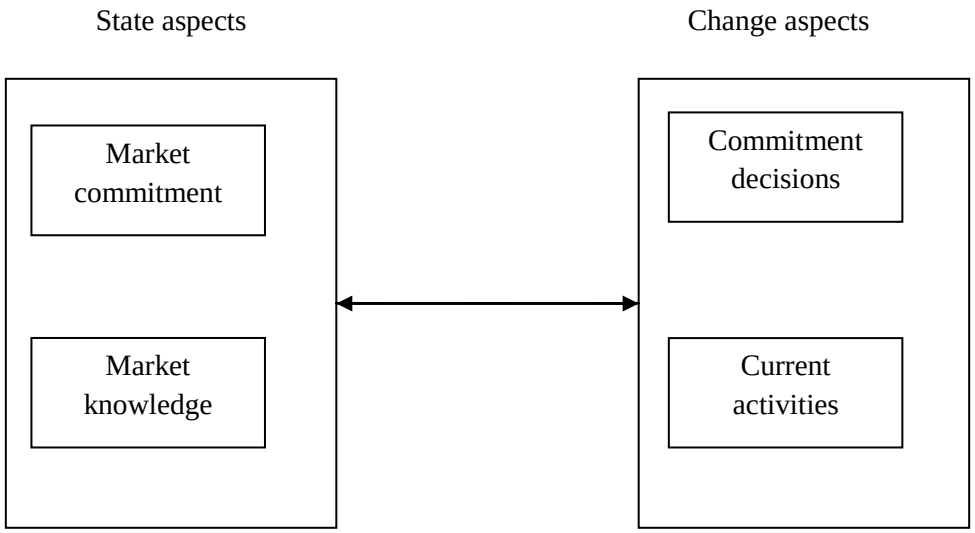


Figure 3. 8. The internationalisation process of the firm

Source: Johanson, J., and Vahlne, J.E. (1990) The mechanism of internationalisation. *International Marketing Review*, Vol. 7, No. 4, pp. 11-24, p. 12.

Johanson and Vahlne (1990, p. 12) differentiate between the state (market commitment and market knowledge) and change (commitment decisions and current activities) aspects of internationalisation. The state and the change aspects interact. The market knowledge and commitment influence firms' foreign market resource commitment decisions and the way current activities are performed. In turn, the foreign market resource commitment decisions and the way current activities are performed affect market commitment and knowledge.

Market knowledge is country-specific and a consequence of experiential knowledge created by business opportunities. It stimulates the internationalisation process and reduces uncertainty. Market commitment, on the other hand, consists of two factors: the amount of resources committed to internationalisation and the degree of foreign market commitment. The amount of the resource commitment is measured with the size of the foreign market investment, the strength of foreign market links, and a degree of commitment difficult to transfer into the alternative use, i.e. sunk costs (Andersen, 1993, p. 211).

When entering the markets with greater psychic distance, the perceived market uncertainty is lower compared to other markets (Vahlne and Wiedersheim-Paul, 1973; in Johanson and Vahlne, 1990, p. 13). Psychic distance refers to similarities between countries that relate to languages, cultures or political systems (Sousa and Bradley, 2015). The notion differs from the concept of cultural distance (Griffith and Dimitrova, 2014) and positively affects organisational performance (Evans and Mavondo, 2002).

The Upsalla model is formed around the following stages of internationalisation (Johanson and Wiedersheim-Paul, 1975; Johanson and Vahlne, 1990, p. 13; Tan et al., 2014): *"(1) no regular export activities, (2) export via independent representatives (agents), (3) establishment of an overseas subsidiary, and (4) an overseas production units.*" Blankenburg Holm et al. (2009) expand this model as given in Figure 3. 9.

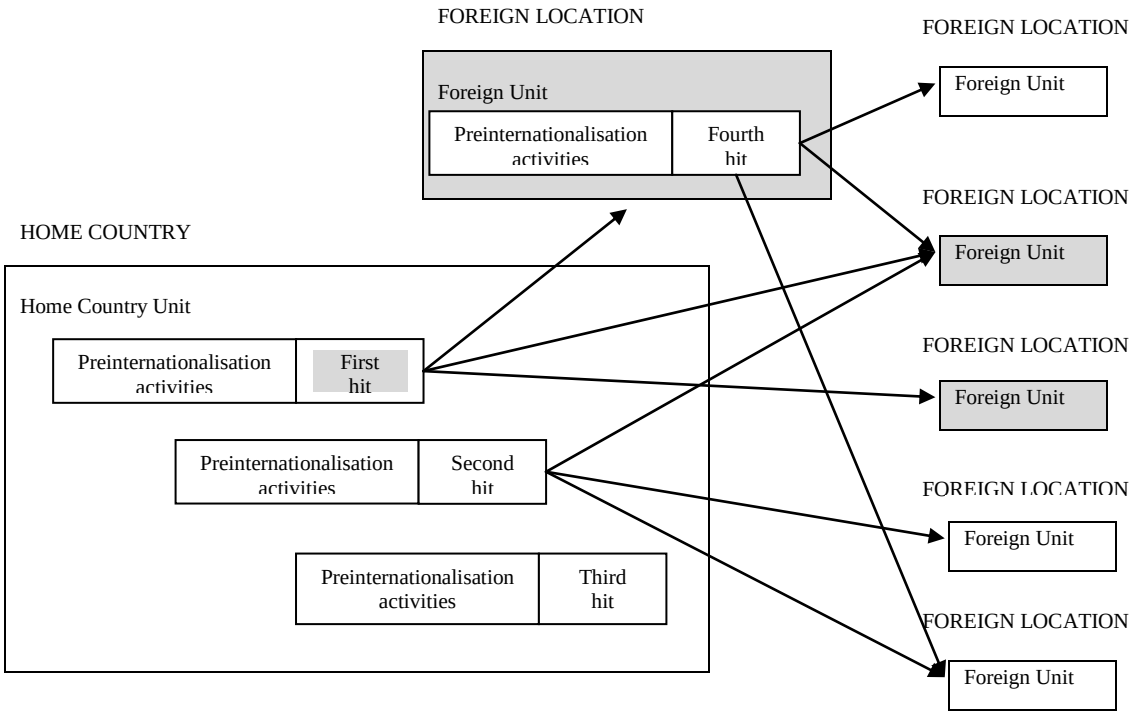


Figure 3. 9. Extended internationalisation process of a firm

Source: Blankenburg Holm, D., Drogendijk, R., Hohenthal, J., Holm, U., Johanson, M., and Zander, I. (2009), The internationalization processes of the multinational corporation – a new research agenda. *Research on Knowledge, Innovation and Internationalization*, Vol. 4, pp. 3-20, p. 9.

Blankenburg et al. (2009) extended the Upsalla model as illustrated with the nonshaded areas in Figure 3.9. They explain international expansion for firms that have already internationalised. Thus, the main difference between the two models is the broadened illustration that internationalisation can occur at any point during the firm's existence.

The criticism has been made against the Upsalla model (Figure 3.8.), describing it as deterministic and dependent on market conditions and transactions costs, not valid for service industries and more homogeneous global circumstances (Johanson and Vahlne, 1990). However, it explains the establishment of foreign subsidiaries, international joint ventures, licensing agreements, international advertising campaigns, international trade, exhibitions and a multitude of other events and actions (Johanson and Vahlne, 1990, p. 11) in the situations: *(1) when firms have large resources, (2) when market conditions are stable and homogeneous, and (3) when a firm has considerable experience in the markets with similar conditions;* in which *(a) managers' actions occur when entrepreneurial opportunities are identified and ascertained in the domestic market, (b) when a single product firm experiences*

linear internationalisation, as opposed to development of a multiproduct or a multibusiness firm, and (c) when focal firms make gradual incremental commitments (Blankenburg Holm et al., 2009).

The Upsalla model is important for understanding the process of open innovation. It describes the behaviour of a firm's foreign resource commitment and how its increase in the stock of knowledge necessary for innovation in relatively non-turbulent and psychically close environment.

3.2.3. Portraying the innovation model of internationalisation

The innovation model of internationalisation extends the Upsalla model of internationalisation. Both models are behaviourally oriented and portray a gradual internationalisation process framed with uncertainty avoidance (Anderson, 1993). The Upsalla model focuses on the process and dynamics of learning about the foreign market, while the Innovation models are more confined to space and time.

The four learning sequence-related Innovation models are displayed in Table 3.3.

Table 3.3. Review of the Innovation-Related Internationalisation Models

	Bilkey and Tesar (1977)	Cavusgil (1980)	Czinkota (1982)	Reid (1981)
Stage 1	Management is not interested in exporting	Domestic marketing: The firm sells only to the home market	The completely uninterested firm	Export awareness: Problem of opportunity recognition, arousal of need
Stage 2	Management is willing to fill unsolicited orders, but makes no effort to explore the feasibility of active exporting	Pre-export stage: The firm searches for information and evaluates the feasibility of undertaking exporting	The partially interested firm	Export intention: Motivation, attitude, beliefs, and expectancy about export
Stage 3	Management actively explores the feasibility of active exporting	Experimental involvement: The firm starts exporting on a limited basis to some psychologically close country	The exporting firm	Export trial: Personal experience from linked exporting
Stage 4	The firm exports on an experimental basis to some psychologically close country	Active involvement: Exporting to more new countries – direct exporting – increases in sales volume	The experimental firm	Export evaluation: Results from engaging in exporting
Stage 5	The firm is an experienced exporter	Committed involvement: Management constantly makes choices in allocating limited resources between domestic and foreign markets.	The experienced small exporter	Export acceptance: Adoption of exporting/rejection of exporting
Stage 6	Management explores the feasibility of exporting to other more psychologically distant countries		The experienced large exporter	

Source: Andersen, O. (1993) On the internationalization process of firms: A critical analysis. *Journal of International Business Studies*, pp. 209-231, p. 213.

Bilkey and Tesar's (1977) and Czinkota's (1982) innovation models are similar with respect to the assumption that a firm might not be interested in internationalisation, i.e. to export (Table 3.3, Stage 1). They explain the export "push" mechanism that directs firms into gradual exporting (Table 3.3., Stage 2). The "push" mechanism also explains entrepreneurial acts that are internally driven and result in innovation and/or internationalisation (Onetti et al., 2012). Moreover, the "push" mechanism can be applied to open innovation as firms possess internal motivation for innovation and internationalisation.

Cavusgil's (1980) and Reid's (1981) study depicts firms that export in the early stages of their existence. Herein, the rapid export "pull" mechanism is explained through the balance of local and foreign networks (Patel et al., 2014).

The innovation models illustrate the gradual internationalisation without explaining why it occurs. Both the eclectic paradigm (ownership, location and internalisation theory) and the transaction costs' approach may provide more relevant explanations of firms' foreign expanision, especially in terms of the later stages of internationalisation.

3.2.4. Other models of firms' internationalisation

In order to gain a complete understanding of the internationalisation antecedents and consequences that complement knowledge-based internationalisation, the Upsalla model and the Innovation model of internationalisation, this section explains the eclectic paradigm and the transaction costs' internalisation theory. Thereby, in the last chapter the empirical analysis is compared with the depicted internationalisation theories to reflect the similarities of open innovation and internationalisation processes.

3.2.4.1. Ownership, location and internalisation theory

The eclectic paradigm theory of internationalisation was developed in the 1980's by a British economist John H. Dunning who studied the economics of foreign direct investment and multinational enterprises (MNEs). The theory explores the ownership-specific, location and internalisation advantages with respect to the MNEs international production strategies (Dunning, 1988; Dunning, 2000; Whitelock, 2002; Cantwell and Narula, 2010; Cantwell,

2014). These advantages enable MNEs to gain higher revenues and to decrease costs (e.g., from the inadequate knowledge about the local market, the institutional and cultural discrepancies, the communications costs and the long distance operations), thereby justifying their foreign market operations (Dunning, 1988).

There are three types of ownership advantages: "(1) *the monopolistic advantages* in the form of the privileged access to markets of natural resources, patent rights, and similar, (2) *technology, knowledge of innovation,* and (3) *the economies of scale and scope, learning, broader access to financial capital throughout an organisation, and advantages from international diversification of assets and risks"* (Dunning, 1988, p. 2; Sun et al., 2012). The ownership advantages are intangible.

The location advantages determine which host markets firms enter to earn full economic rents from the established ownership advantages. Three types of location advantages include: "(1) *economic advantages (quantities and qualities of the factors of production, transport and telecommunications costs, scope and size of the market),* (2) *political advantages (government policies on inward foreign direct investment, intra-firm trade and international production),* and (3) *social, cultural advantages (psychic distance between the home and host market, language and cultural diversities, general attitude towards foreigner and the overall position towards free enterprise)"* (Dunning, 2000, Whitlocke, 2002; Kang and Jiang, 2012; Dunning, 2012).

The internalisation advantages are devised from the foreign market entry modes (Dunning, 2000; Sun et al., 2012). A firm internalises transactions present in non-existent or poorly functioning markets, which have high market transactions costs. In the presence of the internalisation advantages, a firm responds to foreign market challenges by establishing an export subsidiary; while in presence of all three types of advantages, it a firm could set up a foreign production facility (Dunning, 2013).

The eclectic paradigm theory of internationalisation depends, among others, on the size of the MNEs home market, the core competencies of the host country firms, firms' value added activities and the emergence of new markets and is, therefore, more applicable to MNEs coming from the developed than developing countries (Dunning, 2000, p. 165). Hence, the

eclectic paradigm theory is relevant within a dynamic context of the telecommunications industry.

3.2.4.2. Transaction cost theory

The transaction cost theory explains foreign market entry modes depending on the modes of control and the costs of foreign market resource commitment (Williamson, 1985; Ripollés, Blesa and Monferrer, 2012). It is grounded in the industrial organisation theory (Anderson and Gatignon, 1986).

The firm's mode of control depends on the *transaction-specific assets* (investments specialised for one or a few users), *the free-riding potential*, and *the environmental and organisational performance uncertainty*, which influence a firm's ability to break-even on its investment (Anderson and Gatignon, 1986, p. 7). Depending on these four aspects and a possibility of enacted opportunism, the following transaction costs can increase as firm's existing asset specificity increases: *(1) search costs* of gathering information about potential trading partners, *(2) contracting costs* of negotiating and writing agreements, *(3) monitoring costs* connected with supervision of contracts' obligations, and *(4) enforcement costs* of the ex post bargaining and sanctioning partners that evade their contractual obligations (Williamson, 1985; North, 1990; in Dyer, 1997, p. 535-537).

Firms must be aware of the potential leakage of the intellectual property from joint marketing agreements, technology sharing agreements or research cooperations (Teece, 1986, 1987). Innovation cooperation is desirable in cases when the market mechanisms do not encourage performances in low competitive environments (Williamson, 1985; 1988, 1992; Anderson and Gatignon, 1986). These leakages could influence the cooperative innovation efforts (Williamson, 1985, Oxley, 1997, p. 388). As costs of contracting increase, firms should be ready to control the opportunism in innovation cooperation with different modes of governance (Williamson, 1985; Dyer, 1997). Thus, in the global open innovation environment firms should cooperate in cases they can control the technology sharing, either through the intentional leakage of intellectual property or through the cooperation that aims to develop innovations. Examples include innovation communities in which firms intentionally make their intellectual property available. Firms reveal their innovation because they expect future gains to occur from community development. Global environment quickens and makes these

processes more vulnerable. Therefore, customised products demand local knowledge and require a detailed analysis of advantages and disadvantages of foreign entry modes (Andersen and Gatignon, 1986, p. 12) with respect to the possible transaction costs, and the potential costs and benefits of open innovation, reverse innovation and networking.

3.3. Internationalisation indicators

The theories and models given in the previous sections of Chapter 3 explain the phenomena behind the internationalisation. Yet they do not clarify the way internationalisation is measured. Different measures were developed to empirically test and substantiate the theoretical claims. Apart from the Transnationality index (Forsgren, 2013; Johanson and Vahlne, 1977), the Network spread index is the most commonly used to depict the level of internationalisation (Dunning, 1996, p. 10; Ietto-Gillies and Sprague, 2014). The complementarities of these indices enable them to explain the internationalisation phenomenon from a theoretical and empirical perspective.

Particular components of these indices are used to identify the level of internationalisation in the empirical part of this thesis. The theoretical approach to the empirical analysis of this thesis did not require all aspects of these indices to be included due to the predetermined hypotheses. Namely, some of the indices in this section contain indicators that describe the internationalisation process from different perspectives. Internationalisation can be either an input or an output variable of the model. The input variables can have an effect of on the level of innovation produced. Although the causal cycles could be reversed, the theoretical approach to the empirical analysis was based on the identification of internationalisation components that serve as output variables to the model. These indicators were used in the subsequent empirical analysis.

3.3.1. UNCTAD's Transnationality index

The Transnationality index is tailored by UNCTAD and based on the dichotomy between domestic and foreign production. It was first used in 1995 when the UNCTAD's World Investment Report published it for the first time. It reports data on 100 largest transnational firms and 50 small and medium-sized transnational firms from 13 developed countries. The Transnationalionality index takes the average of the three indices, each of which are attributed equal weights. These three indices are (Ramsey, Barakat and Cretoiu, 2012): (1) *The percentage of exports or foreign sales in total sales*, (2) *The percentage of foreign assets in total assets*, and (3) *The percentage of foreign employment in the total employment*.

The advantages of using the Transnationality index encompass the usage of both the supply-side and the location indicators on one side (share of foreign asset and foreign employment), and a demand-side indicators (share of foreign sales) on the other side. Ietto-Gillies and Seccombe-Hett (1997) explain that disadvantages of the Transnationality index come from its failure in distinguishing between the location of the sales and production markets, the neglect of the size of the home country's market and fails to make discrepancies between the firm's activities concentrated in a few or across numerous foreign countries.

The average internationalisation index of large transnational firms is approximately 47 percent. The most internationalised firm in 2012 was Nestle from Switzerland (97.1%) and the least was CITIC Group from China (18.4%) (UNCTAD, 2013a). Countries with the most internationalised firms are: the United States of America (22), France (14), the United Kingdom (14), Germany (10) and Japan (8) (UNCTAD, 2013). This is the result either of their history (e.g., colonial past) or the regulatory regimes that attract foreign firms (e.g., Switzerland). In the Ietto-Gillies and Seccombe-Hett's (1997) study about 80% of all firms in the index came from the five largest countries. Nowadays, the share of the top five countries in the index is lower and accounts approximately 68% (World Investment Report, 2013). The global economic shifts are, thus, evident.

Ietto-Gillies and Seccombe-Hett (1997) note that smaller economies have a higher percentage of international activities than larger economies. The smaller economies are limited in their small domestic market, which is also the impetus for their foreign expansion (UNCTAD, 2013b, p. 25).

The most internationalised telecommunication firms according to the Transnationality index (UNCTAD, 2013a) account for nine percent of the global most internationalised firms. These are namely: (1) Vodafone Group Plc (the United Kingdom, rank 8, 90.4%), (2) Libery Global Inc (United States, rank 17, 85.8%), (3) TeliaSonera AB (Sweden, rank 38, 70.3%), (4) Telefonica SA (Spain, rank 42, 68.4%), (5) VimpelCom Ltd (Russian Federation, rank 59, 59.6%), (6) America Movil SAB de CV (Mexico, rank 65, 58.1%), (7) Deutsche Telekom AG (Germany, rank 67, 57.6%), (8) Vivendi SA (France, rank 69, 57.1%), (9) France Telecom S.A. (France, rank 91, 42.0%) (UNCTAD, 2013a).

When the most internationalised electrical and electronic equipment global firms are added to that amount, the total telecommunications industry accounts for approximately 16% of the most internationalised global firms: (1) Koninklijke Philips Electronics NV (Netherlands, rank 11, 88.0%), (2) Hon Hai Precision Industries (Taiwan Province of China, rank 20, 84.3%), (3) Siemens AG (Germany, rank 29, 77.9%), (4) IBM (United States, rank 53, 61.8%), (5) Hewlett-Packard Co (United States, rank 56, 60.3%), (6) General Electric Co (United States, rank 79, 52.5%), (7) Sony Corporation (Japan, rank 80, 52.3%) (UNCTAD, 2013a).

Apart from the telecommunications industry, the most internationalised industries are: motor vehicles and parts (11 firms), petrochemical (11 firms), pharmaceuticals (10 firms) and beverages, food and tobacco (7 firms) (UNCTAD, 2013a). These industries make up 55% of the sample of all firms that are included in the Transnationality index in 2013.

3.3.2. Magnitude of international cooperation and foreign market presence as internationalisation indicators

The magnitude of international cooperation and foreign market presence is evident in indicators that illustrate the number of markets a firm enters. These indicators include: Network spread index, Transnationality spread index, Level of internationalisation index and Index of two dimensions of internationalisation (Dorrenbacher, 2000; Hassel et al., 2001; Forsgren, 2013; Ietto-Gillies and Sprague, 2014). These indices explain the network spread necessary for understanding international open innovation perspectives. By explaining the ability of a firm to identify its potential partners, gather knowledge from different markets, and engage into a reverse innovation process, these indices explain a firm's chances of global survival and growth. Hence, they are explained in the following sections.

3.3.2.1. Network spread index

Network spread index (NSi) is based on the amount of foreign markets in which the firm has production capacities, including subsidiaries and affiliates (Ietto-Gillies and Seccombe-Hett, 1997).

NSi includes the number of countries in which a firm has a subsidiary, and the number of countries in which the firm invests (DiSteffano and Gambillara, 2014, p. 62). It measures the geographic scope of a network by a firm's presence in foreign markets grouped in: (1) less than six countries, (2) between six and twenty countries and, (3) more than twenty countries.

The results of the network spread may be dependent on the type and size of the sample and firm (larger firms tend to have larger networks), the number of countries involved, the years in which the research was performed and the type of industry (Ietto-Gillies and Seccombe-Hett, 1997). Although NSI shows how firms diversify risk and benefit from opportunities given in the variety of markets, NSi by itself fails in explaining internationalisation because network ties can relate to sales or to production (Ietto-Gillies and Seccombe-Hett, 1997).

Although Transnationality index and Network spread index have a low degree of correlation, using both indicators is useful to illustrate the effect of transnational firms on the balance of trade, the balance of payments, and the design and implementation of industrial policy.

The empirical study in this thesis used the percentage of exports in total sales, the percentage of foreign assets in total assets and the network spread to identify the degree of internationalisation. However, it did not use the percentage of foreign employment in total employment because this component was identified as the input variable in the model during the doctoral workshop conducted at the University of Regensburg in November 2013.

3.3.2.2. Transnationality spread index

Transnationality spread index combines the Transnationality index and Network spread index to gain a composite measure of the two effects (Ietto-Gillies, 1998).

It is created by multiplying the transnationality index with the Network spread index (TNI x NSI). However, these two indices together have a correlation coefficient of only 0.4.

3.3.2.3. Level of internationalisation index

The level of internationalisation index was developed by Sullivan (1994) in the study that included 74 out of 100 internationalised manufacturing and service firms from the United States obtained in the Forbes magazine and ranked according to the total foreign sales (Hassel et al., 2001).

Five variables indicating the level of internationalisation include: the share of foreign sales in total sales, the share of foreign assets in total assets, the number of foreign subsidiaries or affiliates in the total number of subsidiaries or affiliates, the time period of the top managements' international experience in the total years of work experience, and psychic dispersion of international operations (Hassel et al., 2001, p. 5).

A drawback of this index refers to the possible misinterpretations. Namely the overall internationalisation level obtained by this index can be attributed to the high share of one variable, which, if replaced, alters the index interpretation (Hassel et al., 2001).

3.3.2.4. Index of two dimensions of internationalisation

The index of two dimensions of internationalisation (Hassel et al., 2003, p. 1) is composed of:

1. *Index of foreign production activities* measuring investment in foreign production based on the following components:

a) *the share of foreign sales in total sales* which is a performance measure given in the Transnationality index (Sullivan, 1994; İetto-Gillies, 1998),

b) *the share of foreign employment in total employment* which is a structural measure given in the Transnationality index, and

c) *the geographic dispersion of activities in foreign countries* which is an attitudinal measure (Ietto-Gillies, 1998) grouped into: low (less than seven countries), medium (from seven to sixteen countries), and high spread (more than sixteen countries).

2. *Corporate governance index* measuring financial internationalisation based on three variables:

a) *Share of foreign shareholders in total shareholders* denoting openness to the international capital markets (Rubach and Sebora, 1998),
b) *Number of foreign stock exchange listings*, and
c) Usage of national or international accounting standards implying a firm's tendency to communicate with international investors.

The drawback of the two dimensions of internationalisation index comes from its difficulty to sum up the two indices into a single measure. Namely, the two indices measure different aspects of internationalisation. Using the indices separately and depending on the nature of the empirical study could result in greater research insights.

3.3.3. Determinants of a firm's international position with respect to domestic and foreign competitors

The last two sections of this chapter are used to summarise the measures to be used in the empirical study. These include the relative measure of a firm's position against other firms in the industry. Although the managers have an idea about the firm's performance against other firms in the industry, this measure represents a subjective judgement.

The measure was taken from several studies that use ordinal scales to evaluate the firm's performance against its competitors. Consequently, a firm's international position is evaluated against its international competitors according to the following determinants: sales revenue, market share, identified new markets and opportunities, profitability, development costs, time-to-market, time to break-even, brand awareness, rate of new products, services, process or projects' success, customer satisfaction and quality and reliability of a new product, service, process or project (De Luca and Atuahene-Gima, 2007; Langerak, Hultink and Robben, 2004, Doblinger, 2013). These indicators reveal a firm's position on the market and enable the understanding of its success relative to competitors. However, their drawback comes from their subjectivity.

3.3.4. Overview of other objective performance indicators of firms' internationalisation

As opposed to the subjective indicators of firms' internationalisation, the objective indicators measure the firms' actual performance and they are mainly explained as the components of the internationalisation indices in the previous sections of this chapter. The share of exports in total sales, the share of income from international subsidiaries in total income, the share of income from foreign strategic alliances, the share of foreign added value in a firm's total added value, the share of licences sold to foreign firms and the number of new export markets (Doz, Santos and Williamson, 2001; Frishammar and Andersson 2009; Parida, Westenberg and Frishammar, 2013; Lasagni, 2012; Ramsey, Barakat and Cretoiu, 2012; Ietto-Gillies and Sprague, 2014) are examples of objective measures to be used as output variables in the empirical part of the study which originated as components of the Transnationality index, Network spread index and other indices mentioned in the previous sections.

4. SPECIFICITIES OF OPEN INNOVATION IN THE INTERNATIONAL ENVIRONMENT

The contemporary shift from the economics of knowledge towards the economics of creativity increases the importance of innovative activities within a firm and its environment (Hamel, 2011). If the technology, market and social contexts align to support the development of innovative activities (Yun, Park and Avvari, 2011), firms are more likely to experience larger market shares, greater profitability and resilience during economic downturn (Atun, Harvey & Wild, 2007; OECD, 2008; in Cornell, 2012). Hence, the purpose of open innovation is to incite firms' competitiveness by aligning value creation and value appropriation strategies (Belderbos et al., 2014; Wu, 2014). With this in mind, the hypotheses were formed and the empirical research has been conducted.

It is necessary to understand innovation in order to comprehend open innovation processes and outcomes, as well as their influence on internationalisation. Therefore, this chapter describes innovation according to theorists such as Schumpeter (1934, 1942), Kirzner (1973), Henderson and Clark (1990) and Rothwell (1992, 1994), and extends their understandings of the innovation processes to the open innovation perspective.

4.1. Predecessors of the open innovation perspective

4.1.1. Innovation theories from historical perspective

Firms achieve the rise in competitiveness by providing customers with greater value propositions than their competitors. Innovative activities which are parts of a firm's differentiation strategy that enhances the value of the customers' "consumption chain"[2] (MacMillan and McGarth, 2001), reflect a desire of an organisation to take advantage of unused possiblities (Kyläheiko et al., 2011).

There are many definitions of innovation. Schumpeter's (1934) "*innovation is the commercial or industrial application of a new product, process, or method of production"*. Freeman

[2] According to McMillan and McGarth (2001) the customers' "consumption chain" refers to the entire customer experience from the point of product realisation up to disposing it is subject to innovation.

(1982) defines it as "*the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment*" (in Terziovski, 2010). Afuah (1998 in Popadiuk and Choo, 2006) refers to innovation as "*new knowledge incorporated in products, processes, and services*". Wolpert (2002) states that innovation implies "*pursuing radical new business opportunities, exploiting new or potentially disruptive technologies, and introducing changes into the core concept of a firm's business*". Kyläheiko et al. (2011) define it as firms' new product and business model development, the improvement of the existing processes and the creation of new knowledge.

4.1.1.1. Schumpeterian innovation

Innovation is a phased of technological change that follows invention and preceeds its diffusion (Schumpeter, 1934; Stoneman, 2007). It rests on the coevolution of technology, firm and industry structures under the presence of uncertainty (Schumpeter, 1934; Nelson, 2004). Schumpeter states that innovation is made up from two drivers of the economic development: Mark I and Mark II (Malerba, 2007).

Mark I (Schumpeter, 1934, Malerba, 2007; Fagerberg, 2012) denotes the process of *creative destruction* in which the technological ease of entry causes firms to disrupt the existing ways of production, organisation or distribution, thereby diminishing product costs, accumulating capital and obtaining the above normal profits. Mark II (Schumpeter, 1942, Malerba, 2007) denotes innovation as the *creative accumulation* process within large firms' R&D laboratories, which poses barriers to entry. Mark I is open to the industry newcomers, while Mark II is not.

When studying the history of industrial sectors' innovation, Malerba (2007, p. 345-346) found that a Schumpeter Mark I pattern may be present in the beginning of a sector's development. However, new firms enter the market and Mark II is observed under the faster pace of the change in technology, the rise in uncertainty and low barriers to entry. Mature technologies established by large firms with monopolistic powers create the economies of scale and barriers to entry for newcomers (Utterback and Abernathy, 1975 in Malerba, 2007; Pyka and Andersen, 2013). Malerba (2007) does not exclude the possibkility of Mark I to replace Mark II thereafter.

In the contemporary economics of innovation, creative destruction is driven by knowledge and learning (Carayannis, 2008). The firm perspective enforces the view that Schumpeterian opportunities occur in rapidly growing and turbulent markets in which firms develop new-to-the-markets products, patents and collaborate with universities (de Jong and Marsili, 2010). Therefore, the combination of differing perspectives enables better understanding of the innovation processes (Dabić, Cvijanović and Gonzalez-Loureiro, 2011), which are explained below.

4.1.1.2. Innovation according to Kirzner

According to Kirzner (1973) innovation does not need to come from the technological or social changes. Kirzner (1973) states that an entrepreneur captures profits if information asymmetries are discovered before the other competitors in the industry. Hence imperfect knowledge of the market is caused by information access.

Shane (2003, p. 21; Jong and Marsili, 2010) states that compared to Kirzner (1973), the Schumpeterian (1934) opportunities refer to more innovative changes and enable new knowledge. Schumpeterian opportunities bring "new-to-the-market products" and create leadership in the market. Market leaders are followed by imitators (Kirzner, 1999), who disrupt the present market system. Kirznerian opportunities are less innovative than Schumpeter's and refer to replication of the existing forms of knowledge, thereby equilibrating the market processes (Kirzner, 2009, p. 147). Information asymmetry regarding valuable market opportunities decreases with the diffusion of information, as firms imitate the disrupting knowledge allowing the increased competitive activity to erode the value of the opportunity and stabilise the market towards a new competitive equilibrium (Kirzner, 1997). However, perfect imitation cannot occur (Shane, 2003). Therefore, the Kirznerian innovations are incremental, i.e. new to the individual or organisation rather than to the market.

Von Stamm (2003) explains the differences between the two types of innovation: incremental and radical (Table 4.1). This difference is similar to the difference between sustaining and breakthrough or disruptive innovation. Following from the two conceptual differences, OECD's Oslo Manual (2005) defined incremental innovations as innovations with the inadequate amount of originality that includes changes in the product aesthetics or qualities (e.g., on-line booking in travel industry).

Similarly, Christensen and Overdorf‘s (2001, p. 114) sustaining innovation increases the product performance in the advanced user markets, while the disruptive innovations refer to the creation of the entirely new markets. Therefore, the definitions of the sustaining innovation are similar to the definitions of incremental innovation, and the notions of breakthrough or disruptive innovation are similar to those of the radical innovation.

Table 4. 1. Difference between incremental and radical innovation

Focus	Incremental	Radical
Time frame	Short term (6 to 24 months)	Long term (usually 10 year plus)
Development trajectory	Step after step from conception to commercialization, high levels of certainty	Discontinous, iterative, set-backs, high levels of uncertainty
Idea generation and opportunity recognition	Continous stream of incremental improvement; critical events large anticipated	Ideas often pop up unexpectedly, and from unexpected sources, slack tends to be required; focus and purpose might change over the course of the development
Process	Formal, established, generally with stages and gates	A formal, structured process might hinder
Business case	A complete business case can be produced at the outset, customer reaction can be anticipated	The business case evolves throughout the development, and might change; predicting customer reaction is difficult
Players	Can be assigned to a cross-functional team with clearly assigned and understood roles; skill emphasis is on making things happen	Skill areas required; key players may come and go; finding the right skills often relies on informal networks; flexibility, persistence and willingness to experiment are required
Development structure	Typically, a cross-functional team operates within an existing business unit	Tends to originate in R&D; tends to be driven by the determination of one individual who pursues it wherever he or she is
Resource and skill requirements	All skills and competencies necessary tend to be within the project team; resource allocation follows a standardised process	It is difficult to predict skill and competence requirements; additional expertise from outside might be required; informal networks; flexibility is reaquired
Operating unit involvement	Operating units are involved from the beginning	Involving operating units too early can again lead to great ideas becoming small

Source: von Stamm, B. (2003), *Managing Innovation, Design and Creativity*. John Wiley & Sons, Chichester. In: Popadiuk, S., and Choo, C. W. (2006), Innovation and knowledge creation: How are these concepts related? *International Journal of Information Management*, Vol. 26, pp. 302–312, p. 306.

4.1.1.3. Innovation according to Henderson and Clark (1990)

Henderson and Clark (1990, p. 10) disembody the knowledge of product's components and architectural knowledge. According to Henderson and Clark (1990), the architectural knowledge refers to the knowledge of the linkages between components that preserve the core product design. In a successful product development, the knowledge on components and the architectural knowledge are necessary to create (Table 4.2): (a) *Incremental innovation*, (b) *Radical innovation*; (c) *Architectural innovation*; and (d) *Modular innovation* (Henderson and Clark, 1990).

Table 4. 2. Four kinds of innovation

		Core concepts	
		Reinforced	**Overturned**
Linkages between core concepts and components	**Unchanged**	Incremental innovation	Modular innovation
	Changed	Architectural innovation	Radical innovation

Source: Henderson, R.M., and Clark, K.B. (1990), Architectural Innovation: The Reconfiguration of Existing. *Administrative Science Quarterly*, Vol. 35, No. 1, pp. 9-30, p. 12.

A firm adapts to new structures based on innovation, which is aligned to the market and the customer needs (Henderson and Clark, 1990, p. 27). The evolutionary theory proposes that knowledge is found in routines (Nelson and Winter, 1982), and routines are inert and difficult to change. Hence, innovation management results in organisational adaptations that require centralised and strategic planning (Christensen, 2006).

4.1.1.4. Five generations of innovation according to Rothwell

Rothwell (1994) explains a firm's rationale to enter alliances and respond efficiently to market changes. Market changes lead some firms to strategically integrate with external stakeholders. Rothwell (1992, 1994) developed a taxonomy that classifies innovation models according to dominant perceptions of stakeholder integration (McFadzean, O'Loughlin and Shaw, 2005). This taxonomy of five innovation models is displayed in Table 4.3.

Table 4. 3. Rothwell's taxonomy of innovation models

Generation	Type of model	Timeframe	Characteristics of model
I	Technology push model	1950s – mid-1960s	Linear process from invention to commercialisation of a new product, with greater focus on internal R&D to foster better product development than external developments on the market.
II	Need pull model	Mid 1960s – early 1970s	Linear models now shift attention to the market and consumer ("market pull") exhibiting an increase in productivity and balancing supply and demand based on existing technologies.
III	Coupling model	Early 1970s - mid-1980s	Linear processes incorporate distinct stages in which a portfolio of products emerges as a result of consolidation & rationalization strategies to merge R&D and marketing efforts, with an emphasis on scale and experience benefits to include technological push, market pull or a combination of both.
IV	Integrated model	Early 1980s - early 1990s	Shorter product life cycles lead to time-based strategies and more integration between functions and firms results in multiple relationships nurturing R&D, manufacturing and design with customers and supplier, evolving generic technologies, and emphasis on technological accumulation.
V	Systems integrating and network model	From mid-1990s	Flexibility, adaptability and integration with suppliers and customers result in collaborative research and marketing that accumulate technology, enable strategic networking, and increase speed to market as innovation is the focus of corporate strategy.

Source: Adapted from Rothwell (1992, 1994), von Stamm (2003), McFadzean, O'Loughlin and Shaw (2005, p. 361).

Rothwell's (1992, 1994) fifth generation models provide a high degree of integration of internal departments for simultaneous work on new product development on one side, and an

integration of organisation with external stakeholders on the other side. Fifth generation models are, therefore, characteristics for organisations wanting to accelerate the innovation process (McFadzean, O'Loughlin and Shaw, 2005). With respect to the organisational structures, fifth generation models exhibit flatter and more flexible structures and greater organisational and system integration that incite networking and parallel (real time) information processing (Hamel and Prahalad, 2005), and as such are typical for open innovation models.

4.1.2. Indicators of firms' innovative performance

Innovative activities are usually divided into *product* or *service innovation* (developing a new product or service that meets a particular market need), and *process innovation* (embracing a firm's procedures with new input materials, equipment, task specifications, work and information flow mechanisms) (Afuah, 1998; OECD's Oslo Manual, 2005). Afuah (1998) groups product and process innovations into: (1)" *technological innovation* (innovations of components), (2) *market innovation* (innovation of marketing mix components including: distribution channels, product, applications, customer expectations, preferences, needs, and wants), and (3) *organisational innovation* (innovation in strategies, structure, systems, or people in the organization)" (Popadiuk and Choo, 2006, p. 303).

These innovations can be grouped into horizontal (innovations along the value chain) and vertical (innovations in management practices) innovations (Cornell, 2012, p. 34), which rationalise innovation measurements used in a particular research.

Innovation indicators are often indirect as innovation processes and outcomes are intangible and difficult to quantify. Moreover, differing stages of the innovation process (invention, innovation and diffusion; or basic research, applied research, development, and commercialisation) result in various productivity improvements and, hence, do not measure the same effects (Grupp and Mogee, 2004, p. 1374).

Innovation indicators are usually collected for the purpose of national statistics (e.g., European innovation scoreboard) including composite indicators, benchmarking and

scoreboards (Grupp and Mogee, 2004, p. 1375), these indicators do not provide a comprehensive understanding of the majority of innovative activities. That is usually the rationale for conducting the research on innovation through the questionnaire surveys.

The most widely used indicators of firms' innovative performance include:

4.1.2.1. Research and development (R&D) indicators

Research and development (R&D) indicators include:

- *Human resources*: Number of researchers in relation to the total workforce, as e.g., reported by European Commission (Barre, 2005, p. 122).
- *Investment in research and technology development:* Measuring investment in R&D can take the following form: (1) investment in innovation (e.g., R&D) and resulting number of patents and new variety of goods and services, and (2) share of spending on innovation to total spending (Foray, 2004, p. 38).

Although R&D expenditure indicates the knowledge potential and absorptive capacity of a firm, it is 'manufacturing biased', and as an input to the innovation process that can be used more or less efficiently, does not fully explain the output of the innovation process (Kleinknecht, van Montfort and Brouwer, 2002, p. 110).

4.1.2.2. Scientific and technological productivity

Scientific and technological measures include: (1) *number of patents* at the European and US patent offices, (2) *number of scientific publications* and *most cited publications per capita*, i.e. patent citations and economic value of patents, bibliometrics, scientific network analysis through co-authorship, (3) *number of spin-offs* generated, (4) a firm's *cooperation* with other firms/universities/public research institutes, (European Commission, in Barre, 2005).

Kleinknecht, van Montfort and Brouwer (2002) explain that "*patents are an (intermediate) output measure of innovation*". The patent data is publicly available but does not portray non-patented inventions and explains why some patents are not commercialised (Kleinknecht, van Montfort and Brouwer, 2002). Patents differ across industries. In decisions to patent, firms consider the cost of patenting with respect to the costs of imitation. Finally, they explain that

technologies may only be patented to prevent competitors from using it, thereby posing a barrier to entry (Kleinknecht, van Montfort and Brouwer, 2002). ‘A time lead on competitors’, ‘secrecy’ or ‘keeping qualified people in the firm’ are used more often to protect innovation than patents (Kleinknecht and Panne, 2011, p. 439).

4.1.2.3. Innovation finance, output and market

Nowadays firms’ business models provide enough flexibility and resilience to allow firms to change their value propositions and respond to changing customers’ needs (Teece, 2010; Onetti et al., 2012; Zott, Amitt and Massa, 2010). Flexiblity is measured in delivery times or manufacturing lead times (Armbruster et al., 2008, p. 650).

Sales of the ‘new to the firm but not new to the market' products, as the share of turnover (Kleinknecht, van Montfort and Brouwer, 2002), is widely used measure together with the numer of new products, processes, organisational and marketing methods. As an indicator of SME performance, Terziovski (2010) measured: number of product configurations, success of new products launched, accelerated speed to market, reduction in waste, increased market opportunities, increased delivery-in-full-on-time (DIFOT), improved product innovations, improved work methods and processes and increased quality. These items can be assessed by the Likert scale or the quality of innovation can be measured by the number of reworked parts (Armbruster et al., 2008, p. 650).

4.1.2.4. Organisational innovation

Although labour productivity (turnover minus inputs divided by the number of employees) is a possible measure of organisational innovation, Armbruster et al. (2008, p. 650) use the indicator that comprises: “*the implementation of customer- or product-line-oriented segmentation of central departments, decentralisation of planning, operating and controlling functions, balanced scorecard, regular individual consultation, quality circle, continuous improvement process, quality management, simultaneous engineering, cross-departmental temporary development teams, segmentation of production, integration of tasks, internal zero-buffer-principle (kanban) and teamwork in production*.”

Terziovski (2010) uses: (1) the innovation strategy, (2) innovation culture (rewards, informal meetings, and knowledge sharing), and (3) technological capabilities to measure innovation (the similarity of firms' technologies, technology sharing resources, the relevance of technology for a firm's innovation strategy, employee commitment to technology and innovation).

Each of the measures identified a particular aspect of a delivery of a product, service or a process to a market and is as such a valuable indicator of the particular stage of innovation. However, in interpretation of any of the innovation indicators, a researcher needs to have in mind that innovation processes are often intangible and incorporate a wider set of components.

4.1.3. Critical review of drivers and limitations of innovation

Competition is one of the biggest drivers that complement a good innovation strategy. However, innovation is rendered useless if a firm improperly manages its resources or makes incompetent managerial decisions (Cornell, 2012, p. 12).

4.1.3.1. Human resources

Lee et al. (2010, p. 296) made a distinction between the SME and large firms' barriers to innovation. Although SMEs recognise the market need sooner than large firms, they lack the suitable workforce that has an appropriate technological, planning and management ability.

Carter (1994, in Foray 2004) stresses the role of employees as 'agents of change'. He states that employee contribution to innovation in the manufacturing sector is 20%, and in the highly innovative sectors it comes up to 80%. Therefore, the role of management is extremely important. Both, the top level managers and the middle managers' ability to motivate their teams and reduce the ambiguous friction and inertia among employees can result in different outcomes. Similarly, two different business models can yield two different economic outcomes if they lack the appropriate corporate culture and human resources (Chesbrough, 2010b).

4.1.3.2. The role of knowledge and learning

Organisational learning enhances firm competitiveness when a firm's response to a market need is aligned with the firm's environment (Hannan and Freeman, 1984, p. 151). The institutional, cultural and historical elements of a particular industrial sector and its institutionalised practices are important. They provide incentives for the firm's innovation culture and knowledge sharing (Hargadon and Sutton, 1997; Kostova and Roth, 2002; Lewin, Massini, and Peters, 2011).

Moreover, tacit knowledge, routines and abilities might limit the firm's growth (Kumar, 2009, in Kyläheiko et al., 2011). Tacit knowledge is idiosyncratic and path dependent and can be transferred using the unused deficient managerial skills and entrepreneurial efforts (Nelson and Winter, 1982, Teece, 1986, 1987; Goffin and Koners, 2011). There exist cognitive limitations in terms of the limited rationality of the sender and receiver of knowledge and there is a lack of absorptive capacity (Cohen and Levinthal, 1990.). In these cases a product and service development might not go through market mechanisms (Buckley and Casson, 1976.; Teece and Pisano, 2004).

If impediments in terms of knowledge and learning exist, a firm's learning process needs to enhance its absorptive capacity routines in order for a firm to successfully and quickly adopt and diffuse innovation (Lewin, Massini, and Peters, 2011, p. 92). This is relevant because the speed of learning (Hannan and Freeman, 1984, p. 151) is one of the key determinants that incite the firm's innovation performance (Burger and Sydow, 2014). Consequently, early innovation adopters are market leaders in the diffusion of innovations (Lewin, Massini, and Peters, 2011, p. 93).

4.1.3.3. Business model

Due to rapid technological developments, turbulent environment, and uncertainty, the business model's role in a firm's value creation is important for a firm's competitive advantage (Amit and Zott, 2001; Chesbrough, 2007a, 2007b; Huang et al., 2013). A business model is "*a narrative and calculative tool*" that allows decoding, understanding and effectively communicating a strategy, thereby enabling the exploration of a market and the construction of the innovation networks within and across organisations to occur (Doganova

and Eyquem-Renault, 2009). If firms want to benefit from their existing business models, they require a system-level, holistic approach towards the business model innovation: (1) *industry models* (innovations in industry supply chain), (2) *revenue models* (innovations revenues generating processes), and (3) *enterprise models* (innovations in the structure of a firm's value chains) (Giesen et al., 2007; Zott, Amit and Massa, 2010).

Competing solely in technology is becoming increasingly difficulty, and firms' business model value comes from commercialisation of innovative ideas and the cooperation with external sources (Zott, Amit and Massa, 2010, p. 18). In order to be sucessful, a "*business model needs to identify: (1) the value proposition, (2) the market segment, (2) the value chain structure, (3) the revenue generating mechanisms, (4) the position of a firm within the value network, and (5) formulate the competitive strategy*" (Chesbrough, 2003, 2011). Moreover, a business model can be a source of innovation itself (Chesbrough, 2003a, 2007a, 2007b, 2010b). Hence, its role in the open innovation is examined with a construct readiness of a firm to adopt open innovation practices.

4.1.3.4. Inertia

Although a business model should aim at the creation of new customer propositions, the existing organisational inertia might prevent it from efficiently responding to changes (Hannan and Freeman, 1977; Foss and Stieglitz, 2014). Organisational inertia occurs either because of the past experience, or because of the existing and predetermined procedures.

With respect to innovation, Huang et al. (2013) found the negative effect of organisational inertia on open innovation and business model innovation that comes from the riskiness of a business model to disrupt interests and power structures within an organisation.

Moreover, with respect to internationalisation of R&D, Narula (2002) found that R&D inertia results in structural inertia and systematic lock-in that contributes to a domestically based R&D. Narula (2002, p. 813) states that the inertia in R&D internationalisation is higher than in other value-adding activities, such as sales and production. Radical innovations are connected with firm R&D efforts. Hence, inertia occurs. Therefore, firms should use the'voice' or the 'exit' strategy to prevent inertia and the resulitin lock-in (Hirschman, 1970).

Following from a Hamel's (2011) pyramid of innovation, management are innovation's greatest lock, which, due to inertia, inhibits positive organisational changes. This is consistent with Carayannis (2014) who characterises the creative will of an entrepreneur as a prerequistive for successful innovation and firm performance.

4.1.3.5. Institutional environment

A firm's institutional environment can also provide a limitation to innovation. Pigou (1932, in Foray, 2004, p. 119) identified three institutional mechanisms that could be used to overcome the inertia problem: (1) *subsidies,* (2) *direct governmental production, and* (3) *regulated monopoly*. Each of the three mechanisms provides solutions with respect to the inertia of knowledge production. Subsidides enable the source of financing; a direct governmental production tries to overcome the obstacles inherent in large scale projects; and the regulated monopoly in R&D and knowledge production tries to solve the public goods problem.

Patents, copyrights, and registered designs are, therefore, used as the main intellectual property rights, to guarantee exclusive access to knowledge. Herein, institutionalisation emerges through the codification of knowledge given in intellectual property rights. Ultimately, tax credits for research or innovation subsidies are issued to encourage the knowledge production.

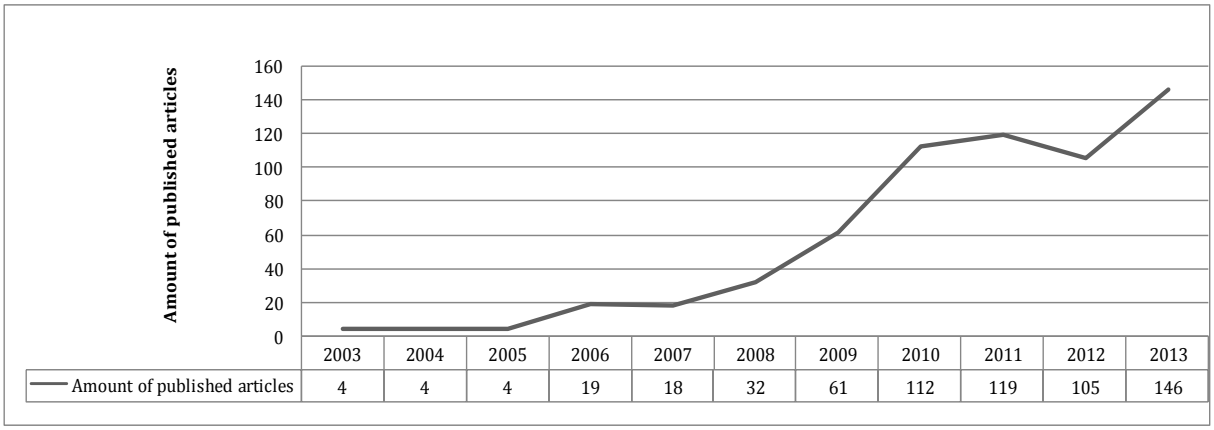
The drawbacks of the three institutional systems include *the hysteresis effect on the probability of receiving a new grant,* and the information asymmetry of governmental selection (Foray, 2004, p. 121).

4.2. Conceptual models of open innovation

4.2.1. Overview of the contemporary open innovation literature

4.2.1.1. Metaanalysis of open innovation literature

In order to comprehend the importance of open innovation, the metaanalysis of open innovation literature was made. The results showed that 643 documents on open innovation were published from 1955 until April 2014. The majority of publications were significant to the field of management (388 papers), business (227 papers), engineering industrial (119 papers) and operations research management (91 papers) based on the journals in which the papers were published. The papers were published in the research area of business economics (440 papers), engineering (178 papers), operations research management science (91 papers), public administration (56 papers), etc. based on the paper classification in which one journal or one paper can attain numerous classifications. The majority of the documents were research papers (523 papers). There were also: editorial materials (49 papers), reviews (33 papers), meeting abstracts (22 papers), proceedings papers (21 papers), book reviews (9 papers) and news items (6 papers), book chapters (1 paper) and corrections (1 paper). Figure 4.1. shows the amount of published papers on the topic of open innovation.



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Amount of published articles	4	4	4	19	18	32	61	112	119	105	146

Figure 4. 1. Amount of published articles on the topic open innovation

Source: Web of Science since 1955.

Although the topic of open innovation is under-researched area, there has been an evident rise in the popularity of the topic of open innovation after 2010 with respect to the amount of published papers. The greatest amount of articles was published in 2013. The special issue

journals published on the topic of open innovation contribute to the rise of its popularity. These include special issues of R&D Management "The future of open innovation" in 2010, International Journal of Transitions and Innovation Systems "Open innovation and Transition: Redefining the boundaries" in 2012, and Research Policy "Open innovation: New insights and evidence" in 2014.

The greatest number of papers came from the authors based in the U.S.A. (149 papers), Germany (94 papers), England (84 papers), Spain (58 papers), the Netherlands (53 papers), Switzerland (48 papers), Italy (35 papers), Sweden (33 papers), Belgium (32 papers), etc. (Appendix 1: Metaanalysis of Open innovation literature - The amount of papers per author's country of origin).

Henry Chesbrough's (2003b) article "The era of open innovation" is the most widely cited paper in the field of open innovation. It had 390 citations in December 2014 (Table 4.4.). The most cited studies in the field focused on the conceptual clarification of open innovation, the role of collaboration, internal innovation capability and consequent absorptive capacity. The most published authors apart from Chesbrough (18 papers) include: Wim Vanhaverbeke (11 papers), and Oliver Gassman (9 papers) (Appendix 1: Metaanalysis of Open innovation literature - 20 authors with the most publications in open innovation).

The research performed in the Web of Science database depicts the top ten most cited papers in the field of open innovation (Table 4.4) in which the majority of papers were published in: R&D Management (40 papers), Technovation (38 papers), International Journal of Technology Management (33 papers), Research Policy (26 papers), and Abstracts Of Papers Of The American Chemical Society (21 papers) (Appendix 1: Metaanalysis of Open innovation literature – Journals containing papers on open innovation).

Table 4. 4. Top ten most cited papers on open innovation

Study	Number of citations	Context
Chesbrough (2003)	390	Conceptual underpinning of open innovation versus closed innovation concepts is described with examples of firms such as Xerox, Apple Computer and Microsoft.
Chesbrough and Crowther (2006)	210	The study portrays firms in low-tech or mature industries to identify their, mainly inbound, open innovation practices.
Dahlander and Gann (2010)	160	Bibliographic and content analysis of Thomson's ISI Web of Knowledge (ISI) database to explain the open innovation concept. It depicts two inbound processes: sourcing and acquiring, and two outbound processes, revealing and selling.
Perkman and Walsh (2007)	151	The study explains the processes of search and acquisition in university-industry linkages that foster open innovation practices: collaborative research, university-industry research centres, contract research and academic consulting.
Henkel (2006)	131	Research on the patterns of free revealing of internal innovations within open source Linux software community. Firms reveal selectively about 50 per cent of the innovations, which is partly explained by firms' characteristics and the purpose of disclosure.
Enkel, Gassmann and Chesbrough (2009)	129	The study summarizes inbound, outbound and coupled open innovation processes.
Cooper (2008)	129	Explains that progressive firms use a Stage-Gate process for open innovation and refer to its challenges (governance issues, overbureaucratizing the process, and misapplying cost-cutting systems, Six Sigma and Lean manufacturing).
van de Vrande et al. (2009)	128	Open innovation practices in SMEs, describing their main motives (market oriented) and challenges (organisational and cultural relations with external stakeholders) in implementation of open innovation practices by SMEs. No differences were found between manufacturing and service industries but the discrepancies exist between small and medium-sized businesses as medium-sized businesses implement more open innovation practices.
Piller and Walcher (2006)	124	Internet-based toolkits for idea competitions (TIC) are studied and developed by authors as a mean of accessing user innovation.
Dodgson, Gann and Salter (2006)	122	The case study of Procter and Gamble's 'Connect and Develop' strategy that uses "innovation technologies" (data mining, simulation, prototyping and visual representation) explains organisational and technological changes effect on open innovation strategy.

Source: Web of Science (2014). Author's representation.

4.2.1.2. Metaanalysis of open innovation and telecommunications literature

Additionally, the metaanalysis of the open innovation literature in telecommunications was conducted in April 2014. Metaanalysis was done in the Web of Science database for all years with topics: ‘open innovation’ and ‘telecommunication’.

Only nine papers in open innovation telecommunications literature were found (Table 4.5). These papers were cited 41 times (without self-citations). The H-index, which measures the productivity and citations, is 3. The first paper on open innovation and telecommunications was published in 2008 by Lee et al. (2008) in the *Asian Journal of Technology Innovation*. The geographic dispersion of open innovation and telecommunications authors depicts that four authors came from Germany, two from South Korea and Spain, and one from Denmark, Norway, England, Switzerland, and Malaysia.

Table 4.5. shows that the literature on open innovation and telecommunications used a qualitative data analysis, employing the in-depth interviews and the case studies analysis. One study used the patenting data (Lee et al., 2008), one structural equations (Devece, 2013) and one the mixed-method research (Alexy, Henkel and Wallin, 2013). The studies focused on the relationships between technological convergence and open innovation (Lee et al., 2008), identification of open innovation instruments (Rohrbeck, Holzle and Gemunden, 2009), standardisation and open innovation (Grotnes, 2009), technology foresight capabilities (Rohrbeck, 2010) and foresight methods (Heger and Rohrbeck, 2012), the social contexts and the role of innovation actors in innovation (Yun, Park and Avvari, 2011; Devece, 2013), relations between the innovation sharing individuals (Carbone et al., 2012) open source software differing impacts on technical and administrative dimensions of different job roles (Alexy, Henkel and Wallin, 2013). Hence, it can be seen that the field of open innovation in the telecommunications industry is relatively under-researched area and lacks quantitative empirical testings.

Table 4. 5. Summary of metaanalysis of open innovation and telecommunications literature

Authors	Focus	Method
Lee et al. (2008)	The relationship between technological convergence and open innovation in which collaboration efforts strongly impacted open innovation strategies. Exploitation-oriented alliances play a key role. Due to high cross-country patents indicate international research and development efforts with increasing strategic alliance activity. Foreign inventors and strategic alliances are therefore increasing.	U.S. co-patenting data to prove the strong, collaborative research of leading mobile firms (Nokia, Motorola, Samsung and LG).
Rohrbeck, Holzle and Gemunden (2009)	Open innovation as a response of incumbents to increased competition by new entrants through 11 open innovation instruments: foresight workshops, executive forums, customer integration, endowed chairs, consortia projects, corporate venture capitalist, internet platforms, joined development, strategic alliances, spin-outs, test market.	15 in-depth interviews with managers in Deutsche Telekom.
Grotnes (2009)	With respect to radical innovations, case lead by established firms in the industry has a process where radical innovations are introduced early in the process, while the case lead by newcomers has a process where radical innovations are introduced late in the process. Different policies towards open membership in standardization initiatives that lead to different open innovation processes. Open membership leads to a coupled process, and a more restricted membership gives separate inside-out and outside-in processes.	2 case studies (Android mobile operating system and the service platform developed by the Open Mobile Alliance).
Rohrbeck (2010)	Building technology foresight capabilities using networks of experts, while increasing the open-innovation capabilities by extending the intertwinement with their environment.	3 case studies and 43 interviews from three major European telecommunication incumbents.
Yun, Park and Avvari (2011)	Innovation processes within social contexts and the role of innovation actors such as government, private sector and citizens in the development and diffusion of the innovations. Illustrating end-users participation in the innovation processes in public sector and the role of innovations in emergency/disaster management under social contexts utilising 'open innovation' frameworks.	2 case studies.

Source: Web of Science (2014). Author's representation.

(Table 4.5. continued)

Authors	Focus	Method
Heger and Rohrbeck (2012)	Success factors for business-field exploration with foresight methods due to integration of multiple perspectives, a high level of uncertainty, interdependencies between customer needs, technological capabilities, competitor behaviour, legislative contingencies, production cost, etc., and the need to involve a high number of external experts and internal stakeholders.	
Carbone et al. (2012)	An ontology-based analysis of plain text providing a semantic contextualization of content support tasks, such as finding semantic distance between contents, and helping in creating relations between people with shared knowledge and interests.	Case studies of three large corporate environments (Bankinter, a financial institution, Telefonica I+D, an international telecommunication firm and Repsol, a major oil firm in Spain).
Alexy, Henkel and Wallin (2013)	Organizational innovation that commercially engages in open source software differing impacts on technical and administrative dimensions of different job roles.	A mixed-method research (qualitative interviews and a survey of a large telecommunications firm's employees)
Devece (2013)	The role of general managers and their competence in information technologies and in the integration of these technologies in knowledge-intensive businesses.	Structural equations on the sample of 122 firms from telecommunications and biotechnology industries.

Source: Web of Science (2014). Author's representation.

4.2.1.3. Metaanalysis of open innovation and internationalisation literature

The final metaanalysis was done in the Web of Science database on the topics of open innovation and internationalisation. It showed that nine papers jointly study the concepts of open innovation and internationalisation (Table 4.6.).

Table 4. 6. Summary of metaanalysis of open innovation and internationalisation literature

Study	Context	Results
Wang et al. (2012)	China's catching up process is studied from the open innovation perspective of Chinese high-tech companies.	Chinese companies use: (1) technology in-licensing, (2) alliances with foreign partners to obtain technologies, (3) cooperate with universities and R&D institutes, and (4) and local industries to gain access to technological skills.
Lee et al. (2008)	As in Table 4,5,	The U.S. co-patenting of major telecom companies indicating foreign alliances for innovation.
Zhu and Chen (2005)	Authors study Chinese firms' innovation with respect to the international innovation environment.	Monitoring, absorbing and learning guide Chinese innovation internationalization providing the investment in internal complementary assets.
Felicio et al. (2013)	Study of the effect of global mindset on 354 Norwegian and Portugese small firms' internationalisation.	Global mindset affects international experience and technical skills of entrepreneurs. Norwegian firms are more affected by global mindset's influence on internationalisation than Portugese firms.
Pawlowski (2013)	Depicts a concept of a born-global innovation to illustrate a parallel open innovation processes in different countries.	The crucial role of social software in knowledge management. Overcoming barriers in open innovation through born-global innovation.
van Geenhuizen and Nijkamp (2012)	Taking advantage of global innovation networks by high-tech firms.	Local and global networks coexist in cities, while globalized companies lose local focus. Losing of local focus can be ameliorated through relationships with universities and developing local market.
Koziol-Nadolna and Wisniewska (2012)	Study of the motives of transnational firms that set up 57 R&D facilities in Poland.	Four types of R&D internationalisation are identified: local adopter, internal performer, local constructor and global constructor.
이상윤 and Hong-Joo (2012)	International innovation cooperation of Korean firms.	An "SME co-ordinator" should manage increased open innovation performance of SMEs for internationalisation.
Wang, Yen and Chen (2009)	Community Innovation Surveys is employed to study the concepts of open innovation in Taiwan.	Successful innovators employ multiple innovations and simultaneously increase their innovation capability. The importance of organizational, marketing and strategic innovations.

Source: Web of Science (2014). Author's representation.

Table 4.6 shows that there is a fairly small amount of literature on open innovation and internationalisation. The literature is diversified. It ranges from studies focused on global

innovation networks, co-patenting, managerial characteristics, localisation and absorptive capacity. This thesis, on the other hand, focuses on the effect of open innovation on internationalisation and the role of possible mediators and moderators of the process. Hence, it depicts the causal effect of open innovation on internationalisation and explores the role of its facilitators.

The next section explains the basic concepts of open innovation which were subsequently empirically tested.

4.2.2. Lead user as a foundation of a firm's innovative performance

Eric von Hippel is one of the first authors who explains the innovation process from the stakeholder engagement perspective. His seminal book 'The Sources of Innovation', explains innovation from the perspectives of users (consumers, customers), manufacturers, suppliers and other firms in different industries. He found that the users greatly contributed to the innovation processes in the following industries: pultrusion processes (90% contribution), scientific instruments (77% contribution), semiconductor and printed circuit board processes (67% contribution), among others, and only 11% to the wire termination equipment. Manufacturers were a dominant source of innovation in tractor shovel-related industry (94% contribution), plastics additives (92% contribution) and engineering plastics industry (90% contribution). Suppliers contributed to wire termination equipment industry (56% contribution), thermoplastics usage industry (36% contribution) and industrial gas usage industry (33% contribution) (von Hippel, 1988, p. 4).

Consequently, von Hippel (1988, p. 107) defined a lead user as the one who possesses the following two characteristics:

a. Lead users face needs that will become a marketplace mainstream needs months or years before the rest of the marketplace encounters them; and
b. Lead users significantly benefit from solutions to those needs.

Innovation collaborations between firms and users spark greater product innovations (Chatterji and Fabrizio, 2013) and enable drastic changes to the existing products which are

too expensive and time-consuming for a firm to make (von Hippel, Thomke and Sonnack, 1999; Chatterji and Fabrizio, 2013).

The likelihood of successful innovation rises with the innovation attractiveness, i.e. their novelty and the expected market demand (von Hippel, 2005). When the radical innovations are done by users, the innovation diffusion time is shortened either through its replication or market commercialisation (von Hippel, 1988, p. 18). The former occurs more frequently than the latter (von Hippel, 1988).

The phases of a new product or service development by a lead user (Figure 4.2.) include: (1) the market, type and level of innovation identification, (2) the trends depiction by observing the people who know and use technology, (3) the lead user identification, and (4) the breakthrough development.

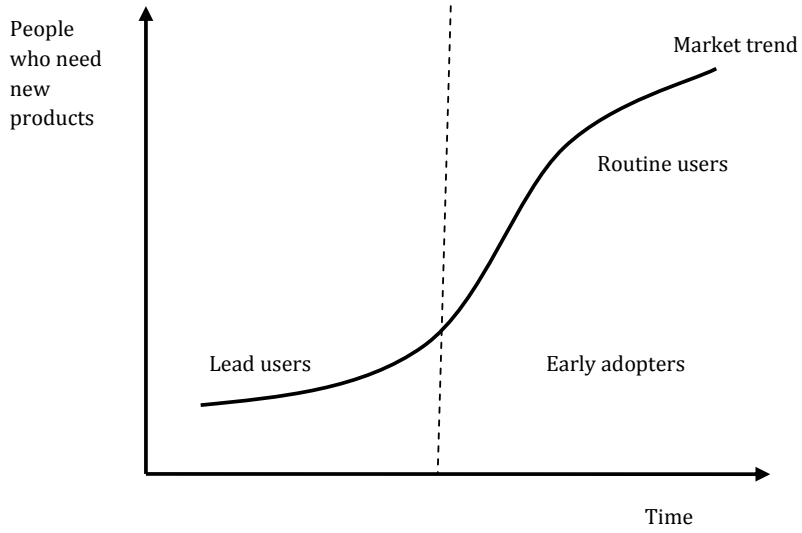


Figure 4. 2. The phases of the new product/service development by a lead user

Source: von Hippel, E., Thomke, S., and Sonnack, M. (2001), Creating breakthroughs at 3M. *Harvard business review on innovation*, Vol. 77, pp. 31-54, p. 38.

The lead-user innovation process is portrayed in Figure 4.3.

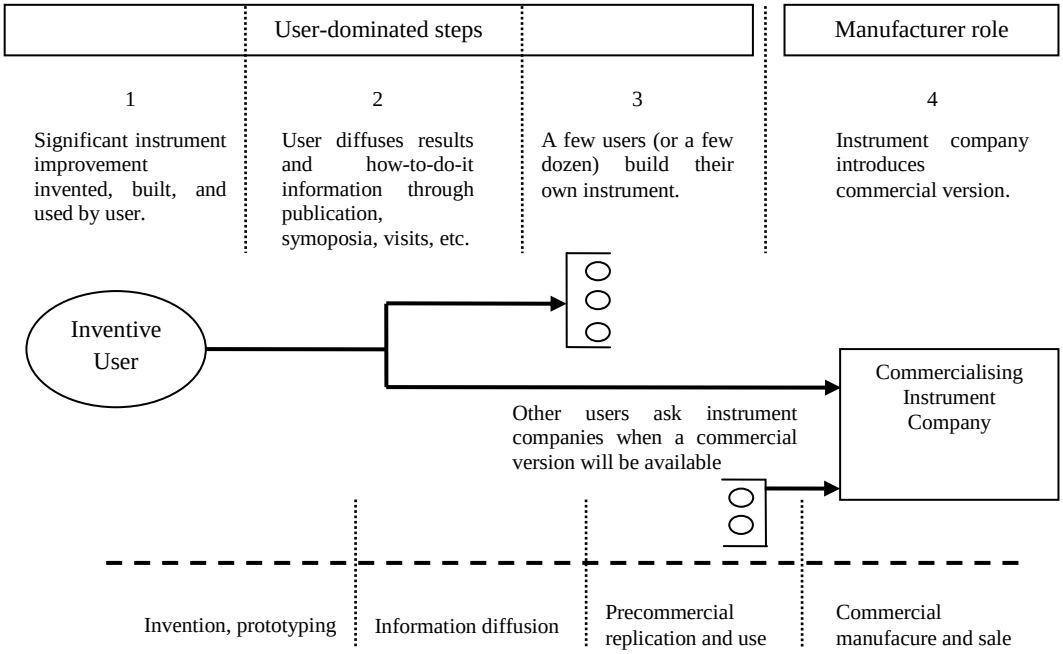


Figure 4. 3. Typical steps in the development and diffusion of a scientific instrument innovation

Source: Von Hippel, E. (1988), *The Sources of Innovation*. New York, Oxford: Oxford University Press, p. 19.

Insititutional factors can sustain user-led innovation (Raasch, Herstatt, and Lock, 2008). This might happen because of the heterogeneity of user needs. As firms manufacture for mass markets they neglect the needs of the niche or small number of users. Hence, users wanting a customised product will either "*develop it themselves or pay a manufacturer to develop it for them*" (von Hippel, 2005, p. 33). The innovative user will invent an instrument, build a prototype, prove the prototype's value, and diffuse detailed information on the value of invention, and its replication method (von Hippel, 1988, p. 19). In that sense the user-led innovations can be incited or prevented by manufacturers (e.g., rejecting to service the modified products) (von Hippel, 1988, p. 99-10).

The extension of the lead-user theory can be applied to the existence of the community innovators. When compared to the independent innovators, community innovations have a greater innovation adoption rate and information availability, thereby implying easier diffusion of innovation (Ogawa and Pongtanalert, 2013).

4.2.3. Innovation theory according to Hargadon and Sutton (1997)

Hargadon and Sutton (1997) made two significant contributions to the innovation theory. Firstly, they described and explained the importance of the knowledge brokering (Hargadon and Sutton, 1997). Secondly, they helped the "Not Invented Here" syndrome diffusion (Hargadon and Sutton, 1997).

The main determinants of their technology brokering model are based on a firm's network in which knowledge is imperfectly shared and ideas originate from the variety of sources and industries; thereby facilitating rapid experimentation, early failure, and the exploitation of information (Thompke, 2001). Solutions to firms' problems are rarely obtained or recognised at the same time a problem occurs. Hence, a firm acts as a "structural hole" that acquires, retains, stores, retrieves and combines the knowledge by introducing solutions (Hargadon and Sutton, 1997). Eventually, this pattern of problem solving emerges as a 'search' routine generating path dependent responses in line with the evolutionary theory. In this way, ideas are transformed and able to fit the radically new environments (Hargadon and Sutton, 1997, p. 723).

The most prominent example of a "structural hole" is Edison's laboratory which used the knowledge from the telegraph industry's electromagnetic power to transfer ideas to telephone and other industries (Hughes, 1989, in Hargadon and Sutton, 1997). Another example they cite is IDEO, a firm which designs products for manufacturers in return for monetary compensation for the time spent designing a product or for the share in the future profits (e.g., among others Apple computer mouse, Oral-B toothbrushes, a coin sorter, in Hargadon and Sutton, 1997, p. 719). Based on IDEO's operations, they developed the technology brokering model illustrated in Figure 4. 4.

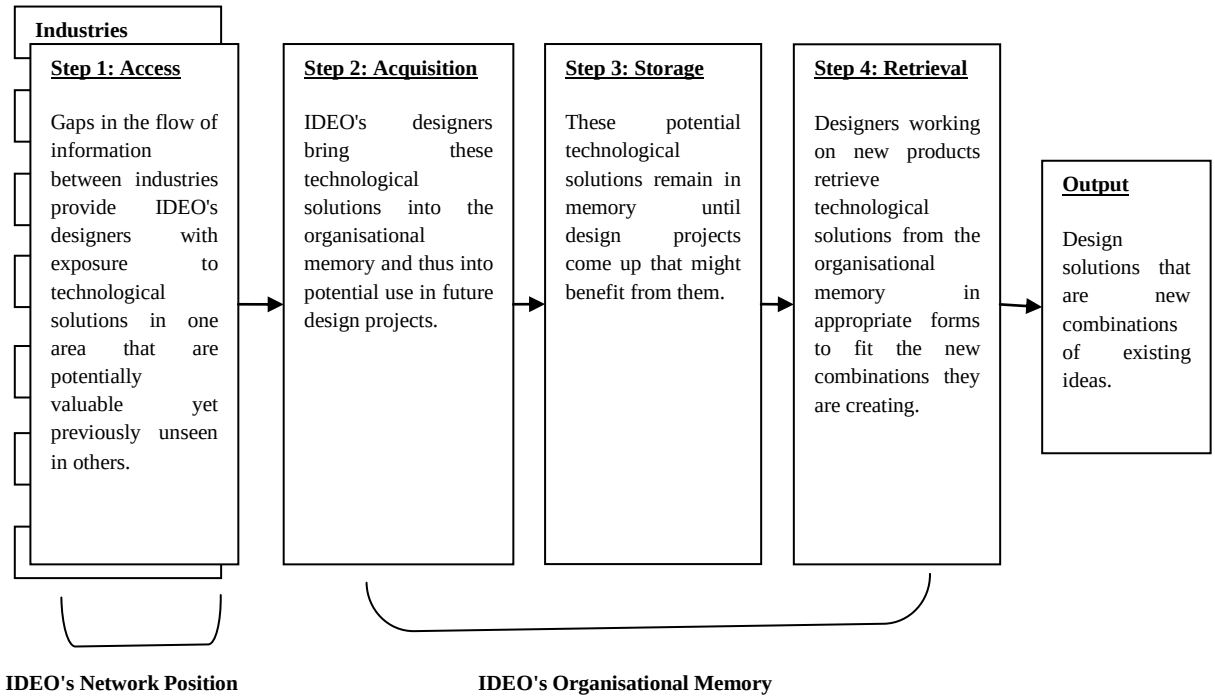


Figure 4. 4. A process model of how innovation occurs through technology brokering

Source: Hargadon, A., and Sutton, R.I. (1997), Technology brokering and innovation in a product development firm. *Administrative Science Quarterly*, Vol. 42, pp. 716-749, p. 725.

The process of technology brokering depends on the geographic and political environment. Hence, organisations should facilitate the brokering processes within their structures, through brainstorming sessions, formal and informal reward systems, and by employing employees with the adequate and necessary knowledge and skills (Hargadon and Sutton, 1997, 2001).

Finally, Hargadon and Sutton (2001) explained that the technology brokering is connected to the "Not Invented Here" (NIH) syndrome defined by Katz and Allen (1982). The "Not Invented Here" (NIH) syndrome refers to the rejection of ideas coming from the firm's external environment due to the perception that the problem can only be solved within a firm. The "Not Invented Here" (NIH) syndrome causes inefficiency and is detrimental to innovation.

4.2.4. Open innovation according to Chesbrough (2003)

The lead user and technology brokering theories, as well as Chesbrough's contemporary research lead Chesbrough (2003a, 2003b) to define open innovation as a *new paradigm shift* in perceptions of firms' innovation systems. Chesbrough (2006) found that the anomalies of the existing innovation theories fail to capture: (1) the spill-over of industrial R&D which was generally perceived as a cost to a business rather than a new opportunity, (2) the treatment of intellectual property rights, (3) the "Not Invented Here" syndrome, and (4) the emergence of spin-offs.

Chesbrough noticed that many technologies remained unutilised, "waited on the shelf" for further internal developments or employees who have developed them to leave the firm and develop them within their own businesses. In these ways a firm in which the innovation emerged failed to capture and retrieve any profits from innovations due to pressures that led executives to cut back or discontinue funding (Wolpert, 2002).

The concept of open innovation gained legitimacy as product life cycles and lower costs and the time of product and service development shortened and due to the lack of access to the technologies and high risk of innovating in isolation (Dahlander and Gann, 2010). It depicts: changes in working conditions (the majority of people do not have a life-time job; hence, a new talent approach is required), job divisions that allow the trade of ideas through market institutions (intellectual property rights, venture capital, technological standards); and new technologies that induce new cooperation and coordination methods in multiple geographic areas (Dahlander and Gann, 2010).

If a firm lacks competence to adapt to external changes, access information and appropriate risk, it can use open innovation as an alternative path to market (Mortara and Minshall, 2011). By using alternative paths to market, firms can become more effective, productive in their utilisation of internal and external resources, bring a higher quality of products onto the market and reduce the delays in the supply and value chains (Chesbrough, 2004, 2006). As they discover and use information, technology and knowledge that is widely dispersed and increase its competitiveness by acquiring information, technology and knowledge at a lower costs than it would take for a firm to develop itself (Chesbrough, 2011).

Although innovation is always ‘open’ to a certain extent and open innovation is not a new phenomena (Chesbrough et al., 2006; Dahlander and Gann, 2010; West et al., 2014), open innovation processes should complement and sometimes substitute closed innovation modes (Lakhani and Tushman, 2012, p. 37). Firms can open their “*inter-organisational networks, organisational structures, evaluation processes and knowledge management systems”* to external processes (Chiaroni, Chiesa and Frattini, 2010). In order to capture the differences between the two innovation modes (open and closed), Table 4. 7. depicts characteristics of closed and open innovation.

Chesbrough (2003) defined open innovation as “*a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology. Open innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model*.”

Similarly, the following definition of open innovation is often used (Chesbrough, 2006, p. 1):

“*Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology*.”

Table 4. 7. Differences between closed and open innovation

	Closed innovation	Open innovation
Relationship towards external knowledge	All experts in the area work for the organisation.	Not all experts in the area are employed by the organisation.
Origin of idea	An organisation uses internal R&D , independently develops and puts product son the market.	Knowledge from external environment is equally important as organisation's internal knowledge. An organisation does not need to create the idea to benefit from the idea. External R&D can create significant value. Internal R&D is necessary in order to preserve the share of that value.
Treatment of the business model	Innovation process should be controlled to not become recognisable.	Creating a better business model by using internal and external ideas is more profitable in the long run.
		Business model is a cognitive tool which is focused on evaluation of R&D projects within an organisation. Cognitive approach allows organisations to filter projects which are in accordance with the model and segregation of those which are not.
Intellectual property rights management	Intellectual property is controlled within the organisation to protect ideas from competition.	External usage of organisational intellectual property is evalued based on costs and benefits, and intellectual property of other organisations is bought in order to enhance an organisation's business model.
	Intellectual property rights are byproducts of innovation and they are licensed or exchanged.	Licensing and exchanging innovations are one part of using intellectual property. These are the key elements of innovation because they are freely exchanged within and outside of organisation and facilitate exploitation of the market of ideas exhange. They can take the form of publications, donations, etc.
Relationship towards environmental knowledge and organisational innovation	'Not invented here' syndrome	Knowledge and innovation are dispersed and quality. Even the most capable and the most sophisticated R&D organisations need to network with external sources of knowledge.
Spreading and dissemination of industrial R&D	Business costs.	Are considered opportunities with which the firm shall spread its existing business model.

(Table 4.7. continued)

	Closed innovation	Open innovation
Intermediary organisations	-	There is a growth of significance of intermediary organisation which ensure access to information and finance (e.g., NineSigma, YourEncore, Innocentive, etc.).
Measures of innovative performance	Share of sales spent on internal R&D, number of new products, share of sales from new products in total sales, number of patents by monetay unit spent for R&D.	The amount of R&D projects conduced within the firm's supply chain (not only within a firm), the share of innovations developed outside of the firm and their dependency on the industry in which the firm is operating, time-to-market and its dependency on the distribution chanels, the share of utilised patents owned by the firm, investments outside of the firm, etc.

Source: Adapted according to Chesbrough, H. (2003b), The era of open innovation. *MIT Sloan Management Review*, Vol. 44, No. 3, pp. 35-41.

Accordingly, he illustrates closed and open systems as in Figure 4.5. (Chesbrough, 2011).

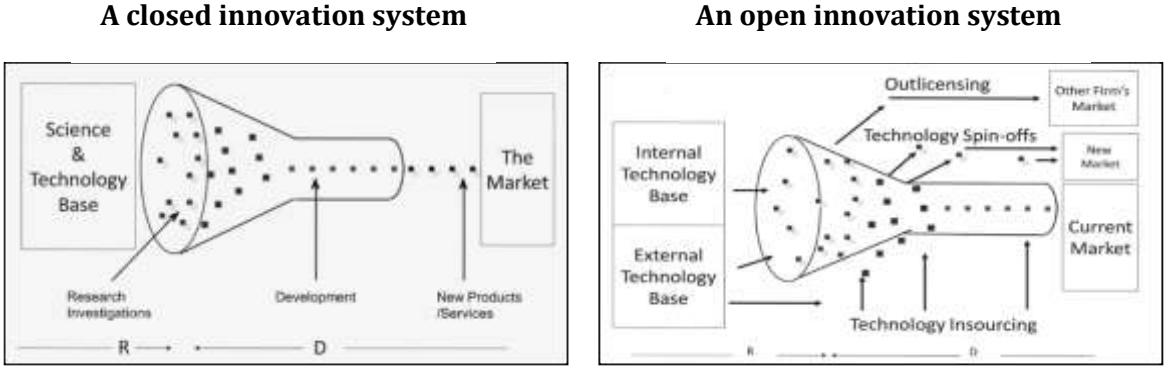


Figure 4. 5. A closed and open innovation system

Source: Chesbrough, H. W. (2011), *Open services innovation: Rethinking your business to grow and compete in the new era*. San Francisco, CA: Jossey-Bass, p. 69-70.

Figure 4.5. illustrates different processes which are driven by *inbound* activities that increase access to skills and competences on the left hand side, and both *inbound and outbound* activities such as the acquisition of knowledge from a variety of sources, the development of effective appropriation strategies and a *firm's system and capabilites* to identify, assmilate and exploit external knowledge and integrate it to internal developments on the right hand side

(Chesbrough, 2003; Laursen and Salter, 2006; Huang and Rice, 2009; Mortara and Minshall, 2011, p. 593-594).

Generally, there exist six types of open innovation strategies: (1) inward open innovation, (2) outward open innovation, (3) upstream vertical collaboration, (4) downstream vertical collaboration, (5) horizontal and (6) knowledge-intensive collaboration (Poot et al., 2009; in Cornell, 2012) that are grouped between exploration and exploitation open innovation strategies (van der Vrande et al., 2009).

Firms exploit external knowledge by imitating competitors (free riding on the first entrant); they consult consumers (von Hippel, 1988) to form products in accordance with their preferences, use publicly available sources of information and university research centers (Chesbrough, 2006). *Outward open innovation or technology exploitation* refer to "*innovation that leverages the existing technological capabilties outside the boundaries of an organisation*" (van der Vrande et al., 2009, p. 424). They encompass: venturing, outward intellectual property rights licensing and employee involvement. *Inward open innovation or technology exploration* implies to activities that enable firms "*to capture and benefit from external sources of knowledge to enhance current technological developments*" (van der Vrande et al., 2009, p. 424). They include: customer involvement, external networking, external participation, R&D outsourcing and inward intellectual property licensing (Chesbrough et al., 2006; Chesbrough and Crowther, 2006; van der Vrande et al., 2009, p. 424; Rangus, 2011; Figure 4.6.).

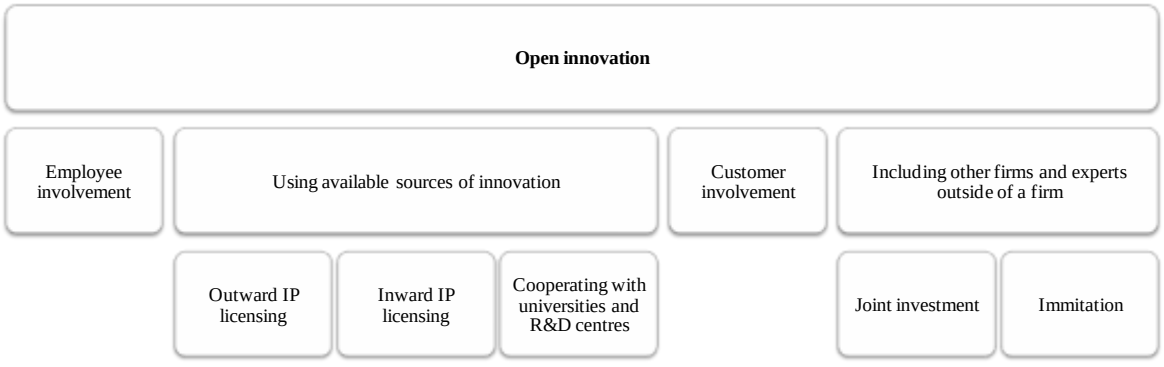


Figure 4. 6. The conceptual model of open innovation proclivity

Source: Adapted from van de Vrande, V., de Jong, J. P. J., Vanhaverbeke, W., and de Rochemont, M. (2009), Open innovation in SMEs: Trends, motives and management challenges, *Technovation*, Vol. 29, No. 6/7, pp. 423-437; and Rangus (2011, p. 4).

4.2.4.1. Open innovation intermediaries

Partnering with other organisations increases firms' success through the access to resources and capabilities (Van de Vrande et al., 2009). Nambisan and Sawhney (2007) name open innovation intermediaries as: invention capitalists, idea scouts, electronic R&D marketplaces, patent brokers, licensing agents, and venture capitalists.

Chesborugh (2003) extended Hargadon and Sutton's (1997) model of technology brokering into open innovation intermediaries. Chesbrough (2003b) describes various types of intermediaries in the open innovation environment along three segments of the innovation value chain: *innovation funding*, *innovation generation*, and *innovation commercialisation*. The first segment participates in open innovation during the innovation-funding portion of the value chain. These include firms that act as innovation investors (firms that invest in external innovation efforts undertaken by other organisations) (Chesbrough, 2003b). Moving up the value chain are firms that are involved in generating innovations. These firms include innovation merchants (firms that innovate for the sole purpose of leasing or selling their innovations) and innovation architects (firms that act as project managers to manage the overall large-scale innovation effort of many firms that are working jointly on the same project). At the end of the value chain are firms that commercialise innovations. These are innovation marketers (firms that profit from marketing their own and others' innovations) and innovation one-stop centers (firms that deliver products and services to customers based on the best innovations, whether they were discovered internally or externally) (Chesbrough, 2003b).

4.2.4.2. Open service innovation

Chesbrough (2007a, 2007b, 2011) also defined open service innovation due to the importance of innovation in knowledge-intensive services in advanced economies. Customers co-creation, external sourcing of ideas, technologies, and services, third-party investment and business models create and capture added value that leads to a more choice and variety for customers and increases the business performance (Figure 4.7.).

Effective service innovation requires utilisation of resources, efficient service value chain, customisation, standardisation, and product and service platform development (Chesbrough, 2011).

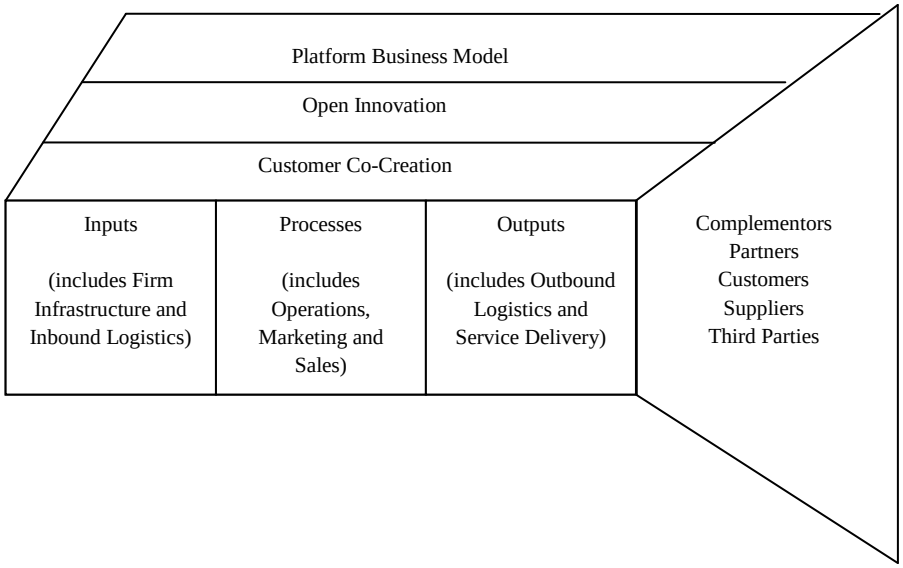


Figure 4.7. Open service value chain

Source: Chesbrough, H. (2011), *Open services innovation: Rethinking your business to grow and compete in the new era*. San Francisco, CA: Jossey-Bass, p. 35.

Open service value chain shows that when the firm's service value chain goes to market, the offerings of their co-operators do the same. The open service innovation makes innovation less costly, less risky and faster through the economies of scale and scope, the increased participation of stakeholders, the integration of knowledge and ecosystems of supporting firms, organisations and individuals (Chesbrough, 2011). Firms' innovation activities bring profits to the other firms if important prerequisites occur: the coherence of the business model's activities, inertia of the business model, new revenue models, front end/back end organisation, and business models platform (Chesbrough, 2007a, 2007b, 2011).

Hence, open innovation is different than a traditional closed innovation (Lakhani and Tushman, 2012, p. 37).

4.2.5. Open knowledge and technology according to Foray (2004)

Economics of innovation differs from the economics of knowledge. In the economics of knowledge, knowledge is an economic good, and it is sticky, non-pecuniar, dispersed, divided, cumulative, partially localised, weakly persistent, non-excludable and non-rival (Foray, 2004).

Rapid growth of knowledge occurs as a consequence of (Machlup, 2014; Foray, 2004, p. 35-36): (1) "*the role of science in the implementation of scientific knowledge bases directly useful to industrial innovation, (2) the appearance of a system of increasingly decentralized knowledge creation in which the production of innovations is a more socially distributed function, and (3) the evolution of industrial architectures towards more complexity and modularity, creating a greater need for new types of knowledge known as "integrative knowledge""* (e.g., standards, common architectures).

Knowledge expands through its codification (Foray, 2004, p. 36) and can be produced (1) *formally* through R&D and (2) *informally* through learning by doing or learning by using (Foray, 2004). The production of knowledge refers to social and private output of innovation, while R&D is an activity devoted to invention and innovation, it contributes to knowledge through human resources, patenting and publications (Foray, 2004, p. 7-10). Hence, (1) knowledge spawns innovation through *systematic and effective base for discovery and innovation,* (2) it allows *better control* (quality, impact, regulation) of new products and processes introduced, and (3) it *spurs entirely new products or processes* (Foray, 2004, p. 55).

In line with open innovation, "*knowledge openness*" (Love, Roper and Bryson, 2011; Foray, 2004, p. 165) occurs in cases of "*rapid disclosure of new knowledge, in which knowledge, both codified and practical, can circulate and be reproduced freely through learning for the purpose of modification or improvement in order to, consequently, generate a positive sum game*." Knowledge openness induces: rapid and complete distribution of knowledge, better coordination between agents, reduction of risk of knowledge duplication between research projects and functions (Foray, 2004, p. 166).

The systems of knowledge openness can occur either within a country (i.e., open science) or within an organisation (i.e., firm's research networks) (Foray, 2004, p. 183-184). It generates

economic efficiencies if incentives (reward systems, better efficiency, and sectoral performance) to the competitive environment exist (Wang, Noe and Wang, 2014; Foray, 2004, p. 181). These notions are relevant to open innovation as they must be fostered with the appropriate firm strategy. Hence, it is necessary to share the knowledge in the international environment while appropriately weighing of the costs and benefits thereof.

4.3. Challenges within the open innovation perspective

4.3.1. Asymmetry of information and coordination of innovation within a business model

The business model is an important aspect of organisational innovation due to its ability to increase organisational flexibility, decrease inertia and overcome commoditisation challenges (Chesbrough, 2010b, Zott, Amit and Massa, 2010; Lakhani and Tushman, 2012, p. 33; Carayannis et al., 2014). Open business models allow collaboration of the partnering organisations in the co-creation of innovation (Chesbrough, 2007b; Gambardella and McGahan, 2010). Furthermore, the emergence of collaborative communities or the development of complementary goods or services enable business models to become sources of innovation themselves (Chesbrough, 2003, 2010; Terziovski, 2010; Zott, Amit and Massa, 2010, p. 18).

Pursuant to a firm's market orientation which is an important contributor to the innovation performance (Narver and Salter, 1990; Jaworski and Kohli, 1993; Božić and Radas, 2005; Sisodiya, 2012), the asymmetry of information occurs between users and manufacturers (von Hippel, 2005) or between competitors. It is a result of sticky information and high costs of innovation development (von Hippel, 2005) that ultimately result in impeded efficiency (Foray, 2004, p. 42).

Various internal factors incite or hinder the asymmetry of information and the coordination of innovation within a business model. They affect open innovation activities. Some of them include: an organisation's complementary assets, innovation absorption capacity, motivation and learning effects and the level of task decomposition within firms (Torkelli, Kock and Salmi, 2009). The influence of these four aspects on an organisation's open innovation are described below.

4.3.1.1. Complementary assets

Complementary assets are "*distinctive resources of alliance partners that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner"* (Dyer and Singh, 1998, p. 666-667).

The existence of complementary assets is an important aspect of open innovation because internal R&D and external openness mutually complement each other by allowing easier assimilation and development of ideas and higher market value of innovations (Teece, 1986; Chesbrough, 2003; Dahlander and Gann, 2010). With respect to collaborations in the international environment, they tend to be generate more valuable, rare and difficult to imitate assets than a single firm assets (e.g., Nescafe and Coca-Cola for Nestea; Dyer and Singh, 1998). Torkelli, Kock and Salmi (2009, p. 182-183) differentiate between: (1) *complementary* propriatory *knowledge* combined with external knowledge to form an innovation, and (2) *complementary assets* such as brand names, distribution or service networks, or manufacturing capabilities.

Firms that generate mutually complementary assets should have compatible decision processes, information and control systems, strategies, capabilities and cultures (Doz, 1996; Wolpert, 2002) to allow advantageous innovation diffusion to occur (Beise, 2004, p. 1002; Wu, Wan and Levinthal, 2013). However, problems of finding potential partners and the access to the accurate and timely information can delay the process and result in the re-combination of complementary assets (Dyer and Singh, 1998). Thus, complementary assets provide a great source of competitive advantage which can be diminished in cases of information asymmetry. Firms need to analyse and be aware of their strengths and weaknesses to readily absorb and develop the complementary assets of their innovation partners. The challenges associated with innovation absorption are therefore provided in the following section.

4.3.1.2. Innovation absorptve capacity

Innovation absorptive capacity is a firm's ability to acquire, assimilate, transform and exploit the information and innovation found in the environment, which requires a flexible business model (Zahra and George, 2002; Dahlander and Gann, 2010; Spithoven, Clarysse and Knockaert, 2011).

When a firm possesses an absorptive capacity, external research and innovation complement the in-house research (Hagedoorn and Wang, 2012). Firms' investments into internal R&D increase firms' absorption potential (Cohen and Levinthal, 1990; Huang and Rice, 2009),

thereby enabling the technology acquisition to reinforce the relationship between technology exploitation and firm performance (Hung and Chou, 2013),

The absorptive capacity and innovation are path-dependent (Cohen and Levinthal, 1990). They evolve through networking (Huang and Rice, 2009, p. 216). Namely, the absorptive capacity develops cumulatively, based on the level of prior skills and knowledge; and its relatedness to a firm's current knowledge.

On the other hand, Diez-Vial and Fernandez-Olmos's (2012) study illustrated that the amount of internal knowledge does not necessarily influence the absorption of external knowledge. Knowledge stems from people (Dabić, 2011). Hence, the creation of absorptive capacity might not occur (Cohen and Levinthal, 1998) if it is locked into an embedded knowledge base, rigid capabilities, and a path-dependent managerial cognitions (Sedoglavich, Akoorie and Pavlovich, 2014). Therefore, an organisations' institutional elements such as trust, internal competition, complementary resources, technological uncertainty, consumer competition, future uncertainty (Khoja and Maranville, 2010) and human capital (Vinding, 2006) influence absorptive capacity development. However, absorptive capacity also depends on the organisation's external environment and on the transfers of knowledge across and within subunits (Todorova and Durisin, 2007).

Todorova and Durisin (2007) integrated absorptive capacity model of Cohen and Levinthal (1990) with Zahra and George's (2002) model and added the feedback loop on the knowledge source (Figure 4.8).

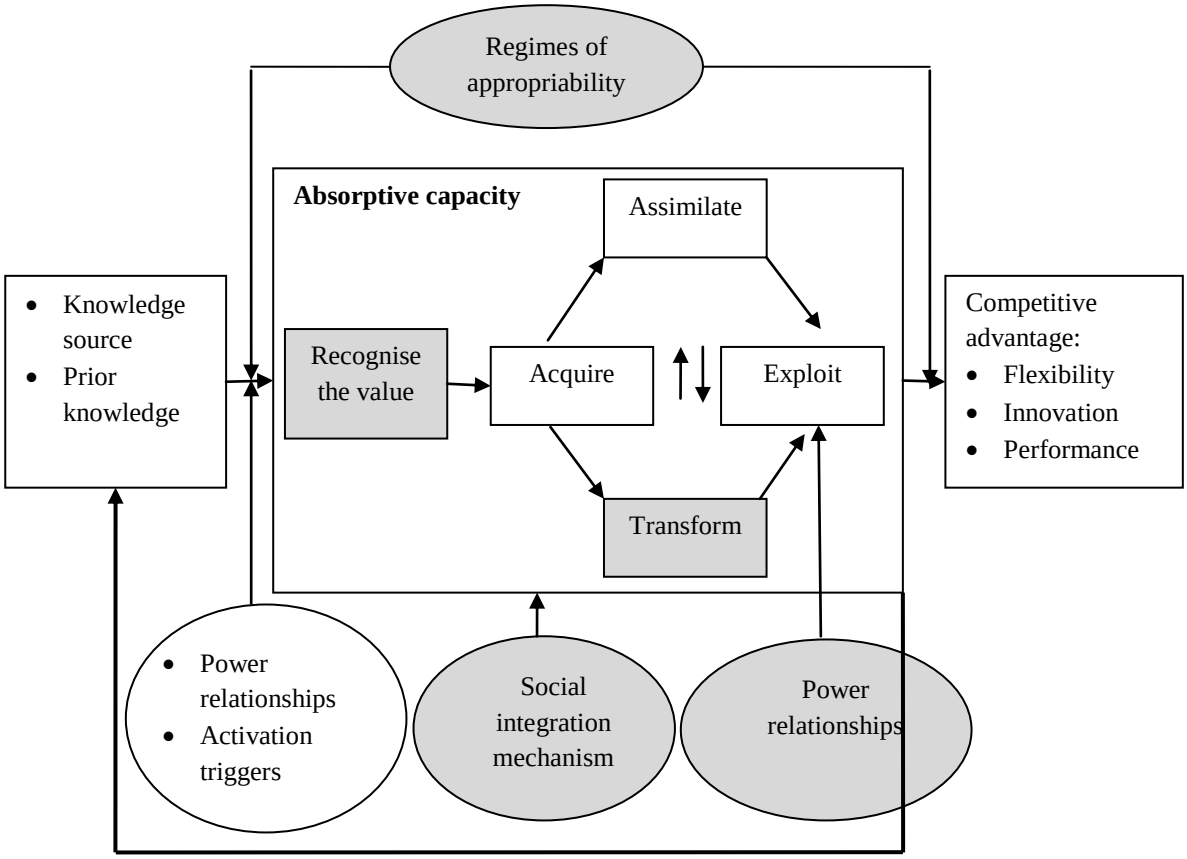


Figure 4. 8. A refined model of absorptive capacity

Source: Todorova, G., and Durisin, B. (2007), Absorptive capacity: Valuing a Reconceptualization. *The Academy of Management Review*, Vol. 32, No. 3, pp. 774-786, p. 776.

According to Todorova and Durisin's (2007) model, the assimilation and identification of new knowledge are influenced by investments in potential innovation collaborations in which integration influence knowledge absorption processes.

Apart from Todorova and Durisin's model, absorptive capacity is decomposed according to its influence on firms' innovation performance:

1) **Potential and realised absorptive capacity** (Zahra and George, 2002). Potential absorptive capacity consists of the acquisition and the assimilation capacity. It can be enhanced with the organisational *coordination* capabilities (e.g., cross-functional

interfaces), participation in decision making, and job rotation. Transformation and exploitation are parts of the realised absorptive capacity, which can be enhanced by *socialization* capabilities (e.g., connectedness and socialization tactics), and formalisation (Jansen, van den Bosch and Volberda, 2005).

2) **Capabilities of internal and external absorptive capacity** (Lewin, Massini, and Peters, 2011). Complementary absorptive capacity routines encompass formal and informal structures for the "*selection of ideas*, the *ways of sharing, combining and updating knowledge and practices"* on one hand, and "*identification of external knowledge* and routines for *learning from other organisations"* on the other hand (Lewin, Massini, and Peters, 2011). They are facilitated by good management practices of stimulating exploration, assimilation, and the transfer of knowledge back to the organisation (Lewin, Massini, and Peters, 2011, p. 85).
3) **"Technological" and "non-core" absorptive capacity** (Sedoglavich, Akoorie and Pavlovich, 2014). There exists a positive relationship between non-core absorptive capacity and international strategy exists and there is no relationship between technological absorptive capacity and international strategy (Sedoglavich, Akoorie and Pavlovich, 2014, p. 10). Sedoglavich (2012, p. 452) concludes that international activities are influenced by the firm's technology, but not the other way around.

4.3.1.3. Motivation and learning effects

A timely response to market conditions is enabled by opportunity and risk recognition (Beise, 2004, p. 1012) grounded in learning about different environments (Kogut & Zander, 1992; Teece, Pisano, & Shuen, 1997; Todorova and Durisin, 2007, p. 783). Herein, the motivation to learn and incite external participation into its innovation processes is important (Dahlander and Piezunka, 2014).

Hence, two types of knowledge become critical for successful innovations: (1) *technological knowledge* for exploratory learning (Cohen and Levinthal, 1990), and (2) *market knowledge* for exploitative learning. With respect to the two types of knowledge, firms participate in distinct international innovation networks (Dittrich and Duysters, 2007) that make them learn about and identify open innovation possibilities in a different way. This thesis' empirical study defined the generic (market-oriented) and specific (technically-oriented) identifications of open innovation possibilities.

4.3.1.4. The level of task decomposition within firms

Traditional, internal organisation-centered models of innovation and open innovation models imply different organisational boundaries and organizational designs (Lakhani and Tushman, 2012; Figure 4. 9.).

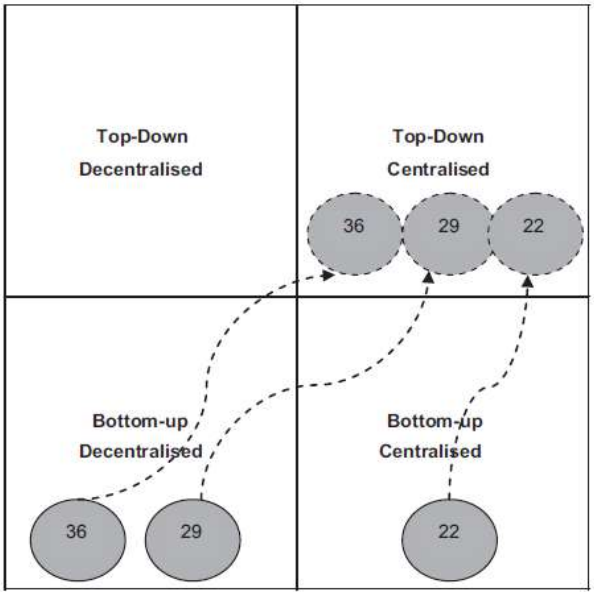


Figure 4. 9. Shift in open innovation adoption approach detected in their sample

Source: Mortara, L., and Minshall, T. (2011), How do large multinational firms implement open innovation? *Technovation*, Vol. 31, pp. 586-597, p. 593.

The differences in designs imply there is a need for coordination of open innovation activities within a firm (Mortara and Minshall, 2011) in which decentralised learning is enabled through teamwork effort, while the centralised learning allows time for innovation but can also inhibit it (Burgess, 2013).

Innovation processes should be flexible, allowing a firm to decompose its innovation tasks and access the necessary knowledge in a timely manner that does not affect the way an organisation functions (Lakhani and Tushman, 2012). Self-organising innovation communities in which firms gain necessary knowledge and innovation foster collaboration, process decomposition and knowledge dispersion (von Hippel, 2005; Chesbrough, 2010). In this way open innovation complements traditional innovations.

4.3.2. Relationship between speed and quality of a new product development

The agility and adaptability of product specification are important for the success of radical innovations in which trade-offs occur between the *quality* of the products on one side, and *delays* and *budget over-runs* on the other side (Blindenbach-Driessen et al., 2010; in Candi et al., 2013, p. 135).

If firms do not possess the necessary amount of internal R&D that fosters innovation efforts, they may access it quickly through its external acquisition (Lee et al., 2010, p. 295). This strategy is used when firms need to survive on the market. Its drawback is that it can result in lower competitive advantage because the benefits arising from the lengthy innovation processes result in building up tacit knowledge, reputation and relationships with external customers and partners (DiMinin, Frattini and Piccaluga, 2010, p. 157; Wang and Wang, 2012). Moreover, as inventions age, the uncertainty in their value appropriation is overcome and the likelihood of their commercialisation rises (Nerkar and Shane, 2007, p. 1158).

On the other hand, lengthier innovation process lead to the greater quality and availability of information about the market and about the innovation to the market, thereby resulting in the emergence of substitutes that may reduce the possible returns from innovation appropriation (Nerkar and Shane, 2007).

4.3.3. Limitations of the various intellectual property rights protection modes

Intellectual property rights facilitate research collaboration (Carayannis, 1999) in product or service developments of various technical complexities (Foray, 2004). Patents are examples of technically specific, industrial intellectual property rights that protect ideas and incorporate a degree of novelty, and copyrights are examples of non-technically specific intellectual property rights which protect the explanation of an idea (Foray, 2004, p. 131 and 140). The main purpose of the intellectual property rights is to *attract investors, enhance allocation of resources, reduce risk of duplication, and facilitate* trade in *information* (Foray, 2004, p. 103). Thereby, their value for open innovation is displayed in positive knowledge externalities (West et al., 2014)

If intellectual property is easily replicated, they are inefficient inhibitors of the firm's propriatory knowledge (Teece, 1986; Todorova and Durisin, 2007, p. 781). Hence, firms' R&D networks often have centres in domestic markets in order to protect innovation within the familiar environments (Di Minin and Bianchi, 2011). On the other hand, the deterministic nature and secrecy of intellectual property rights may disable new opportunities arising from collaborations with differing stakeholders (Wolpert, 2002; Belderbos et al., 2014).

Von Hippel (2005, p. 10) states that innovators sometimes freely reveal innovations because of the positive reputation and network effects of innovation diffusion that originates with it. Namely, a trade secret might not be a successful long-term strategy because many other innovators posses similar knowledge that can further improve the existing innovation process.

4.3.4. Game theory of managing and sharing innovation

Networking provides an interactive platform for the knowledge generation, collaboration and and transfer, enhances the availability of external knowledge and establishes a firm's cooperative pattern necessary for obtaining complementary know-how (Huang and Rice, 2009). It lowers firm's R&D costs (Pyka, 2007) and enhances firms' trust, reputation, reciprocity and interdependence (Larson, 1992).

'Informal know-how trading' is an important aspect of game theory associated with open innovation (von Hippel, 1988; Pyka, 2007, p. 365). Actors (firms) in the network could be better off if an appropriate coordination and patterns of industrial R&D (Pyka, 2007) allow firms to obtain valuable unique expertise (Chesbrough, 2010; Keupp and Gassmann, 2009b; Huang and Rice, 2009). Some factors affecting firms' willingness to share and manage information are explained below.

4.3.4.1. Availability of alternative innovative solutions

The structure of different forms of openness is displayed in Table 4.8. The aspects of freely revealing or sourcing innovation are opposed to the acquisition or sale of innovations, thereby posing challenges with respect to the costs of the product or service development. This is especially meaningful in the international environment in which foreign sourcing can result in

superior innovation performance (Kafouros and Forsans, 2013) although it might come with the increase in the cost of international innovation search. Alternatively, free revelation or sourcing of innovation might decrease the size of profits for the developing firm.

Table 4. 8. Structure of different forms of opennes

	Inbound open innovation	Outbound open innovation
Pecuniary	Acquiring	Selling
Non-pecuniary	Sourcing	Revealing

Source: Dahlander, L., Gann, D.M. (2010), How open is innovation? *Research Policy*, Vol. 39, str. 699-709, p. 703.

Torkelli, Kock and Slami (2009, p. 189) state that game theoretic issues pertain to the reciprocity of information sharing. If a potential user of a focal firm's knowledge expects to profit from applying that knowledge, a focal firm may hesitate to actually provide the knowledge, i.e. unless it will lose out on its future value. The choice of governance mechanisms (e.g., joint venture, merger) aligns the interests of both firms that benefit from the innovation. Hence, the game theory is played in the following way (Torkelli, Kock and Slami, 2009):

1) Firms sell innovations to the same partners from which they were bought.
2) Openness occurs through a bilateral exchange, developing over time and reducing the amount of broad search and random partner selection.
3) Communities of openness emerge as a result of repeated transactions between the firms.
4) As the value to firms of receiving the knowledge increases, the reciprocal sharing of information occurs mostly between large established firms.

4.3.4.2. Process of search and making innovations available in the market

Time-consuming and expensive internal product and service development demand from firms to seek solutions to the internal innovation obstacles on the market. The process is usually performed by engineers with knowledge on innovation (Pyka, 2007). Nonetheless, although acquainted with technical specificities, engineers might not be able to recognise potential partners because of their possibly poor managerial experience related to their inability to

acquire comprehensive non-technical information (Dyer and Singh, 1998). These limitations might lead to a broad innovation search (Garriga, von Krogh and Spaeth, 2013).

Hence, firms' search strategies can vary in depth and breadth (Garriga, von Krogh and Spaeth, 2013). Deep, thorough search positively affects incremental innovation, and the search breadth relates to radical innovation (Chiang and Hung, 2010).

4.3.4.3. Network externalities

Innovation diffusion causes network externalities to increase the benefits of innovation within different national and organisational contexts (Beise, 2004). Torkelli, Kock and Slami (2009, p. 187-188) indicate that in the presence of network externalities (and before the emergence of a standard) the *effect of complementary assets and absorptive capacity is muted, and the propensity to use external knowledge increases*. As explained by the network theory, this happens due to the coexistence of personal and professional relationships which shape the dynamics of innovation diffusion and enable adjustments to the changing market conditions and new strategic opportunities (Ceci and Iubatti, 2012).

Network externalities (Stoneman, 2007, p. 381): (1) propagate the number of innovation users, (2) reduce the *uncertainty* of the future dominant technology application, (3) provide *complementary inputs* to innovation processes, (4) *reinforce alternative diffusion drivers* and might beneficialy in the process of standard creation. They aid in innovation diffusion and facilitate open innovation and act as motivating factors for firms wishing to join the innovation landscape.

Open innovation is an important aspect of increasing firms' competitiveness in which game theoretic issues incure costs for firms. Therefore, institutional arrangements must set the foundation for easier collaboration and sharing of innovation between firms pursuing open innovation and internationalisation strategies.

Based on the theoretical issues presented up to this point, the next chapter describes the theoretical model placed in the setting of telecommunications industry.

5. PROPOSITION OF THE INTERNATIONALISATION MODEL ACCORDING TO OPEN INNOVATION IN THE TELECOMMUNICATIONS INDUSTRY

Previous chapters described the concepts of institutional environment, open innovation and internationalisation with a purpose of increasing firms' competitiveness. This chapter merges the given concepts and presents the model that was empirically tested in Chapter 6.

Firstly, the reasons for incorporating the telecommunications industry into the empirical research are explained. The global history and significance of the telecommunications industry is depicted. Since the Croatian telecommunications industry was chosen as the setting of the empirical research, its main indicators, trends and objectives are subsequently shown.

Secondly, the conceptual model of internationalisation of firms according to open innovation perspective is depicted together with the proposed model's variables and the explanation of the expected contribution of the empirical research.

5.1. Rationale for including telecommunications industry in the empirical research

High-technology sectors and knowledge-intensive services are typically chosen settings for the research on innovation and innovative performance. The rationale behind it comes from the fact that the advancements in these sectors occur more often than in any other industrial sectors. These sectors are either of strategic importance (aerospace and information technology) or of general benefit to the society (pharmaceuticals).

During the last century information and communications technology has become a foundation for the development of other industrial sectors (Shao and Lin, 2001; Groznik et al., 2003; Linestone, 2011).

The telecommunications industry influences the overall national economy (Yang et al., 2013). Its influence encompasses the development of businesses, communications and governmental power. Moreover, the majority of born global firms (Weerawardena et al., 2007) and the

highest share of products which go through incremental and radical changes are found in this sector (Andrijević-Matovac, 2005).

The telecommunications industry is composed of knowledge-intensive services (NACE J divison) and manufacturing of electronic components (NACE C21 and C26 division in 2010; Eurostat, 2013). Since the research on open innovation and internationalisation is bounded by institutional environment, it demands a specific research population within the information and communications technology. Hence, the empirical research was primarily conducted on the telecommunications industry.

The following sections describe the historic significance of the telecommunications industry in the world and present its key indicators for the Republic of Croatia. These indicators set the foundation for the interpretation of the empirical research data.

5.1.1. History and significance of the telecommunications industry in the world

5.1.1.1. Intertwoveness of telecommunications geopolitical and economic sphere

"If information is power, whoever rules the world's telecommunications system commands the world."

Peter J. Hugill (1999, p. 2)

Hugill (1999) sentence describes the geopolitical and economic importance of telecommunications based on the long run bidirectional causality between telecommunications infrastructure developments and economic growth (Pradhan et al., 2014). Primarily, breakthroughs in telecommunications have shaped the world and defined it as we know it today (e.g., the emergence of the first user friendly public telegraph line in 1844). Secondly, its strategic importance encompasses the military, economic and strategic spheres making it highly dependable on the regulatory environment, institutions and government objectives in which the shifts of global powers occur (e.g., Bell's transatlantic telephone cable in 1956 or satellite communications) (Hugill, 1999).

Hugill (1999, p. 18, p. 241) argues that regional power groupings in the era of geopolitical multipolarity, can be predicted on the basis of their communication strategy (e.g., its shift from Britain to the U.S. in 1956) which is nowadays based on satellites as an affordable strategic geopolitical tool.

As noted earlier in this thesis, European countries were fragmented between the developed North-Western countries and the less developed South-Eastern countries. Their telecommunications were highly regulated with a monopoly of one government-own enterprise and in which markets single operators created a lack of incentives for the increase in efficiency, quality, diversity and innovation (Sabolić, 2007, p.12). A positive relationship between the effective regulation and investment was hindered by the absence of the sound legal framework, the weak regulation and the government intervention (Paleologos and Polemis, 2013).

The attempts to deregulate and liberalise the telecommunications industry began in Europe in 1987 and finished in 1998 with the liberalisation of the voice telephony and telecommunications infrastructure licensing (Sabolić, 2007; Bažant et al., 2007, p.17 and 18 in Krajnovic et al., 2011, p. 12; Yang et al., 2013). Liberalisation resulted in the emergence of competitive pressures that incited infrastructure investment by government-owned incumbents and reduced investments of private incumbents (Lestage et al., 2013).

The strategic importance of telecommunications is indisputable and seen not only through the eyes of economists but also with respect to geopolitics and strategy.

5.1.1.2. Telecommunications technology, patents and international agreements

The international strategy of the global telecommunications firms is tailored to offer the same product on all international markets (Bartlett and Ghoshal, 1989). With respect to standardisation, the three Kondratieff cycles in telecommunications were based on capital-intensive information and transport infrastructures in which the telephone occupies a localised, national niche in an international environment (Hughill, 1999, p. 53). Radio formed a foundation for the mobile telephony and the programmable computer evolved into a personal computer in the late 1960s (Hugill, 1999, p. 20). Each technology carries

geopolitical (Hughill, 1999, p. 20-21) and economic and business importance (Carayannis, Clark and Valvi, 2013).

Due to the nature of technological breakthroughs it is important to identify the importance of knowledge and innovation shaped by the exploitation of the intellectual property rights in global telecommunications environment. Hence, the example of Marconi who foresaw the significance of the radio technology for the international communications. He controlled his and some of the other inventors' patents until the international agreements, manipulation of domestic politics and patent pooling forced him out of the monopoly power (Hughill, 1999, p. 92-97).

Morconi was forced to create his own firm to exploit his patenting rights, thereby controlling the transit of communication. By protecting his intellectual property rights, his firm created geopolitical problems to other countries' firms, leaving the concern that the United Kingdom would control the global telecommunications (Hugill, 1999). His monopoly ended after several international radiotelegraph conferences, but his patents regained its profitability after the U.S. Congress passed the acts which enabled him to exploit his patents in ships and shore installations (Headrick, 1991, p. 121; Hugill, 1999, p. 121).

In order to exploit technological developments, innovations and intellectual property rights, a firm must be able to position itself in the industry and decide upon its strategies to exert the greatest benefits. Technological developments and patenting raise competitiveness through: (1) the user model (the anticipation of customers' reactions),(2) the competitive model (the anticipation of the reactions of competitors and perception of a profit competitor), and (3) the entrepreneurial model (selection of the course of action depending on the user and the competitive model) (Audestad et al., 2006, in Krajnovic, 2011, p.2).

The following section therefore portrays the global telecommunications data which help firms to grasp a better understanding of their positions, the size and trends in the market.

5.1.1.3. Contemporary global telecommunications definitions and data

Indicators presented in this section grasp the comprehensiveness and the importance of the global telecommunications industry.

5.1.1.3.1. Global telecommunications indicators

The leading publisher of technology, regulatory and standard information on global telecommunications statistics is the International Telecommunications Union (ITU) which was founded during the second International Telegraph Conference in 1868 in Vienna. It gathers historical data encompassing telegraph, telephone and radio statistics since the late 19th and early 20th centuries.

Fixed electronic communications network is used to provide voice services and is the base for the provision of other services in the telecommunications market. These services include leased lines used by mobile operators and Internet service providers without their own transmission facilities (International Telecommunications Union, 2014, p. 5). Europe stands out with the rise of 28% in the fixed-broadband penetration rate compared with the global average of 10%. Its global slow down is contrasted only in in developing countries (International Telecommunications Union, 2014).

There are about 3 billion Internet users globally and 2.3 billion mobile broadband users showing the mobile-broadband penetration rate of 32%: 21% in developing countries, 64% in Europe, 59% in the Americas, 25% in the Arab States, 23% in the Asia-Pacific and 19% in Africa (International Telecommunications Union, 2014). Africa exihibits the fastest growing market segement (growth rate of 40% in Africa) (International Telecommunications Union, 2014).

Mobile-cellular penetration is 121% in developed and 90% in developing countries, approaching the saturation levels portrayed in the lowest growth rate of 2.6% globally, which is mainly attributed to the rise of mobile penetration in developing countries (International Telecommunications Union, 2014). ITU (2014) reports that 40% of the world population uses the Internet, and that the highest Internet penetration rate in 2014 was 75% in European countries.

5.1.1.3.2. *European telecommunications trade statistics*

The interest of this study encompasses the geographical boundaries of the Republic of Croatia. The Republic of Croatia is a part of the European Union since 1 July 2013. Hence, its key indicators on European trade and regional integration telecommunications agreements are obtained from the World Trade Organisation's website and illustrated in Appendix 2 (WTO, 2014).

European countries' telecommunications equipment exports are mainly directed to the other European states (9.7 billion U.S. dollars) and the U.S.A. (6.1 billion U.S. dollars); while the exports of integrated circuits and electronic components flow towards the other Asian countries (4.7 billion U.S. dollars) and China (3 billion U.S. dollars) (WTO, 2014).

Regional integration agreements statistics of the 28 European Union countries in 2013 shows that imports to the European Union countries are the highest between the countries themselves (244.187 agreements) in office and telecom equipment, and with the countries in Europe[3] (95.203 agreements) in electronic data processing and office equipment, telecommunications equipment (121.753 agreements) and integrated circuits (31.300 agreements).

This section concludes the analysis of global telecommunications exclamating the following points:

- the usage and regional trade supremacy of the European Union countries,
- the developing countries' growth potential,
- the mobile-cellular penetration saturation,
- and the changing nature of telecommunications from voice transmission to imaging, audio, documents and similar data transmission to be enabled by the modern Internet access.

[3] Both in the European Union and outside of the European Union.

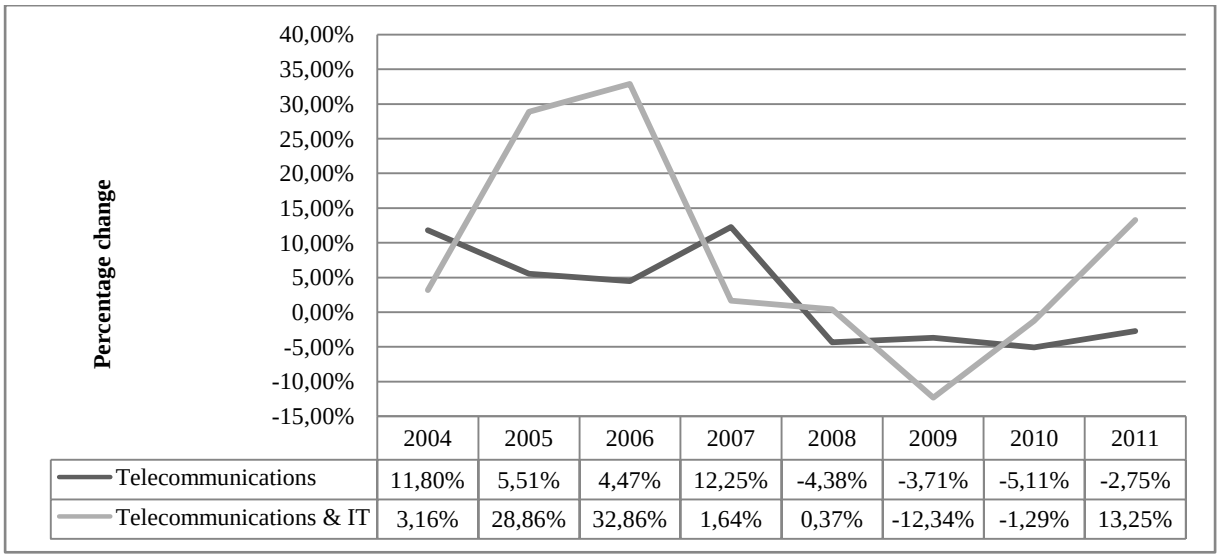
5.1.2. Outline of the Republic of Croatia's telecommunications industry

This section firstly describes the Croatian telecommunications market in order to give an outline of the Croatian telecommunications industry.

Croatian telecommunications market is characterised by oligopoly (Krajnović, Čičin-Šain and Predovan, 2011), human capital intensity and strong spatial concentration (Vuković and Kovačević, 2010). These characterstics together with the low financing availability and internal resistence to change create obstacles to innovation (Andrijević-Matovac, 2005). Moreover, services generate higher profits and are a dominant part of the sector (Vuković and Kovačević, 2010). Firms enter the Croatian telecommunications industry if the positive impact of fast-growing industries, high technological opportunity and the lack of entry barriers coexist (Kovačević and Vuković, 2007a, 2007b). Between 1997 and 2004 the productivity of the telecommunications industry increased due to a rise in revenue and a fall in employment (Kovačević and Vuković, 2007a).

An overview of the contemporary telecommunications industry data provided by the Croatian Regulatory Authority for Network Industries ("HAKOM") shows the composition of the electronic communications market services in total revenue in 2012 (Appendix 2). The majority of revenue comes from the mobile network services (51.30%), fixed network services (24.21%) and Internet access services (18.49%) (HAKOM, 2013, p. 18).

Year-on-year change in operative revenue given in Orbis database (2013) is given in Figure 5.1.



	2004	2005	2006	2007	2008	2009	2010	2011
Telecommunications	11,80%	5,51%	4,47%	12,25%	-4,38%	-3,71%	-5,11%	-2,75%
Telecommunications & IT	3,16%	28,86%	32,86%	1,64%	0,37%	-12,34%	-1,29%	13,25%

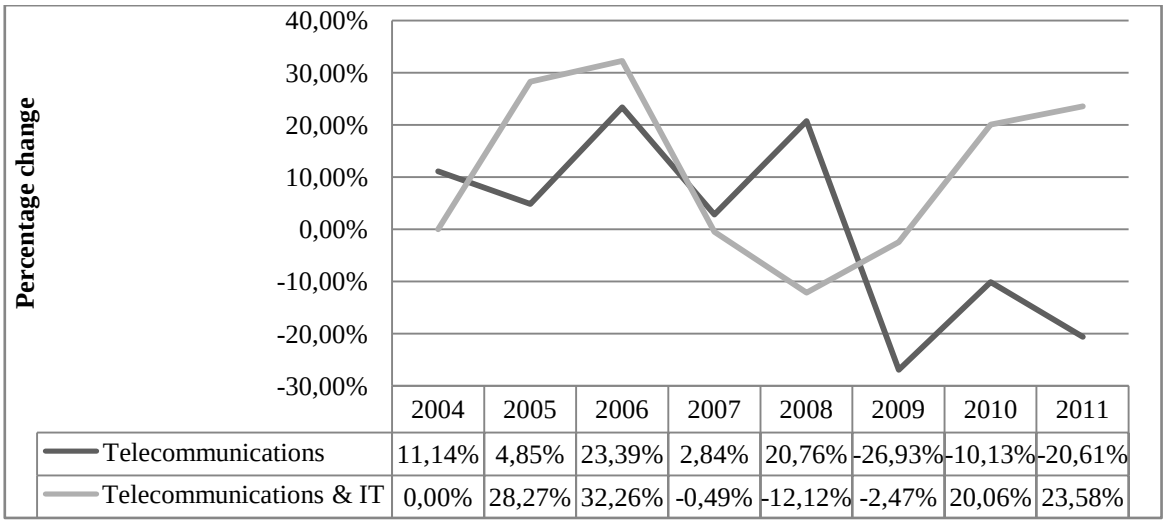
Figure 5. 1. Year-on-year change in operative revenue

Source: Orbis (2013) Database [online]. Available at: orbis.bvdinfo.com (1 November 2013)

The year-on-year change in operative revenue (Figure 5.1.) shows that the telecommunications industry started its downturn in 2008. This downturn aligns with the start of the global recession. The change in operative revenue is responsive to global market conditions. There was a rise in information technology services revenue in 2011 and the fall in the total telecommunications industry's revenue. Telecommunications industry is more institutionally bounded than information technology services. Therefore, its revenue is less responsive to global market conditions and more responsive to domestic market conditions.

Although HAKOM's (2013) Annual Activity Report for 2012 emphasises the rise in infrastructure and equipment investment, especially in the electronic communications market (Appendix 2), Croatian telecommunications investments are below the average European Union's telecommunications investment (HAKOM, 2013, p. 21).

Data on the Croatian telecommunications services and merchandise trade (Appendix 2) shows that, apart from telecommunications services, balance of trade is in deficit. The trade in telecommunications services records a surplus as a result of the Croatian tourism. Namely, more tourists, who use Croatian mobile network operators to make international calls, arrive to Croatia than do Croatian tourists go abroad. Yearly changes in exports are illustrated in Figure 5.2.



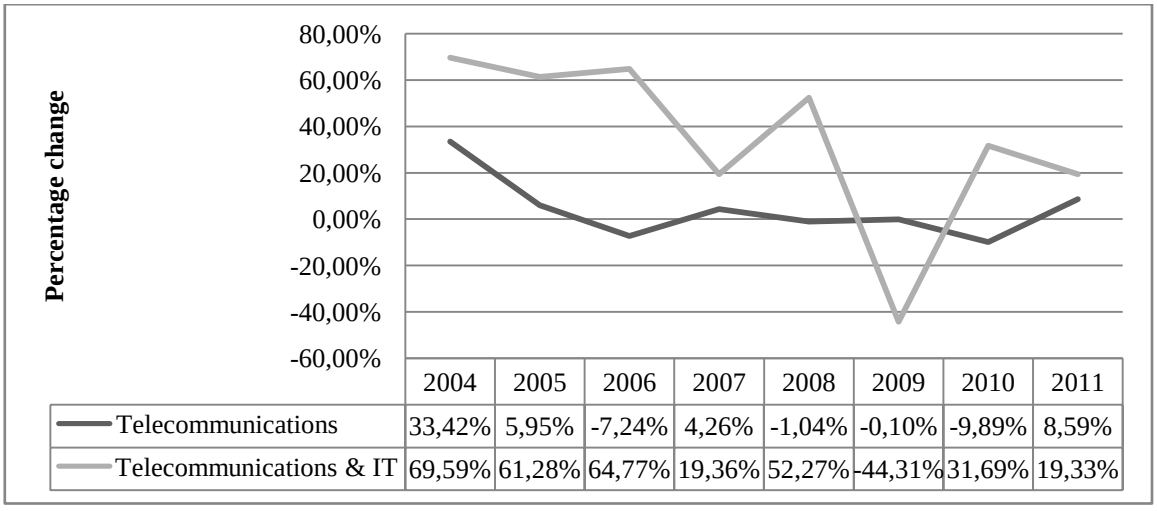
	2004	2005	2006	2007	2008	2009	2010	2011
Telecommunications	11,14%	4,85%	23,39%	2,84%	20,76%	-26,93%	-10,13%	-20,61%
Telecommunications & IT	0,00%	28,27%	32,26%	-0,49%	-12,12%	-2,47%	20,06%	23,58%

Figure 5. 2. Year-on-year change in exports

Source: Orbis (2013) Database [online]. Available at: orbis.bvdinfo.com (1 November 2013)

Figure 5.2. shows greater dynamics of the information and communications industry compared to telecommunications alone. The information and communications industry exhibits a lower fall in exports and a faster recovery implying lower institutionalisation to a national environment.

Figure 5.3. shows the yearly change of intangible assets in the information and communications technology, while the values of intangible assets are given in the Appendix 2.



	2004	2005	2006	2007	2008	2009	2010	2011
Telecommunications	33,42%	5,95%	-7,24%	4,26%	-1,04%	-0,10%	-9,89%	8,59%
Telecommunications & IT	69,59%	61,28%	64,77%	19,36%	52,27%	-44,31%	31,69%	19,33%

Figure 5. 3. Year-on-year changes in intangible assets

Source: Orbis (2013) Database [online]. Available at: orbis.bvdinfo.com (1 November 2013)

The values and yearly changes of values of intangible assets in the information and communications technology are larger and more responsive for information and communications technologies firms than firms dealing only with telecommunications. The data is similar to the data on operative revenue and exports.

5.1.2.1. Croatian fixed telecommunications market

The *Croatian Telecom*'s (*T-HT*) monopoly on the Croatian telecommunications market ended in 2003 and set the foundation for the telecommunications market liberalisation of the the first alternative operator, *Optima Telekom* in 2007 (HAKOM, 2013).

Privatisation outcomes depend on regional factors related to market profitability, wealth, and geography (Gasmi et al., 2013). Similarly, liberalisation in the Croatian telecommunications market led to a greater market competition, a decline in *T-HT*'s market share, the rise in the number of users, the fall in prices (such as broadband Internet access and monthly access fees) and an increase in the quality of services (HAKOM; 2013; Krajnović et al., 2011). Special service packages with lower prices and new services were created in order to attract new users and preserve the existing ones (HAKOM, 2013). Other European countries and firms experienced the analogous processes in which regulation incited efficiencies and competition reduced the price levels accros the industry (Fraquelli and Vannoni, 2000).

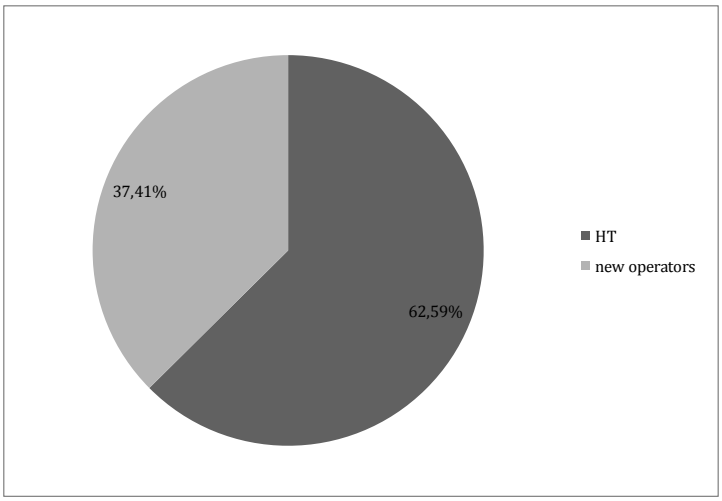


Figure 5. 4. Fixed telephony market share

Source: HAKOM (2014), Market share. [online] Available at: http://www.hakom.hr/UserDocsImages/2014/e_trziste/GOD%20ENG%202013_Market%20share%20by%20subscribers-fixed.pdf [22 July 2014]

However, *T-HT* nowadays serves 62.59% of the market and owns the majority of the fixed telephony market (Figure 5.4.) T-HT's share is attributable to the HAKOM's ex ante regulation (HAKOM, 2013).

In the light of a sharp decrease in the number of fixed telephone subscriptions in Croatia since 2010 aligned with global trends the total revenue from fixed telephone services fell by 7.69% from 2011 to 2012, HAKOM (2013, p.28) reports that this decrease comes from the substitution of fixed public communications networks with mobile networks and increased use of broadband services.

5.1.2.2. Croatian mobile telecommunications market

The first analogue mobile network service in Croatia began in 1990 and its liberalisation started in 1998. The first private and commercial mobile network operator entered the market in 1999 (HAKOM, 2013). After *VIPnet*'s market entrance, the third mobile operator *Tele2* began its commercial operation in 2005 (HAKOM, 2013). Competitions intensified in 2006 and 2007 through strong marketing campaigns, tariff options, expansion of services and lower prices.

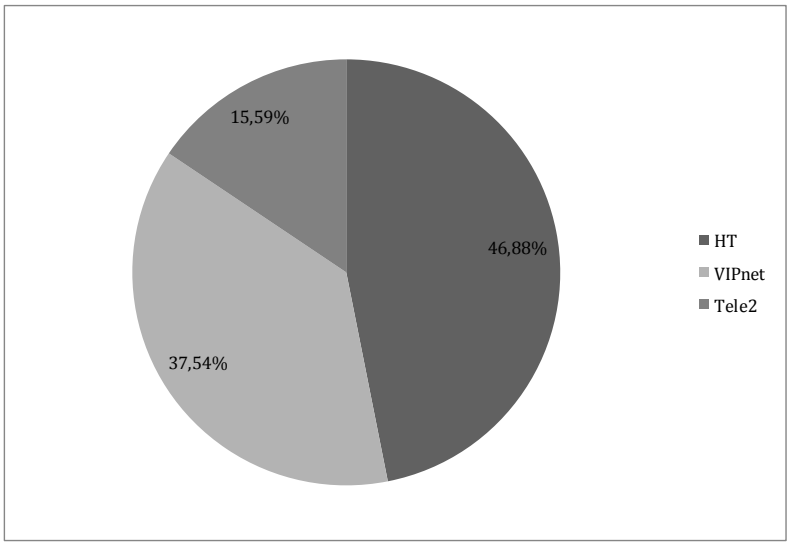


Figure 5. 5. Mobile-cellular-telephony market share

Source: HAKOM (2014). Market share. [online] Available at: http://www.hakom.hr/UserDocsImages/2014/e_trziste/GOD%20ENG%202013_Market%20share%20by%20subscribers_mobile.pdf [22 July 2014]

In the mobile-cellular telephony the majority of the market share is held by *HT* (46.88%) (Figure 5.5.). *VIPnet* follows (37.54%), while *Tele2* owns the lowest market share (15.59%). A low share of the market held by new operators cames with the problems of wholesale line rental provision (HAKOM, 2013, p. 28-29).

In 2011 the number of mobile cellular subscriptions peaked and reached more than 5.1 million subscribers in Croatia, and in 2013 it positioned itself at about 4.9 million (International Telecommunications Union, 2014). The Croatian population was about 4.26 million in 2013 (Croatian Bureau of Statistics, 2014). Accordingly, mobile network penetration peaked in 2010 amounting to 143.45% and 114.64% in 2013 (HAKOM, 2013). Sabolić (2007, p. 270) notes that the mobile penetration reached the saturation level due to the join dominance of two operators. After the third operator, Tele2, entered the market, mobile penetration started to rise. Fall in the number of subscriptions in the years following the peak came from: the changing habits of consumers (users downsized the number of SIM cards), the introduction of new tariff bundles (a significant amount of free minutes and data traffic), lower or similar prices of telephone calls towards other national mobile and fixed networks (HAKOM, 2013, p. 35). Additionally, the global economic crisis influenced a downturn.

5.1.2.3. Croatian Internet market

Establishment of the *Croatian Academic and Research Network* (*CARNet*), as the first Internet Service Provider (ISP) in Croatia, in 1991 led to the introduction of the Internet in Croatia (HAKOM, 2013; Krajnović et al., 2011). *CARNet*'s first international connection was set up in October 1992 through Austria. Today, 68.58% of the total broadband subscriptions are attributed to those of the fixed communication network and the remaining 31.42% are formed by the mobile telecommunications network (HAKOM, 2013).

5.1.2.4. Croatian telecommunications market overview

The Croatian telecommunications industry is composed of several main players who possess the highest amount of the market share: *T-HT*, *VIPnet*, *Tele2*, *Ericsson Nikola Tesla*, *Nokia Siemens Networks*, *GDIGisdata*, *OiV*, and others (Figure 5.6.).

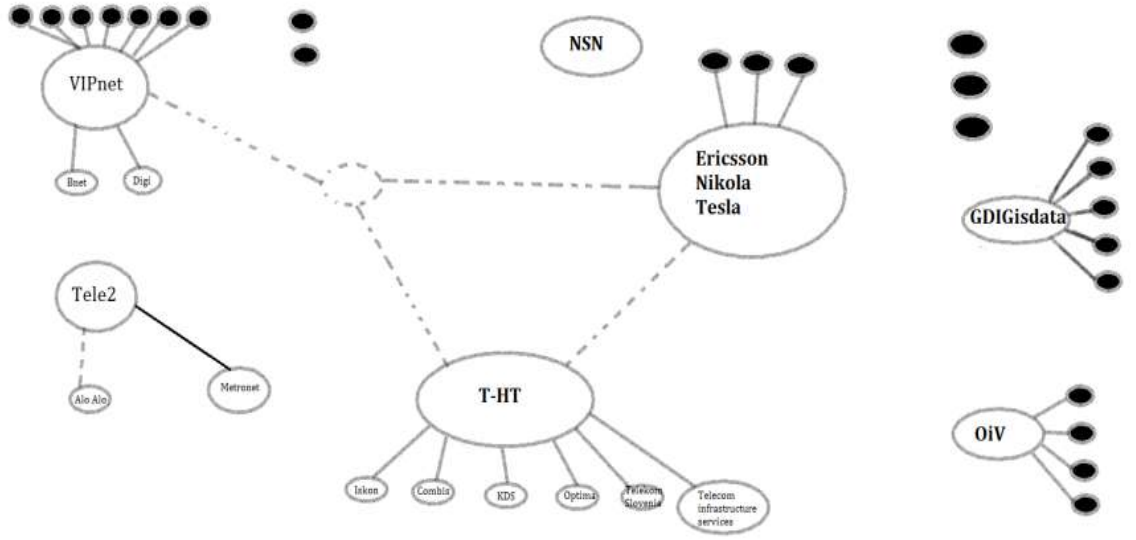


Figure 5. 6. Structure of the telecommunications industry

Source: Author's representation.

The incumbent *HT* preserved the highest share in all market segments with respect to the number of users, revenue and outgoing traffic in spite of the liberalisation of the telecommunications market (Appendix 2; HAKOM, 2013). The industry structure fosters various ties among the service providers and other firms in the industry. The connections are noted in terms of marketing, distribution and sales, but also with respect to the industry's innovation efforts which expand into international domain. Namely, the majority of the players on the telecommunications market are in foreign ownership: *T-HT* by *Deutsche Telekom*; *VIPnet* by *Austria Telekom*; *Ericsson Nikola Tesla* and *Tele2* with their Swedish counterparts.

5.1.2.5. SWOT analysis of the Croatian telecommunications industry

This section summarises strengths, weaknesses, opportunities and threats of the Croatian telecommunications market (Figure 5.7.).

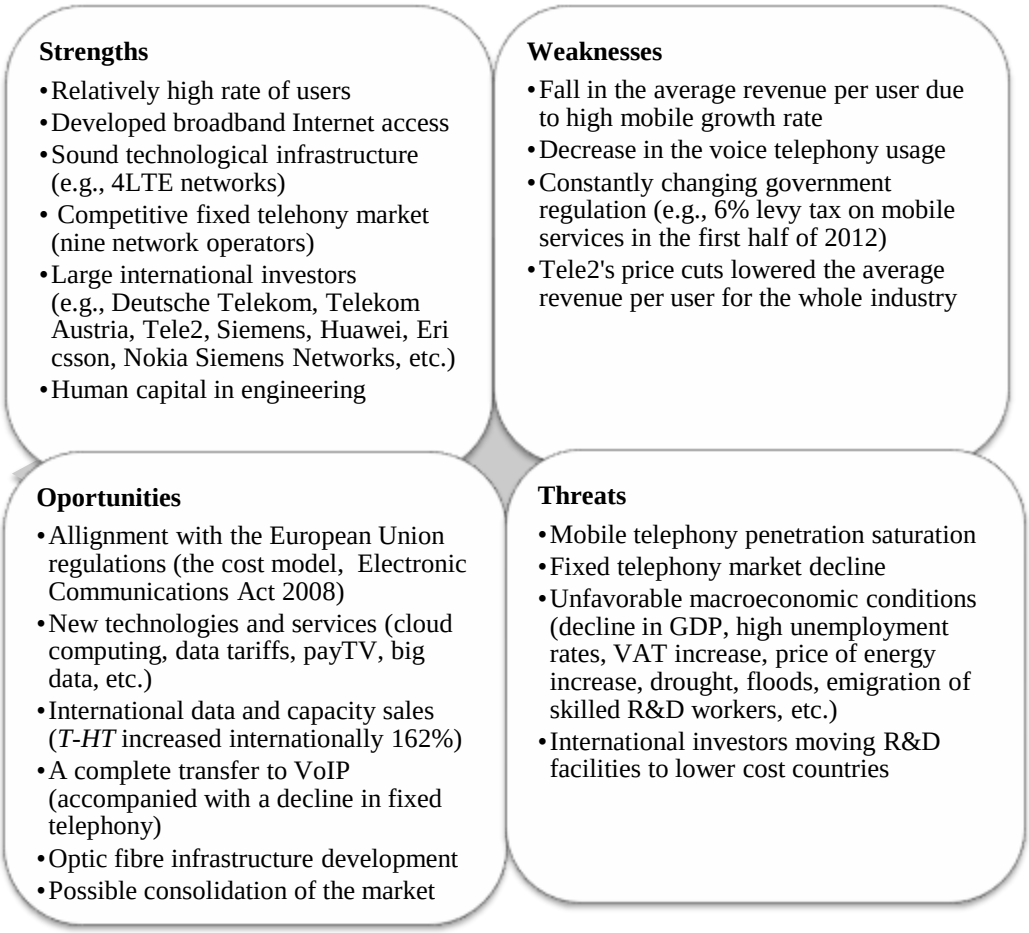


Figure 5. 7. SWOT Analysis of the Croatian telecommunications

Source: Adapted from HAKOM (2013) Annual activity report for 2012. [online] Available at: http://www.hakom.hr/UserDocsImages/2013/izvjesca_i_planovi/Annual%20Activity%20Report%202012_HAKOM.pdf (22 July 2014); and HT (2013) *Annual investor report*. [online] Available at: http://www.t.ht.hr/investitori/pdf/Godisnje-izvjesce-Uprave-o-stanju-i-poslovanju-Drustva-12.pdf (22 July 2014)

5.2. Conceptual model of internationalisation according to open innovation perspective in the telecommunications industry

The previous chapters and the historical and contemporary telecommunications data presented earlier in this chapter, provide the rationale for the conceptual model presented in this section.

Inefficient cooperation with government agencies and research institutes encompass the main shortages of the Croatian innovation environment (European Commission, 2013). Government agencies' tardy business decisions disable the progress in the industry. Moreover, once a firm sets up a successful business model, it is difficult to alter it. A firm's inertia to change the existing model can cause the under-utilisation of business potential and the loss of a competitive advantage (Hannan and Freeman, 1984; Chesbrough, 2011; Huang et al., 2013; Škrtić and Mikić, 2009). Inertia within a firm disables it to use open innovation and respond to market changes. Therefore, it is important to recognise the source of inertia, and identify the types and organisational reactions to inertia. Hirschman (1970) and Furrer, Tjemkes and Henseler (2012) describe the set of strategic reactions which organisations use to respond to changes in the environment and overcome inertia. These strategic reactions include: opportunism, exit from the market, neglect, patience, considerations, creativity and aggression. These reactions imply active and passive modes of businesses' open innovation and internationalisation.

In terms of firms' network relationships the hierarchical control and the strength of a firm are the main determinant of a firm's competitiveness (Wright and Dana, 2003). Successful firms share the knowledge with other firms and transform information into knowledge by adjusting themselves to the environment which creates and uses that knowledge (Taft et al., 2012). With that in mind internationalisation through the global value chains increases firms' efficiencies and profits (Wright and Dana, 2003, p. 139).

The purpose of this thesis is to constructively and comprehensively analyse the influence of open innovation on innovation and internationalisation in order to understand and identify the dynamics of the innovation processes in the Croatian telecommunications industry.

This is to be done by answering the following research questions:

1) What is the relationship between firms' open innovation and internationalisation?

2) How do firms manage different open innovation perspectives in cases of institutional inertia? How can a firm overcome institutional inertia?

3) How does the institutional environment influence the relationship between open innovation and internationalisation?

In line with the research questions, Hypothesis 1 examines the effect of open innovation on internationalisation. It is formed around three sub-hypotheses: the effect of open innovation on innovation performance, the effect of open innovation on international position and the effect of open innovation on international success.

Hypotheses 2 and 3 measure the moderated-mediation effects, i.e. the mediation effects in the relationship between open innovation and internationalisation through innovation. Hypotheses 2, 3, 4 and 5 incorporate the subjective indicators based on the previously existing surveys and adapted to correspond to the content of this research. Hypothesis 2 measures the formality of cooperation practices in the firms' innovation exchange (De Luca and Atuahene-Gima, 2007; Zahra, Ireland and Hitt, 2000; Lichtenthaler, 2010). Independent moderating variable in Hypothesis 3 is the knowledge and skills of management. Three types of knowledge and management skills are measured: international knowledge, managerial and teamwork skills (Zahra and George, 2002; Oviatt and McDougall, 1995; Bloodgood et al., 1996; Burgel and Murray, 1998; Westhead, Wright and Ucbasaran, 1998; Griffith and Hoppner, 2013). Hypotheses 4 measures the moderation effect of innovation on internationalisation. Independent moderating variable in Hypothesis 4 is a subjective indicator of radical innovation, which measures the extent to which a firm's innovation is new to the market (Sisodiya, Johnson and Gregoire, 2013; Delingonul, et al., 2011; Liao, Tsai and Hsu, 2012). Hypothesis 5 measures the institutional regulatory support for innovation internationalisation, which is a subjective independent indicator of the government role in open innovation and internationalisation (Busenitz, Gomez and Spencer, 2000; Doz, Santos and Williamson, 2001).

A detailed statement of the hypotheses and their explanations follow.

Hypothesis 1. The level of open innovation a firm undertakes positively influences the firms' internationalisation.

Hypothesis 1a. A more active open innovation positively influences the firms' innovation performance.

Hypothesis 1b. A more active open innovation positively influences the firms' international position.

Hypothesis 1c. A more active open innovation positively influences the firms' international success.

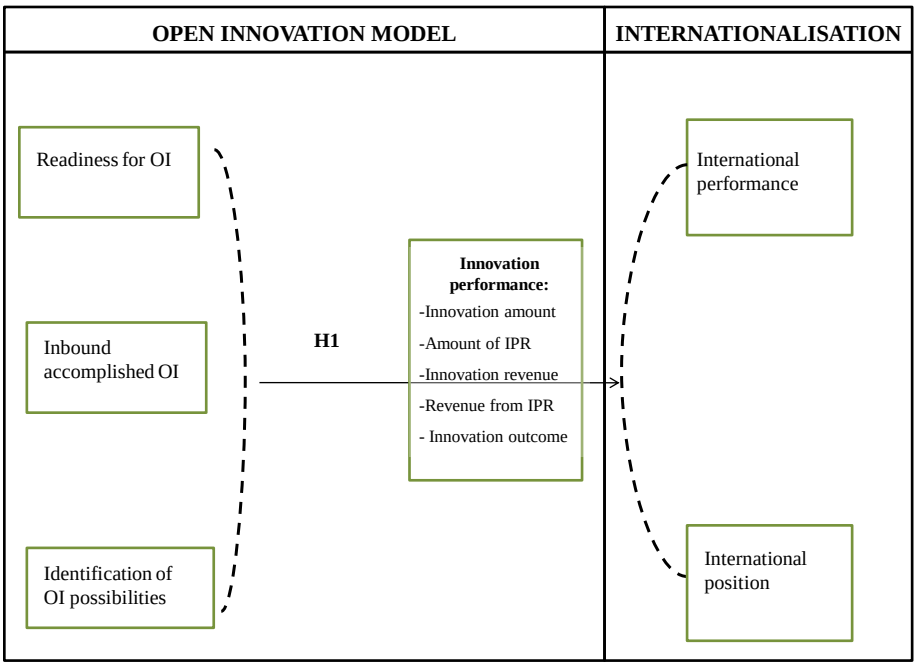


Figure 5. 8. Proposed model for Hypothesis 1

In order to study the similarities between open innovation and internationalisation and to determine their significance, four perspectives of open innovation are examined. These four OI perspectives include: readiness for open innovation, generic (market-oriented) identification of open innovation possibilities, specific (technically-oriented) identification of open innovation possibilities and inbound accomplished open innovation. Three sub-hypotheses examine differences in the activity of open innovation that are explained with respect to the innovation performance which serves as a prerequisite for successful

internationalisation. The first hypothesis tests whether higher open innovation induces greater internationalisation (Knight and Cavusgil, 2004; Kyläheiko et al., 2011) according to two measures: the international position of a firm relative to other firms in the industry and the firms' international performance in terms of revenue generated abroad. Better international position points to the greater ability to access external information and knowledge, and can, in turn, lead to greater open innovation (Tsai, 2001). It is, therefore, an essential indicator of internationalisation.

Firms' international position is defined by: a firm's revenue compared to international competitors, sales in relation to international competitors, market shares in relation to international competitors, profit compared to international competitors, quality of new products compared to international competitors (De Luca and Atuahene-Gima 2007; Langerak, Hultink and Robben, 2004, Doblinger, 2013). International success is measured by the share of revenue from overseas sales in total revenues of the firm, the share of income from foreign subsidiaries in total revenues and the number of markets in which the firm is active (Doz, Santos and Williamson, 2001; Frishammar and Andersson 2009; Parida, Westenberg and Frishammar, 2013; Lasagni, 2012; Christensen 2006).

In the review of 356 publications on telecommunications services internationalisation the majority of contributions focused on regulation policy, strategic alliances and incumbents' reactions to deregulation and liberalisation encompassing wireline telephony, while contemporary technologies and segments of mobile and broadband Internet are neglected (Jakopin, 2008).

In order to portray the dynamics of international activities and the open innovation perspectives, this hypothesis examines the relationships between them.

Hypothesis 2. *A higher rate of formal cooperation between firms moderates the relationship between open innovation and internationalisation through the firms' innovation performance.*

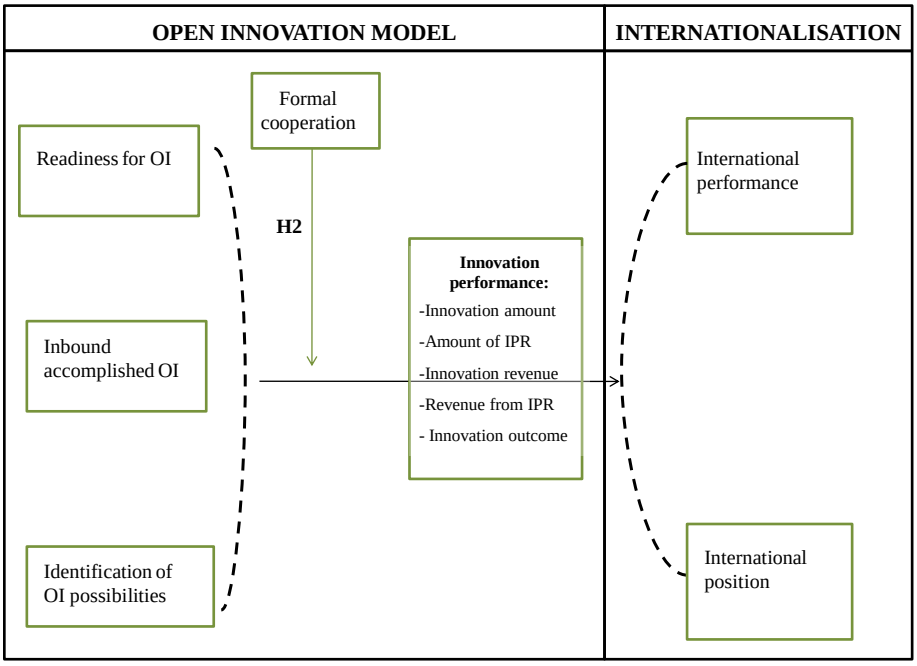


Figure 5. 9. Proposed model for Hypothesis 2

In order to examine the dynamics within the proposed open innovation and internationalisation model, different open innovation perspectives are subjected to several moderators such as formal cooperation and knowledge and skills of a project team. Innovation can be bought on the market or acquired in return for the future profits on one hand, or it can be sold or given to the market on the other hand (Dahlander and Gann, 2010). Innovation can be licensed or rented, while the purpose of its incorporation into a product or process can be established outside of its present horizontal or vertical cooperation practices (Lee et al., 2010). If a firm opts for some of these market innovation transactions, it opted for a new way of commercialisation of innovations that follows a certain level of formality (Chesbrough, 2003; von Hippel, 2005; Dahlander and Gann, 2010; Lee et al., 2010; Parida, Westerberg and Frishammar, 2013). Formal cooperation model in the second hypothesis measures the extent of formal collaboration and innovation exchange (De Luca and Atuahene-Gima, 2007; Zahra, Ireland and Hitt, 2000; Lichtenthaler, 2010).

Innovation culture involves arranging firms' internal business processes in line with market trends which are mobilised via behavioural and constitutive approaches (Doz, Santos and

Williamson, 2001; Delingonul et al., 2013). Behavioural access to enterprise strategic cooperation for innovation depends on management commitment, trust, and their opinions about sharing knowledge and porous borders of cooperation and exchange of innovation (Deligonul et al., 2013). It is characterized by a lower degree of the innovation transfer formalization and portrayed through constituents' industrial secrets and established mechanisms of formal relationships between the carrier and the recipient of innovation such as: formal intellectual property rights and joint ventures for the development of a new product or service (Deligonul et al., 2013).

Hence, formality matters. Du, Leten and Vanhaverbeke (2014) found that project management formality moderates the influence of open innovation partnerships on performance. Science-based partners perform better under less formal cooperation, while market-based partnership is carried out better under higher formality. Consequently, differences between formal and informal partnerships are influenced by: lack of qualified staff, amount of radical innovations, the size of R&D investment, number of employees and market orientation (Božić, 2007). On the other hand, Häussler (2010) found that in the relationship with competitors firms regulate knowledge outflow more in formal channels and less with informal, while collaborations decrease the importance of formality and tends to foster knowledge exchange. Moreover, service open innovation is more informal than manufacturing open innovation (Mina, Bascavusoglu-Moreau and Hughes, 2014). Although formal mechanisms of cooperation are crucial in the transfer of knowledge, the process of requesting and assigning innovation requires a critical level of network externalities and available innovation on the market (Torkelli, Kock and Salmi, 2009) which is transferred through informal channels in which a critical level of constituent's formal mechanism leads to rigidities in the transfer of innovations and their lower efficiency. These theoretical underpinnings show the necessity of testing the second hypothesis.

Hypothesis 3. *Knowledge and skills of the project team moderate the relationship between open innovation and internationalisation through the firms' innovation performance.*

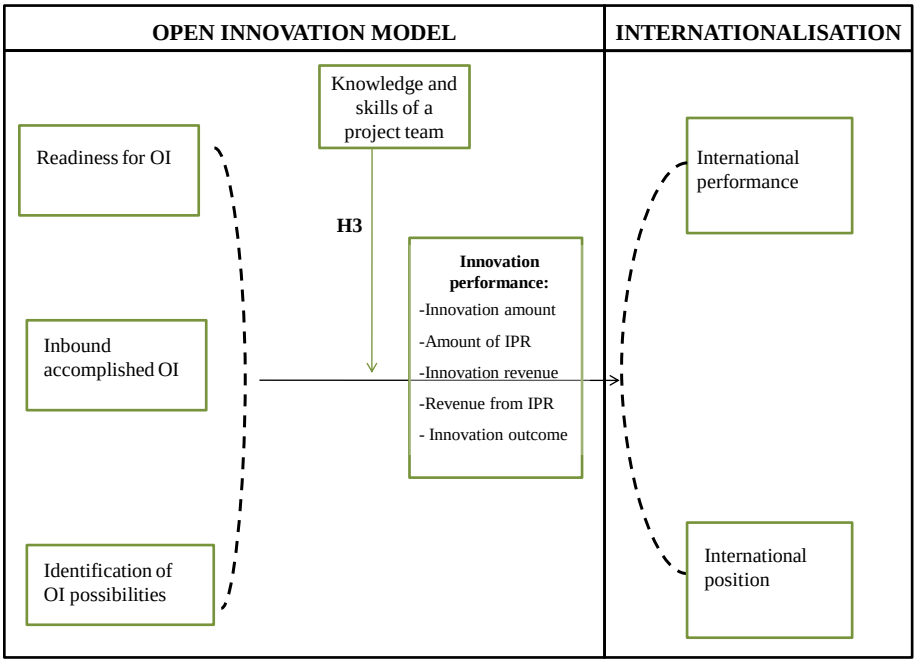


Figure 5. 10. Proposed model for Hypothesis 3

Inertia has the ability to change existing business models (Chesbrough, 2011), knowledge and coordination which originates from bounded rationality and a dominant logic guided managers (Verbeke and Yuan, 2007; Doz, Santos and Williamson, 2001). Inertia is a problem to conducting business as it lowers a firm's ability to utilize the accelerated creation of knowledge and a growing number of beneficial stakeholder interactions. If managers are aware of the presence of inertia, they could work towards its alleviation thereby transforming inert enterprises into globally competitive and successful innovators. Specific knowledge and skills are required to incite the innovation processes. The independent moderating variable in the third hypothesis measures and analyses the knowledge and skills of the project team that could lower the level of internal inertia and induce better innovation and internationalisation performance (Zahra and George, 2002; Oviatt and McDougall, 1995; Bloodgood et al., 1996; Burgel and Murray, 1998; Westhead, Wright and Ucbasaran, 1998; Griffith and Hoppner, 2013). International performance requires the integration of commitment, entrepreneurial agility, managerial skills, international experience, education and global vision that lead to the growth of learning and open approach to collaboration and exchange of information and innovation (Zahra and George, 2002; Verbeke and Yuan, 2007; Miočević and Crnjak-

Karanović, 2010). Du Chatenier et al. (2010) stress the role of brokering solutions and socially competent open innovation professions. Hence, the importance of inspecting which knowledge and skills of project teams are beneficial to exert greater influence of open innovation on internationalisation.

Hypothesis 4. *Innovation which is new to the market moderates the relationship between a firm's innovation performance and internationalisation more than the innovation which is new to the firm.*

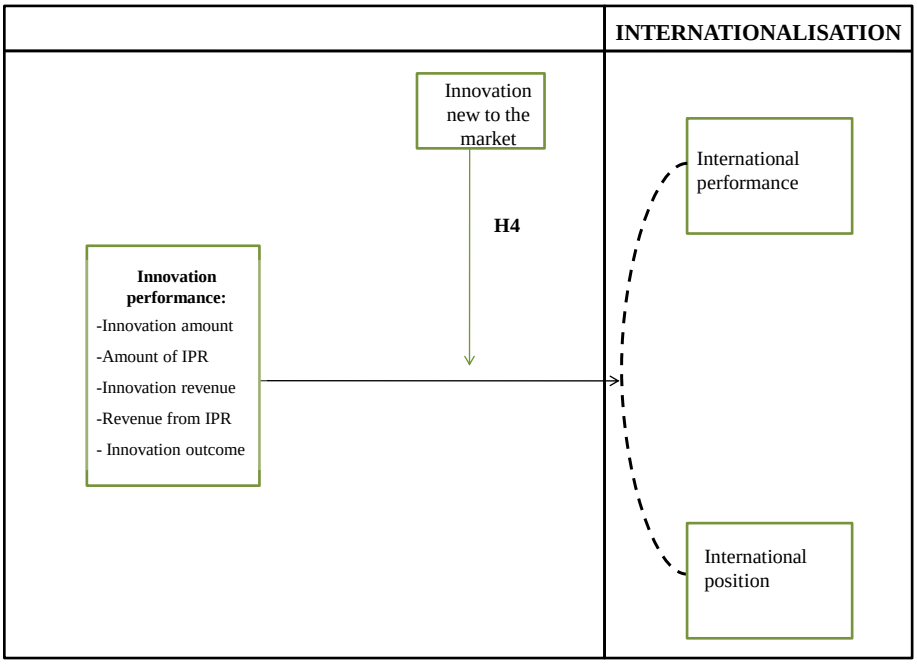


Figure 5. 11. Proposed model for Hypothesis 4

Innovation performance is measured with the speed and radicalness of innovation (Liao, Tsai and Hsu, 2012; Sisodiya, Johnson and Gregoire, 2013), as well as current innovation performance (De Luca and Atuahene-Gima, 2007; Langerak, Hultink and Robben, 2004; Terziovski, 2010). Given the differences between Pasteur, plastic Bohr and Edison's quadrant described by Donald Stokes (1997), the differences exist in fundamental and applied research. In order to describe the radicalness of innovation, the survey asks questions on the extent to which the innovation is new to the market. Hence, the independent moderating variable in the fourth hypothesis is a subjective indicator of radicalness of innovation for the market

(Sisodiya, Johnson and Gregoire, 2013; Delingonul, et al., 2011; Liao, Tsai and Hsu, 2012). Baković (2011) found that radical innovations positively influence business performance, and that incremental innovations do not influence business performance. Therefore, the fourth hypothesis examines the improvement or development of an entirely new product or service in relation to existing products and services on the market which indirectly affects the relationship between innovative performance and international activities of the firm.

Hypothesis 5. Institutional environment affects the firms' innovation performance.

Hypothesis 5a. *The effect of the institutional environment on the firms' innovation performance is mediated by open innovation.*

Hypothesis 5b. *The effect of the institutional environment on the firms' international performance is mediated by the firms' innovation performance.*

Hypothesis 5c. *The effect of the institutional environment on the firms' international position is mediated by the firms' innovation performance.*

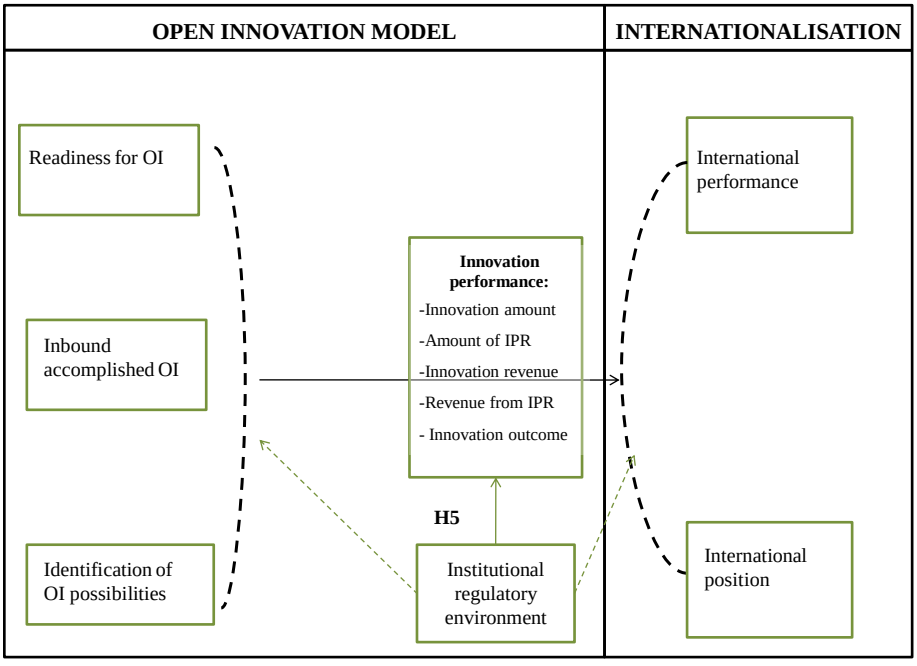
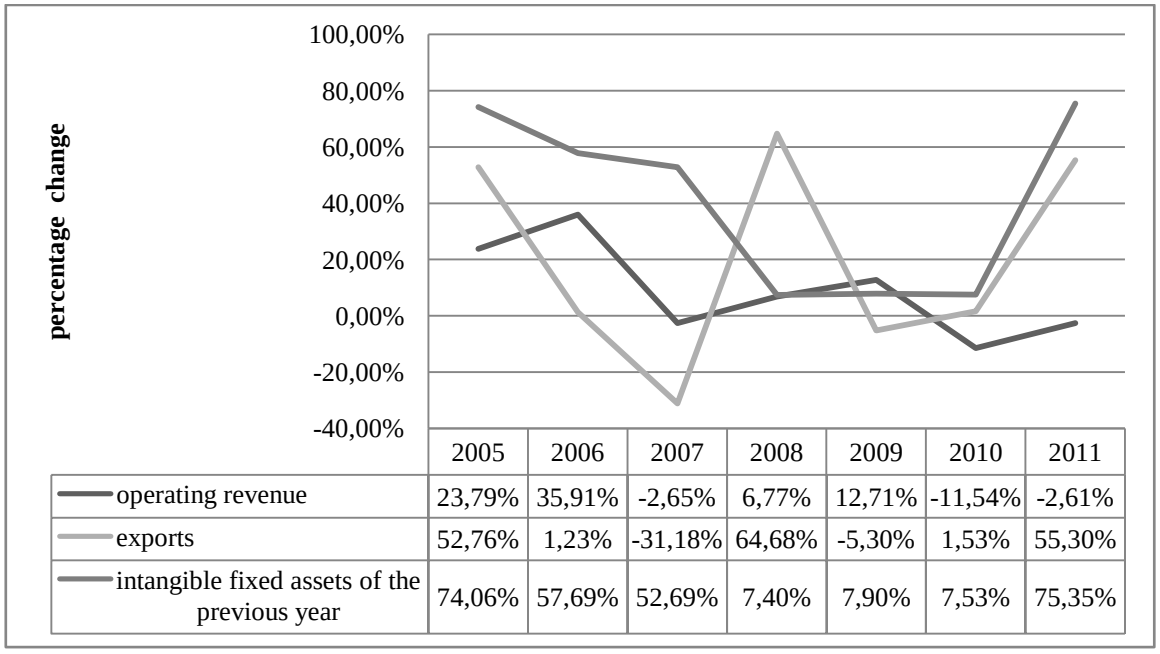


Figure 5. 12. Proposed model for Hypothesis 5

The telecommunications industry is sector specific which must be taken into account when researching the topics connected with its markets with a specific focus on the market entrance

of multinational network operators and the emergence of the SMEs (Sabolić, 2007, p. 26-49). The Croatian telecommunications industry recorded a growth in revenue and exports before the 2008 recession occurred. Although exports show better responsiveness to changing market conditions compared to operating revenue (particularly exports of telecommunication services), total operating revenue, exports and value of intangible assets after 2008 recession depict the lack of recovery in line with domestic market trends (Orbis, 2013). If the change in the value of intangible assets compared to the previous year (the value of patents, licenses, goodwill and other) is compared with the change in the value of operating revenue and exports, slower change is evident in the value of intangible assets and a strong correlation between percentage change in exports with the value of intangible assets (Figure 5.13, Orbis, 2013). This is interpreted as the sensitivity of the telecommunications industry in terms of the institutional environment.



	2005	2006	2007	2008	2009	2010	2011
operating revenue	23,79%	35,91%	-2,65%	6,77%	12,71%	-11,54%	-2,61%
exports	52,76%	1,23%	-31,18%	64,68%	-5,30%	1,53%	55,30%
intangible fixed assets of the previous year	74,06%	57,69%	52,69%	7,40%	7,90%	7,53%	75,35%

Figure 5. 13. Relationship between operating profits, exports and intangible fixed assets of the telecommunication SMEs

Source: Orbis (2013) Database [online]. Available at: orbis.bvdinfo.com (1 November 2013)

The institutional environment influences the support for development and exploitation of technology thereby allowing market entries to occur (Meyer and Rowan, 1977). Moreover, better institutional environment contributes to the easier and more successful innovation and internationalisation (Foray, 2004; Verbeke and Yuan, 2007; Cooke, 2004; Doz, Santos and

Williamson, 2001; Scott, 2001; Xu and Shenkar, 2002; Lakhani and Tushman, 2012). Institutional characteristics result from national and organizational culture (Hofstede, 2001), regions (Foray, 2004) and industrial sector. Characteristics of a management team, general knowledge, competitive environment and market turbulence are parts of the institutional features of an innovative and entrepreneurial culture in an international environment. National subsidies, direct protection of the state and the market which influences the growth and accumulation of knowledge (Foray, 2004) includes normative (the role of values and norms in the expectations and obligations), regulatory (the degree to which institutions are helping businesses) and cognitive elements (knowledge about certain procedures within the project team) (Busenitz, Gomez and Spencer, 2000) arising from the idiosyncratic culture and environment in which firms operate, and whose forms of application make it easy to access intellectual property rights protection, reduce the cost of innovation search, competitive pressures and technological turbulence while allowing innovative firms to emerge.

Institutional governance influences telecommunications efficiency whose successful reform is impacted by institutional environment (Mohamad, 2014). Given the importance of institutional support and its role in the reaction of telecommunications industry to market conditions, the fifth hypothesis tests the role of the institutional environment on the relationship between the open innovation perspectives, innovation and internationalisation.
The subjective indictor of the importance and the role of government support for cooperation and internationalisation (independent variable) was used in the fifth hypothesis (Busenitz, Gomez and Spencer, 2000; Doz, Santos and Williamson, 2001), i.e., the extent to which government aids firms in open innovation and foreign market entry.

Finally, the research model is given in Figure 5.14.

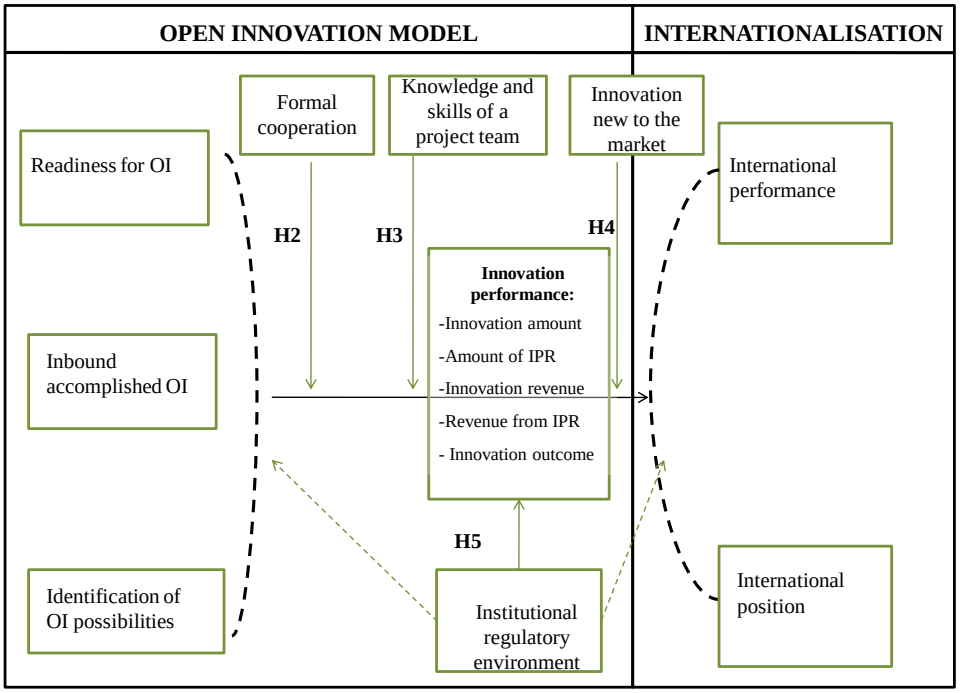


Figure 5. 14. Proposed research model

5.3. Selection and explanation of the proposed model's variables

This section describes the measurement scale and the constructs of the questionnaire survey. Previously developed measures were adapted to fit the purpose of this study with the multiple items scales for each of the constructs (Churchill, 1979). The constructs were validated and tested for consistency as shown in sections 6.1.2. and 6.1.3. Each of the initially proposed constructs followed from the literature as explained in the following sections and presented in Table 5.1.

Table 5. 1. Proposed model's initial constructs' literature

Variable	Explanation	Literature
Firm's international performance	The share of exports in total sales, the share of income from international subsidiaries in total income, the share of income from foreign strategic alliances, the share of foreign added value in a firm's total added value, the share of licences sold to foreign firms, the number of new export markets.	Jaworski and Kholi (1993) Doz, Santos and Williamson (2001), Frishammar and Andersson (2009), Parida, Westenberg & Frishammar (2013); Lasagni (2012), Christensen (2006), Vanhaverbeke (2012), Ramsey, Barakat and Cretoiu (2012), Ietto-Gillies and Sprague (2014)
Firm's relative international position	Sales revenue, market share, identified new markets and opportunities, profitability, development costs, time-to-market, time to break-even, brand awareness, , rate of new products, services, process or projects' success, customer satisfaction and quality and reliability of a new product, service, process or project compared to international competitors	Jaworski and Kholi (1993), De Luca and Atuahene-Gima (2007), Langerak, Hultink and Robben (2004), Doblinger (2013)
Innovation performance	Amount and the average revenue generated from new products, services, projects, licences, patents, topographic designs, industrial designs, trademarks and copyrights. The extent to which a firm's innovation performance increased as a result of its innovation strategy: faster time-to-market, increased number of innovation adoptions, lower unit costs, lower production costs, lower development costs, increased technical performance, increased quality and greater number of product, service, process or project configurations.	Lasagni (2012), Terziovski (2010)
Open innovation perspectives	- **Readiness** for open innovation - how firms adapt their business models for a development of new products and services; - **Identification of open innovation possibilities** – how firms identify open innovation possibilities, - **Accomplished open innovation** – the extent to which the external sources were used in a product, service or process development.	- Huang et al. (2013), Johnson, Christensen and Kagermann (2008), Moore (2004), Parida, Westerberg and Frishammar (2013), Sisodiya et al. (2013); Hung and Chou (2013) - University of Melbourne ARC project "Assessment of Innovation Capability Models to Create Innovation Driven Firms" and Committee for Economic Development of Australia and The Business Council of Australia's project "Management and Innovation in the 21st Century" - Chesbrough (2003), Chesbrough and Crowther (2006), Lind, Holmen and Pedersen (2012), Hung and Chou (2013), Sisodiya et al. (2013), Parida, Westerberg and Frishammar (2013) and Huang et al. (2013)
Fromal cooperation mechanisms	The extent to which firms use formal methods of cooperation in product, service or process development: strategic alliances, licensing, patents, joint project teams, formal progress reports, trade secrets, seminars, information technology, explicit management control system, top-down or bottom-up communication processes, exchange of employees between project teams, flatter organisational structure.	De Luca and Atuahene-Gima, (2007), Zahra, Ireland and Hitt (2000), Lichtenthaler (2010) and Terziovski (2010)
Knowledge and skills of project managers	Commitment, agility, flexibility, confidence, good tolerance for ambiguity, technologically educated, international experience and cultural understanding, contribute to organisation's global vision, international understanding, prioritisation, understanding customer/user requirements, continuously educated, possess good knowledge about domestic and international market.	Zahra and George (2002), Oviatt and McDougall (1995), Bloodgood et al. (1996), Burgel and Murray (1998), Westhead, Wright and Ucbasaran (1998), Griffith and Hoppner (2013).

Source: Author's representation.

5.3.1. Construct of open innovation

Open innovation perspectives were composed of three distinctive constructs. The open innovation constructs aimed to capture the perspectives consistent with Carayannis and Provance's (2008) indicators of input, throughput and output innovation. The first perspective relates to the firms' readiness to innovate, the second perspective to the identification of open innovation possibilities and the third perspective to the actually performed open innovation.

Open innovation was measured with 22 items. Five items pertain to the readiness of a business unit to openly innovate, eleven items measure practices used for the identification of open innovation possibilities, and six items measure the accomplished open innovation.

Readiness for open innovation refers to a firm's ablity to adapt its business model to a development of new products and services. Herin, the adaptation implies the lack of negative consequences for the firm's existing processes and structures. In measuring the firm's readiness to innovate Huang et al. (2013) use a four-item construct based on Johnson, Christensen and Kagermann's (2008) and Moore's (2004) definition of business model innovation. According to them, business model innovation includes repositioning a customers' value proposition and redesigning the firms' profit formula. The construct of readiness for open innovation used in this thesis includes five items. Three items were derived from the questionnaire of Huang et al. (2013), and the remaining two items measure a responsiveness of a firm's structures and processes' to collaborate with other firms on a new product, service, process and project development (Parida, Westerberg and Frishammar, 2013; Sisodiya et al., 2013; Hung and Chou, 2013).

Identification of open innovation possibilities is measured by fourteen items. Each of the fourteen items describes practices that firms used to identify ideas for a new product, service or process development, i.e. their organisational learning practices. They included: benchmarking, quantitative data analysis, social networks, market research studies, explicit tracking of competitors' findings, trade fairs and conferences, reverse engineering, gathering information from suppliers, publications, sharing organisation's goals and visions, publishing organisation's research discoveries, hiring R&D personnel, technological forecasting or foresight, and the use of users, customers or consumers in the product, service or process development. The majority of items were acquired from the Australian Research Council

Discovery Project on Assessment of Innovation Capability Models to Create Innovation Driven Firms at the Centre for Global Innovation Management, University of Melbourne; and the project by Committee for Economic Development of Australia and The Business Council of Australia on Management and Innovation in the 21st Century obtained from the University of Melbourne, Melbourne Institute of Applied and Social Research (obtained from Terziovski, M., in March 2014). The items on organisational learning were adjusted to fit the purpose of this research, i.e. the identification of open innovation possibilities. The consequent analysis made a distinction between the *generic (market-oriented)* and *specific (technically-oriented)* identification of open innovation possibilities. The distinction is in accordance with papers that studied the impact of technological learning on market performance and proposed a differentiation between strategic and basic operational learning (Carayannis and Alexander, 2002).

Accomplished open innovation construct evaluates firms' actually performed open innovation. The construct includes a nine-item scale composed of questions on inbound (outside-in), coupled and outbound (inside-out) practices. The questions on accomplished open innovation were obtained from: Chesbrough (2003), Chesbrough and Crowther (2006), Lind, Holmen and Pedersen (2012), Hung and Chou (2013), Sisodiya et al. (2013), Parida, Westerberg and Frishammar (2013) and Huang et al. (2013). The items measured the extent to which firms used clients, competitors, suppliers, government agencies, research institutes and universities in product, service or process design to: gather information, exchange experiences, buy or use technology, adopt available external knowledge and technology to internal developments, jointly undertake R&D activities, develop a product or cooperate on a project, promote ideas that cannot be self-developed, sell a firm's non-core technology and commercialise a firm's intellectual property.

5.3.2. Construct of innovation performance

Firms' innovation performance construct was adopted from Terziovski (2010). Firms' innovation performance included the evaluation of firms' (1) *amount of innovation*, (2) *the average revenue generated from innovations* and (3) *the extent to which a firm's innovation performance increased as a result of its innovation strategy*. All of the items were evaluated

on a 7-point scale. The amount and the average revenue of innovations were measured for products, services, projects, licences, patents, topographic designs, industrial designs, trademarks and copyrights. Additionally, the extent to which a firm's innovation performance increased as a result of its innovation strategy measured the following innovation outcomes: faster time-to-market, increased number of innovation adoptions, lower unit costs, lower production costs, lower development costs, increased technical performance, increased quality and greater number of product, service, process or project configurations.

5.3.3. Construct of internationalisation

Firms' internationalisation was devised into two categories corresponding to Jaworski and Kholi's business performance measure (1993, p. 60). Jaworski and Kholi (1993, p. 60) used the judgemental and objective measure on a 5-point Likert scale. This research incorporates the objective measure of international performance and the judgemental measure of firms' international position on a 7-point Likert scale that are presented in Chapters 3.3.2. and 3.3.3.

5.3.4. Construct of innovation culture

A thorough literature review resulted with a proposed model that assimilated two constructs relevant for the research on open innovation and internationalisation. These constructs could moderate the influence of open innovation on innovation performance and include: knowledge and skills of management and formal collaboration and innovation exchange.

The *formality of cooperation in open innovation* construct follows from De Luca and Atuahene-Gima, (2007), Zahra, Ireland and Hitt (2000), Lichtenthaler (2010) and Terziovski (2010). A fourteen-item scale examined the extent to which firms use formal cooperation practices with external sources in a product, service, process or project development. These examined practices included: strategic alliances, licensing, patenting, joint project teams, formal progress reports, trade secrets, seminars, information technology, explicit management control system, '*top-down*' or '*bottom-up*' communication processes, exchange of employees between project teams, and flatter organisational structure. In order to distinguish formal and

informal cooperation practices, formal practices were defined as those that comprise contractual relationships.

The *knowledge and skills of project team* construct measures the level of knowledge and management skills in the project team (Zahra and George, 2002; Oviatt and McDougall, 1995; Bloodgood et al., 1996; Burgel and Murray, 1998; Westhead, Wright and Ucbasaran, 1998; Griffith and Hoppner, 2013). This construct was initially described with nine items obtained from the literature: international experience, international education and global vision, commitment, agility, flexibility, confidence, good tolerance for ambiguity and mutual trust (Zahra and George, 2002; Oviatt and McDougall, 1995; Bloodgood et al., 1996; Burgel and Murray, 1998; Westhead, Wright and Ucbasaran, 1998; Griffith and Hoppner, 2013). Additional five items were included in the survey after the interviews with the industry's managers and academic researchers took place. The additional five items included: technological education, international understanding, excellence in defining an organisation's priorities, understanding the requirements of customers and markets, continuous education and excellent knowledge of domestic and international markets.

5.3.5. Construct of radical innovation

The *radical innovation* construct measures the extent to which the innovation is new to the market. It is composed of seven items on the Likert scale from 1 to 7 asking whether the firm develops a product, service, process or a project based on the technology that was not used before, is a first of its kind in the industry, completely new to the industry and different than others on the market (Sisodiya, Johnson and Gregoire, 2013; Delingonul et al., 2011; Liao, Tsai and Hsu, 2012). An objective quantitative measure of radical innovation that is depicted by more than 30% decrease in the production costs or by the five times increase in the performance were not included in this study.

5.3.6. Construct of institutional regulatory environment

The institutional environment in which a firm operates is composed of its cognitive, normative and regulatory dimension. This research examines its regulatory dimension to allow a critique of and recommendations for the governmental role in the innovation process. The construct of *institutional regulatory environment* is based on five items describing the government's regulatory role in the new product, service, process or project development (Busenitz, Gomez and Spencer, 2000). A 7-point Likert scale measures the extent to which government agencies support product, service or process development by: identifying potential international markets, having special projects for organisations wishing to develop a new product, service or a process, sponsor organisations wishing to develop a new product, service or a process, and help organisations to find market niches for their new products, services or a processes.

5.4. Control variables of the proposed model

5.4.1. Defining the control variables given in the industry's environment

In line with the research objectives, there might exist the influences from the industry's environment that impact the research results: the effect of technological turbulence and the effect of market competitiveness. The two items were measured on a 7-point scale, ranging from "not at all" to "very much" and examined using a confirmatory factor analysis (section 6.2.).

Technological turbulence was taken from Jaworski and Kholi's study (1993). The items measured the subjective opinion on: (1) the changes in technology that provide big opportunities in the industry; (2) a number of new product ideas enabled through technological breakthroughs; (3) major technological developments; and (4) the perceived change in technology. However, because this research is based on one industry sector, these variables should not affect the proposed hypotheses.

5.4.2. Defining the control variables within the industry

Apart from the variables in the industry's environment, the variables within the industry are those that are specific for firms within the same industry and subsequently might have an effect on the tested hypotheses. These include: the firm's international experience, type of ownership, age of a firm and size of a firm.

A firm's age and international experience is measured in terms of the years present on the domestic or international market. Types of ownerships include: private ownership, government ownership, foreign ownership and publicly listed firms. The size of a firm is measured in terms of revenue and the number of employees and it is based on the European Commission's classification. Firm's average annual revenue for the past four years was devised between: 0 and 5 million HRK, 5 and 15 million HRK, 15 and 75 million HRK, 75 and 350 million HRK, and more than 350 million HRK. The firm's size based on the number of employees was divided into: 1 employee firm, 2-5 employees, 6-10 employees, 11-50 employees, 51 and 150 employees, 151 and 250 employees, and more than 251 employees.

5.4.3. Defining the control variables from a firm

Different organisational departments might exhibit different sources of funding and, therefore, result in different performances. R&D within the firm is an example of this type of variable that shows the innovation dedication of a firm. R&D is measured with a share of firm's R&D expenditure in its total income and with the number of employees working in the R&D department.

5.5. Expected contribution of the research model

The limitations of the domestic market and the accession into the European Union in 2013 entail Croatian firms to be innovative in order to survive on a domestic market and become internationally competitive. The removal of barriers to trade and research, the growth in information technology and the availability of information enable new approaches to innovation in which firms utilise the existing resources and become more internationally competitive.

Open innovation is an approach to innovation that promotes collaboration and considers firms' internal and external resources equally important (Chesbrough, 2003). The concept of open innovation is, jointly with smart specialisation, one of the priorities of the European economic strategy. The European Union's Horizon 2020, Enterprise and Innovation Strategy, exemplifies open innovation as a strategic tool that fosters organisational, national and regional competitiveness in the global environment. Some European regions are establishing innovation networks to encourage open innovation. These innovation networks are based on clusters and encourage the emergenece of intermediary organisations that facilitate the transfer, discovery and availability of innovation. Wales is an example of a region with an innovation network that facilitates the growth of regional competitiveness through cooperation and exchange of innovation between small and large firms and various other organisations. Moreover, Intel, SAP, Nokia, IBM, Cadbury and P&G are some of the firms that use open innovation to achieve global competitiveness.

Although the research on open innovation exists (e.g., Chesbrough, 2003), the majority of studies on early adopters of open innovation are not applicable to the contemporary periods (e.g., due to different institutional frameworks). The first papers on open innovation were case studies aimed at improving the innovation performance of multinational enterprises. The predominantly qualitative studies lacked the knowledge on how and when to conduct open innovation (Huizingh, 2011). Only recent studies describe the impact of networking on firms' performance (Gronum et al., 2012). Furthermore, studies on open innovation examined the influence of international and domestic cooperation on firms' innovative capacity (research and development activities) and were based on the Community Innovation Survey (Ebersberger et al., 2011). The existing research on open innovation shows that only a few studies describe motivations and barriers to open innovation (van der Vrande et al., 2009),

and the impact of open innovation on the international success (e.g. Podmetina, 2011). Moreover, the studies were mainly based on a sample of firms from developed and large economies, ignoring the importance of open innovation for internationalisation of transitional economies (e.g., Croatian telecommunications industry). Furthermore, the literature lacks a comprehensive comparison of open innovation and internationalisation of firms of various sizes. To my knowledge there is neither a similar research in this area nor an integrated model that describes the interaction between different open innovation perspectives and internationalisation. Hence, there is a need for a quantitative and content analysis available from the data obtained from questionnaire surveys, patents, and financial reports, whose purpose is to explain firms' strengths, weaknesses, motivations and barriers to open innovation in the global environment. Thus, open innovation is extremely important and contemporary in both the scientific and professional community.

This thesis systematically and comprehensivly reviewed and critically analysed domestic and foreign literature on on open innovation and internationalisation. In that manner it supported the development of scientific thoughts connecting open innovation to internationalisation. The contribution of this thesis extends to the empirical research provided in the conceptual models of open innovation and internationalisation. The research examined the importance and the role of different open innovation perspectives on internationalisation in the Croatian telecommunications industry. It emphasised the need for a constructive approach to strengthening firms' absorptive capacities within the global marketplace. The model and conclusions deriving from the research aspire to be implemented in the existing national policy frameworks on one side, and adapted by innovative firms competing on the global market on the other side.

Specifically, the resulting knowledge provides insights into the structure of the international activities of the telecommunications industry in the Republic of Croatia, their open innovation perspectives and the institutional constraints of the domestic market aiming to support the internationalisation of innovative firms. By comparing the firms' international positions, the study provides insights into the identification of appropriate strategies that facilitate a response to internationalisation and open innovation challenges in domestic and international markets. Their identification is essential for strengthening the innovation performance of Croatian firms in the telecommunication industry and enables the comparisons and conclusions regarding the firms' international competitiveness.

6. RESULTS OF THE EMPIRICAL ANALYSIS OF INTERNATIONALISATION ACCORDING TO OPEN INNOVATION PERSPECTIVE IN THE CROATIAN TELECOMMUNICATIONS INDUSTRY

6.1. Methodological framework of empirical research

This section discusses the methodological framework of the empirical research. It interprets the population and characteristics of the empirical research, explains the survey items and constructs and portrays the procedure and scope of the performed empirical research.

6.1.1. Population and characteristics of the empirical research

The empirical research is based on the firms from the Croatian telecommunications industry. The telecommunications industry implies to firms whose at least fifty per cent of added value activities come from:

- high-technology manufacturing industries, and
- knowledge-based telecommunications services (Eurostat, 2008).

High-technology manufacturing industries (e.g., manufacturing of communication equipment) are specified under the NACE statistical classifications 26.3 and 26.4. Knowledge-based telecommunications services are assigned to NACE statistical classification 61 (Eurostat, 2008).

Telecommunications firms are classified either under manufacturing or services. However, service telecommunications often do some manufacturing, and manufacturing telecommunications firms provide some service. Therefore, this empirical research integrated both types of activities and the term "telecommunications industry" is used to refer to the both types of telecommunications domains. Figure 6.1 shows the structure of the Croatian telecommunications industry obtained from the Orbis database (2013) for the 2012 data.

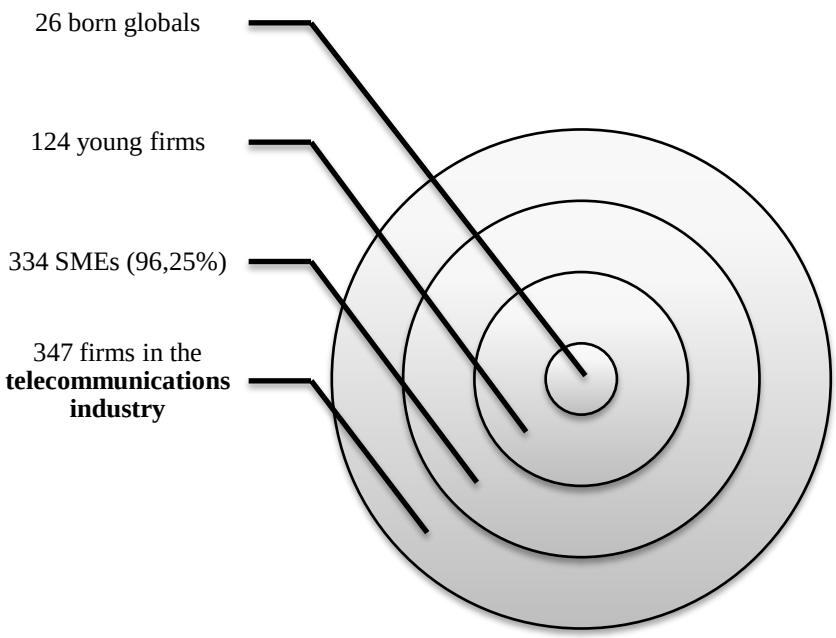


Figure 6. 1. Croatian telecommunications industry overview

Source: Orbis (2013) Database [online]. Available at: orbis.bvdinfo.com (1 November 2013). Author's representation.

The Croatian telecommunications industry comprises 347 firms (Orbis, 2013). There are 334 (96.25%) small and medium-sized firms. Approximately 110 firms exported in the periods between 2003 and 2012 (e.g., 26 telecommunications firms reported exports in 2003, 41 in 2007 and 55 in 2012) (Orbis, 2013). 304 firms reported to possess some form of intangible assets and four firms were born-again globals. Orbis reports only two firms that own patents for their innovations. These firms are Ericsson Nikola Tesla and Elektrokem. Ericsson Nikola Tesla is a large joint-stock firm and a member of the Ericsson Group, while Elektrokem is a medium-sized privately owned firm.

Orbis database shows that only about 14.41% of firms export (Orbis, 2013). If a random sample is composed out of a hundred firms, then exporting firms should account about 14 to 15% of the sample. This is a relatively small amount of firm that would not represent a statistically significant amount necessary for the empirical analysis. The statistical analysis should include at least thirty firms that export. In a random sample non-exporting firms should represent approximately 170 firms. Therefore, a purposive sampling was used to compare firms with different levels of internationalisation. The sample aimed to incorporate 30% of the basic data set, i.e. approximately 100 responses. Firms that were initially

contacted were obtained from the Orbis database and the Croatian Registrar of the publicly available financial data. The composition of the firstly contacted firms is displayed in Table 6.1.

Table 6. 1. Composition of firstly contacted Croatian telecommunications firms according to the NACE statistical classification

NACE statistical classification	Percentage	Number of contacted firms	Composition of contacted firms
26.3	18.69%	19	• 1 large (Ericsson Nikola Tesla), • 3 medium (RIZ, Elektrokem, AVC), • 15 small
61.1	46.11%	46	• 3 large (HT, Optima, B-net), • 2 medium (Metronet, H1), • 41 small
61.2	13.08%	13	• 4 large (Vipnet, Tele2, Odašiljači i veze, Nokia Siemens Network), • 2 medium (Vipnet usluge, Printec), • 7 small (export)
61.3	2.18%	2	• 2 small (Digi)
61.9	19.94%	20	• 1 large (Iskon), • 19 small
TOTAL	**100%**	**100**	• **9 large,** • **7 medium,** • **84 small**

Source: Orbis (2013) Database [online]. Available at: orbis.bvdinfo.com (1 November 2013) and the Croatian Registrar of the publicly available financial data (2013).

60 (18.69%) firms are manufacturing firms under NACE 26.3 statistical classification, and 260 (81.31%) are telecommunications services firms under NACE 61. Specifically to telecommunications services, 148 (46.11%) firms pertain to NACE 61.1, 42 (13.08%) firms to NACE 61.2, 7 (2.18%) to NACE 61.3, and 64 (19.94%) to NACE 61.9.

In 2012 44 firms reported exports in the Croatian telecommunications industry (Orbis, 2013). Orbis database and the Croatian Registrar of the publicly available financial data are limited by the lack of: (1) data on export of subsidiaries, which transfer a share of their income to

their foreign headquarters, (2) information on foreign added value, and (3) the relative international position of the firm. These three types of data are of interest in this empirical research. Several internationalisation items described in previous chapters were identified with the questionnaire survey. There might exist differences in responses on internationalisation compared to those depicted in the databases.

6.1.2. Designing the research instrument

This thesis is composed of two types of measures, actual and perceptual measures. Similar reasoning was used by Sisodiya et al. (2013). The actual measures are the objective interpretation of publicly reported data in the Croatian Financial Agency's database and the Orbis database. The data from the two databases used several dependent variables (e.g., a percentage of exports) for the identification of the sample. Data gathered through the survey are perceptual as they pertain to the respondents' opinions.

Where permitted, the perceptual scales used Jaworski and Kohli's (1993) reasoning on the questionnaire development and adoption of the pre-existing measures. The questionnaire and scale development procedure followed the pattern depicted in Figure 6.2.

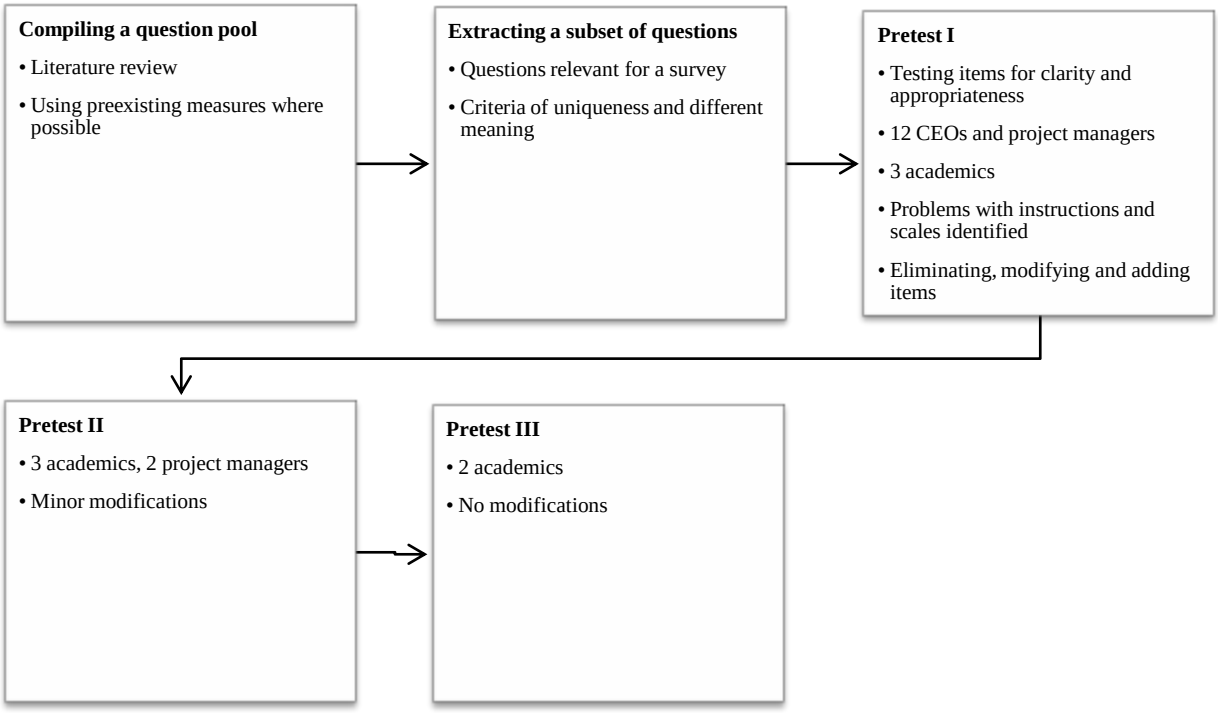


Figure 6. 2. Procedure of the questionnaire survey design

Source: Author's representation.

The pre-existing measures accumulated a large pool of items for each of the proposed constructs. These items were compiled and placed in the survey according to the identified constructs. For example, multiple items were generated to correspond to each of the three open innovation perspectives.

Special attention was given to meaningfully differentiate the constructs and items, and to assign items to the constructs. The criteria of uniqueness were used (Churchill, 1979). When the items for the constructs were chosen, special attention was given to logically organise the survey. Some items were reversely coded in order to minimise the response bias.

Similar to Jaworski and Kohli (1993), items were firstly tested for clarity and suitability in personally administered pre-tests. Twelve CEOs and R&D and marketing departments' project managers were interviewed. They were asked to complete the questionnaire and indicate any ambiguity or difficulty they experienced in responding to the items. They were also asked to offer suggestions regarding the survey or scales used. The first pre-test indicated problems with the instructions and scales. Comments from the academic researchers in the field of innovation, marketing and management were especially valuable.

According to the feedback from the industry representatives and academic researchers, some items were eliminated, some were modified, and additional items were developed. A modified questionnaire survey was pretested for the second time on the three academic experts who were asked to critically evaluate the items from the standpoint of construct and item specificity on one side, and the clarity of construction on the other side. Based on the obtained critique some items were eliminated and others were revised. In that way items' idiosyncrasy and precision were improved.

The last pre-test phase included interviews with two academic researchers. They completed the survey and evaluated it in a debriefing session with the researcher. Only a few points were raised in order to finally refine the survey (in line with Jaworski and Kohli, 1993).

The final structure of the survey items is given in Figure 6.3. The survey's individual measures were discussed in the section 5.3. The questionnaire survey is available in the Appendix 3.

Figure 6. 3. Structure of the questionnaire survey

Source: Author's representation.

A detailed structure of each survey component is available in the Appendix 3 (Table 10.1. Components of the questionnaire survey and components of particular constructs).

6.1.3. Procedure and scope of the empirical research

Empirical research encompassed the entire population of the telecommunications industry. It included both service and manufacturing firms in order to illustrate the industry's environment and avoid the bias between manufacturing and service firms explained in the previous section (Section 6.1.1.). The data gathering procedure and the proposed scope of the empirical research are described in this section.

Primary research began after gathering and analysing the secondary sources of information. The Erasmus Network "Open innovation" project financed by the European Commission was used as a referene point. Figure 6.4 shows the procedure of the empirical research. It started with the preparatory work, followed by the data gathering procedure and finished with the data analysis.

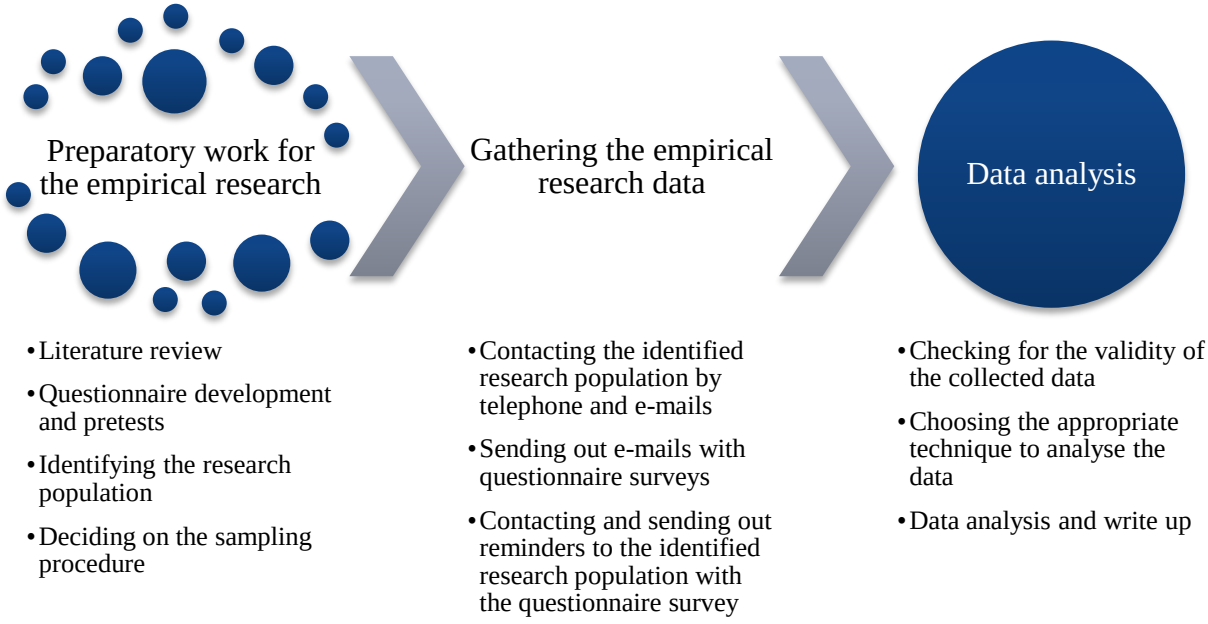


Figure 6. 4. Procedure of the empirical research

Source: Author's representation.

The preparatory work for the empirical research encompassed the literature review, questionnaire development, research sample identification and decisions on the sampling procedure. The literature review, items for the questionnaire development and research population identification were explained in the previous sections.

The sampling procedure was performed on the geographical area of the Republic of Croatia. The telecommunications industry's firms formed the observation units. Part of the basic dataset was gathered from the publicly available sources: the Registrar of the publicly available financial data's yearly reports and yearly reports obtained from the Orbis and Amadeus databases. The Orbis and Amadeus database contain the European firms' financial data. The majority of data in Orbis database and the Registrar of the publicly available financial data correspond to each other. The Registrar of the publicly available financial data of the Republic of Croatia lists 321 firms in the telecommunications industry and the Orbis database (2013) lists 347 firms. Due to this discrepancy firms from both datasets were contacted.

For the purpose of the research, the method of examination was used. It was based on the structured questionnaire survey, which served as a research instrument. The survey was conducted on the senior members of the project team. Senior project team members were considered to be able to provide information on firm's internationalisation and open innovation. Respondents were identified and contacted over the phone before filling in the survey.

Data gathering processes included identification of the purposive sample of telecommunications firms. The purposive sample which aimed to incorporate approximately the similar number of internationalised and non-internationalised firms, and which included firms with higher values of intangible assets in order to gain an insight into the difference in structures of firms' open innovation and internationalisation practices. After the telecommunications firms were identified, the researcher firstly contacted them firstly over the telephone and then by e-mail asking them to fill in the survey. The survey was sent by post to the respondents who were not able to be personally interviewed. Only a small number of firms responded via interviews and post. If only these results were used, the analysis would be based on a sample that is too small for the valid statistical analysis. Hence, the sampling procedure was expanded to include all the firms in the telecommunications industry. In that

way the study included the entire research population and reduced the bias that might have been caused by following different sampling techniques.

After the preliminary contacts with the firms were made, the additional e-mails were sent out through the social network *Linkedin*. The social network allowed the identification of the professionals in the marketing, sales or product or service development departments that have the knowledge on product and service development and internationalisation. It also allowed the identification of CEOs of smaller firms or their respective Heads of Production, Marketing or Sales. The responses of the final survey were primarily gathered through the social network *Linkedin*. After two weeks, the respondents, who did not reply to the initial e-mail or did not fill in the survey, were contacted for the second time and reminded to fill in the survey.

Section 6.2. illustrates the data analysis procedure on the characteristics of the research sample, detailed data analysis techniques and the results corresponding to the predefined research hypotheses.

6.2. Illustration and results' analysis of the empirical research

6.2.1. Characteristics of the empirical research sample

The data gathering procedure started in March 2014 and finished in May 2014. It studied the firms' open innovation perspectives and their effect on innovation and internationalisation.

The empirical analysis incorporated the sample of 128 Croatian telecommunications senior managers' responses. The respondents asked to fill in the survey were: CEOs and Heads of product or service development, marketing or sales departments of the Croatian telecommunications firms. There were 18 firms with multiple respondses in the sample. 18 responses were anonymous, i.e. respondents did not name a firm they represent. The unit of analysis is a firm and only one response per firm was used in the statistical analysis. Where the multiple responses per firm existed, the responses were averaged so that the mean of the given responses was calculated and included in the subsequent analysis. After the ambiguous data were eliminated, the analysis counted the total of 88 firms in the sample. There were 347 firms in the telecommunications industry. Hence, the response rate of 25.36% is satisfactory for this type of research (Tkalac Verčić, 2010, p. 103). Moreover,

Multiple responses were possible about a firm ownership. 76 respondents stated that their firm is privately owned; 19 that it was foreign-owned; 16 claimed that the firm was a joint-stock company; and one firm in the sample was government owned.

Table 6.2 shows that 67 (76.1%) firms in the sample were established after 1996, i.e. after the Croatian Independence war. Croatian firms underwent a transition after the 1990's from the former socialist to the current market system. Moreover, 49 (55.8%) firms were established after 2001 and 13 (14.8%) after 2010.

Table 6. 2. Firms' age and international experience

Year	Foundation		Internationalisation	
	Croatia (n=88)	Percentage	Croatia (n=84)	Percentage
before 1950	0	0.0%	1	1.2%
1951-1980	3	3.4%	2	2.4%
1981-1995	18	20.5%	4	4.8%
1996-2000	18	20.5%	14	16.7%
2001-2005	18	20.5%	14	16.7%
2006-2010	18	20.5%	29	34.5%
After 2010	13	14.8%	20	23.8%

Source: Author's calculation.

The respondents were asked to indicate the first year a firm internationalised through, but not exclusive to, exports, outsourcing or international joint ventures. The results displayed in Table 6.2. show that 7 (8.4%) firms internationalised before 1996 which is explained by the firms' foundation in the former socialist system of Yugoslavia. The total of 63 (75.0%) firms internationalised after 2001, 49 (58.3%) after 2006 and 20 (23.8%) after 2010. One response was recorded where the average internationalisation year occured after the year of foundation. This firm, Siemens, underwent a change in ownership and the transition to its current legal form occurred after its actual date of internationalisation. Hence, this response is not perceived as false and was kept in its current form in the analysis.

The size of the firms, the size of the R&D department and the average size of the project teams are presented in Table 6.3.

Table 6. 3. Size of the firm, R&D and project teams

Number of employees	Size of the company		Size of R&D		Size of project teams	
	Croatia (n=88)	Percentage	Croatia (n=86)	Percentage	Croatia (n=85)	Percentage
1	3	3.4%	8	9.3%	9	9.4%
2-5	11	12.5%	38	44.2%	32	38.8%
6-10	14	15.9%	13	15.1%	24	28.2%
11-50	23	26.1%	12	12.8%	16	18.8%
51-150	9	9.1%	9	11.6%	4	4.7%
151-250	9	12.5%	0	1.2%	0	0.0%
more than 250	19	20.5%	6	5.8%	0	0.0%

Source: Author's calculation.

The sample illustrates that 51 (57.9%) firms have 50 or less employees implying that 57.9% of firms are small firms. 18 (20.4%) firms have between 51 and 250 employees, i.e. are medium-sized firms. 19 (21.6%) firms have more than 250 employees or are large firms.

The size of the R&D department portrays a much different picture. 46 (53.5%) firms have between one and five employees dedicated to their R&D department, and 25 (27.9%) firms have between six and fifty R&D employees. In 15 (18.6%) firms the R&D department counts more than 51 employee.

The size of the project team varies according to the project and assignment. The respondents were asked to evaluate the average size of the project team. This measure was used to estimate the scale of firms' projects. It was assumed that the smaller project teams imply smaller scale projects. 41 (48.2%) respondents indicated a fairly small project team size that have between one and five members. 44 (51.7%) respondents indicated that their project team size counts more than six employees.

The size of the turnover of the respondents' firms is showed in Table 6.4.

Table 6. 4. Firms' turnover

Size	Average annual turnover in the last four years	
	Croatia (n=84)	Percentage
0 - 5 million HRK	28	33.3%
5 - 15 million HRK	13	15.5%
15 - 75 million HRK	12	14.3%
75 - 350 million HRK	17	20.2%
more than 350 million HRK	14	16.7%

Source: Author's calculation.

28 (33.3%) firms had an average annual turnover between 0 and 5 million HRK in the last four years. 25 (29.8%) firms had the average annual turnover between 5 and 75 million HRK. If the size of a firm is measured according to to the amount of turnover, 53 (63.1%) firms in the sample are small firms. 17 (20.2%) firms' average annual turnover was between 75 and 350 million HRK, which makes them medium-sized firms and only 14 (16.7%) firms are large firms that obtained more than 350 million HRK in turnover. In measuring the firm's sizes, there is a consistency between the size of a turnover and number of employees.

The consistency is confirmed with the Spearman's correlation coefficients. Namely, the two variables are not normally distributed. Shapiro-Wilk's tests' p values for both variables are 0.00. Spearman's correlation coefficient between the size of the turnover and the number of employees is $r_s = 0.85$. It is a nonparametric correlation coefficient significant at the one percent significance level. It shows that the existence of a strong correlation between the number of employees and the amount of turnover.

The respondents were asked to indicate the change of turnover that has occurred in the last four years. Their responses are displayed in the Table 6.5.

Table 6. 5. Firms' change in turnover in the last four years

	Change in the average annual turnover in the last four years	
	Croatia (n=86)	**Percentage**
Significantely decreased	7	8.1%
Somewhat decreased	18	20.9%
Not changed/stayed the same	12	14.0%
Somewhat increased	22	25.6%
Significantely increased	22	25.6%
Not applicable	5	5.8%

Source: Author's calculation.

Responses in the Table 6.5. show that in the last four years the turnover has decreased for 25 (29.1%) firms. It has stayed the same for 12 (14.0%) firms and increased for 44 (51.2%) firms. The amount of the firms whose turnover increased is significant for the interpretation of the responses, especially having in mind the current recession in the Republic of Croatia and the fact that many telecommunications firms, which were initially contacted, underwent restructuring or liquidation and did not respond to the survey. 5 (5.8%) firms indicated that the question is not applicable to their firm, which might be the result of the firms being too young to answer this question.

The size of the R&D expenditure is measured as a share of R&D in the firm's total turnover. The respondents were asked to state the percentage of turnover attributed to their firms' research and development activities (Table 6.6.).

Table 6. 6. Firms' R&D expenditure

R&D expenditure	Share of R&D in total turnover	
	Croatia (n=87)	Percentage
0%	1	1.1%
1 - 3%	13	14.9%
4 - 5%	23	26.4%
6 - 10%	14	16.1%
11 - 20%	21	24.1%
21 - 30%	10	11.5%
more than 30%	5	5.7%

Source: Author's calculation.

37 (42.4%) respondents indicated that the R&D expenditure of their firms is less than 5% of a firm's total turnover, 35 (40.2%) respondents stated it is between 6% and 20% and 15 (17.2%) respondents stated that the R&D expenditure is greater than 21% of the total turnover.

Respondents were asked about their firm's headquarters location because this measure also provides an indicator of internationalisation (Table 6.7.). It influences firms' decisions on the selection of entry markets, market trends, and the indicators of financial performance (e.g., the repatriation of profits).

Table 6. 7. Firms' headquarters location

Headquaters location	Croatia (n=88)	Percentage
Croatia	17	19.3%
Abroad	71	80.7%

Source: Author's calculation.

71 (80.7%) firms' headquarters are located abroad, and only 17 (19.3%) firms have headquarters in Croatia. The telecommunications firms in the sample are predominantely foreign-owned with branches or subsidiaries in Croatia used for expansion of their market shares, exploration of new markets or to follow their main client into new markets.

Table 6.8. portrays a firm's dependence on a single main client or a customer. The structure of the dependence varies with the main clients' income or purchases from the main client.

Some firms' incomes are not as dependent on a particular client, whilst the other firms' incomes are highly attributable to a single client or customer.

Table 6. 8. Share of turnover from the main client or customer

Main client dependence	Croatia (n=85)	Percentage
1 - 10%	26	30.6%
11 - 20%	18	21.2%
21 - 30%	15	17.6%
31 - 50%	10	11.8%
51 - 70%	7	8.2%
71 - 90%	5	5.9%
more than 90%	4	4.7%

Source: Author's calculation.

44 (51.8%) firms obtain less than 20% of their revenue from their single client and 41 (48.2%) obtain more than 21% of their revenue from their main client. 25 (29.4%) firms generate between 21% and 50% of their revenue from their main client. 16 (18.8%) firms are highly dependent on their main client because the share of revenue generated from their main client is greater than 50%. These responses, although important, might mislead the interpretation implying a reader to think they indicate that the main or the biggest client provides approximately 20 per cent of the turnover and the other clients provide only 1-2% of the turnover each. However, the same firm might have an additional six clients with each holding approximately 15 per cent of the turnover, making a firm's turnover highly dependent on those clients as well. Hence, this measure is given as an assumption of the firm's main client dependence and should be carefully interpreted.

Firms' clients can be domestic or international. Hence, the survey included the question on the location of the main clients (Table 6.9.). The presumption was that the main clients are those clients with which firms have long lasting relationships. It implies that firms might follow clients to their particular markets and take into account international, instead of domestic market needs.

Table 6. 9. Location of firms' main clients

Main client location	Croatia (n=87)	Percentage
Croatia	59	67.8%
Abroad	28	32.2%

Source: Author's calculation.

59 (67.8%) respondents' main clients come from Croatia, i.e. are domestic clients. 28 (32.2%) of respondents' main clients come from abroad. Therefore, the majority of firms' take care of the domestic market needs. It was assumed that the firm's headquarters location are correlated with the location of firms' main clients. Shapiro-Wilks' tests' p value for both variables is 0.00 which does not indicate a normal distribution. The correlation was tested with the Spearman's correlation coefficient as a non-parametric test. Spearman's correlation coefficient (ρ) showed a negative correlation between the two variables (r_s = - 0.49) under a one per cent significance level. It implies that if a firm's headquarters are in Croatia, its main client is located abroad, and vice versa. However, the correlation is not that strong.

Table 6.10. shows the types of projects in which telecommunications firms are involved. Multiple responses per firm were possible showing that the total of 201 projects were being undertaken.

Table 6. 10. Types of telecommunications projects

Project types	**Croatia** (n=201)	**Percentage**
Optical networks	31	15.4%
Satellite communication	12	6.0%
Inteligent networks	15	7.5%
Mobile network	34	16.9%
Fixed network	40	19.9%
Enhancing quality and application of networks	34	16.9%
E-business	20	10.0%
Other (e.g. WiFi, mobile applications, etc.)	15	7.5%

* multiple responses were possible

Source: Author's calculation.

Croatian telecommunication firms are mainly focused on fixed network projects (40 or 19.9% of the firms), mobile network projects (34 or 16.9% of the firms), enhancing the quality and application of network (34 or 16.9% of the firms) and optical network projects (31 or 15.4% of the firms). A smaller number of firms work with intelligent networks (15 or 7.5% of the

firms), e-business (20 or 10.0% of the firms), satellite communication (12 or 6.0% of the firms) and WiFI, mobile applications and other project types (15 or 7.5% of the firms).

Multiple responses were also possible to indicate the type of industry of the firms' projects. This question can help in interpretation of the amount of innovations in products, services, processes or projects. The rationale is that if a firm deals with production, it will offer more innovation in products than firms that deal with services or information technology. The results are portrayed in Table 6.11.

Table 6. 11. Telecommunications industry type

Telecommunications industry type	Croatia (n=141)	Percentage
Information technology	75	53.2%
Services	53	37.6%
Production	10	7.1%
Infrastructure	3	2.1%
Other	0	0.0%

* multiple responses were possible

Source: Author's calculation.

A total of 141 responses pinpointed that 75 (53.2%) firms in the sample deal with information technologies, whilst 53 (37.6%) firms deal with services. On the other hand, infrastructure projects are done by 3 (2.1%) firms, and production by 10 (7.1%) firms.

6.2.1.1. Internationalisation

International performance was examined with: (1) the share of exports in total sales, (2) the share of income from foreign subsidiaries, (3) the share of income from foreign strategic alliances, (4) the share of the foreign value added in the total value added and (5) the share of licenses sold to foreign organisations (Table 6.12.).

Table 6. 12.a. Firms' level of international performance

Internationalisation	Share of exports in total sales		Share of income from foreign subsidiaries		Share of income from foreign strategic alliances	
	Croatia (n=88)	Percentage	Croatia (n=88)	Percentage	Croatia (n=87)	Percentage
0%	15	17.0%	37	42.0%	34	39.1%
1 - 10%	20	22.7%	19	21.6%	23	26.4%
11 - 20%	15	17.0%	8	9.1%	11	12.6%
21 - 30%	4	4.5%	4	4.5%	4	4.6%
31 - 40%	9	10.2%	6	6.8%	4	4.6%
41 - 50%	6	6.8%	2	2.3%	3	3.4%
more than 50%	19	21.6%	12	13.6%	8	9.2%

Source: Author's calculation.

Table 6.12.b. Firms' level of international performance

Internationalisation	Share of foreign added value in the total added value		Share of licenses sold to foreign organisations	
	Croatia (n=87)	Percentage	Croatia (n=88)	Percentage
0%	26	29.9%	42	47.7%
1 - 10%	20	23.0%	20	22.7%
11 - 20%	10	11.5%	4	4.5%
21 - 30%	10	11.5%	10	11.4%
31 - 40%	10	11.5%	0	0.0%
41 - 50%	1	1.1%	6	6.8%
more than 50%	10	11.5%	6	6.8%

Source: Author's calculation.

15 (17.0%) respondents reported that they had no exports. Between 1 and 10 percent of exports in total sales were reported by 20 (22.7%) firms. 34 (38.6%) firms' share of exports in total sales was between 11 and 50% and 19 (21.6%) firms' share of exports in total sales was greater than 50%.

The firms predominantly do not own international subsidiaries. 37 (42.0%) of respondents declared they have no income from foreign subsidiaries. 39 (44.3%) respondents stated that their firms' share of income from foreign subsidiaries is between 1 and 50 per cent, while 12 (13.6%) respondents declared to have more than 50 per cent of their income from foreign subsidiaries.

Similarly, the share of income from foreign strategic alliances showed that 34 (39.1%) firms did not have an income from strategic alliances. 34 (39.1%) firms receive between 1 and 20%

of their income from foreign strategic alliances and 19 (21.8%) firms obtain more than 21% of their income from their strategic alliances.

The greatest discrepancy in firms' internationalisation performance is evident in the share of licences sold to foreign organisations. 42 (47.7%) firms in the sample do not have any licences sold to foreign organisation. On the other hand, 46 (52.2%) firms in the sample had at least one per cent of income attributable to the sales of foreign licences.

The spread of firms' internationalisation was also examined (Table 6.13.). The internationalisation spread counted the number of countries in which a firm is present. Since Croatia is a small market, access to a greater number of foreign markets might offset current or future gain in the international performance.

Table 6. 13. Internationalisation spread

Number of foreign markets	Croatia (n=88)	Percentage
0	14	15.9%
1	11	12.5%
2	14	15.9%
3	11	12.5%
4	2	2.3%
5	6	6.8%
6 and more	30	34.1%

Source: Authors' calculation.

Table 6.13. shows that 14 (15.9%) firms operate only in Croatia. This data is aligned with the data that 15 firms reported no exports. The foreign market presence might be established through outsourcing; hence the discrepancy. Spearman's rank correlation coefficient was calculated for the variables: number of foreign markets and firms' headquarters location (r_s = - 0.39). It indicates a negative correlation between a firm's location and the number of foreign markets in which a firm is present. If firms' headquarters are located abroad, the correlation coefficient shows that they tend to enter into less foreign markets.

6.2.1.2. Cooperation practices

Figure 6.5 describes the way firms cooperate with other firms in a new product, service or process development. Cooperation practices are ranked according to their importance provided by the survey responses ranging on the Likert scale from 1 ”not at all” to 7 “very much”. Group mean responses are represented in the Figure 6.5.

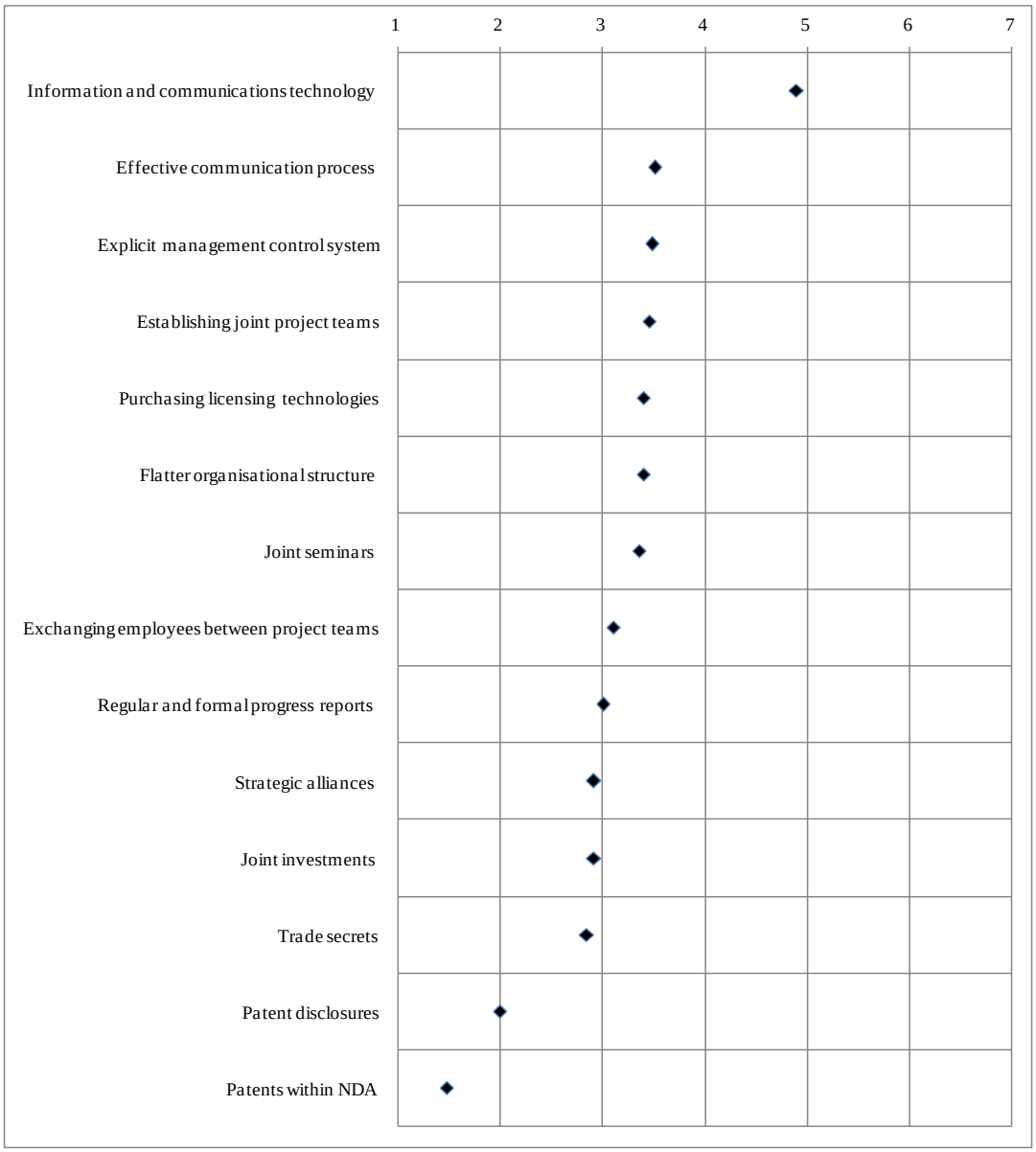


Figure 6. 5. Firms’ cooperation practices

Source: Author’s calculation.

Information and communications technology obtained the greatest importance for cooperation in innovation (Figure 6.5.). Effective communication process, explicit management control system, joint project teams, the purchase of licensing technologies, flatter organisational structure and joint seminars are similarly important for cooperation. Exchanging employees between project teams and regular and formal progress reports follow. Strategic alliances, joint investments and trade secrets do not rank very well. Patent disclosures and disclosing patents within the non-disclosure agreements (NDAs) are perceived as the least important for cooperation.

6.2.1.3. Knowledge and skills of the project team

Figure 6.6. displays the average level of the project team members' knowledge and skills necessary the for a new product, service or process. The items were evaluated on the Likert scale from 1 to 7, from "not at all" to "very much". The mean response for each items was calculated.

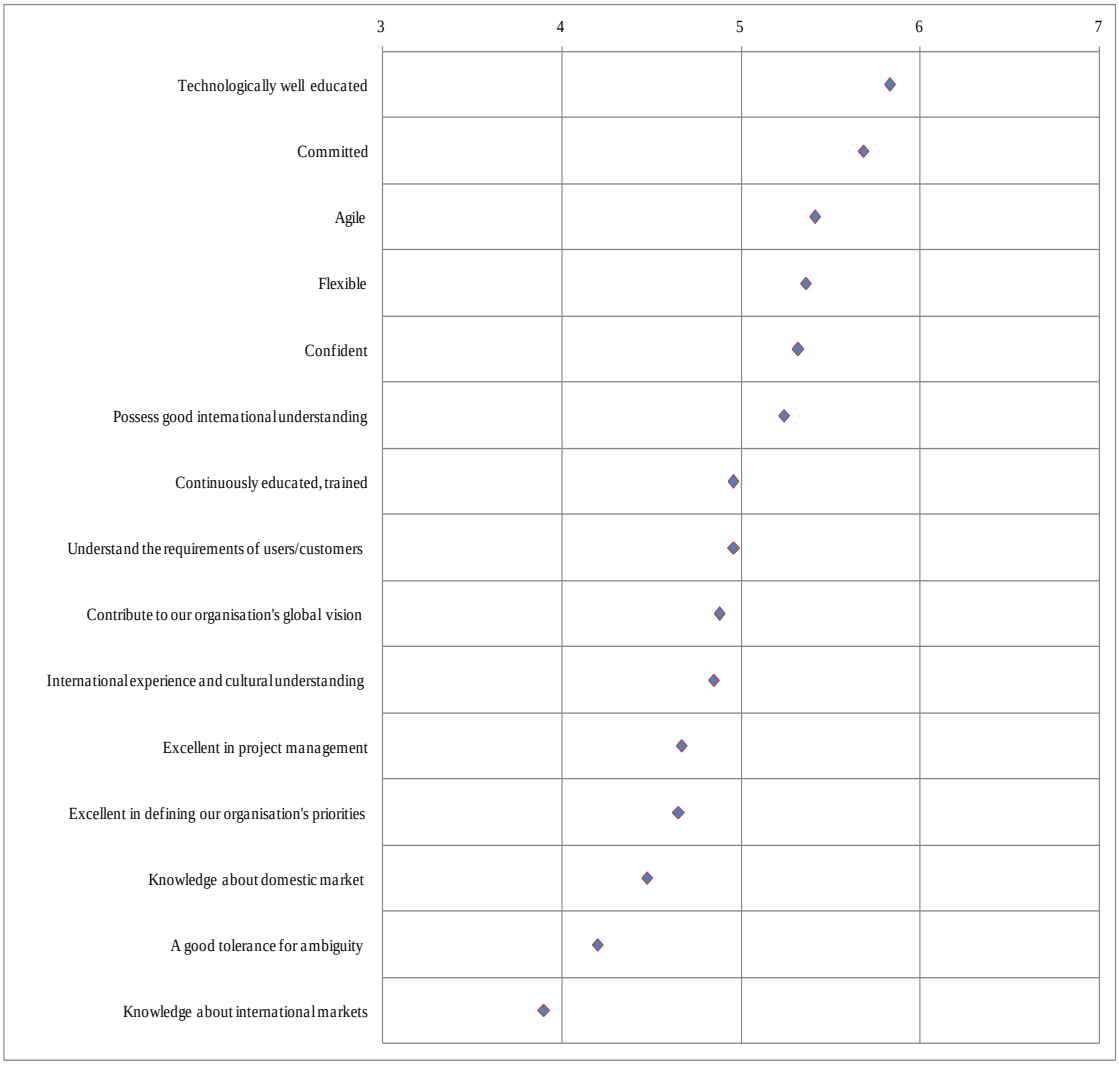


Figure 6. 6. Knowledge and skills of the project team members

Source: Authors' calculation.

Technological education of project team members is important. Commitment, agility, flexibility, confidence and a good international understanding follow. Project team members' continuous education and training, understanding of the requirements of users and customers, contribution to organisation's global vision and the international experience and cultural understanding follow. Excellence in project management, defining organisations' priorities, knowledge about domestic market and good tolerance for ambiguity are all rated with the above average scores. It is interesting to note that the knowledge about international markets has the lowest importance. The respondents on average do not perceive that their teams possess a good knowledge about international markets which is significant in a new product, service or process development.

6.2.1.4. Innovation performance: Innovation amount

Respondents were asked about the amount of innovation their firms developed in the last four years (2010, 2011, 2012 and 2013). The answers were recorded on the Likert scale ranging from 1 "no innovation" to 7 "a lot of innovation". Innovation amount was measured in terms of new products, services, processes, licences, patents, copyrights, trademarks, industrial designs and topography of semiconductor products. The responses per innovation item were averaged (mean) and are displayed in Figure 6.7.

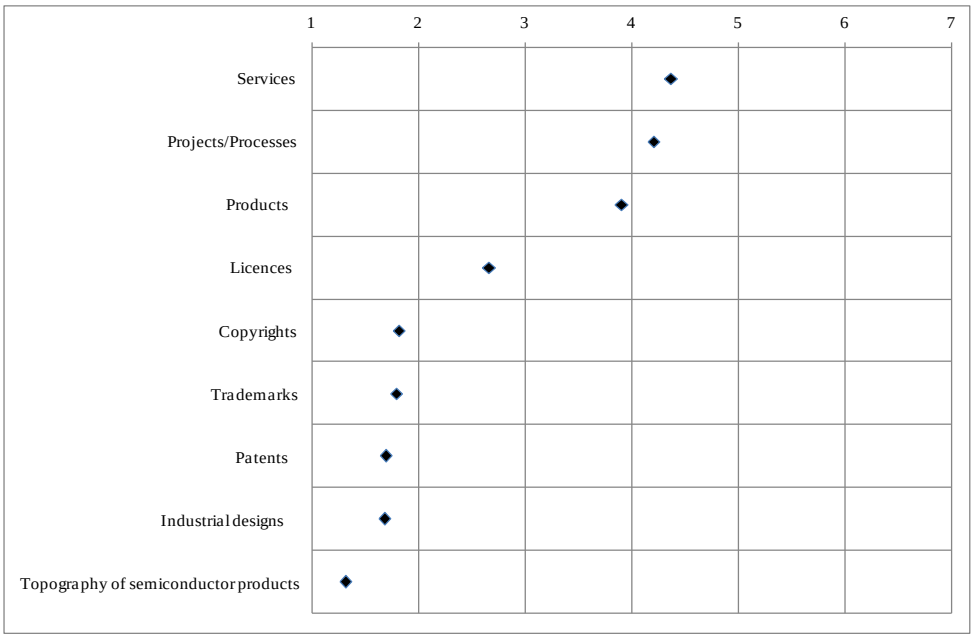


Figure 6. 7. Firms' innovation amount

Source: Author's calculation.

The highest average amount of innovation for all firms in the sample was recorded in services and is followed by the innovation in processes. Innovations in services, processes and products show the above average level of innovation. Licences, copyrights, trademarks, patents, industrial designs and topography of semiconductor products all show the below average amounts of innovation which are almost insignificant.

With respect to the Spearman's correlation coefficients, firms in the service industry do not exhibit significance with respect to any type of innovation. The firms in information technologies are positively and significantly correlated with the amount of products (r_s = 0.26), processes (r_s = 0.31), licences (r_s = 0.32), trademarks (r_s = 0.22) and copyrights (r_s =

0.27). Infrastructure firms are positively and significantly correlated with the amount of patents (r_s = 0.29), while firms in production are correlated with the amount of new products (r_s = 0.33), patents (r_s = 0.25), industrial designs (r_s = 0.32) and copyrights (r_s = 0.24).

6.2.1.5. Innovation performance: Revenue from innovation

The respondents were asked to evaluate the average revenue in the last four years (2010-2013) generated from innovations in products, services, processes, licences, patents, topography of semiconductor products, industrial designs, trademarks and copyrights (Table 6.14).

Table 6. 14.a. Firms' revenue from innovations

Revenue from innovation	Products		Services		Processes/Projects	
	Croatia (n=85)	Percentage	Croatia (n=86)	Percentage	Croatia (n=85)	Percentage
0%	15	17.6%	5	5.8%	14	16.5%
1 - 10%	15	17.6%	10	11.6%	12	14.1%
11 - 20%	11	12.9%	9	10.5%	13	15.3%
21 - 30%	13	15.3%	12	14.0%	16	18.8%
31 - 40%	10	11.8%	15	17.4%	8	9.4%
41 - 50%	6	7.1%	16	18.6%	10	11.8%
more than 50%	15	17.6%	19	22.1%	12	14.1%

* the total of all revenue streams per organization/respondent does not add up to 100%

Source: Author's calculation.

Table 6.14.b. Firms' revenue from innovations

Revenue from innovation	Licences		Patents		Topography of semiconductor products	
	Croatia (n=83)	Percentage	Croatia (n=84)	Percentage	Croatia (n=83)	Percentage
0%	45	54.2%	70	83.3%	75	90.4%
1 - 10%	13	15.7%	7	8.3%	5	6.0%
11 - 20%	5	6.0%	3	3.6%	2	2.4%
21 - 30%	6	7.2%	3	3.6%	1	1.2%
31 - 40%	4	4.8%	1	1.2%	0	0.0%
41 - 50%	3	3.6%	0	0.0%	0	0.0%
more than 50%	7	8.4%	0	0.0%	0	0.0%

* the total of all revenue streams per organization/respondent does not add up to 100%

Source: Author's calculation.

Table 6.14.c. Firms' revenue from innovations

Revenue from innovation	Industrial designs		Trademarks		Copyrights	
	Counts (n=84)	Percentage	Counts (n=84)	Percentage	Counts (n=84)	Percentage
0%	71	84.5%	67	79.8%	68	81.0%
1 - 10%	10	11.9%	10	11.9%	12	14.3%
11 - 20%	2	2.4%	5	6.0%	4	4.8%
21 - 30%	1	1.2%	1	1.2%	0	0.0%
31 - 40%	0	0.0%	1	1.2%	0	0.0%
41 - 50%	0	0.0%	0	0.0%	0	0.0%
more than 50%	0	0.0%	0	0.0%	0	0.0%

* the total of all revenue streams per organization/respondent does not add up to 100%

Source: Author's calculation.

17.6% of the firms' share of new products was less than 1% of the total product sales; for 17.6% between 1 and 10%; for 47.1% of the firms between 11 and 50%; and for 17.6% of the firms the share in the revenue was higher than 50%.

Similarly, the revenue generated from new services in the total sales of that service shows that new services generated the revenue lower than 1% for 5.8% of the firms. New services generated the revenue between 1 and 10% for 11.6% of the firms, between 11 and 50% for 60.5% of the firms, and higher than 50% for 22.1% of the firms.

For 16.5% of the firms the revenues generated from new processes in the total sales of that processes was lower than 1%. For 14.1% of the firms it was between 1 and 10%. For 55.3% of the firms it was between 11 and 50%, and for 14.1% of the firms it was higher than 50%.

The revenue generated from the sale of intellectual property rights shows that: 54.2% of firms did not generate any revenue from licences; 83.3% of the firms did not generate any revenue from patents; 90.4% of the firms from topography of semiconductor products; 84.5% of the firms from industrial designs; 79.8% of the firms from trademarks and 81.0% of the firms from copyrights. It can be observed that firms, on average, do not generate any revenue from their intellectual property rights apart from licences. A lot of intellectual property rights are not utilised or do not portray a high or any added value to the firm. Additional possible explanation is that firms might not be interested to take advantage of their existing intellectual property rights.

6.2.1.6. Innovation performance: Average revenue from innovations

Figure 6.8. shows the average revenue generated from innovations. The mean for each item was calculated for all respondents in the sample.

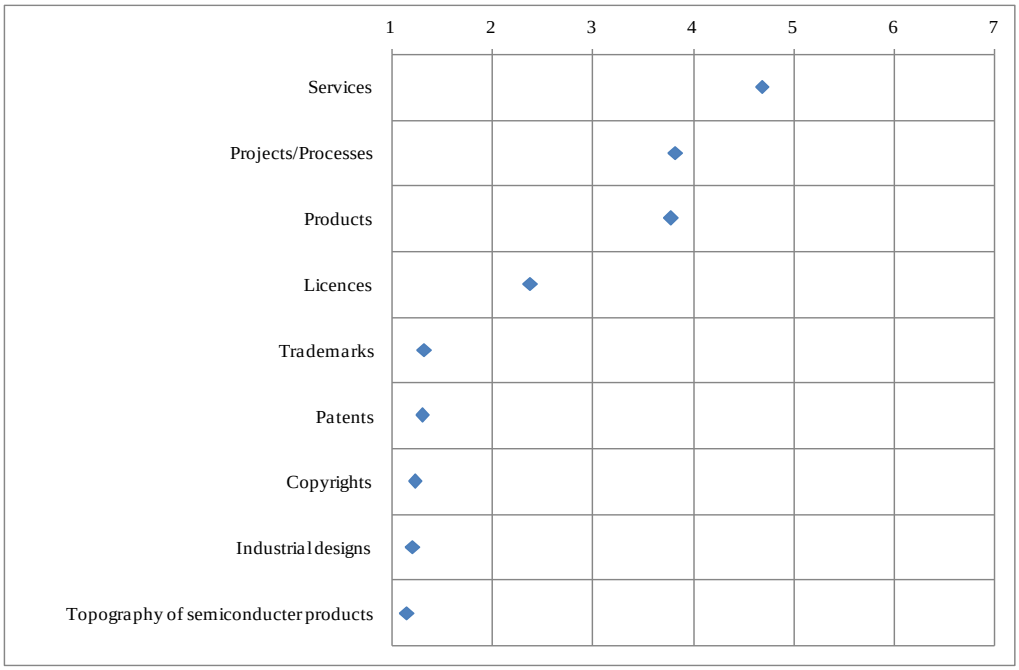


Figure 6. 8. Firms' average revenue from innovations

Source: Author's calculation.

The revenue generated from innovations in services was the highest revenue generated from innovations. Innovations in services comprised about 21-30% of the revenue from services. The average revenue generated from innovations in products comprised approximately 11-20% of the revenue from the sale of products. The average revenue generated from innovations in processes comprised about 11-20% of revenue generated from processes. The average revenue generated from licences accounts for roughly 1-10% of the license revenue, while patents, topography of semiconductor products, industrial designs, trademarks and copyrights generate almost no revenue for the firms in the sample (0%).

Innovation amount and revenue from innovations have been compared and the Spearman's correlation coefficient was calculated. There exists a correlation between the amount of new products and revenue from new products (r_s = 0.42), amount of new services and revenue from new services (r_s = 0.45), new process and revenue from new process (r_s = 0.56), licences

and revenue from licences (r_s = 0.74), patents and revenue from patents (r_s = 0.71), topographies of semiconductor products and revenue from topographies of semiconductor products (r_s = 0.55), industrial designs and revenue from industrial designs (r_s = 0.57), trademarks and revenue from trademarks (r_s = 0.66) and copyrights and revenue from copyrights (r_s = 0.60). Even though there is a correlation between these variables, it is not as high as it would be expected. The highest correlation coefficient is exhibited between the amount of licences and the revenue from licences, whilst the second highest correlation is seen between the amount of patents and revenue from patents. On the contrary, the lowest correlation is between the amount of new products and the revenue from new products. In general, the amount of intellectual property rights and the revenues generated from them show higher levels of correlation than the amounts of new products, services or processes. This might imply that the intellectual property rights' revenue is better utilised than the revenue from new products, services or process.

6.2.1.7. Innovation performance: Innovation outcomes

Innovation outcomes refer to perceived or actual performance of organisations occurring as a result of organisations' innovation strategy (Figure 6.9).

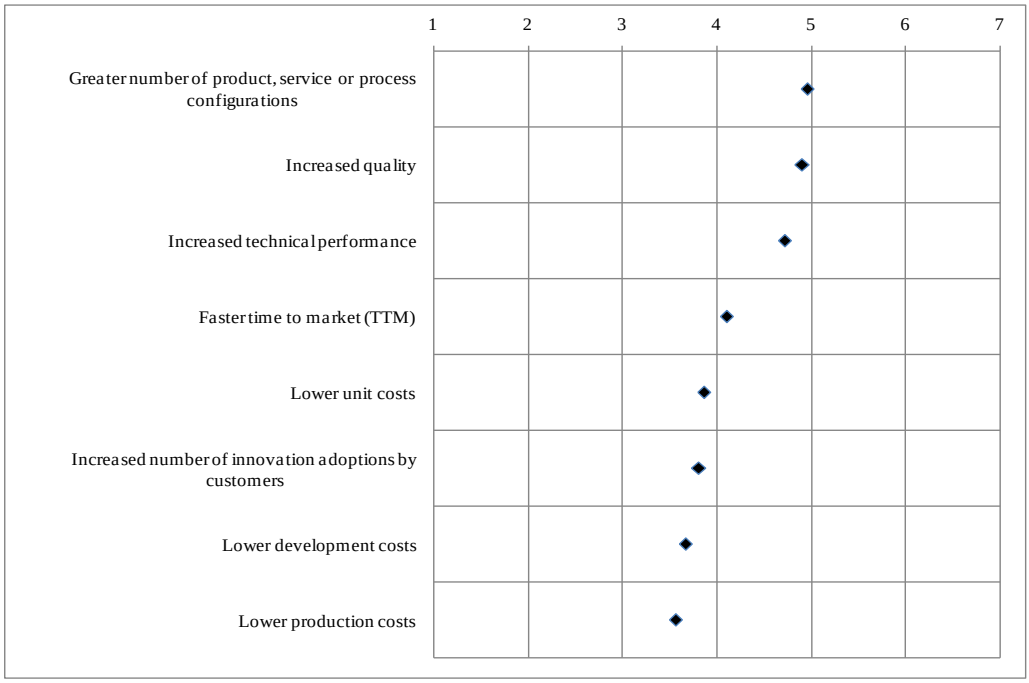


Figure 6. 9. Firms' innovation outcomes

Source: Author's calculation.

Figure 6.9. shows the mean of all responses for a particular item. Greater number of product, service and process configurations, increased quality and increased technical performance obtained the highest average rank in terms of firms' innovation outcomes. Faster time to market, lower unit costs, the number of innovation adoptions by customers, lower development and production costs follow and portray the above-average results in innovation. It can be concluded that firms benefit from innovations but their benefits are not directly transmitted into higher revenue but rather indirectly through innovation outcomes. This was tested in the hypothesis measuring the mediation effects of innovation outcomes.

6.2.1.8. Open innovation practices

Firms were asked on the extent of usage of open innovation practices for a new product, service or process development. The answers were recorded on the Likert scale from 1 "not at all" to 7 "very much". This question was put in the online survey at a later date than other questions. Some respondents were sent an additional e-mail requesting them to respond solely to this question. This question was answered by 49 respondents. The mean of all responses for each open innovation practice is depicted in Figure 6.10.

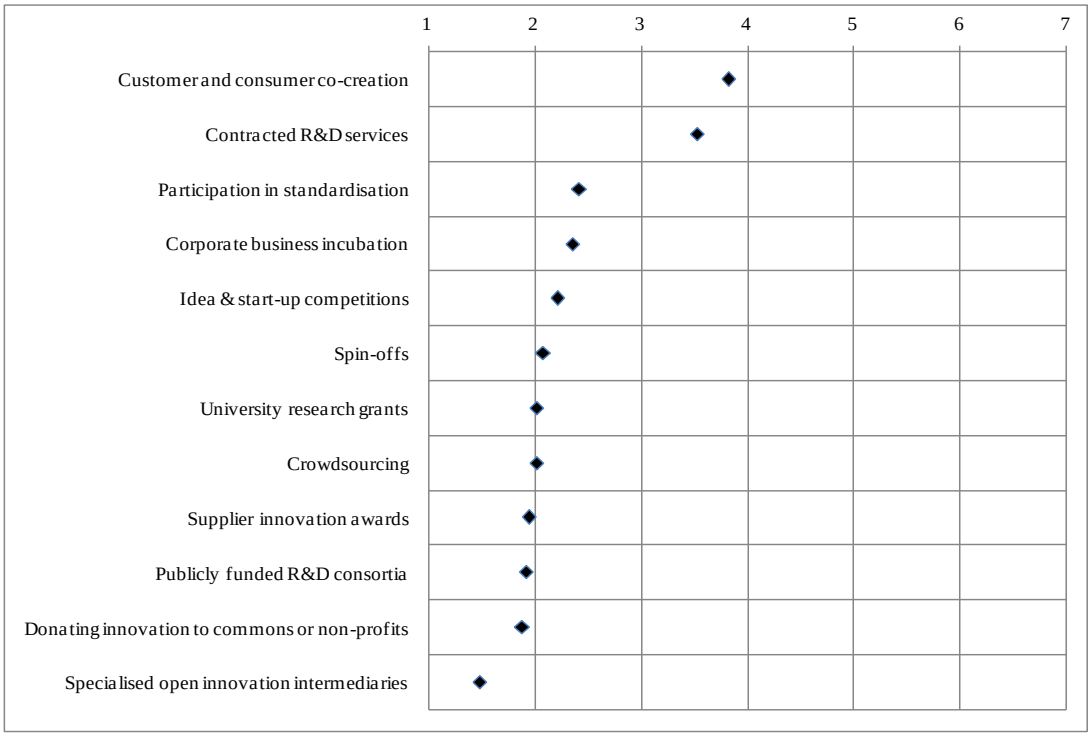


Figure 6. 10. Firms' open innovation practices

Source: Author's calculation.

Figure 6.10. depicts customer and consumer co-creation as the most commonly used open innovation practice. Contracted R&D services followed. Other practices are rarely used, and specialised open innovation intermediaries are the most rarely used practice. Nevertheless, the results on the open innovation practices are skewed to the left, implying their lack of utilisation in the Croatian telecommunications industry. Consistent with previous studies, the customer and consumer co-creation is the most widely used practice.

6.2.1.9. Open innovation perspectives: Accomplished open innovation

Respondents were asked to rate their firms' accomplished open innovations based on eight statements. Accomplished open innovations were rated on a Likert scale from 1 "not at all" to 7 "very much". The statements were based on firms' innovation cooperation with various external stakeholders. External stakeholders include: clients, competitors, suppliers, government agencies, research institutes, universities or any other possible organisations with which a fim can cooperate on a new product, process or service development. The accomplished open innovation statements were based on: inbound open innovation, coupled open innovation, and outbound open innovation.

Inbound open innovation involved innovation accomplished with external stakeholders. The examined practices were: gathering information, exchanging experiences, buying or using technology, adopting available external knowledge and technology to internal developments. Coupled open innovation asked questions on joint undertakings of R&D activities and joint product or process developments. Outbound open innovation asked questions about the level of externalisation of ideas that cannot be self-developed, firms' sale of non-core technology and commercialisation of intellectual property rights. Means were calculated for all items and the results are displayed in Figure 6.11.

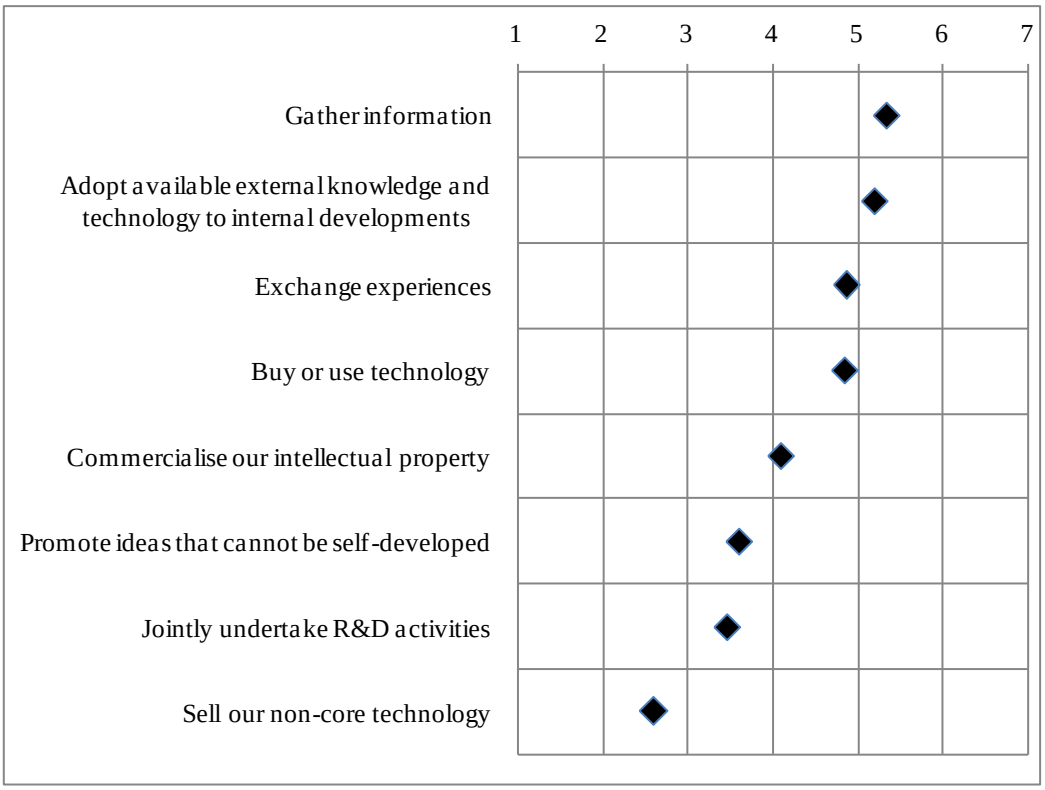


Figure 6. 11. Accomplished open innovation

Source: Author's calculation.

Respondents evaluated that their firms' innovation cooperation with external stakeholders involves gathering information, adopting available external knowledge and technology to the internal developments, exchange of experiences or purchase or usage of a firm's technology. Commercialisation of firms' intellectual property rights, promotion of ideas that cannot be self-developed, joint undertaking of R&D activities and the sale of firms' non-core technology are fairly underrepresented. It can be noted that inbound open innovation is used to a moderate extent, and that the accomplished outbound open innovation is relatively under-utilised. Firms do not perceive the gains that could be obtained from selling their non-core technology or collaboration with external stakeholders and the share of their knowledge for new developments.

6.2.1.10. Open innovation perspectives: Identification of open innovation possibilities

When asked how their firms identify open innovation possibilities, the respondents were asked to evaluate the ways or sources of ideas for a new product, service or process development. Fourteen means and sources were singled out from the previous innovation

surveys (Terziovski, 2010). Similarly to previous graphs, means of all items were calculated for all responses in the sample and the results are presented in Figure 6.12.

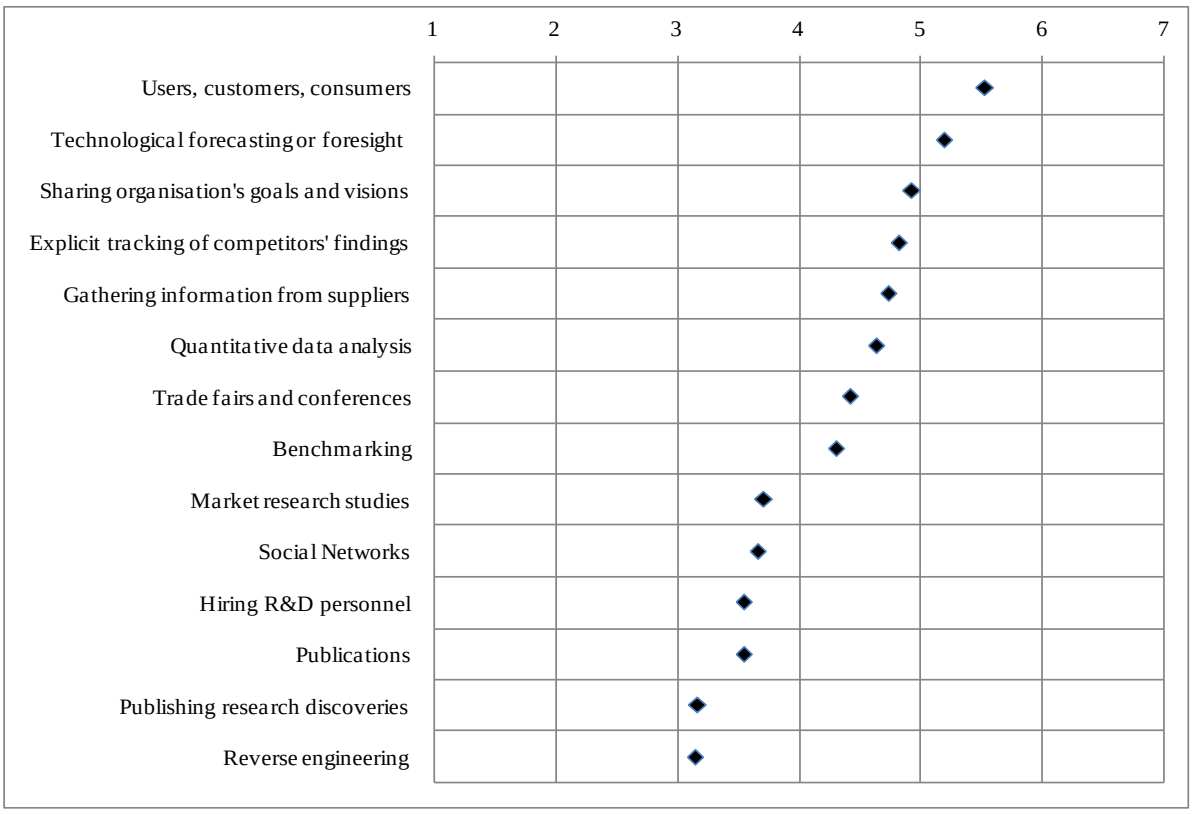


Figure 6. 12. Identification of open innovation possibilities

Source: Author's calculation.

Firms in the Croatian telecommunications industry mainly used the information gathered from customers, consumers and users to identify open innovation possibilities. Technological forecasting and foresight, and sharing the organisation's goals and visions follow. Explicit tracking of competitors' findings, gathering information from suppliers, quantitative data analysis, trade fairs and conferences and benchmarking are used to some extent. Market research studies, social networks, hiring R&D personnel, publications, reverse engineering and publishing research discoveries are fairly unused sources of open innovation. Firms seem not to perceive the value of publishing research discoveries or direct R&D personnel. Customers are the important source of open innovation, which is consistent with the questions on the open innovation practices and accomplished inbound open innovation. Sharing firms' goals and visions is used more than it was expected when composing the survey because

when firms decide to find new ideas outside of their organisation, they are more prepared to share their goals and visions.

6.2.1.11. Open innovation perspectives: Readiness for open innovation

Certain flexibility needs to be obtained in a business model for it to adjust and accommodate to new products, services or processes. The respondents were asked to evaluate how much flexibility their processes and structures enable them to develop new products, services or processes without negative effects on their core businesses. The mean of the answers was taken for all items. Figure 6.13. shows the readiness for open innovation for all the firms in the sample.

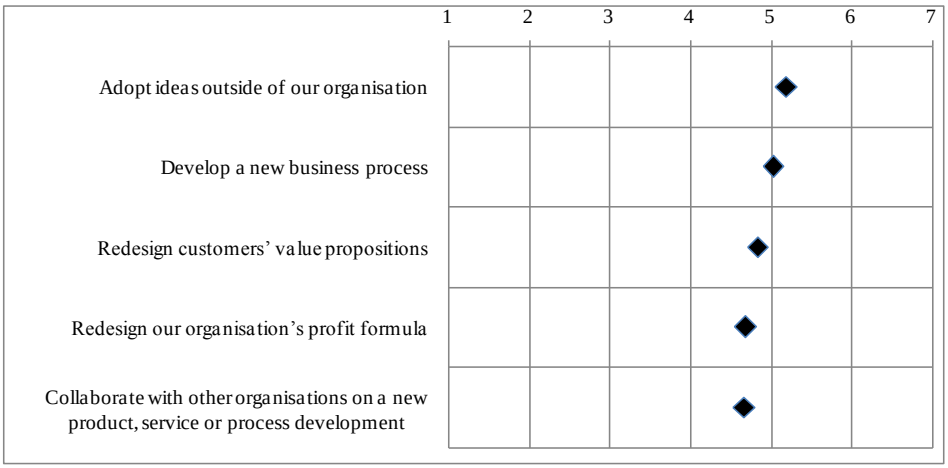


Figure 6. 13. Readiness for open innovation

Source: Author's calculation.

In general, firms seem to have a business model flexibility that enables their readiness to undertake open innovation. The respondents' answers are skewed to the right implying positive perceptions about their firms' readiness for open innovation. Firms' flexibility is perceived in terms of adoption of ideas outside of the organisation. A slightly lower amount of business models' flexibility is evident in responses on new business process developmet, customers' value propositions redesign, collaboration with other organisations and organisations' profit formula redesign.

6.2.1.12. Stakeholder dependence

Figure 6.14. shows the extent to which a firm's product, service or process development is dependent on firms' stakeholders. This dependence implies the importance of stakeholders for the innovation process and, consequently, suggests stakeholders to be used in open innovation. The mean of all responses for a particular item was calculated and used in the analysis (Figure 6.14.).

Figure 6. 14. Stakeholder dependence

Source: Author's calculation.

The results show that the firms are, on average, the most dependent on their clients, customers and users. Secondly, firms seem to be dependent on other organisations within the telecommunications industry. Dependence on the organisations in other industries follows. Product, service and process developments in the telecommunications industry are less dependent on publicly available information, government agencies, research institutes and universities.

Spearman's correlation coefficient was calculated for correlations between stakeholder dependence and the amount of innovations. It shows that neither the dependence on clients, customers and users, other organisations within the telecommunications industry, nor the dependence on organisations in other industries significantly correlates to any type of

innovation. Innovation in services is negatively correlated with dependence on government agencies (r_s = - 0.21) implying a possible negative impact of the government agencies on the amount of innovation in services. Furthermore, dependence on research organisations is positively correlated with the amount of licences (r_s = 0.24), patents (r_s = 0.33), topography of semiconductor products (r_s = 0.27) and industrial designs (r_s = 0.25) and copyrights (r_s = 0.23). It is not significantly correlated with the amount of products, services, processes or projects and trademarks which is interpreted in the research organisations' dependence on innovations that cannot be internally performed, opposed to those innovations that can be done by the firms themselves.

Similarly, the correlation coefficient between the stakeholder dependence and revenue from innovations was calculated. Correlations between firms' dependence on clients, customers and users, on other organisations within the telecommunications industry or dependence on organisations in other industries do not significantly correlate to any type of revenue from innovation.

Revenue from new products is positively correlated with dependence on government agencies (r_s = 0.22) implying a positive connection between the government agencies and the revenue from new products. Furthermore, dependence on research organisations is positively correlated with revenue from patents (r_s = 0.36), topography of semiconductor products (r_s = 0.25), industrial designs (r_s = 0.24) and copyrights (r_s = 0.29). It is not significantly correlated with revenue from products, services or processes, licences and trademarks. This can be interpreted in a similar manner as correlation between the dependence on research organisation and innovation amounts. Publicly available information are negatively correlated with the revenue from services (r_s = - 0. 22) and positively with the revenue from topography of semiconductor products (r_s = 0.25). The information, which is already available on certain developments in the technology or customer preferences, becomes available to all firms in the industry and revenues eventually fall. On the other hand, publicly available information can positively influence the revenue from topography of semiconductor products, or vice versa, because the availability of information on new sectoral developments facilitates the market transactions of those innovations.

6.2.2. Relationship between internationalisation and open innovation in the telecommunications industry

The appropriate statistical methods were used in order to interpret and analyse the obtained data. The method of descriptive statistics was used to describe a sample and outline the fundamental relationships between the variables of interest. Inferential statistics examined the hypothesised relationships between variables. Correlation, regression, multivariate analysis and parametric, i.e. nonparametric, tests were used. The consistencies of constructs were checked by multivariate statistical factor analysis. Structural equation models were used to examine all hypotheses. Statistical packages SPSS, AMOS and Excel were employed for the analysis of the given data.

Analysis of latent constructs and paths was based on the model depicted in Chapter 5. Based on the previously constructed model and the relationships that were assumed before the empirical research was performed, structural equation modelling was used to test the proposed relationships and hypotheses (Velicer and Jackson, 1990, p. 20-21).

6.2.2.1. Confirmatory factor analysis of the hypothesised constructs

Chapter 5.3. described the model's variables. The items and constructs in the survey were based on the items that were identified in the literature. Hence, the hypothesised constructs were tested with the confirmatory factor analysis (Velicer and Jackson, 1990, p. 20-21).

Confirmatory factor analysis was made in SPSS Amos by using a maximum likelihood estimation method on a sample size of 88 responses that represented one response per firm.

After the in-depth analysis of the questionnaire items had been carried out, the following constructs were identified and the confirmatory factor analysis (CFA) was performed. Constructs were:

1) Open innovation:
    a. Readiness for open innovation,
    b. Inbound accomplished open innovation,
    c. Specific identification of open innovation possibilities,
    d. Generic identification of open innovation possibilities,

2) Innovation:
    a. Innovation amount,
    b. Amount of intellectual property rights,
    c. Innovation revenue,
    d. Revenue from intellectual property right,
    e. Innovation outcomes.
3) Internationalisation:
    a. International performance,
    b. Relative international financial position,
    c. Relative international financial growth,
    d. Relative international customer satisfaction.
4) Mediators:
    a. Institutional regulatory environment

The confirmatory factor analysis procedure and results are given in Appendix 4.

All of the constructs showed high internal validity with *p values* ≥ 0.5, NFI ≥ 0.9 and CFI ≥ 0.9. RMSEA was lower than 0.08 for all Open innovation constructs apart from the Specific identification of open innovation possibilities construct (RMSEA = 0.14), which was above the proposed threshold for a good model fit. Considering all other indices depicted a good fit, and RMSEA tends to be inflated in small sample sizes, the construct Specific identification of open innovation possibilities was kept in the analysis with the proposed four items.

6.2.2.2. Exploratory factor analysis of moderators

Exploratory factor analysis is performed on several variables that were used in the moderated mediation analysis in Hypotheses 2, 3 and 4. A detailed description of the procedure and contructs used in the exploratory factor analysis are given in Appendix 5. The final list of moderators that were proposed in Chapter 5.2. included:

a. Formal cooperation (Cronbach's alpha = 0.82),
b. Knowledge and skills of the project team: teamwork skills (Cronbach's alpha = 0.91), managerial skills (Cronbach's alpha = 0.89) and international knowledge (Cronbach's alpha = 0.85),
c. Innovation new to the market (Cronbach's alpha = 0.87).

6.2.2.3. The results of the hypotheses testing

6.2.2.3.1. Hypothesis 1: The level of open innovation a firm undertakes positively influences the firms' internationalisation.

The rationale for examining the relationships in the Hypothesis 1 is given in Chapter 5.2. Hypothesis 1 is divided into three sub-hypotheses:

H1.a: A more active open innovation positively influences the firms' innovation performance.

H1.b: A more active open innovation positively influences the firms' international position.

H1.c: A more active open innovation positively influences the firms' international success.

The hypotheses constructs of the open innovation, internationalisation and innovation are examined by the use of structural equation modelling. The results of the performed analysis are given in the section below.

6.2.2.3.1.1. Hypothesis 1a. A more active open innovation positively influences the firms' innovation performance.

Structural equation modelling is performed on four open innovation constructs and the innovation amount construct. The results are presented in Table 6.15.

Table 6. 15. Effect of Open innovation on the Innovation amount

	Effect of Open innovation factors on the Innovation amount factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.36***	0.01	0.13	26.24	0.39	25	0.92	0.99	0.02	0.00	0.09
Inbound accomplished open innovation	-0.08	0.56	0.01	17.43	0.49	18	0.92	1.00	0.00	0.00	0.09
Generic identification of open innovation possibilities	0.32**	0.02	0.10	21.62	0.25	18	0.91	0.98	0.05	0.00	0.11
Specific identification of open innovation possibilities	0.21	0.13	0.04	14.82	0.54	16	0.93	1.00	0.00	0.00	0.09

Source: Author's calculation.

Table 6.15. shows that all the indices evaluating the structural and measurement model provide a very good fit of the model to the data (p value (χ^2) ≥ 0.05, NFI ≥ 0.9, CFI ≥ 0.95, RMSEA ≤ 0.08). Structural model shows the significant effect of Readiness for open innovation and Generic identification of open innovation possibilities on the amount of innovation an organisation produces. Readiness for open innovation's effect on innovation amount is significant on one percent significance level, while the Generic identification of open innovation possibilities' effect on innovation amount is significant on a five percent significance level.

Readiness for open innovation is the most significant predictor of the innovation amount. Inbound accomplished open innovation produced the insignificant but negative effect on the amount of innovation. The firms might perceive themselves as ready for innovation. Their marketing departments might scan the environment to identify new ideas. However, the generic identification is not translated into a specific identification that is used for more sophisticated products, services and processes. Hence, the inbound open innovation does not really persist and even if it does, it does not produce a significant effect on the amount of new products, services and processes made by a firm.

Table 6. 16. Effect of Open innovation on the Amount of intellectual property rights

	Effect of Open innovation factors on the Innovation amount in intellectual property rights factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.26**	0.03	0.07	25.15	0.80	32	0.93	1.00	0.00	0.00	0.05
Inbound accomplished open innovation	0.16	0.22	0.03	34.82	0.25	30	0.89	0.98	0.04	0.00	0.10
Generic identification of open innovation possibilities	0.33***	0.01	0.11	18.66	0.67	22	0.94	1.00	0.00	0.00	0.07
Specific identification of open innovation possibilities	0.34**	0.02	0.11	18.88	0.76	24	0.92	1.00	0.00	0.00	0.06

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically (p<0.05) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Indices evaluating the structural and measurement model of the effect of Open innovation factors on the Amount of intellectual property rights an organisation produces provide a very good fit of the model to the data (P value (χ^2) ≥ 0.05, NFI ≥ 0.9, CFI ≥ 0.95, RMSEA ≤ 0.08). Table 6.16. shows that Readiness for open innovation, Generic and Specific identification of open innovation possibilities exhibit significant impact on the amount of intellectual property rights. Inbound accomplished open innovation does not have a significant effect on the Amount of intellectual property rights. The greatest effect on the Amount of intellectual

property rights is exerted from the Specific identification of open innovation possibilities. Specific identification occurs when an organisation has already identified areas in which they want to explore new developments and is lacking fine-tuning that corresponds with the higher amounts of specific intellectual property rights.

Table 6. 17. Effect of Open innovation on Revenue from Innovation

	Effect of Open innovation factors on the Innovation revenue factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.30	0.13	0.09	28.34	0.20	23	0.89	0.98	0.05	0.00	0.11
Inbound accomplished open innovation	0.29*	0.09	0.09	32.99	0.13	25	0.79	0.94	0.06	0.00	0.11
Generic identification of open innovation possibilities	0.27*	0.09	0.07	21.72	0.20	17	0.87	0.97	0.06	0.00	0.12
Specific identification of open innovation possibilities	0.14	0.38	0.02	16.63	0.12	11	0.87	0.95	0.08	0.00	0.15

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically ($p<0.05$) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: Author's calculation.

With respect to the effect of Open innovation factors on the Revenue from innovations (Table 6.17.), only Inbound accomplished open innovation and Generic identification of open innovation possibilities affect innovation revenue significantly, on a ten per cent significance level. Structural and measurement model describe a very good fit of the model to the data (P value (χ^2) ≥ 0.05, NFI ≈ 0.9, CFI ≥ 0.95, RMSEA ≤ 0.08).

Specific identification of open innovation possibilities does not have the effect on the revenue generated from innovation in products, services, processes and licenses because these innovations relate to the intellectual property rights an organisation develops. The opposite occurs in the generic identification of open innovation possibilities. Inbound accomplished open innovation influences revenue from innovation, and the Readiness for open innovation does not influence the revenue from innovation because the Readiness might have an indirect effect on the revenues generated from innovations.

Table 6. 18. Effect of Open innovation on the Revenue from intellectual property rights

	Effect of Open innovation factors on the Revenue from intellectual property rights factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.19	0.11	0.04	43.16	0.09	32	0.91	0.97	0.06	0.00	0.11
Inbound accomplished open innovation	0.04	0.74	0.00	39.24	0.18	32	0.89	0.98	0.05	0.00	0.10
Generic identification of open innovation possibilities	0.35***	0.01	0.12	31.40	0.14	24	0.92	0.88	0.6	0.00	0.11
Specific identification of open innovation possibilities	0.26*	0.07	0.07	21.18	0.57	23	0.94	1.00	0.00	0.00	0.08

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically (p<0.05) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Table 6.18. shows the impact of Open innovation factors on the Revenue from intellectual property rights. Only Generic (p value ≤ 0.01) and Specific identification of open innovation possibilities (p value ≤ 0.10) could predict the revenue generated from the intellectual property rights. If an organisation actively scans the environment to find innovative ideas, it will produce a higher amount of intellectual property rights. On the other hand, although organisations might be ready and perform inbound open innovation, they will not translate them into intellectual property rights without a specific knowledge. Structural and measurement model depict a very good fit of the model to the data (P value (χ^2) ≥ 0.05, NFI $\approx$ 0.9, CFI ≈ 0.95, RMSEA ≤ 0.08).

Table 6. 19. Effect of Open innovation on the Innovation outcome

	Effect of Open innovation factors on the Innovation outcome factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.48***	0.00	0.23	66.73	0.18	57	0.91	0.99	0.04	0.00	0.08
Inbound accomplished open innovation	0.12	0.34	0.02	67.44	0.14	56	0.90	0.98	0.05	0.00	0.09
Generic identification of open innovation possibilities	0.51***	0.00	0.26	58.19	0.05	42	0.92	0.97	0.07	0.00	0.11
Specific identification of open innovation possibilities	0.22	0.11	0.05	60.88	0.06	45	0.90	0.97	0.06	0.00	0.10

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically (p<0.05) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Readiness for open innovation and Generic identification of open innovation possibilities predict Innovation outcome on a one per cent significance level (Table 6.19.). If organisations' processes and structures enable innovation, they will achieve certain innovation outcomes (e.g., lower development, unit or production costs or lower time to market). On the other hand, Generic identification of open innovation possibilities shows that their usage might increase Innovation outcomes. Although the same effect would be expected

with Inbound open innovation, data do not support this conclusion. A positive but insignificant effect of inbound open innovation on innovation outcomes implies more actions are necessary to increase the organisations' ability to absorb the inbound open innovations. Nonetheless, the structural and measurement model show a very good fit of the model to the data (P value (χ^2) ≥ 0.05, NFI ≥ 0.9, CFI ≥ 0.95, RMSEA ≤ 0.08).

6.2.2.3.1.2. Hypothesis 1b. A more active open innovation positively influences the firms' international position.

Firms' relative international positions are studied through three constructs which are explained in the Section 6.2.2.1. Structural equation models with Open innovation factors as predictors and the Relative international position constructs are depicted in Tables 6.20., 6.21. and 6.22.

Table 6. 20. Effect of Open innovation on the Relative international financial position

	Effect of Open innovation factors on the Relative international financial position factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi2$	p ($\chi2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.17	0.14	0.03	19.19	0.79	25	0.96	1.00	0.00	0.00	0.06
Inbound accomplished open innovation	0.18	0.16	0.03	34.47	0.12	26	0.92	0.98	0.06	0.00	0.11
Generic identification of open innovation possibilities	0.34***	0.01	0.12	25.88	0.10	18	0.94	0.98	0.07	0.00	0.13
Specific identification of open innovation possibilities	0.30**	0.03	0.09	15.54	0.56	17	0.96	1.00	0.00	0.00	0.09

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically (p<0.05) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Table 6.20. identifies the effects of Open innovation on the Relative international financial position. Structural and measurement model show a very good fit of the model to the data (P value (χ^2) ≥ 0.05, NFI ≥ 0.9, CFI ≥ 0.95, RMSEA ≤ 0.08).

The influence of Generic and Specific open innovation possibilities are significant predictors of firms' relative international financial position. A firm's relative international financial position results from the search of ideas outside of the firms' internal organisational environment. On the contrary, firms' financial positions are not influenced by the Readiness for open innovation and Inbound accomplished open innovation. Open innovation is a relatively new paradigm whose unresolved issues (e.g., the intellectual property rights

ownership) might prevent firms from using them. The firms have not yet learned how to extract benefits from these activities.

Table 6. 21. Effect of Open innovation on the Relative international financial growth

	Effect of Open innovation factors on the Relative international financial growth factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.28**	0.04	0.08	51.18	0.06	37	0.93	0.98	0.07	0.00	0.11
Inbound accomplished open innovation	0.26*	0.07	0.07	51.25	0.11	40	0.92	0.98	0.06	0.00	0.10
Generic identification of open innovation possibilities	0.34**	0.02	0.12	35.11	0.09	25	0.95	0.98	0.07	0.00	0.12
Specific identification of open innovation possibilities	0.27*	0.08	0.07	42.97	0.04	28	0.93	0.97	0.08	0.02	0.12

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically (p<0.05) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Open innovation has an important influence on the Relative international financial growth. The results of the structural equation models (Table 6.21.) show the structural and measurement model' good fit of the model to the data (P value (χ^2) $\geq$ 0.05, NFI $\geq$ 0.9, CFI $\geq$ 0.95, RMSEA $\leq$ 0.08).

Readiness for open innovation and Generic identification of open innovation possibilities are stronger and significant predictors of Relative international financial growth. Their p values are below 0.05. Inbound accomplished open innovation and Specific identification of open innovation possibilities both have p values lower than 0.10 and are significant predictors of the Relative international financial growth. It is important to note that the relationships between all Open innovation factors and Relative financial growth factor are positive and significant implying benefits to future financial performance that might occur as a result of the open innovation. These benefits but exhibit the sign of dynamism and point to possible future gains.

Table 6. 22. Effect of Open innovation on the Relative international customer satisfaction

	Effect of Open innovation factors on the Relative international customer satisfaction factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Readiness for open innovation	0.27**	0.03	0.07	19.70	0.71	24	0.95	1.00	0.00	0.00	0.07
Inbound accomplished open innovation	0.29**	0.04	0.08	35.99	0.03	24	0.88	0.95	0.08	0.03	0.13
Generic identification of open innovation possibilities	0.14	0.25	0.02	13.73	0.55	15	0.96	1.00	0.00	0.00	0.09
Specific identification of open innovation possibilities	0.24	0.13	0.06	12.72	0.76	17	0.95	1.00	0.00	0.00	0.07

ıe results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

d practically (coefficients > 0.3) significant.

.4 which shows suffient discriminant validity among the latent constructs.

Source: Author's calculation.

Both Readiness for open innovation and the Inbound accomplished open innovation influence the Relative international customer satisfaction on a five per cent significance level, and neither Generic nor Specific identification of open innovation possibilities do not (Table 6.22.). The firms' ability to adapt their processes and structures and take their innovation from the external to internal environment influences the added value of these products, services and processes more than the process of identification of ideas from external environment. As in other models, structural and measurement indices show a very good fit of the model to the data (P value (χ^2) ≥ 0.05, NFI ≥ 0.9, CFI ≥ 0.95, RMSEA ≤ 0.08).

6.2.2.3.1.3. Hypothesis 1c. A more active open innovation positively influences the firms' international success.

The effect of Open innovation on International performance is displayed in Table 6.23.

Table 6. 23. Effect of Open innovation on the International performance

	Effect of Open innovation factors on the International performance factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence	
Readiness for open innovation	0.22*	0.07	0.05	35.58	0.30	32	0.91	0.99	0.04	0.00	0.09
Inbound accomplished open innovation	0.01	0.96	0.00	28.88	0.63	32	0.90	1.00	0.00	0.00	0.07
Generic identification of open innovation possibilities	0.13	0.33	0.02	18.93	0.33	17	0.92	0.99	0.04	0.00	0.11
Specific identification of open innovation possibilities	0.28**	0.04	0.08	28.91	0.03	16	0.87	0.93	0.10	0.03	0.15

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically ($p<0.05$) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

Source: Author's calculation.

The results of the structural equation models (Table 6.23.) show that the Readiness for open innovation and the Specific identification open innovation possibilities are significant predictors of the International performance. Readiness for open innovation is significant on a ten per cent significance level, and the Specific identification of open innovation possibilities is significant on a five per cent significance level. Adapting the processes and structures and actively scanning for new specific ideas for improvements of products or services aids firms' international performance. On the other hand, Inbound accomplished open innovation and Generic identification of open innovation possibilities are insignificant predictors of firms' international performance because firms might use them for incremental innovations instead of radical innovations. Radical innovations would incorporate higher added value and result in higher competitiveness of firms' products and services in the international market.

6.2.2.3.2. Hypothesis 2: A higher rate of formal cooperation between firms moderates the relationship between open innovation and internationalisation through the firms' innovation performance.

The rationale for testing the hypothesed relationship is given in Chapter 5.2. The explanation of the procedure and results of the mediation analysis are given in Appendix 6. Only the significant mediations presented in the previous section were tested for moderation effects.

The effect of open innovation on internationalisation is mediated by firms' innovation performance. The mediated relationship was tested for the multigroup differences between firms with higher and lower levels of formality in cooperation with other firms. The formal cooperation construct was split into two groups based on the construct's median. One group represented more formal cooperation, and the other group represented the lower cooperation formality. The moderation effect of the two groups was tested in IBM's statistical software package SPSS AMOS. Two sets of comparisons were of interest: the group differences and path coefficients. The path invariance model of moderation effects is given in the Appendix 7. The results of the group differences of four proposed mediations are depicted in Table 6.24.

Table 6. 24. Moderated mediation of formal cooperation (Summary of the model comparison)

		χ^2	DF	p (χ2)	NFI	CFI	RMSEA			R^2	Group differences
								90% confidence interval			
1) Generic OI_Innovation amount_Rel. Inter. financial position	Unconstrained model	116.76	98	0.10	0.83	0.97	0.05	0.00	0.08	0.20	NO
	Constrained model	131.63	110	0.08	0.80	0.96	0.05	0.00	0.08	0.11	
2) Generic OI_IPR amount_Rel. Inter. financial position	Unconstrained model	144.82	116	0.04	0.80	0.95	0.05	0.02	0.08	0.10	YES
	Constrained model	195.35	129	0.00	0.73	0.89	0.08	0.05	0.10	0.08	
3) Specific OI_IPR amount_Inter. Performance	Unconstrained model	209.16	138	0.00	0.67	0.85	0.08	0.06	0.10	0.28	YES
	Constrained model	260.87	151	0.00	0.59	0.76	0.09	0.07	0.11	0.21	
4) Specific OI_IPR amount_Rel. Inter. financial position	Unconstrained model	200.27	122	0.00	0.72	0.86	0.09	0.06	0.11	0.31	YES
	Constrained model	260.30	134	0.00	0.64	0.78	0.10	0.09	0.12	0.02	

Source: Author's calculation

The analysis evaluates the difference between an unconstrained model which assumes that the groups are yielding different values of the parameters when the model is applied to the data, and a constrained model that assumes that the groups are yielding equivalent values of parameters when the model is applied to the data. The models were assessed based on χ^2, NFI, CFI and RMSEA (Table 6.24.). For both groups, both unconstrained and constrained models chi-square is statistically significant in the following relationships: (1) Readiness for open innovation's effect on International performance through Amount of intellectual property rights; (2) Generic identification of open innovation possibilities' effect on Relative

international financial position through Amount of intellectual property rights; (3) Specific identification of open innovation possibilities on International performance through Amount of IPR, and (4) Specific identification of open innovation possibilities on Relative international financial position through Amount of intellectual property rights.

6.2.2.3.3. Hypothesis 3: Knowledge and skills of the project team moderate the relationship between open innovation and internationalisation through the firms' innovation performance.

This section describes the knowledge and skills of the project teams, which were tested for moderation in the relationship between open innovation, innovation and internationalisation.

Three constructs depicted the knowledge and skills of the project team:

1) Teamwork skills
2) Managerial skills
3) International knowledge

Each of the three constructs was split into two groups based on the construct's median. One group represented higher levels of skills or knowledge, while the other group represented lower level of skills or knowledge.

Moderated mediation is done separately for each of the three constructs by using a method of multigroup moderation. The results of the multigroup moderated mediation are presented as a summary of constrained and unconstrained models.

6.2.2.3.3.1. Teamwork skills moderate the relationship between open innovation and internationalisation through the firms' innovation performance.

Summary of the moderated mediation's structural equation models for teamwork skills differences is given in Table 6.25.

Table 6. 25. Moderated mediation of teamwork skills (Summary of the model comparison)

		χ^2	DF	p (χ^2)	NFI	CFI	RMSEA			R^2	Group differences
								90% confidence interval			
1) Generic OI_Innovation amount_Rel. Inter. financial position	Unconstrained model	91.86	98	0.66	0.85	1.00	0.00	0.00	0.05	0.20	NO
	Constrained model	101.13	110	0.72	0.84	1.00	0.00	0.00	0.04	0.17	
2) Generic OI_IPR amount_Rel. Inter. financial position	Unconstrained model	131.04	116	0.16	0.83	0.98	0.04	0.00	0.07	0.14	NO
	Constrained model	137.58	129	0.29	0.82	0.99	0.03	0.00	0.06	0.10	
3) Specific OI_IPR amount_Inter. Performance	Unconstrained model	158.90	138	0.11	0.75	0.96	0.04	0.00	0.07	0.03	NO
	Constrained model	170.71	151	0.13	0.74	0.96	0.04	0.00	0.07	0.18	
4) Specific OI_IPR amount_Rel. Inter. financial position	Unconstrained model	159.31	122	0.01	0.78	0.94	0.06	0.03	0.08	0.07	NO
	Constrained model	166.08	134	0.03	0.77	0.94	0.05	0.02	0.08	0.12	

Source: Author's calculation

6.2.2.3.3.2. Managerial skills moderate the relationship between open innovation and internationalisation through the firms' innovation performance.

Summary of moderated mediation structural equation models with respect to managerial skills is given in Table 6.26.

Table 6. 26. Moderated mediation of managerial skills (Summary of the model comparison)

		χ2	DF	p (χ2)	NFI	CFI	RMSEA			R^2	Group differences
								90% confidence interval			
1) Generic OI_Innovation amount_Rel. Inter. financial position	Unconstrained model	110.07	98	0.19	0.83	0.98	0.04	0.00	0.07	0.18	NO
	Constrained model	125.60	110	0.15	0.81	0.97	0.04	0.00	0.07	0.19	
2) Generic OI_IPR amount_Rel. Inter. financial position	Unconstrained model	152.27	116	0.01	0.80	0.94	0.06	0.03	0.09	0.25	NO
	Constrained model	160.69	129	0.03	0.79	0.95	0.05	0.02	0.08	0.11	
3) Specific OI_IPR amount_Inter. Performance	Unconstrained model	173.66	138	0.02	0.74	0.93	0.05	0.02	0.08	0.11	NO
	Constrained model	185.60	151	0.03	0.72	0.93	0.05	0.02	0.08	0.17	
4) Specific OI_IPR amount_Rel. Inter. financial position	Unconstrained model	168.73	122	0.00	0.77	0.92	0.07	0.04	0.09	0.13	NO
	Constrained model	176.58	134	0.00	0.76	0.93	0.06	0.03	0.08	0.17	

Source: Author's calculation

6.2.2.3.3.3. International knowledge moderate the relationship between open innovation and internationalisation through the firms' innovation performance.

Table 6.27. summarises the unconstrained and a constrained models of group differences between team's international knowledge.

Table 6. 27. Moderated mediation of international knowledge (Summary of the model comparison)

		χ2	DF	p (χ2)	NFI	CFI	RMSEA			R^2	Group differences
								90% confidence interval			
1) Generic OI_Innovation amount_Rel. Inter. financial position	Unconstrained model	97.98	98	0.48	0.90	1.00	0.00	0.00	0.05	0.19	NO
	Constrained model	107.09	110	0.56	0.89	1.00	0.00	0.00	0.04	0.15	
2) Generic OI_IPR amount_Rel. Inter. financial position	Unconstrained model	116.73	116	0.46	0.89	1.00	0.01	0.00	0.04	0.15	NO
	Constrained model	126.39	129	0.55	0.88	1.00	0.00	0.00	0.04	0.13	
3) Specific OI_IPR amount_Inter. Performance	Unconstrained model	188.53	140	0.00	0.70	0.89	0.06	0.04	0.09	0.15	NO
	Constrained model	205.17	153	0.00	0.68	0.89	0.06	0.04	0.08	0.12	
4) Specific OI_IPR amount_Rel. Inter. financial position	Unconstrained model	167.00	122	0.00	0.84	0.95	0.05	0.03	0.07	0.12	NO
	Constrained model	177.60	134	0.01	0.82	0.95	0.05	0.03	0.07	0.10	

Source: Author's calculation

Hypothesis 3 shows that the group differences in the effect of project members' teamwork skills, managerial skills and international knowledge do not exist with respect to the moderation effect the open innovation perspectives have on internationalisation through the amount of intellectual property rights.

6.2.2.3.4. Hypothesis 4: Innovation which is new to the market moderates the relationship between the firm's innovation performance and internationalisation more than the innovation which is new to the firm.

A direct relationship between innovation and internationalisation constructs is examined in Hypothesis 4. Summary of the unconstrained and constrained models' comparisons (Table 6.28.) displays the differences between two groups: innovation new to the market and innovation new to the firm.

Table 6. 28. Moderation of new to the market innovations (Summary of the model comparison)

		$\chi 2$	DF	p ($\chi 2$)	NFI	CFI	RMSEA			R^2	Group differences
								90% confidence interval			
1) Innovation Amount_International Performance	Unconstrained model	50.67	48	0.37	0.87	0.99	0.03	0	0.08	0.15	YES
	Constrained model	71.04	56	0.09	0.81	0.95	0.06	0	0.09	0.03	
2) Innovation Amount_Relative international financial position	Unconstrained model	30.81	38	0.79	0.94	1.00	0.00	0.00	0.05	0.11	YES
	Constrained model	47.45	45	0.37	0.90	0.99	0.03	0.00	0.08	0.09	
3) Innovation Amount_Relative international financial growth	Unconstrained model	75.52	58	0.06	0.89	0.97	0.06	0.00	0.09	0.02	YES
	Constrained model	96.34	67	0.01	0.86	0.95	0.07	0.04	0.10	0.04	
4) Innovation Amount_Relative international customer satisfaction	Unconstrained model	30.43	36	0.73	0.91	1.00	0.00	0.00	0.06	0.01	YES
	Constrained model	43.14	43	0.47	0.88	1.00	0.01	0.00	0.07	0.04	
5) Amount of IPR_International Performance	Unconstrained model	77.59	66	0.16	0.82	0.97	0.05	0.00	0.08	0.14	NO
	Constrained model	89.82	75	0.12	0.79	0.96	0.05	0.00	0.08	0.16	
6) Amount of IPR_Relative international financial position	Unconstrained model	48.16	48	0.47	0.91	1.00	0.01	0.00	0.07	0.02	NO
	Constrained model	61.27	56	0.29	0.89	0.99	0.03	0.00	0.08	0.07	
7) Revenue from innovation_Relative international customer satisfaction	Unconstrained model	28.41	34	0.74	0.90	1.00	0.00	0.00	0.06	0.01	NO
	Constrained model	33.06	41	0.81	0.88	1.00	0.00	0.00	0.05	0.03	
8) Revenue from IPR_International Performance	Unconstrained model	65.19	64	0.44	0.88	1.00	0.02	0.00	0.07	0.10	YES
	Constrained model	118.93	73	0.00	0.79	0.90	0.09	0.06	0.11	0.18	
9) Innovation outcome_Relative international financial growth	Unconstrained model	203.99	130	0.00	0.83	0.93	0.08	0.06	0.10	0.05	YES
	Constrained model	224.09	143	0.00	0.81	0.92	0.08	0.06	0.10	0.04	
10) Innovation outcome_Relative international customer satisfaction	Unconstrained model	138.07	92	0.00	0.84	0.94	0.08	0.05	0.10	0.03	NO
	Constrained model	149.90	103	0.00	0.82	0.93	0.07	0.05	0.10	0.08	

Source: Author's calculation

Although the results show some effect of innovations that are new to the market on the relationship between innovation and internationalisation, the path coefficients (Appendix 8) do not show a direct influence of new to the market innovation on the path between innovation and internationalisation. Hence, this hypothesis is rejected.

6.2.2.3.5. Hypothesis 5: Institutional environment affects firms' innovation performance.

Hypothesis 5 consists of three subhypotheses.

6.2.2.3.5.1. Hypothesis 5.a. The effect of the institutional environment on the firms' innovation performance is mediated by open innovation.

The effect of the institutional environment on the firms' innovation performance mediated by open innovation is depicted in Table 6.29.

Table 6. 29. Effect of the institutional environment on innovation performance mediated by open innovation

Mediation	Direct without mediator	Direct with mediator	Indirect	χ2	DF	p (χ2)	GFI	NFI	CFI	RMSEA		
											90% confidence interval	
1) Institutional environment_Readiness for OI_Innovative amount	0.41 (0.04)	0.22 (0.08)	Yes (p = 0.08)*	58.89	69	0.80	0.92	0.92	1.00	0.00	0.00	0.04
2) Institutional environment_Inbound accomplished OI_Innovative amount		0.23 (0.08)	Not significant (p = 0.88)	80.57	70	0.18	0.89	0.87	0.98	0.04	0.00	0.08
3) Institutional environment_Generic identification of OI possibilities_Innovative amount		0.17 (0.16)	Not significant (p = 0.33)	70.72	59	0.14	0.90	0.89	0.98	0.05	0.00	0.08
4) Institutional environment_Specific identification of OI possibilities_Innovative amount		0.20 (0.11)	Not significant (p = 0.83)	67.89	57	0.15	0.90	0.89	0.98	0.05	0.00	0.08
5) Institutional environment_Readiness for OI_Innovative amount in IPR	0.56 (0.00)	0.33 (0.01)	Not significant (p = 0.14)	99.72	83	0.10	0.88	0.88	0.98	0.05	0.00	0.08
6) Institutional environment_Inbound accomplished OI_Innovative amount in IPR		0.38 (0.00)	Not significant (p = 0.86)	118.83	82	0.01	0.85	0.84	0.94	0.07	0.04	0.10
7) Institutional environment_Generic identification of OI possibilities_Innovative amount in IPR		0.35 (0.00)	Not significant (p = 0.28)	79.77	67	0.14	0.89	0.89	0.98	0.05	0.00	0.08
8) Institutional environment_Specific identification of OI possibilities_Innovative amount in IPR		0.36 (0.00)	Not significant (p = 0.21)	80.73	67	0.12	0.89	0.89	0.98	0.05	0.00	0.08
9) Institutional environment_Readiness for OI_Revenue from Innovation	0.32 (0.12)	0.17 (0.22)	Not significant (p = 0.13)	77.61	69	0.22	0.89	0.88	0.99	0.04	0.00	0.08
10) Institutional environment_Inbound accomplished OI_Revenue from Innovation		0.18 (0.18)	Not significant (p = 0.71)	88.80	71	0.08	0.88	0.85	0.96	0.05	0.00	0.09
11) Institutional environment_Generic identification of OI possibilities_Revenue from Innovation		0.18 (0.17)	Not significant (p = 0.35)	71.67	59	0.13	0.89	0.88	0.98	0.05	0.00	0.09
12) Institutional environment_Specific identification of OI possibilities_Revenue from Innovation		0.24 (0.08)	Not significant (p = 0.58)	80.73	56	0.19	0.90	0.88	0.98	0.04	0.00	0.08
13) Institutional environment_Readiness for OI_Revenue from IPR	0.14 (0.16)	0.12 (0.26)	Not significant (p = 0.16)	87.40	82	0.32	0.89	0.90	0.99	0.03	0.00	0.07
14) Institutional environment_Inbound accomplished OI_Revenue from IPR		0.15 (0.18)	Not significant (p = 0.54)	97.59	81	0.10	0.87	0.88	0.98	0.05	0.00	0.08
15) Institutional environment_Generic identification of OI possibilities_Revenue from IPR		0.13 (0.24)	Not significant (p = 0.20)	79.96	69	0.17	0.89	0.90	0.99	0.04	0.00	0.08
16) Institutional environment_Specific identification of OI possibilities_Revenue from IPR		0.17 (0.14)	Not significant (p = 0.71)	72.11	67	0.31	0.90	0.91	0.99	0.03	0.00	0.07
17) Institutional environment_Readiness for OI_Innovative outcome	0.31 (0.11)	0.09 (0.40)	Not significant (p = 0.14)	147.34	121	0.05	0.86	0.88	0.98	0.05	0.00	0.08
18) Institutional environment_Inbound accomplished OI_Innovative outcome		0.17 (0.12)	Not significant (p = 0.69)	167.76	123	0.01	0.84	0.84	0.96	0.06	0.04	0.09
19) Institutional environment_Generic identification of OI possibilities_Innovative outcome		0.22 (0.30)	Not significant (p = 0.42)	129.28	100	0.03	0.87	0.89	0.97	0.06	0.02	0.08
20) Institutional environment_Specific identification of OI possibilities_Innovative outcome		0.17 (0.14)	Not significant (p = 0.66)	112.58	101	0.20	0.88	0.90	0.99	0.04	0.00	0.07

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

Almost all model fit indices show a good fit ($p(\chi^2)\geq 0.05$, GFI, NFI and CFI are above or approximately 0.90, RMSEA is below 0.08). In order to satisfy Kenny's (2014) mediation effects' assumptions, direct effects without mediators were tested. Only the effects of Institutional regulatory environment on the Innovation amount and the Amount of intellectual property rights are significant. All other effects are insignificant. This means that government agencies have the effect on the amount of innovation and intellectual property rights and not on the revenue obtained from these activities. Firms revenue are the result of the firms' commercialisation efforts.

Each of the direct effects with mediators exhibited a fall in significance. They became insignificant or their coefficients decreased after the mediating variable was introduced.

Indirect effects are tested with a non-parametric bootstrapping method as in the mediating effects for Hypotheses 2 and 3 (Kenny, 2014, Bollen and Stine, 1990; Shrout and Bolger, 2002).

Only one mediation was significant. The mediation is the effect of institutional regulatory environment on the amount of innovation through the firms' readiness for open innovation. The firms already need to have structures and processes necessary for adoption of open innovation practices in order for the governments' agencies to increase their innovation activities. All other perspectives such as Inbound accomplished open innovation, Generic and Specific innovation were not influenced by the institutional regulatory environment.

6.2.2.3.5.2. Hypothesis 5.b. The effect of the institutional environment on the firms' international performance is mediated by the firms' innovation performance.

Effect of the institutional regulatory environment on the firms' international performance mediated by innovation performance is displayed in Table 6.30.

Table 6. 30. Effect of the institutional environment on international performance mediated by innovation performance

Mediation	Direct without mediator	Direct with mediator	Indirect	χ2	DF	p (χ2)	GFI	NFI	CFI	RMSEA		
											90% confidence interval	
1) Institutional environment_Innovation amount InternationalPerformance	0.07 (0.54)	-0.02 (0.85)	Yes (p = 0.06)*	69.33	68	0.43	0.90	0.91	1.00	0.02	0.00	0.07
2) Institutional environment_Amount IPR_InternationalPerformance		-0.09 (0.48)	Yes (p = 0.04)**	94.30	81	0.15	0.87	0.89	0.98	0.04	0.00	0.08
3) Institutional environment_Revenue from Innovation_InternationalPerformance		-0.01 (0.96)	Not significant (p = 0.28)	83.77	68	0.09	0.89	0.88	0.97	0.05	0.00	0.09
4) Institutional environment_Revenue from IPR_InternationalPerformance		-0.02 (0.84)	Not significant (p = 0.25)	97.92	83	0.13	0.88	0.89	0.98	0.05	0.00	0.08
5) Institutional environment_Innovation Outcome_InternationalPerformance		-0.05 (0.69)	Yes (p = 0.03)**	169.21	120	0.00	0.84	0.87	0.96	0.07	0.04	0.09

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

Almost all model fit indices show a good fit ($p(\chi^2) \geq 0.05$, GFI, NFI and CFI are above or approximately 0.90, RMSEA $\leq$ 0.08). A direct relationship between the Institutional regulatory environment and the International performance without and with mediators is insignificant (p value $\geq$ 0.10). Indirect effect is significant in the relationship between the Institutional environment and the International performance when the following mediators are included: (1) the Amount of innovation; (2) the Amount of intellectual property rights, and (3)

the Innovation outcome. If a direct relationship is not significant, Kenny (2014) states the mediation is also not significant.

6.2.2.3.5.3. Hypothesis 5.c. The effect of the institutional environment on the firms' international position is mediated by the firms' innovation performance.

The mediation of innovation performance on the relationship between the institutional environment and firms' relative international position is displayed in Table 6.31.

Table 6. 31. Effect of the institutional environment on international position mediated by the firm's innovation performance

Mediation	Direct without mediator	Direct with mediator	Indirect	$\chi 2$	DF	p ($\chi 2$)	GFI	NFI	CFI	RMSEA		
											90% confidence interval	
1) Institutional environment_Innovation amount_Relative International Financial Position	0.15 (0.17)	0.08 (0.44)	Yes (p = 0.08)*	46.51	60	0.90	0.93	0.95	1.00	0.00	0.00	0.03
2) Institutional environment_Amount of IPR_Relative International Financial Position		0.08 (0.50)	Yes (p = 0.02)**	76.65	69	0.25	0.89	0.92	0.99	0.04	0.00	0.07
3) Institutional environment_Revenue from Innovation_Relative International Financial Position		0.14 (0.24)	Not significant (p = 0.66)	57.44	60	0.57	0.91	0.93	1.00	0.00	0.00	0.06
4) Institutional environment_Revenue from IPR_Relative International Financial Position		0.14 (0.21)	Not significant (p = 0.30)	84.04	71	0.14	0.89	0.92	0.99	0.05	0.00	0.08
5) Institutional environment_Innovation Outcome_Relative International Financial Position		0.10 (0.38)	Yes (p = 0.06)*	120.95	103	0.11	0.87	0.91	0.99	0.04	0.00	0.07
6) Institutional environment_Innovation amount_Relative International Financial Growth	0.25 (0.05)	0.20 (0.10)	Yes (p = 0.10)*	84.17	78	0.30	0.90	0.92	0.99	0.03	0.00	0.07
7) Institutional environment_Amount of IPR_Relative International Financial Growth		0.23 (0.07)	Not significant (p = 0.21)	109.03	88	0.06	0.88	0.91	0.98	0.05	0.00	0.08
8) Institutional environment_Revenue from Innovation_Relative International Financial Growth		0.21 (0.09)	Not significant (p = 0.19)	79.19	78	0.44	0.90	0.92	1.00	0.01	0.00	0.06
9) Institutional environment_Revenue from IPR_Relative International Financial Growth		0.25 (0.05)	Not significant (p = 0.27)	106.37	91	0.13	0.88	0.91	0.99	0.04	0.00	0.08
10) Institutional environment_ Innovation Outcome_Relative International Financial Growth		0.20 (0.10)	Yes (p = 0.05)**	254.13	141	0.00	0.77	0.84	0.92	0.10	0.08	0.11
11) Institutional environment_Innovation amount_Relative International Customer Satisfaction	0.08 (0.49)	-0.03 (0.85)	Yes (p = 0.04)**	38.47	57	0.97	0.94	0.95	1.00	0.00	0.00	0.00
12) Institutional environment_Amount of IPR_Relative International Customer Satisfaction		0.09 (0.47)	Not significant (p = 0.70)	82.30	69	0.13	0.89	0.90	0.98	0.05	0.00	0.08
13) Institutional environment_Revenue from Innovation_Relative International Customer Satisfaction		-0.02 (0.86)	Yes (p = 0.07)*	52.60	58	0.68	0.92	0.92	1.00	0.00	0.00	0.05
14) Institutional environment_Revenue from IPR Relative_International Customer Satisfaction		0.12 (0.29)	Not significant (p = 0.14)	80.32	71	0.21	0.89	0.91	0.99	0.04	0.00	0.08
15) Institutional environment_Innovation Outcome_Relative International Customer Satisfaction		-0.03 (0.82)	Yes (p = 0.06)*	117.27	101	0.13	0.88	0.91	0.99	0.04	0.00	0.07

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

Although all relationships exhibited a good model fit, a direct relationship without a mediator was only significant for the effect of the Institutional environment on the Relative international financial growth. A direct relationship between the Institutional environment on one side, and the Relative international financial position and the Relative international customer satisfaction, on the other side, were insignificant (p value $\geq$ 0.10). Hence, they were left out of the indirect effect analysis.

In analysis of a direct relationship between the Institutional environment and Relative international financial growth, the significant mediators were the Innovation amount and the Innovation outcome. If government agencies influence the relative international financial growth of telecommunications firms, this relationship will be mediated by the higher amounts of new products, services and processes firms have (p value = 0.10) and their lower unit costs, development costs or time to market (p value = 0.05). Government regulations might increase

firms' international growth. If the increase in international financial growth occurs through the higher amounts of innovation, it is increased because of the increase in the firms' expected future competitiveness. Similar reasoning explains the mediation effect of the Innovation outcomes.

6.3. The evaluation of scope and quality of the model and the future research recommendations

The empirical research encompassed: the choice of the industrial sector to be used in the empirical research, construction and testing of the survey questionnaire which served as a research instrument, contacting firms, and extensive and exhaustive analysis of the constructs that align with the proposed hypotheses. The constructs were identified from the literature before the empirical research had been conducted. The model examined whether the significant relationships identified in the environments of developed economies and different sectors result in similar conclusions in the geographical scope of the Republic of Croatia. Additionally, the effect of different open innovation perspectives on innovation and internationalisation was tested. To my knowledge, a similar research that incorporates various open innovation perspectives and their influence on innovation and internationalisation does not exist. Hence, this approach enabled the categorisation of open innovation perspectives and their influence on innovation and internationalisation in a way that has not been studied previously in the literature. Hence, the mentioned open innovation perspectives categorisation and their effects on innovation and internationalisation present a scientific contribution of this thesis.

The originally proposed model was altered to include four open innovation perspectives: (1) the internal *readiness* for open innovation, (2) the *generic* (market-oriented) identification of open innovation possibilities, (3) the *specific* (technically-oriented) identification of open innovation possibilities, and (4) the inbound *accomplished* open innovation. In that way it was possible to study open innovation from the internal organisational perspective, firms' innovation search practices and the actually performed open innovation activities.

Innovation performance was measured with five constructs: (1) innovation amount, (2) amount of intellectual property rights, (3) innovation revenue, (4) revenue from intellectual property rights and (5) innovation outcome. Internationalisation was measured with: (1) international performance, (2) the firm's relative international financial position, (3) the firm's relative international financial growth and (4) the firm's relative international customer satisfaction.

The research was done in the geographic area of the Republic of Croatia. It was conducted on the firms from the telecommunications industry. The entire population of firms from the telecommunications industry was contacted (347 firms). Initially 128 responses were obtained. After the data has been cleaned to obtain a single response per firm, 88 responses were gathered. The nature of the thesis proposal made the analysis a bit cluttered with fragmented displayed results. Namely, the statistical software package AMOS did not allow for a full structural model with second order contructs to be completed because of the relatively small sample (88 firms) for that type of analysis. This presents a drawback of the research.

The research related each first order latent input construct to the first order latent output construct. Mediations were examined according to Kenny's (2014) steps. They firstly identified significant relationships and tested mediations of the significant relationships. The model was extensive. Nonetheless, the examined relationships provide an insight into the similarities and differences between open innovation and internationalisation with a summary portrayed along the finally adjusted model as portrayed in Figure 6.15. and in Table 6.32., Table 6.33. and Table 6.34.

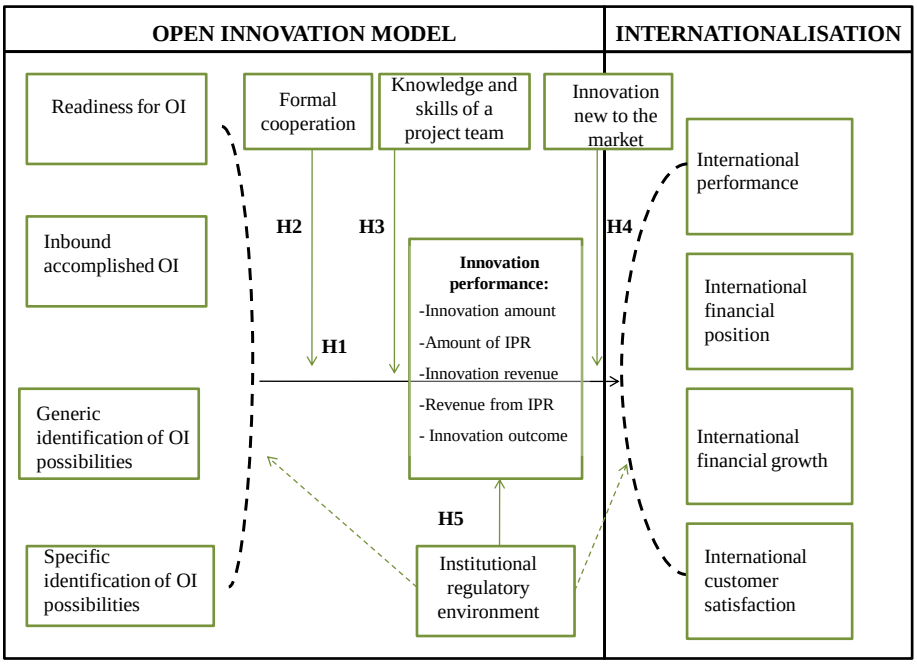


Figure 6. 15. Open innovation-Internationalisation model with the defined constructs

Source: Author's representation.

The nature of the proposed model and hypotheses demanded the use of structural equation modelling which was done in the statistical software package SPSS Amos. The data (Shapiro-Wilks tests) exhibit a non-normal distribution. Confirmatory and exploratory factor analyses were done (Appendix 4 and 5) to identify the latent constructs. Structural models were examined and the presence of multigroup differences was tested. The multigroup moderated mediation analysis was used.

The research incorporated the concept of internationalisation into the open innovation research agenda. It examined direct and indirect links between open innovation and internationalisation and the role of institutional regulatory environment in it. The moderating roles of possible inhibitors or stimulators of better internationalisation were also examined.

Summary of the Hypothesis 1's tested relationships is given in Table 6.32., Table 6.33. and Table 6.34.

Table 6. 32. Summary of the effect of Open innovation on Innovation

Open innovation factors	**Innovation factors**				
	Innovation amount	**Amount of IPR**	Innovation revenue	Revenue from IPR	Innovation outcome
Readiness for OI	√	√	-	-	√
Inbound accomplished OI	-	-	-	-	-
Generic identification of OI possibilities	√	√	-	√	√
Specific identification of OI possibilities	-	√	-	-	-

Note: The positive relationships imply a $p \leq 0.05$.

Source: Author's representation.

Table 6.32. shows that the greatest effect on innovation is exerted from the *generic* identification of open innovation possibities. This implies the importance of market orientation in transferring the innovations from the firm's environment into a firm. Both types of identification of open innovation possibilities significantly influence the amount of intellectual property rights. However, only the *generic* identification of open innovation possibilities influences the revenue from the intellectual property rights. The nature of

identification of open innovation possibilities implies that better market scanning brings an innovation closer to buyers.

The strongest effect on innovation is observed in the influence of the *readiness* of the business model for open innovation and the *generic* identification of open innovation possibilities on the innovation outcomes. This implies that the internal organisational responsiveness and external search methods generate intermediate results for a firm in terms of lower unit costs or higher quality of products, services or processes.

The inbound *accomplished* open innovation does not have a significant effect on innovation. Although firms are market-orientated, there is either a failure to commercialise the results of identified open innovation possibilities, or firms only scan the environment and rely on their internal capabilities to develop innovations.

Out of all innovation indicators, the amount of the intellectual property rights is the mostly impacted by the examined open innovation perspectives. Hence, the propriatory knowledge is a significant output of open innovation. Future research should study the interaction of the *readiness* of a business model and the *generic* identification of open innovation possibilities for better interpretation of their relationship.

Table 6. 33. Summary of the effect of Open innovation on Internationalisation

Open innovation factors	**Internationalisation factors**			
	International performance	Relative international financial position	Relative international financial growth	Relative international customer satisfaction
Readiness for OI	-	-	√	√
Inbound accomplished OI	-	-	-	√
Generic identification of OI possibilities	-	√	√	-
Specific identification of OI possibilities	√	√	-	-

Note: The positive relationships imply a $p \leq 0.05$.

Source: Author's representation.

With respect to the effect of differing open innovation perspectives on internationalisation, it is interesting to note the effect of the *readiness* of firms for open innovation and the *generic* (market-oriented) identification of open innovation possibilities on the relative international financial growth (Table 6.33). Both types of identification of open innovation possibilities

influence firms' international position, while the *readiness* for open innovation and the generic identification of open innovation possibilities induce the greatest effect on firms' relative financial growth. The only significant influence on the objective measure of international performance (i.e., the revenue from exports or foreign subsidiaries as shares of total revenue) is attributed to the *specific* (technically-oriented) ways firms learn about or identify open innovation possibilities. The summary of the tested hypotheses is given in Table 6.34.

Table 6.34. Hypotheses 1, 2, 3, 4 and 5 results overview

Hypothesis	Support	Significant findings
H1a	Partially supported	*Generic (market-oriented) identification of OI* possibilities has the effect on the greatest amount of innovation factors.
		Inbound accomplished OI does not have any influence of innovation.
		The majority of OI perspectives influence the *Amount of IPR*.
	Open innovation positively influences firms' innovation performance.	
H1b	Partially supported	*Readiness for OI* affects relative *international financial growth* and *customer satisfaction*.
		Generic (market-oriented) identification of OI possibilities affects relative *international financial position* and *growth*.
	Open innovation positively influences firms' international position.	
H1c	Partially supported	Only *specific (technically-oriented)* identification of OI possibilities affects *international performance*.
	Open innovation does <u>not</u> influences firms' international performance.	
H1	**Open innovation positively influences firms' internationalisation.**	

(Table 6.34. continued)

Hypothesis	Support	Significant findings	
H2	Partially supported	**Moderation Mediation effect**	**Significance level**
		Formal cooperation moderates '*specific identification* of OI possibilities – international performance' relationship *after* mediating effect of IPR amount.	The presence of higher levels of formal cooperation impacts the 'specific identification of OI possibilities – international performance' relationship *after* mediating effect of IPR amount.
		Formal cooperation moderates 'specific identification of OI possibilities – relative international financial position' relationship *after* mediating effect of IPR amount.	The presence of higher levels of formal cooperation impacts the 'specific identification of OI possibilities – relative international financial position' relationship *after* mediating effect of IPR amount.
	Formal cooperation moderates some aspects of the OI-Innovation-Internationalisation relationship.		
H3a	Not supported	**Moderation Mediation effect**	**Significance level**
		Teamwork skills moderate 'readiness for OI possibilities –international performance' relationship *after* mediating effect of IPR amount.	The presence of higher levels of teamwork skills does not impact the 'readiness for OI–international performance' relationship *after* mediating effect of IPR amount.
H3b	Not supported	**Moderation Mediation effect**	**Significance level**
		Managerial skills moderate 'OI–internationalisation' relationship *after* mediating effect of innovation.	The presence of higher levels of managerial skills does not impact the 'OI–internationalisation' relationship *after* mediating effect of innovation.
H3c	Not supported	**Moderation Mediation effect**	**Significance level**
		International knowledge moderate 'OI–internationalisation' relationship *after* mediating effect of innovation.	The presence of higher levels of international knowledge does not impact the 'OI–internationalisation' relationship *after* mediating effect of innovation.
H3	**Knowledge and skills do <u>not</u> moderate the OI-Innovation-Internationalisation relationship.**		

(Table 6.34. continued)

Hypothesis	Support	Significant findings	
H4	Not supported	**Moderation effect**	**Significance level**
		Innovation new to the market moderates 'innovation – internationalisation' relationship.	The presence of higher level of the innovation new to the market does not have an impact on the 'innovation-internationalisation' relationship.
	Radical innovation does <u>not</u> moderate the Innovation-Internationalisation relationship.		
		'Institutional environment–innovation' relationship *is mediated* by the effect of OI.	OI does not mediate the 'institutional environment–innovation' relationship.
H5b	Not supported	**Mediation effect**	**Significance level**
		'Institutional environment–international performance' relationship *is mediated* by the effect of innovation.	*Amount of IPR* does not mediate the 'institutional environment–international performance' relationship.
			Innovation outcomes do not mediate the 'institutional environment–international performance' relationship.
H5c	Partially supported	**Mediation effect**	**Significance level**
		'Institutional environment–international position' relationship *is mediated* by the effect of innovation.	*Innovation outcomes* mediate the 'institutional environment–relative international *financial growth*' relationship.
	Innovation mediates the institutional environment-international position relationship.		
H5	**Institutional environment affects firms' international growth through innovation outcomes.**		

Source: Author's representation.

The overview of the results of the tested Hypotheses shows that with the statistical analysis performed, only the moderated mediation and mediation effects illustrated in Figure 6.16. and Figure 6.17.were signficant on a five per cent significance level.

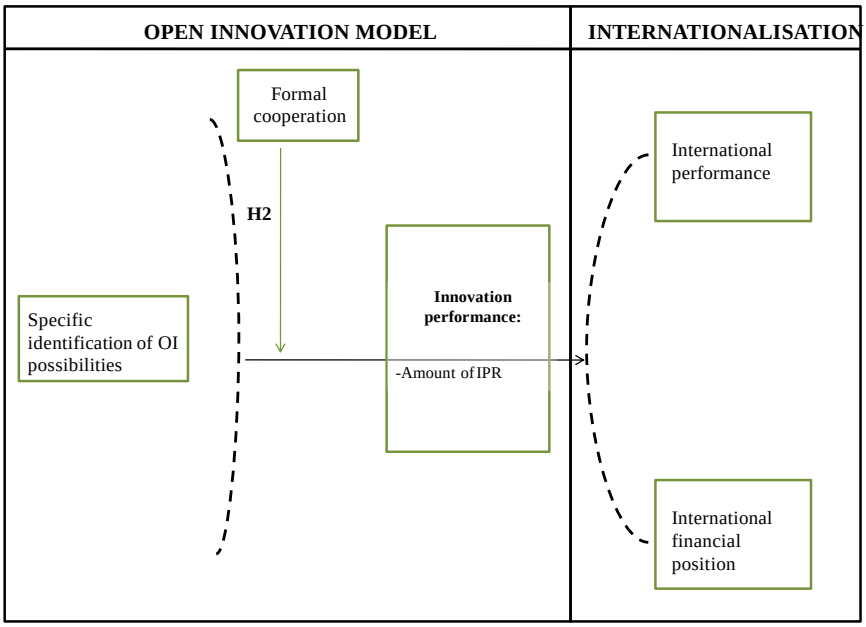


Figure 6. 16. Multigroup moderated mediation of Formal cooperation on the relationship between Specific identification of open innovation possibilities and International performance through the Amount of intellectual property rights

Source: Author's representation.

Formal cooperation moderates the relationship between *specific* (technically-oriented) identification of open innovation possibilities and international performance and relative international financial position after the mediating effect of the amount of intellectual property rights. Formalised relationships are important for the effects of learning about or identifying open innovation possibilities from a technological perspective (specific identification of OI possibilities). Competitive advantage can be created by enforcing formalised relationships during the specific identification of open innovation possibilities.

Knowledge and skills of the project team did not exhibit any significant importance on the relationship between open innovation and internationalisation through innovation. Innovation which is new to the market does not moderate the relationship between innovation on internationalisation.

With respect to the institutional regulatory environment, a significant relationship is observed in its effect on international financial growth through innovation outcomes (e.g., lower unit costs or higher quality or developed products or services) (Figure 6.17.). Therefore,

institutions influence innovation and internationalisation and could incite firms' future competitiveness.

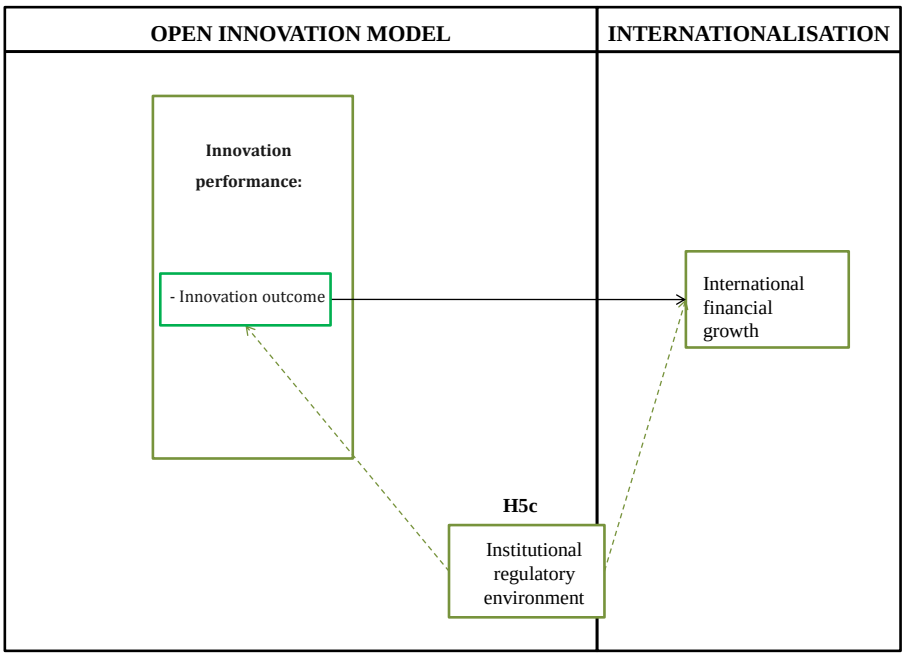


Figure 6. 17. Mediation of the effect of institutional environment on internationalisation through innovation

Source: Author's representation.

The final model that depicts the influences of open innovation on internationalisation through innovation as illustrated in Figure 6.18.

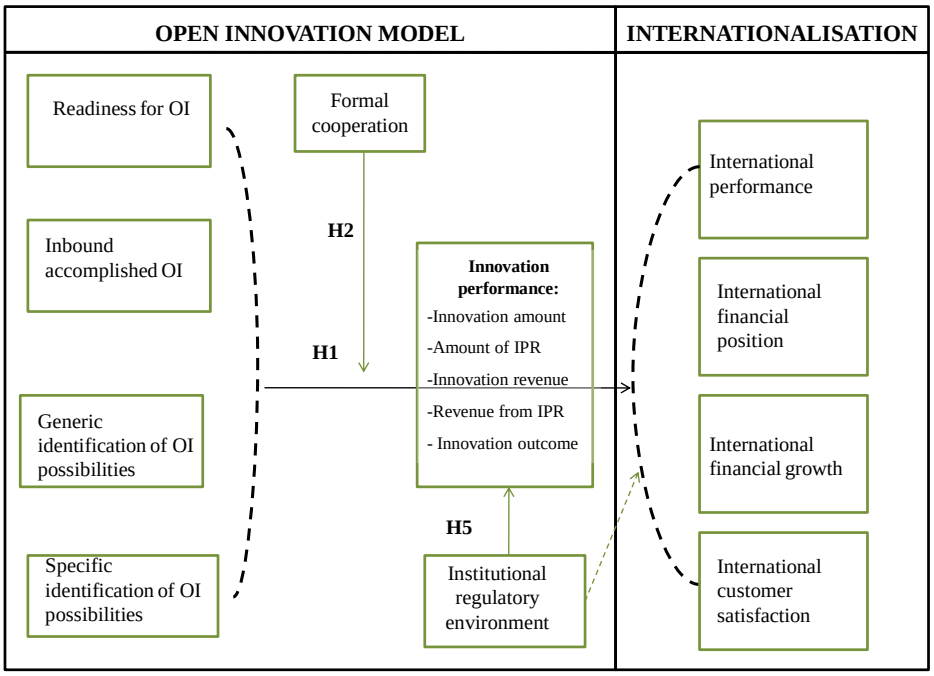


Figure 6. 18. The final model of significant relationships in the Open innovation-Innovation-Internationalisation model

Source: Author's representation.

Recommendations for future research

Although the open innovation perspectives were not merged into the second order construct of open innovation, the future research could test how differing open innovation perspectives interact and their resulting influences on innovation and internationalisation.

The future research should compose the second order contructs (obtained through a exploratory factor analysis) to test the hypothesised relationships. It would be interesting to use a different statistical software package to test the hypotheses (e.g., SmartPLS). Moreover, it would be beneficial to conduct a longitudinal research, on the multitude of industries and factors that affect the open innovation process and increase the sample size. Clustering could be used to enable differences in strategies that would be based on different characterstics of firms' open innovation, innovation culture and internationalisation. In that way future studies could depict more generalisable conclusions.

7. CONCLUSION

Contemporary European Union's initiative within the Horizon 2020, Enterprise and Innovation strategy gave rise to the significance of open innovation. The European Union member states form clusters of open innovation activities through regional initiatives and programs offering venture capital, advice, networking and innovation intelligence. This thesis followed Chesbrough's (2006) approach to open innovation that explains it as "*the purposive inflow and outflows of knowledge that encompass firms' entire value creation and appropriation, as well as increased coordination of activities necessary for the success in the international environment*"; and Johanson and Vahlne's (1990, p. 11) internationalisation defined as "*a process in which an enterprise gradually increases its international involvement*". Although it is too early to measure the results of the European Union's open innovation policies, their influence on the international competitiveness should be measured on a firm, regional and national level.

The first chapter of this doctoral thesis explains the theoretical framework of interdependencies between open innovation and internationalisation. Institutional, evolutionary and network theories are used as the foundation for the smart specialisation policy. The smart specialisation policy is applied by the European Commission to enhance the regional economic development and promote regional innovation and collaboration. The institutional theory explains open innovation and internationalisation on the national level, the network theory on the regional level and the evolutionary theory on the firm level.

This thesis approached open innovation and internationalisation in the telecommunications industry from the institutional entrepreneurship perspective (Johnson and Greenwood, 2007). Institutional entrepreneurship shows how changes in technology incite growth outside of the firm's current institutional and geographic boundaries (Brousseau and Raynaud, 2011; Khalil, 2013). Moreover, the institutional theory explains how the regulative, normative and cultural-cognitive influences (Scott, 2001; Busenitz, Gomez and Spencer, 2000) enable organisational changes and induce new business models for firms' internationalisation (Beise, 2004). Each of the open innovation perspectives (readiness for open innovation, identification of open innovation possibilities and the accomplished open innovation) implies a different level of institutionalisation and, therefore, portrays differing results with respect to innovation and internationalisation. The empirical research also examined the effect of the institutional

regulatory environment on open innovation perspectives and internationalisation because the transitional environments of the Croatian telecommunications industry called for the examination of the appropriate formal (e.g., exhibited in private property) and informal institutional structures (e.g., fostered by trust) (Puffer, McCarthy and Boisot, 2009). It was found that innovation mediates the relationship between the institutional environment and the firm's international growth.

The evolutionary theory extends the institutional theory to encompass the influences of the organisational routines and "*search*" processes (Nelson and Winter, 1982). Herein, the organisational routines are used to explain the readiness of the firm's business model for open innovation, teamwork skills, managerial skills and international knowledge.

International innovation diffusion depends on a firm's position in the network and its capacity to manage and benefit from network relationships (Takada and Jain, 1991; Dyer and Singh, 1998; Beise, 2004; Baron, 2007; Auh and Menguc, 2009; Azarian, 2010; Mortara and Minshall, 2011; Cornell, 2012; Felicio, Couto and Caiado, 2014). The theory of distinctive competences (Selznik, 1957) and the knowledge-based theory (Penrose, 1959) were used to comprehend how firms benefit from organisational resources (Tipurić, 2014, p. 169-175). Organisational resources are found in the human, social and structural capital (Burt, 1997, Nahapiet and Ghoshal, 1998; both in Baron 2007). Herein, the network theory explains how firms' communication patterns help them achieve innovation and internationalisation goals. The results have shown that the formal ways of cooperation moderate the relationships between the identification of open innovation possibilities, the amounts of intellectual property rights and the firms' international performance. Namely, the closer formal ties minimise the transaction costs, enhance the governance system, increase production efficiency and speed up the commercialisation process (e.g., Fukuyama, 1995; North, 1990, in Dyer and Singh, 1998, p. 673-676).

The third chapter explains internationalisation through the perspectives of international entrepreneurship and corporate entrepreneurship. International entrepreneurship studies small and young firms' internationalisation process (Oviatt and McDougall, 1994; Keupp and Gassman, 2009a) and portrays a cross-border entrepreneurial activity through intrapreneurial acts of corporate entrepreneurship (Zahra, Ireland and Hitt, 2000; Zahra and George, 2002; Oviatt and McDougall, 2005; all in Hornsby et al., 2013; Vesper, 1990; Pinchot, 1985; Guth and Ginsberg, 1990; Zahra, 1991; Sharma and Chrisman, 1999; Hartmann, 2014). Limited by

the market size, firms in the small open economies need to use their existing technologies to tap new international markets, discover differentiated localised knowledge and improve their existing products, services and processes through a feedback loop created from their international experience and specific localised customer demands (Dabić, 2012; Sedoglavich, 2012). This thesis takes the view that the process of entering new geographic markets is an act of entrepreneurship (Lu and Beamish, 2001, p. 565). Hence, the international entrepreneurship (Oviatt and McDougall, 2005) and internationalisation theories are used to portray the ways and outcomes of internationalisation.

The knowledge-based internationalisation relates the knowledge-based theory to the internationalisation theory (Buckley and Casson, 1976, 2009; Johanson and Vahlne, 2007; Casillas et al., 2009). The Upsalla model connects the state (market commitment and knowledge) and the change (commitment decision and current activities) aspects of internationalisation (Johanson and Vahlne, 1990). The Innovation model of internationalisation explains the gradual processes of internationalisation (Bilkey and Tesar, 1977; Cavusgil, 1980; Czinkota, 1982; Reid, 1981). The internalisation of some transactions, the strong reliance on alternative governance structures to access resources, the establishment of foreign location advantages and the control over unique resources (Oviatt and McDougall, 1994) align with the open innovation rationale. The transaction costs theory incorporates *transaction-specific assets, free-riding potentials,* and *the environmental and organisational performance uncertainty* into a model of the firm's performance (Anderson and Gatignon, 1986, p. 7). It explicates how market entry modes rely on the modes of control and the costs of market resource commitment (Williamson, 1985; Ripollés, Blesa and Monferrer, 2012), which explains the reasons for using open innovation and internationalisation. Specifically, firms in the global open innovation environment cooperate when they have control over the technology. The control is exercised through the intentional leakages of intellectual property or their secrecy depending on the expected outcomes and strategies at a particular stage of the innovation process. Global environment shortens the innovation process and enables firms to create customised products. Herein, firms need to evaluate the transaction costs of open innovation and internationalisation.

The third chapter describes the internationalisation indicators: the UNCTAD's Transnationality index, the Network spread index (NSi; Ietto-Gillies and Seccombe-Hett, 1997), the Transnationality spread index (Ietto-Gillies, 1998), the Level of internationalisation

index (Sullivan, 1994) and the Index of two dimensions of internationalisation (Hassel et al., 2003). It also distinguishes between the subjective (a firm's international position evaluated against its international competitors) and objective measures of internationalisation (measures of the firms' actual international performance).

The metaanalysis of the open innovation literature described in the fourth chapter revealed that 643 documents (523 research papers) on open innovation were published in the period between 1995 and April 2014. The U.S.A. (149 papers), Germany (94 papers) and England (84 papers) were the countries of origin of the majority of the published papers. Henry Chesbrough is the most cited open innovation author (18 papers). His paper "The era of open innovation" is the most cited paper in the field of open innovation (390 citations in December 2014). Moreover, there were nine papers on open innovation and telecommunications, and only nine papers that jointly study the concepts of open innovation and internationalisation. Hence, the relative lack of literature on open innovation and internationalisation depicts it as an unexplored research area.

The fourth chapter also describes innovation (Schumpeter, 1934, 1942; Kirzner, 1973; Henderson and Clark, 1990; Rothwell, 1992, 1994), the drivers and limitations of innovation (human resources, knowledge and learning, business model, inertia and institutional environment) and the innovation indicators (R&D, scientific and technological measures of productivity, innovation finance, output and market indicators, and the indicators of organisational innovation).

Moreover, the fourth chapter portrayed the lead user model of innovation (von Hippel, 1988), the technology brokering model (Hargadon and Sutton, 1997, 2001), Chesbrough's open innovation (2003a, 2003b, 2006) and Foray's (2004) open knowledge. It explained the asymmetry of information and coordination of innovation within a business model from the perspectives of complementary assets and innovation absorption capacity, the trade-off between the speed and quality of a new product development and the limitations of intellectual property rights' protection modes. Moreover, it explained the problematics of managing and sharing innovation in terms of the availability of alternative innovative solutions, the process of search and making innovations available on the market, task decomposition within organisations and network externalities.

The fifth chapter explained the constructs and hypothesised relationships of the open innovation and internationalisation model. It clarified why the empirical research focused on the telecommunications industry. The telecommunications industry is of strategic importance for a nation and is affected by institutional regulatory environment (Hugill, 1999) which influences the overall national economy (Yang et al., 2013). The telecommunications industry is innovative with the highest share of innovative products in total products (Andrijević-Matovac, 2005). The global telecommunications indicators depict the usage and the regional trade supremacy of the European Union countries, the developing countries' growth potential, the saturation of the mobile-cellular penetration, and the changing nature of telecommunications technologies (ITU, 2014; WTO, 2014). Croatian telecommunications are characterised with the oligopoly in the fixed, mobile and internet markets (Krajnović, Čičin-Šain and Predovan, 2011), human capital intensity, strong spatial concentration (Vuković and Kovačević, 2010), low financing availability and internal resistence to change (Andrijević-Matovac, 2005). Moreover, the Croatian telecommunications' industry yearly change in intangible assets is correlated with the yearly change in exports (Orbis, 2013). Hence, the Croatian telecommunications industry provides an interesting population for the empirical research on open innovation, internationalisation and institutional regulatory environment.

The sixth chapter illustrated the results of the empirical research. To my knowledge this is the first study of this type done on the geographical setting of the Republic of Croatia, and the first that describes the relationship between the four open innovation perspectives, innovation and internationalisation. Depicted open innovation (OI) perspectives include: (1) the *readiness* of a business model to adopt OI practices, (2) the *accomplished inbound* OI, (3) the generic (market-oriented) and (4) *specific* (technically-oriented) identification of OI possibilities. *Readiness* of firms for open innovation implies internal flexibility and agility of the business model to incorporate external developments or externalise its innovations for future profits. *Inbound accomplished* open innovations refer to the firms' actually conducted inbound open innovation. The ways firms learn about or identify opportunities for open innovation was captured with the *generic* (market-oriented) activities, and *specific* (technically-oriented) activities. The *generic* (market-oriented) identification of open innovation activities encompassed active market scanning for possible innovations (e.g., benchmarking, quantitative data analysis and the use of social networks and market research studies). The *specific* (technically-oriented) identification of open innovation possibilities encompassed the search of the technical knowledge (e.g., trade fairs and conferences, reverse

engineering, gathering information from suppliers, and publications). In addition to four OI perspectives, innovation performance was measured with five constructs: (1) innovation amount, (2) amount of intellectual property rights, (3) innovation revenue, (4) revenue from intellectual property rights and (5) innovation outcomes. Internationalisation was measured with four constructs: (1) international performance, (2) a firm's relative international financial position, (3) a firm's relative international financial growth and (4) a firm's relative international customer satisfaction. This depiction presents a novel and scientific contribution of this thesis. The empirical model also tested the influence of innovation culture on the relationship between innovation and internationalisation. Innovation culture is studied in terms of firms' cooperation practices and project teams' knowledge and skills. Finally, open innovation and internationalisation policy recommendations stem from the effect of the institutional regulatory environment which effect is tested in the study.

The research was performed on the entire population of the Republic of Croatia's telecommunications industry which showcased a potentially successful innovative global industry in the setting of a transitional small open economy constrained by institutional regulatory changes and a recent accession into the European Union. Structural equation modelling (SEM) was used for the data analysis purposes. Correlations, exploratory and confirmatory factor analyses, path analysis, mediations and multi-group differences were tested in the statistical software package SPSS and Amos. The sample encompassed 88 firms which were predominantly small and medium-sized. In this manner, the thesis gave an extensive and comprehensive overview on the nature of open innovation processes in the Republic of Croatia's telecommunications industry. Several interesting findings emerged.

Firstly, 79.5% of the sample was composed of small and medium-sized firms (firms with less than 250 employees) and 20.5% of the sample represents large firms (firms with more than 250 employees). 84.1% of the firms in the sample are internationalised, i.e. they operate on one or more foreign markets. The majority of the surveyed firms have their headquarters abroad (80.7% of the sample) and their main clients in Croatia (67.8% of the sample). A strong gloCal focus was depicted (Carayannis and Von Zedtwitz, 2005). The surveyed firms came from the service sector and had the majority of innovations in services. These innovations result with the small amount of intellectual property rights. The success in international performance (exports of products or services, revenue from foreign strategic alliances, etc.) was obtained mainly from selling services abroad (e.g., roaming charges).

With respect to open innovation, the surveyed firms perceive customers and users as their main sources of innovation. Firms perceive themselves as *ready* for open innovation. Their perception is based on the adoption of external ideas and the adaptation of external ideas to current product and service portfolios. Firms' perception of *readiness* is not really founded on the redesign of the organisation's profit formula. This implies that their perception of the *readiness* for open innovation is not grounded in firms' internal processes and routines.

Similarly, the *accomplished open innovation* items illustrate that firms mainly gather information and adopt external ideas. Firms disregard both joint R&D with other firms and the sale of their innovations. Thus, the collaborative and outbound open innovations generally do not occur among the surveyed firms.

Open innovation practices are not particularly utilised. Open innovation practices include the organisational use of the specialised open innovation intermediaries, crowdsourcing, spin-offs, idea competitions and corporate business incubation. Customer co-creation and contracted R&D services are among the most utilised practices, which is consistent with the finding that the surveyed firms perceive customers and users as their main source of innovation. It can be concluded that the level of corporate entrepreneurship among the surveyed firms is low.

Information and communication technology, effective communication processes and joint project teams are the most used innovation *cooperation* practices. Patents are generally not used in innovation cooperation.

According to the perception of the surveyed firms, technological skills are the most important skills for innovation project team members. The knowledge about international markets is the least important for innovation. This is the result of managerial decisions about the project placement being made at the top organisational level and operationalised on the project team level. The majority of user innovations come from the marketing departments' communications with customers and users. Firms could benefit from better collaboration between the technical and marketing staff, and greater inclusion of the technical staff in the idea generation processes.

Secondly, the hypotheses were tested according to the proposed research questions. The first research question was: **What is the relationship between firms' open innovation and internationalisation?** In order to answer this question the study of the effect of open innovation perspectives (the *readiness* of a business model to adopt OI practices, the *accomplished inbound* OI, the generic (market-oriented) and *specific* (technically-oriented) identification of OI possibilities) on innovation and internationalisation was required.

The results showed that open innovation influences innovation. Specifically, the *generic* (market-oriented) identification of open innovation possibilities affects the greatest amount of innovation factors, and the majority of open innovation perspectives (the *readiness* for open innovation, the *generic* and *specific* identification of open innovation possiblities) influence the amount of intellectual property. The *inbound accomplished* open innovation does not influence any of the innovation factors (innovation amount, the amount of the intellectual property rights, innovation revenue, the revenue from intellectual property rights or innovation outcome). This finding is consistent with Radas (2005) who found that the intensity of cooperation between science and industry does not imply more patents, newer products or services or greater shares of sales from new products of services, i.e., the finding implies to a failure in commercialisation of ideas.

With respect to the international performance, only the *specific* (technologically-oriented) identification of open innovation possibilities exerted a significant effect on innovation. Open innovation does not have a significant positive influence on international performance.

However, open innovation has the effect on the relative international position. Namely, the *generic (market-oriented)* identification of open innovation possibilities affects relative international financial position and growth; the *readiness* for open innovation influences the relative international financial growth and customer satisfaction. It is interesting to note that the highest direct effect of all open innovation perspectives was exerted on the *relative international financial growth*. Open innovation is a fairly new way of approaching innovation in the Croatian telecommunications industry and firms did not exhibit its effects on performance, especially in terms of international competitiveness. However, the potential of open innovation to unlock future gains in innovation and international competitiveness of firms should incite them to use open innovation today.

Thirdly, mediation effects were analysed according to Kenny's (2014) procedure. The mediation analysis requires the examination of the relationship between innovation and internationalisation. The results show that innovation mediates the relationship between open innovation and internationalisation. The strongest direct influence of innovation on internationalisation is evident in the effect of: (1) the amount of intellectual property rights on international performance and international financial position, (2) the amount of new products or services on relative international financial position and customer satisfaction; and (3) innovation outcomes on financial growth and customer satisfaction. If a firm develops intellectual property, it will yield higher revenues. Moreover, if a firm improves the quality of its products or services, a customer satisfaction might imply future growth.

The *readiness* for open innovation does not influence internationalisation through innovation. As noted earlier, although firms believe they are ready for open innovation, their internal routines and skills fail to capitalise and transcend ideas for open innovation into their performance gains.

On the other hand, the ways the Croatian telecommunications firms "*search*", learn about and identify open innovation possibilities implies that firms attempt to be more competitive. Due to the lack of internal innovations, they are looking for solutions outside of their internal organisational environments. This outward *search* for innovations is transcended into the higher international performance observed in the mediating effect of the amounts of intellectual property rights. The relationship between the firms' search for innovation, the amount of intellectual property rights and internationalisation can be furthered with the organisational reward systems for knowledge diffusion, reproduction and the capture of the external knowledge (Foray, 2004). These incentives must be accompanied by appropriate institutional environments because they might fail its purpose in the markets with the lack of competition and low marginal cost of diffusion (Foray, 2004, p. 181), i.e., in the Croatian telecommunications market.

The findings are consistent with the studies which found the mediating effect of knowledge sharing on innovation (e.g., Hu and Randel, 2014). This thesis deepens the former studies with respect to different ways of identification of open innovation possibilities, i.e., *generic* (market-oriented) and *specific* (technically-oriented). The two types of knowledge (i.e., explorative and exploitative) correspond to the ways firms learn about and identify open

innovation possibilities, and are meaningful for the interpretation of the empirical analysis' results. The technological knowledge presents the critical knowledge component in the exploratory learning (Cohen and Levinthal, 1990), which explains why firms fail to exploit what they have learnt.

Moreover, a possible explanation why the *generic (market-oriented)* identification of open innovation possibilities does not translate into international competitiveness can be found in the lack of appropriate product or service placement which is done in accordance with demands of the domestic customers. The gaps between the technical requirements and design norms at home and abroad occur because of the managers' inability to identify firms' global potentials and capitalise on it (Bartlett and Ghoshal, 2000). Consequently, foreign customers' demands are not incorporated into a product or service and foreign customers do not benefit from the existing product or service lines that are designed for a domestic consumer.

Fourthly, the second research question asked: **How do firms manage different open innovation perspectives in cases of institutional inertia? How can a firm overcome institutional inertia?** Herein, the moderating effects of two organisational innovation culture factors were studied: formal cooperation and knowledge and skills of the project team. Formal cooperation between firms represents the ways firms are dealing with various stakeholders (customers, competitors within the industry, competitors from other industries, research institutes, etc.). The knowledge and skills of the project team represent firms' internal capabilities to fight inertia.

Neither teamwork skills, managerial skills nor international knowledge of the project team moderate the relationship between open innovation, innovation and internationalisation. Similar results were obtained by Položki-Vokić, Hernaus and Marić (2007) when modelling the international knowledge and the firm performance. This can be explained in the idiosyncratic nature of skills and knowledge necessary for new product, service or process development at the team level as opposed to the strategic level. It is noted that the decisions about the new product, service or process development are taken on the strategic levels and that there exists a lack of cooperation between the marketing department and technical staff. These notions were confirmed in Hypothesis III.

The firm's formal cooperation with competitors influences the relationship between the *specific* (technically-oriented) identification of open innovation possibilities on one side, and the international performance and the international position on the other side, if the relationship is mediated with intellectual property rights. Firms possess the complementary resources and capabilities necessary for innovation. Hence, formal cooperation moderates the *specific* identification of open innovation possibilities' effect on the commercialisation of intellectual property. The value of flexible relationships comes from encouraging a dynamic cooperation, which can be limited in formal relationships. Formal relationships are important in the beginning of open innovation process, when there is a lack of trust between innovation partners. Trust facilitates the flexibilities in open innovation. This implies to situations in which the perceived value of innovations (given in the amount of intellectual property rights) is high. Hence, the transaction cost approach applies.

Fifth, the radical innovation is the innovation which is new to the market as opposed to the innovation which is new to the firm. Its moderation effect on the relationship between innovation and internationalisation was not significant. This finding is not consistent with previous studies on the relationships between the radical innovation and firm performance. The surveyed firms' innovations were predominantely incremental. The firms' competitiveness in global markets results in technologies that evolve incrementally and marginally affect firms' chances of profiting from them.

Schumpeter's Mark II notions can be observed in the mature technologies and technological change that followed defined trajectories and established a presence of large firms with monopolistic powers in which the economies of scale, learning curves, barriers to entry and financial resources play an important role (Stamm, 2003). The Croatian telecommunications industry portrays these characteristics. Hence, the lack of effect of radical innovation might come from the fact that institutional processes hinder radical innovation; customer reactions are easily anticipated, and impede the flexibility, persistence and willingness to experiment.

Sixth, the last research question was: **How does the institutional environment influence the relationship between open innovation and internationalisation?** In order to answer the third question the relationship between government agencies' support for internationalisation and innovation was tested. Institutional regulatory support should foster trust between organisations and intellectual property rights' protection that stimulate development of

intellectual property and enables internalisation of benefits of various open innovation perspectives.

Institutional regulatory environment influences the firms' international financial growth through innovation outcomes (e.g., lower unit costs or higher quality or developed products or services). Institutions have a strong influence on innovation and their subsequent internationalisation could incite the development of further competitiveness. This should not be done through regulation of open innovation. The regulatory framework influences policies that lower unit costs of production. Therefore, the institutional environment supports firms' international position by indirectly influencing identified innovation mechanisms.

Finally, in order to overcome inertia and deficiencies in institutional regulatory environment, and in order to foster organisational flexibility with respect to innovation and internationalisation, a behavioural perspective should be taken. Firms need to adopt external innovations into their internal organisational processes and routines. A reduction of information asymmetry and investment into internal research capacities enables the absorpotion capacity growth. Firms use the transaction costs approach and should exercise exit and voice strategies (Hirschman, 1970) with respect to customisation of external ideas to internal processes and *gloCal* demands (Carayannis and Von Zedtwitz, 2005).

Moreover, firms can benefit from cooperation with R&D institutes (e.g., Institute Ruđer Bošković) and universities (e.g., University of Zagreb's Faculty of Electrical Engineering and Computing). If the cooperation with R&D institutes and universities is facilitated with the institutional regulatory support, and aligned with the European Union's strategy with respect to formation of open innovation clusters, it can unlock the telecommunications industry's regional potential. Firms, especially SMEs, can become more competitive through international cooperation which transcends the boundaries of a small open economy and caters the needs of larger markets.

Contribution of this thesis extends to the development of the empirical research which was performed as a result of the theoretical conceptual models of open innovation and internationalisation. The research emphasised the importance and the role of open innovation in the Croatian firms' internationalisation, as well as the need for a constructive approach to this topic. The thesis described the influence of different open innovation perspectives on

internationalisation, and showed how firms should use open innovation to increase their innovation and competitive capacities necessary to achieve a better positioning on the global market. Moreover, the influences of innovation culture and institutional regulatory environment add to the extensive overview of the relationships between four differing open innovation perspectives, innovation and internationalisation. The resulting knowledge gives an insight into the structure of the international activities of the telecommunications industry in the Republic of Croatia, their open innovation perspectives and institutional constraints of a domestic market, thereby portraying the appropriate strategies to the challenges arising from internationalisation and open innovation.

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APPENDICES

Appendix 1: Metaanalysis of open innovation literature

Table 8.1. Amount of papers according to author's country of origin

Author's country of origin	Amount of papers
USA	149
GERMANY	94
ENGLAND	84
SPAIN	58
NETHERLANDS	53
SWITZERLAND	48
ITALY	35
SWEDEN	33
BELGIUM	32
SOUTH KOREA	25
TAIWAN	22
DENMARK	21
FRANCE	18
PEOPLES R CHINA	18
AUSTRIA	17
CANADA	17
AUSTRALIA	16
NORWAY	15
FINLAND	14
IRELAND	9
JAPAN	8
INDIA	6
PORTUGAL	6
SINGAPORE	5

Author's country of origin	Amount of papers
WALES	5
ESTONIA	4
ISRAEL	4
SCOTLAND	4
GREECE	3
NORTH IRELAND	3
PERU	3
COLOMBIA	2
NEW ZEALAND	2
SLOVENIA	2
TURKEY	2
BRAZIL	2
COSTA RICA	1
HUNGARY	1
LITHUANIA	1
LUXEMBOURG	1
MALAYSIA	1
MEXICO	1
POLAND	1
ROMANIA	1
SAN MARINO	1
SERBIA	1
SOUTH AFRICA	1
THAILAND	1

Source: Web of Science since 1955

Table 8.2. Type of papers on open innovation

Type of publication	Amount
Article	523
Editorial material	49
Review	33
Meeting abstract	22
Proceedings paper	21
Book review	9
News item	6
Book chapter	1
Correction	1

Source: Web of Science since 1955

Table 8.3. 20 authors with the most papers in open innovation

Author	Number of papers
Lichtenthaler	29
Chesbrough	18
Vanhaverbeke	11
Gassmann	9
Von krogh	9
Frattini	8
Spithoven	8
Frishammar	7
Chiesa	6
Fuller	6
Henkel	6
Matzler	6
Alexy	5
Bianchi	5
Chiaroni	5
Clarysse	5

Source: Web of Science since 1955

Author	Number of papers
Finnegan	5
Mortara	5
Roijakkers	5
Saguy	5

Source: Web of Science since 1955

Table 8.4. Journals that publish papers on open innovation

Journal	Amount of papers
R D MANAGEMENT	47
RESEARCH TECHNOLOGY MANAGEMENT	40
TECHNOVATION	38
INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT	33
RESEARCH POLICY	26
ABSTRACTS OF PAPERS OF THE AMERICAN CHEMICAL SOCIETY	21
JOURNAL OF PRODUCT INNOVATION MANAGEMENT	18
TECHNOLOGY ANALYSIS STRATEGIC MANAGEMENT	16
CALIFORNIA MANAGEMENT REVIEW	14
TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE	14
CREATIVITY AND INNOVATION MANAGEMENT	11
INDUSTRY AND INNOVATION	9
INNOVATION MANAGEMENT POLICY PRACTICE	9
SERVICE INDUSTRIES JOURNAL	9

Source: Web of Science since 1955

Journal	Amount of papers
INTERNATIONAL ENTREPRENEURSHIP AND MANAGEMENT JOURNAL	8
MANAGEMENT DECISION	8
JOURNAL OF UNIVERSAL COMPUTER SCIENCE	7
MIT SLOAN MANAGEMENT REVIEW	7
ORGANIZATION SCIENCE	7
DRUG DISCOVERY TODAY	6
EXPERT SYSTEMS WITH APPLICATIONS	6
JOURNAL OF ENGINEERING AND TECHNOLOGY MANAGEMENT	6
ASIAN JOURNAL OF TECHNOLOGY INNOVATION	5
FUTURE MEDICINAL CHEMISTRY	5
IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT	5
JOURNAL OF BUSINESS RESEARCH	5
JOURNAL OF STRATEGIC INFORMATION SYSTEMS	5
SCIENTOMETRICS	4
TRENDS IN FOOD SCIENCE TECHNOLOGY	4
EXPERT OPINION ON DRUG DISCOVERY	4

Source: Web of Science since 1955

Appendix 2: Telecommunications services balance of trade

Table 9.1. Basic data on the electronic communications market in 2012

Basic data on the electronic communications market	Amount
Registered telephone service operators in the fixed public communications network	34
Operators providing telephone services in a fixed electronic communications network	13
Operators of mobile public communications networks GSM/DCS	3
Operators of mobile public communications networks UMTS	3
Radio networks	170
Television networks (digital television)	7
Users of telephone services in the fixed network	1.454.133
Users of carrier pre-selection services (CPS)	165.679
Users of leased line services (WLR)	105.185
Users of telephone services in the fixed network	4.971.351
Broadband Internet users - total	1.216.659
Broadband users via fixed public communications network	890.324
Broadband users via mobile public communications network	326.335
Cable television connections (CTV)	148.062
TV connections based on IPTV	366.974
Satellite television connections (SATTV)	108.447
Realised Co-locations	565
Active unbundled local loops	323.233
Ported numbers in fixed public communications networks	799.844
Ported numbers in mobile public communications networks	476.281

Source: HAKOM (2013) *Annual activity report for 2012*. [online] Available at: http://www.hakom.hr/UserDocsImages/2013/izvjesca_i_planovi/Annual%20Activity%20Report%202012_HAKOM.pdf (22 September 2014), p. 19.

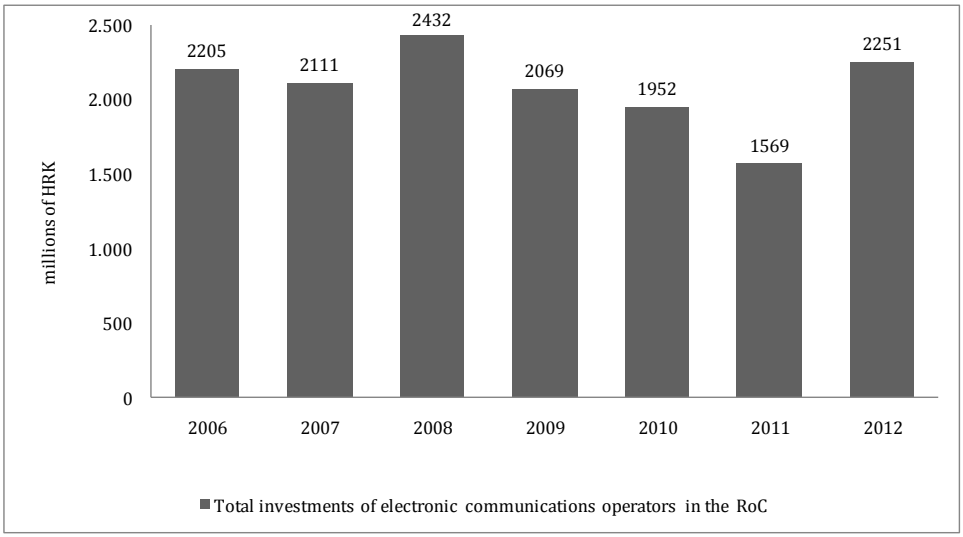

Figure 9.1. Total investments of electronic communications operators

Source: HAKOM (2013) *Annual activity report for 2012*. [online] Available at: http://www.hakom.hr/UserDocsImages/2013/izvjesca_i_planovi/Annual%20Activity%20Report%202012_HAKOM.pdf (22 September 2014), p. 20.

Table 9.2. Telecommunications services balance of trade in millions of US dollar at current prices

Type of service	Flow	2009	2010	2011	2012	2013
Communications services	Export	259	230	307	271	234
	Import	143	136	169	171	164
Telecommunication services	Export	252	223	297	262	226
	Import	139	131	153	157	151
Computer and information services	Export	163	170	244	248	245
	Import	242	232	258	240	239
Royalties and license fees	Export	32	32	24	31	25
	Import	211	224	272	283	240

Source: WTO (2014). Time series of international trade in merchandise and commercial services. [online] Available at: http://stat.wto.org/StatisticalProgram/WSDBViewData.aspx?Language=E (20 October 2014)

Table 9.3. Telecommunications commodity balance of trade in millions of US dollar at current prices

Type of commodity	Flow	2009	2010	2011	2012	2013
Office and telecom equipment	Export	280	256	220	242	173
	Import	1193	1181	1031	963	1186
Electronic data processing and office equipment	Export	71	50	55	41	40
	Import	433	418	426	358	398
Telecommunications equipment	Export	61	46	46	141	92
	Import	602	616	500	539	562
Integrated circuits and electronic components	Export	149	159	119	60	41
	Import	158	147	105	66	226

Source: WTO (2014). Time series of international trade in merchandise and commercial services. [online] Available at: http://stat.wto.org/StatisticalProgram/WSDBViewData.aspx?Language=E (20 October 2014)

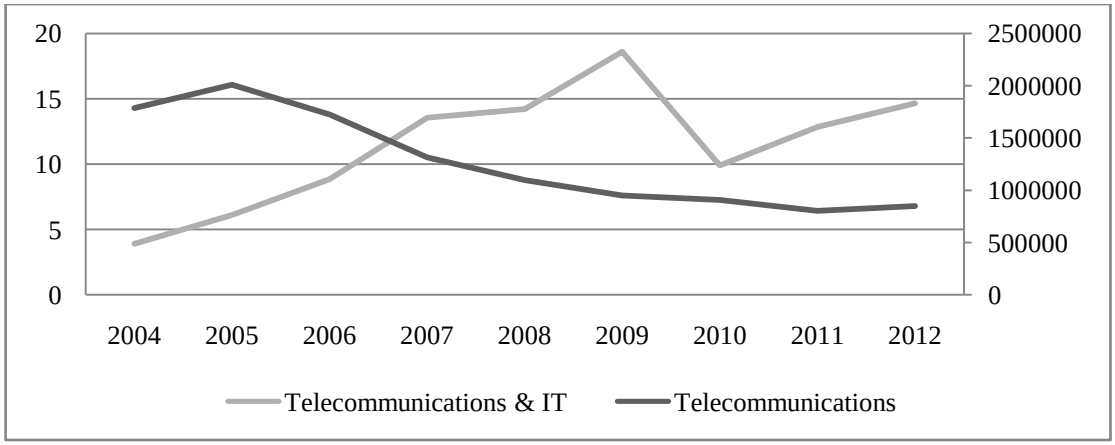

Figure 9.2. Values of intangible assets

Source:Orbis (2013) Database [online]. Available at: orbis.bvdinfo.com (1 November 2013)

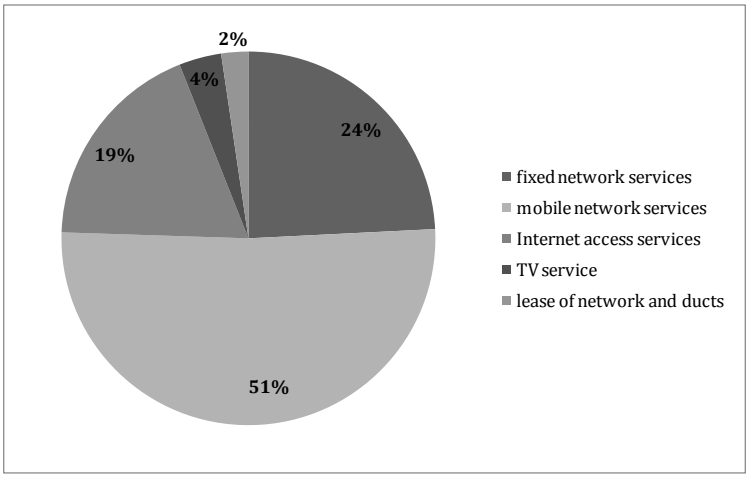

Figure 9.3. Shares of services in total telecommunications revenue

Source: HAKOM (2013) *Annual activity report for 2012*. [online] Available at: http://www.hakom.hr/UserDocsImages/2013/izvjesca_i_planovi/Annual%20Activity%20Report%202012_HAKOM.pdf (22 July 2014), p. 18.

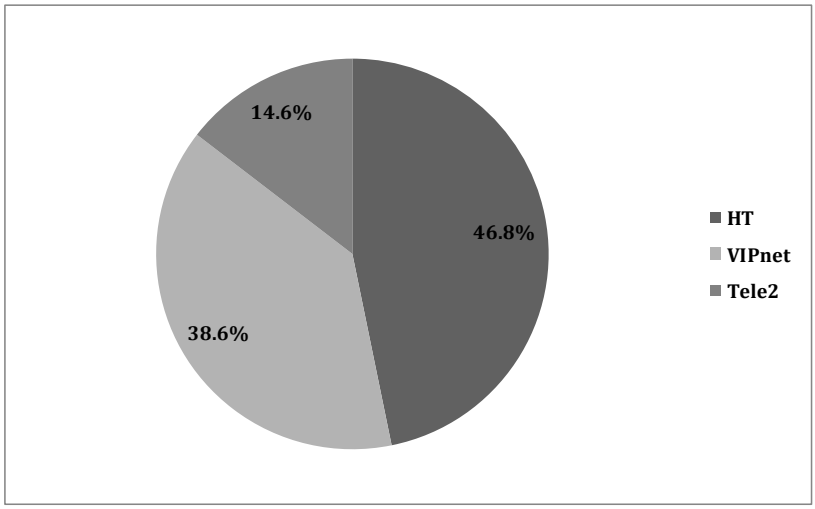

Figure 9.4. Market shares of operators in relation to the number of users

Source: HAKOM (2013) *Annual activity report for 2012*. [online] Available at: http://www.hakom.hr/UserDocsImages/2013/izvjesca_i_planovi/Annual%20Activity%20Report%202012_HAKOM.pdf (22 July 2014), p. 36.

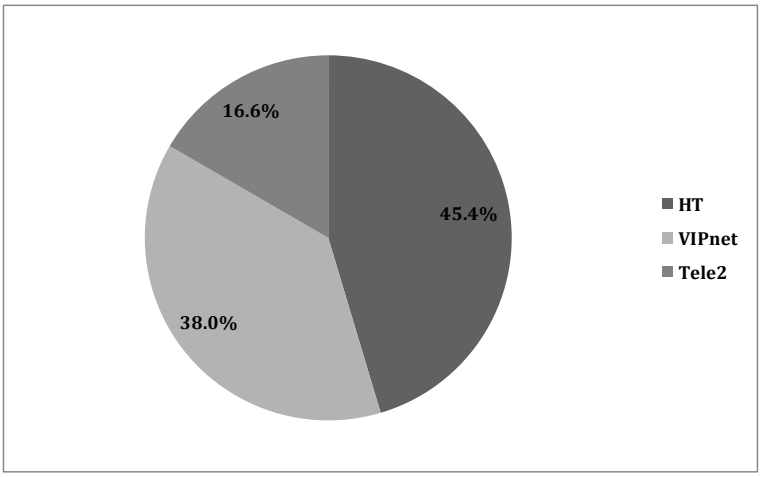

Figure 9.5. Market shares of operators in relation to revenue

Source: HAKOM (2013) *Annual activity report for 2012*. [online] Available at: http://www.hakom.hr/UserDocsImages/2013/izvjesca_i_planovi/Annual%20Activity%20Report%202012_HAKOM.pdf (22 July 2014), p. 37.

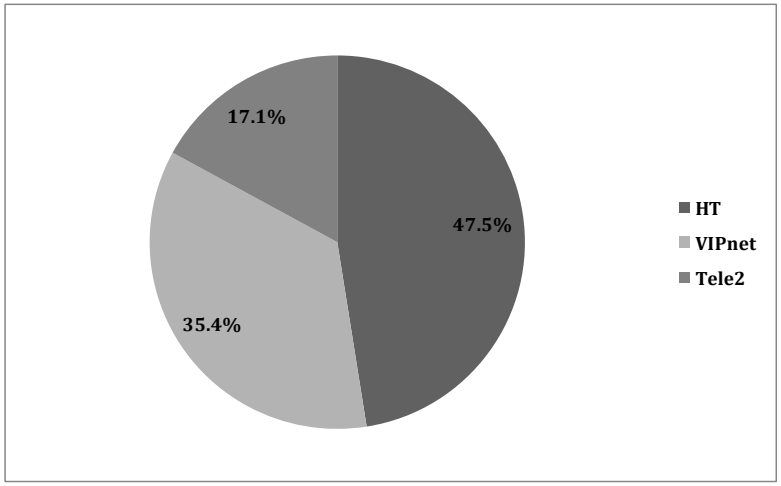

Figure 9.6. Market shares of operators in relation to outgoing telephone traffic

Source: HAKOM (2013) *Annual activity report for 2012*. [online] Available at: http://www.hakom.hr/UserDocsImages/2013/izvjesca_i_planovi/Annual%20Activity%20Report%202012_HAKOM.pdf (22 July 2014), p. 37.

Appendix 3: Open innovation and internationalisation survey

Table 10.1. Components of the questionnaire survey and components of particular constructs

Introduction	Goals of the research
	Respondents
	Date of completion
	Confidentiality clause
Industrial setting	Technological uncertainty
	Competitive intensity
	Newness of innovation to industry vs. to the company
	Institutional (regulatory) environment
Open innovation practices	Readiness for open innovation
	Identification of open innovation possiblities (organisational learning)
	Accomplished open innovation (inbound, outbound, coupled)
Internationalisation	Internationalisation performance
	International position
Innovation culture	Formal cooperation practices
	Knowledge and skills of project team
Innovation performance	Amount of innovations
	Average revenue generated from innovations
	Extent of increased performance due to innovation
Demographics	Firm age
	Firm size
	R&D expenditure
	Turnover
	International activity

Source: Author's representation.

Measuring Organisations' Internationalisation and Open Innovation Practices

Dear Sir, Dear Madam,

This questionnaire is divided into six brief sections that cover demographics, industrial setting, open innovation practices, internationalisation, innovation culture and innovation performance.

"**'Open innovation'** is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology." (Chesbrough, 2006)

The goal of this research is to identify organisations' level of open innovation and internationalisation practices by answering the following questions: What is the relationship between organisations' open innovation and internationalisation practices? How does the institutional environment affect the relationship between open innovation practices and successful internationalisation? To what extent are organisations' open innovation practices influenced by institutional inertia?

What is important to note when completing the questionnaire?

- This questionnaire should be completed by senior managers or operations managers working on a new product, service or process development.
- Please complete the questionnaire by 30 April 2014.
- The information you provide is fully **confidential and anonymous**. It will not be disclosed without your approval.
- **Please answer all questions**. If you are not sure about an answer to a specific question, please provide your closest assessment.
- There are no right or wrong answers. The aim of this research is to understand the experts' opinion.
- Some questions might seem similar, but they are put in the questionnaire for statistical reasons, and hence, we kindly ask you to answer them.

What benefits will you gain from this research?

- An insight into a **practical analysis** conforming to the data of other organisations in the industry.
- You support the **international scientific and research project**.

For more information, please e-mail Maja Bašić at mbasic@efzg.hr or telephone on 099/2330-374.

Thank you for your cooperation.

Do you wish to receive the **Executive Summary** derived from this research?

Please provide your e-mail address._____

1. INDUSTRIAL SETTING

Please estimate for the past four years (2010, 2011, 2012 and 2013).

1.1.a. Industry:

Tick all that apply.

A) Services B) Manufacturing C) Infrastructure D) Information Technologies

E) Other:_____

1.1.b. Main industry:

Tick the one which provides the main source of revenue.

A) Telecommunications B) Food, Beverages, Tobacc

C) Textile, Clothing, Footwear D) Wood, Wood Products and Furniture

E) Paper, Paper Products, Printing and Publishing

F) Chemicals, Petroleum and Coal Products,

G) Non-metallic Mineral products H) Basic Metal Products

I) Fabricated Metal Products J) Transport Equipment

K) Other Machinery and Equipment (Including Electronics and Electrical)

L) Software M) Medicine, biomedicine and pharmaceuticals

N) Other: _____

1.1. c. If your organisation deals with telecommunications, what type of products, services or processes have you mainly done in the past four years (2010, 2011, 2012 and 2013):

Tick all that apply.

A) Optical networks B) Satellite communications C) Intelligent networks

D) Mobile networks E) Fixed networks

F) Enhancement of application and network quality services G) E-business

H) Other. What? _____

1.2. Is your organisation part of any cluster? YES NO

Cluster is a geographic concentration of interconnected businesses, suppliers, and associated institutions in a particular field.

If it is, which one? _____

1.3. To what extent do you encounter technological uncertainty in your industry?

	1-not at all						**7-very much**
Technology in our industry **is changing rapidly.**	1	2	3	4	5	6	7
Technological breakthroughs provide great possibilities for our industry.	1	2	3	4	5	6	7
A large number of **new product ideas have been made available by technological breakthroughs** in our industry.	1	2	3	4	5	6	7

1.4. To what extent do you perceive competitive intensity in your industry?

	1-not at all						**7-very much**
Competition in our industry is **intense.**	1	2	3	4	5	6	7
Domestic competition in our industry is **intense.**	1	2	3	4	5	6	7
There are many **promotion "wars"** in our industry (marketing campaigns, ads, promotions, "buy one, get one free", etc.).	1	2	3	4	5	6	7
Price competition in the industry is common.	1	2	3	4	5	6	7

1.5. In designing our product, service or process, we generally use the requirements of:

A) Domestic customers. B) International customers.

C) Both domestic and international customers.

1.6. a. To what extent is a product, service or process your organisation develops <u>new to your industry?</u>

	1-not at all 7-very much
Our product, service or process:	
a) uses **technology** which was **<u>not used before</u>**.	1 2 3 4 5 6 7
b) is the **<u>first of its kind</u>** in the industry.	1 2 3 4 5 6 7
c) is highly innovative and **<u>completely new in the industry</u>**.	1 2 3 4 5 6 7
d) is **<u>different from others</u>** on the market.	1 2 3 4 5 6 7

1.6. b. To what extent is a product, service or process your organisation develops <u>new to your organisation?</u>

	1-not at all 7-very much
A **product, service or process** is completely **<u>new to our organisation</u>**.	1 2 3 4 5 6 7
Technology necessary to develop a product, service or process is completely **<u>new to our organisation</u>.**	1 2 3 4 5 6 7
Experience necessary to develop a product, service or process is completely **<u>new to our organisation</u>.**	1 2 3 4 5 6 7

1.7. To what extent is your product, service or process <u>development dependent on the following sources</u>?

1-not dependent at all	**7-completely dependent**
a) Clients/customers/users *(e.g. desires and preferences)*	1 2 3 4 5 6 7
b) Other organisations within our industry *(suppliers, subsidiaries, service providers, e.g. industry standards)*	1 2 3 4 5 6 7
c) Organisations in other industries *(suppliers, subsidiaries, service providers, e.g. new trends)*	1 2 3 4 5 6 7
d) Government agencies *(e.g. regulators, entrepreneurship incubators, export agencies)*	1 2 3 4 5 6 7
e) Research institutes or universities *(e.g. technologies and knowledge)*	1 2 3 4 5 6 7
f) Publicly available information *(trade fairs, conferences, newspapers, television, patents)*	1 2 3 4 5 6 7

1.8. To what extent do <u>government agencies' support</u> your industry's product, service or process development?

	1-not at all 7-very much
<u>Government agencies</u>	
a) help in **<u>identifying potential international markets</u>** for a new product, service, process.	1 2 3 4 5 6 7
b) have **<u>special projects</u>** for organisations wishing to develop a new product, service, process.	1 2 3 4 5 6 7
c) **<u>sponsor organizations</u>** which help with a new products, service or process development.	1 2 3 4 5 6 7
d) **<u>sponsor organizations</u>** which helps to identify potential collaborators in designing new products, services or processes.	1 2 3 4 5 6 7
e) **<u>help us to find new market niches</u>**, even when our organisation does not do well.	1 2 3 4 5 6 7

2. OPEN INNOVATION PRACTICES

Please estimate for the past four years (2010, 2011, 2012 and 2013).

"Open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology." (Chesbrough, 2006)

2.1. Please rate your organisation's readiness for open innovation.

	1-not at all 7-a lot
Without negative effects on our core business, our processes and structures enable us to:	
a) Redesign our organisation's profit formula. *(How we extract value from our business.)*	1 2 3 4 5 6 7
b) Redesign customers' value propositions.	1 2 3 4 5 6 7
c) Develop a new business process.	1 2 3 4 5 6 7
d) Collaborate with other organisations on a new product, service or process development.	1 2 3 4 5 6 7
e) Adopt ideas outside of our organisation.	1 2 3 4 5 6 7

2.2. Please rate the following statements on the identification of open innovation possibilities.

	1-not at all 7-a lot
To what extent does your organisation use the following practices to identify ideas for a new product, service or process development?	
a) Benchmarking	1 2 3 4 5 6 7
b) Quantitative data analysis	1 2 3 4 5 6 7
c) Social networks	1 2 3 4 5 6 7
d) Market research studies	1 2 3 4 5 6 7
e) Explicit tracking of competitors' findings	1 2 3 4 5 6 7
f) Trade fairs and conferences	1 2 3 4 5 6 7
g) Reverse engineering	1 2 3 4 5 6 7
h) Gathering information from suppliers	1 2 3 4 5 6 7
i) Publications *(trade magazines, government publications)*	1 2 3 4 5 6 7
j) Sharing your goals and visions	1 2 3 4 5 6 7
k) Publishing your research discoveries	1 2 3 4 5 6 7
l) Hiring R&D personnel	1 2 3 4 5 6 7
m) Technological forecasting or foresight *(e.g. technology scan, strategic roadmaps, expert panels)*	1 2 3 4 5 6 7
n) Users, customers, consumers	1 2 3 4 5 6 7

2.3. Please rate the following statements on the <u>innovation that was accomplished</u> with various external sources.

External sources: clients, competitors, suppliers, government agencies, research institutes, universities, etc.

		1-not at all 7-a lot
In designing our product, service or process, we have used various external sources to:		
a)	Gather information.	1 2 3 4 5 6 7
b)	Exchange experiences.	1 2 3 4 5 6 7
c)	Buy or use technology.	1 2 3 4 5 6 7
d)	Adopt available external knowledge and technology to internal developments.	1 2 3 4 5 6 7
e)	Jointly undertake R&D activities.	1 2 3 4 5 6 7
f)	Develop a product or cooperate on a project.	1 2 3 4 5 6 7
g)	Promote ideas that cannot be self-developed.	1 2 3 4 5 6 7
h)	Sell our non-core technology.	1 2 3 4 5 6 7
i)	Commercialize our intellectual property.	1 2 3 4 5 6 7

2.4. Please rate your organisation's <u>open innovation</u> practices.

How many new products, services or processes has your organisation:	
✓ **<u>identified</u>** from external sources?	1-none 2 3 4 5 6 7-a lot
✓ **<u>implemented</u>** from external sources?	1-none 2 3 4 5 6 7-a lot
✓ **<u>put on the market</u>** from external sources?	1-none 2 3 4 5 6 7-a lot

	2.5. To what extent does your organisation use the following practices for a new product, service or process development?	
a)	Contracted R&D services *(e.g. for design, test and simulation)*	1-not at all 2 3 4 5 6 7-a lot
b)	Specialised open innovation intermediaries *(e.g. NineSigma, InnoCentive, Yet2.com, IdeaCrossing, Hyve)*	1-not at all 2 3 4 5 6 7-a lot
c)	Idea and start-up competitions	1-not at all 2 3 4 5 6 7-a lot
d)	Supplier innovation awards	1-not at all 2 3 4 5 6 7-a lot
e)	University research grants	1-not at all 2 3 4 5 6 7-a lot
f)	Customer and consumer co-creation	1-not at all 2 3 4 5 6 7-a lot
g)	Crowdsourcing *(e.g. crowd voting, solution proposal, crowd funding)*	1-not at all 2 3 4 5 6 7-a lot
h)	Publicly funded R&D consortia	1-not at all 2 3 4 5 6 7-a lot
i)	Spin-offs	1-not at all 2 3 4 5 6 7-a lot
j)	Corporate business incubation *(e.g. venture funding, intrapreneur programs, incubation structures, VC partnerships)*	1-not at all 2 3 4 5 6 7-a lot
k)	Participation in standardization	1-not at all 2 3 4 5 6 7-a lot
l)	Donating innovation to commons or non-profits	1-not at all 2 3 4 5 6 7-a lot

3. INTERNATIONALISATION

Please estimate for the past four years (2010, 2011, 2012 and 2013).

3.1. Indicate your organisation's performance according to the following areas.

a) share of exports in total sales	0% 1-10% 11-20% 21-30% 31-40% 41-50% more than 50%
b) share of income from foreign subsidiaries in total income	0% 1-10% 11-20% 21-30% 31-40% 41-50% more than 50%
c) share of income from foreign strategic alliances	0% 1-10% 11-20% 21-30% 31-40% 41-50% more than 50%
d) share of foreign added value in the total added value	0% 1-10% 11-20% 21-30% 31-40% 41-50% more than 50%
e) share of licences sold to foreign organisations	0% 1-10% 11-20% 21-30% 31-40% 41-50% more than 50%

3.2. How good, compared to your closest international competitors, is your performance in the following areas?

1 – completely worse 4 – equal to foreign competitors 7- better than foreign competitors	
a) Total sales revenue	1 2 3 4 5 6 7
b) Total market share	1 2 3 4 5 6 7
c) Number of identified new markets and opportunities	1 2 3 4 5 6 7
d) Total profitability	1 2 3 4 5 6 7
e) Total development costs	1 2 3 4 5 6 7
f) Time-to-market (from concept to commercialization)	1 2 3 4 5 6 7
g) Time to break-even	1 2 3 4 5 6 7
h) Brand awareness	1 2 3 4 5 6 7
i) Rate of new products, services or processes' success	1 2 3 4 5 6 7
j) Customer satisfaction	1 2 3 4 5 6 7
k) Quality of a new product, service or process	1 2 3 4 5 6 7
l) Reliability of a new product, service or process	1 2 3 4 5 6 7
m) Growth of the sales revenue	1 2 3 4 5 6 7
n) Growth of the market share	1 2 3 4 5 6 7
o) Total turnover	1 2 3 4 5 6 7

3.3. On how many international markets is your organisation active?	**0 1 2 3 4 5 6&more**

Location of your organisation's international activity.

Tick all that apply.

Southeast Asia, China, Japan, India, USA, Canada, Europe, Russia, South America, Africa, Middle East, Other:_____

4.INNOVATION CULTURE

4.1. To what extent does your organisation use the following methods to <u>cooperate</u> with external sources in designing a product, service or process?

External sources: clients, competitors, suppliers, government agencies, research institutes, universities, etc.

	1-not at all						**7-a lot**
a) Strategic alliances	1	2	3	4	5	6	7
b) Purchasing licensing technologies	1	2	3	4	5	6	7
c) Patent disclosures	1	2	3	4	5	6	7
d) Patents within non-disclosure agreements	1	2	3	4	5	6	7
e) Establishing joint project teams	1	2	3	4	5	6	7
f) Regular and formal progress reports	1	2	3	4	5	6	7
g) Joint investments	1	2	3	4	5	6	7
h) Trade secrets	1	2	3	4	5	6	7
i) Joint seminars	1	2	3	4	5	6	7
o) Information and communications technology (e.g. Skype meetings)	1	2	3	4	5	6	7
j) Explicit management control system	1	2	3	4	5	6	7
k) Effective “top-down” & “bottom-up” communication process	1	2	3	4	5	6	7
l) Exchanging employees between project teams	1	2	3	4	5	6	7
m) Flatter organisational structure	1	2	3	4	5	6	7

4.2. Please rate the following statements on the <u>knowledge and skills of your project team</u>.

	1-not at all						**7-a lot**
While collaborating with other organisations for a new product, service or process development, my team members are:							
a) committed	1	2	3	4	5	6	7
b) agile	1	2	3	4	5	6	7
c) flexible	1	2	3	4	5	6	7
d) confident	1	2	3	4	5	6	7
e) have a lack of a tolerance for ambiguity	1	2	3	4	5	6	7
f) technologically well educated	1	2	3	4	5	6	7
g) possess good international experience and cultural understanding	1	2	3	4	5	6	7
h) contribute to our organisation's global vision	1	2	3	4	5	6	7
i) possess good international understanding	1	2	3	4	5	6	7
j) excellent in defining our organisation's priorities	1	2	3	4	5	6	7
k) understand the requirements of users/customers	1	2	3	4	5	6	7
l) continuously educated, trained	1	2	3	4	5	6	7
m) possess excellent knowledge about domestic market	1	2	3	4	5	6	7
n) possess excellent knowledge about international market	1	2	3	4	5	6	7

5. INNOVATION PERFORMANCE

Please estimate <u>for the past four years (2010, 2011, 2012 and 2013)</u>.

5.1. Please rate your organisation's innovation performance.

How many innovations has your organisation had in the past 4 years?		What was the **<u>average revenue</u>** generated from the following innovations?
1-none 2 3 4 5 6 7-a lot	• **Products**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Services**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Processes/Projects**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Licences**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Patents**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Topography of semiconductor products**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Industrial designs**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Trademarks**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%
1-none 2 3 4 5 6 7-a lot	• **Copyrights**	0% 1-10% 11-20% 21-30% 31-40% 41-50 more than 50%

5.2. As a result of your innovation strategy, to what extent do the following outcomes occur based on perceived or actual performance of your organisation?

a) **Faster time to market** (TTM) (from concept to commercialization)	1-never 2 3 4 5 6 7-all the time
b) Increased number of **innovation adoptions**	1-never 2 3 4 5 6 7-all the time
c) **Lower unit costs**	1-never 2 3 4 5 6 7-all the time
d) **Lower production costs**	1-never 2 3 4 5 6 7-all the time
e) **Lower development costs**	1-never 2 3 4 5 6 7-all the time
f) **Increased technical performance**	1-never 2 3 4 5 6 7-all the time
g) **Increased quality**	1-never 2 3 4 5 6 7-all the time
h) **Greater number of product, service or process configurations**	1-never 2 3 4 5 6 7-all the time

6. DEMOGRAPHICS

6.1. What is the name of your organisation?_____

6.2. Your organisation is: A) Privately-owned B) Government owned
C) Foreign-owned D) Publicly listed company

6.3. When was your organisation established?

A) before 1950's B) 1950-1980 C) 1981-1995 D)1996-2000
E) 2001-2005 F) 2006-2010 G) After 2010

6.4. When did your organisation become internationally active?

A) before 1950's B) 1950-1980 C) 1981-1995 D)1996-2000
E) 2001-2005 F) 2006-2010 G) After 2010

The first step in your international activity was:

Tick all that apply.

A) Outsourcing B) Exporting
C) International joint ventures and strategic alliances D) Other. What? _____

6.5. How many employees does your organisation have?

A) 1 B) 2-5 C) 6-10 D) 11-50
E) 51-150 F) 151-250 G) more than 251

6.6. How many employees work in the R&D in your organisation?

A) 1 B) 2-5 C) 6-10 D) 11-50
E) 51-150 F) 151-250 G) more than 251

6.7. How many employees does your project team have?

A) 1 B) 2-5 C) 6-10 D) 11-50
E) 51-150 F) 151-250 G) more than 251

6.8. What is your organisation's average annual turnover for the past four years (2010, 2011, 2012 and 2013)?

A) 0 – 5 million HRK B) 5 – 15 million HRK C) 15 – 75 million HRK
D) 75 – 350 million HRK E) more than 350 million HRK

6.9. In the past four years (2010, 2011, 2012 and 2013), your turnover has:

A) Significantly decreased B) Somewhat decreased
C) Not changed/stayed the same D) Somewhat increased
E) Significantly increased F) Not applicable

6.10. What is your organisation's R&D expenditure as a percentage of turnover?

A) 0% B) 1 – 3% C) 4 - 5% D) 6 - 10%
E) 11 – 20% F) 21 - 30% G) more than 31%

6.11. Is headquarters of your organisation in Croatia? YES NO

6.12. What is the percentage of income that comes from your main client/customer?

A) 1 - 10% B) 11 – 20% C) 21 - 30% D) 31 - 50%
E) 51 – 70% F) 71 - 90% G) more than 90%

6.13. Where is your main client/customer located? A) in Croatia B) overseas

6.14. Are you the owner of the organisation you work in? YES NO

If you are, what percentage of ownership do you hold?

A) less than 1% B) 1 – 5% C) 6 - 10% D) 11 - 20%
E) 21 – 30% F) 31 - 50% G) more than 50%

6.15. Gender: Male Female

Thank you for your participation!

Do you have any comments on open innovation and internationalisation of organisations or about the study itself?

Appendix 4: Confirmatory factor analysis

Confirmatory factor analysis was made in SPSS Amos using a maximum likelihood estimation method on a sample size of 88 responses representing one response per firm. Maximum likelihood estimation procedure was applied because it estimates the values of parameters that would result in the highest likelihood of the dataset matching the proposed model. This method iterates solutions which are then compared with predicted relationships in the actual or observed data. If the matrices of the proposed and actual model are consistent, the model is interpreted as credible (Meyers, Gamst and Guarino, 2013, p.867). There exist absolute and incremental fit indices according to which hypothesized models can be evaluated.

Absolute fit indices confirm how much of the variance in the covariance matrix has been accounted by the model. They do not compare the models like the incremental fit indices do. Chi-square (χ^2) test, Root mean square error of approximation (RMSEA) and the Goodness of Fit Index (GFI) are some of the indices.

Chi-square (χ^2) test is the appropriate measure of fit for models with small number of cases (Kenny, 2014; Meyers, Gamst and Guarino, 2013, p. 868). Sample sizes having between 75 and 200 responses are considered small number of cases. Therefore Chi-square (χ^2) tests are used to estimate the fit of the model between predicted and observed relationships in this thesis. Chi-square ($\chi 2$) test's p value informs on the validity of the following hypothesis:

H_0: There is no relationship between the predicted and observed relationships. $\chi^2 = 0$

H_1: There is a relationship between the predicted and observed relationships. $\chi^2 \neq 0$

In case of a large *p value* H_0 is accepted even though $\chi 2 = 0$ is impossible in practice. The conclusion would imply that the difference is completely explained by sampling. On the other hand, Chi-square (χ^2) tests possess a drawback. They are affected by the size of the correlations in the model. Models with larger correlations suffer from poorer fit (Kenny, 2003). Chi-square (χ^2) test exhibits a lot of Type I[4] errors when variables have non-normal

[4] Type I error occurs when the null hypothesis (H_0) is true, but is rejected. It is also called a ***false positive***. Type II error occurs when the null hypothesis is false, but erroneously fails to be rejected. . It is also called a ***false negative***.

distributions, especially distributions with kurtosis (Kenny, 2003). Considering that the obtained data have non-normal distributions other indices were used to assess the fit of the model.

Root mean square error of approximation (RMSEA) is a non-centrality parameter based upon the residual matrix. RMSEA calculates the discrepancies between the observed and predicted covariances based on the following formula:

$$\frac{\sqrt{(\chi 2 - \mathrm{df})}}{\sqrt{[\mathrm{df}\,(\mathrm{N}-1)]}}$$

RMSEA is currently the most popular measure of a model fit and is reported in almost all papers with respect to CFA or SEM. MacCallum, Browne and Sugawara (1996) used 0.01, 0.05, and 0.08 thresholds to indicate excellent, good, and mediocre fit, while some other authors use a 0.1 threshold as a cut off point. However, Kenny (2003) suggests using RMSEA confidence intervals. Confidence intervals are obtained in AMOS and are in the range between 10% and 90% of the data. Lower values of the 90% confidence interval are very close to zero and the upper values should be lower than 0.08. The width of the confidence interval is informative about the precision of the estimate, while a drawback of RMSEA is its increase with smaller sample sizes (Kenny, 2014).

Jöreskog and Sörbom's (1984) ***Goodness of Fit Index (GFI)*** does not perform as well with latent variable models as with path models and has too many Type I errors when the sample size is large. Although some studies report GFI, it is left out of this thesis.

There exist other indices which are used to minimize the probability of the Type I and Type II errors in the analysis. ***Incremental fit indices*** account for the differences between the proposed and the "null" model. They place the model on a continuum between the worst and the best possible models and their interpretation is analogous to R^2. The worst possible model is called the null or independence model where all the variables in the model have variation but no correlation implying that means in the analysis equal their actual values.

Incremental measures of fit include: χ^2/df, the Comparative Fit Index (CFI) and Bentler-Bonett Index or the Normed Fit Index (NFI).

χ^2/df less than two shows a good fit and χ^2/df between two and five indicates an acceptable fit,

If ***Comparative Fit Index (CFI)*** holds a value greater than 0.95, a very good fit to the model is suggested and values greater than 0.9 point to a good fit. CFI suffers from bias in models with a lot of parameters meaning that the index will be larger in those models. CFI is computed by the following formula:

$$\frac{(\chi 2 - \mathrm{df})(\text{null model}) - (\chi 2 - \mathrm{df})(\text{proposed model})}{(\chi 2 - \mathrm{df})(\text{null model})}$$

Similarly to CFI, ***the Normed Fit Index (NFI)*** shows a very good fit if its values are greater than 0.95 and a good fit is indicated with values greater than 0.9 (Bentler & Bonett, 1980).

$$\frac{\chi 2(\text{null model}) - \chi 2(\text{proposed model})}{\chi 2(\text{null model})}$$

When comparing the models in SEM, measures whose lower values show a better model fit include: Akaike Information Criterion (AIC), BCC, Bayesian Information Criterion (BIC) and ECVI. During a post model estimation, coefficients greater than 0.3 show a better model fit, while the correlations between factors in the model should be less than 0.8.

Taking a sample size into consideration, some authors propose that there should be at least 15 cases per measured variable or indicator (Stevens, 2009). 88 responses are a small sample with which it is impractical to conduct structural equation modelling with all constructs displayed in one structural equation model. Therefore, constructs' path analyses are done individually. Normality of some data is violated which could inflate Chi-square (χ^2) tests and absolute measures of fit more than incremental measures. Hence, both absolute and incremental measures of fit are reported in the analysis.

Prior to running a confirmatory factor analyses, missing values were imputed. After a lot of consideration has been given to impute the missing values by series' linear regression through identifying monotone relationships, it was decided to replace the missing values with series mean in order to reduce the possible bias that could be caused with different imputation methods in the already small dataset.

After the in-depth analysis of the questionnaire items has been carried out, the following constructs were identified and the ***confirmatory factor analysis*** (CFA) was performed. Constructs are:

2. Open innovation (Table 11.1):
    a. Readiness for open innovation,
    b. Inbound accomplished open innovation,
    c. Specific identification of open innovation possibilities,
    d. Generic identification of open innovation possibilities,
3. Innovation (Table 11.2):
    a. Innovation amount,
    b. Amount of intellectual property rights,
    c. Innovation revenue,
    d. Revenue from intellectual property right,
    e. Innovation outcomes.
4. Internationalisation (Table 11.3):
    a. International performance,
    b. Relative international financial position,
    c. Relative international financial growth,
    d. Relative international customer satisfaction.
5. Mediators (Table 11.4):
    a. Institutional regulatory environment

Reported confirmatory factor analysis results are given in the Tables below.

Table 11.1. Confirmatory factor analysis of the Open innovation constructs

CFA	Open innovation constructs							
	Croatia (n=88)	$\chi 2$	df	$\chi 2/df$	p	NFI	CFI	RMSEA
Readiness for open innovation	5 items	1.47	4	0.37	0.83	0.99	1.00	0.00
Inbound accomplished open innovation	5 items	6.43	5	1.29	0.27	0.92	0.98	0.06
Specific identification of OI possibilities	4 items	2.64	1	2.64	0.10	0.96	0.97	0.14
Generic identification of OI possibilities	4 items	0.93	1	0.93	0.33	0.99	1.00	0.00

Source: Author's calculation.

All of the constructs show high internal validity with *p values* ≥ 0.5, NFI ≥ 0.9 and CFI ≥ 0.9. RMSEA is lower than 0.08 for all Open innovation constructs apart from the construct Specific identification of open innovation possibilities where RMSEA is 0.14 which is above the proposed threshold for a good model fit. Considering all other indices point to a good fit,

and RMSEA tends to be inflated in small sample sizes, the construct Specific identification of open innovation possibilities is kept in the analysis with the proposed four items.

Readiness for open innovation construct is composed of five items. Five items measure the amount of innovative changes firms' processes and structures allow them to make without negative effects on their core businesses. These innovative changes include:

Readiness 1) redesigning organisations' profit formula,
Readiness 2) helping customers redesign their value propositions,
Readiness 3) developing new business processes,
Readiness 4) collaborating with other organisations on a new product, service, process or project development.
Readiness 5) adopting ideas outside of their organisation.

Inbound accomplished open innovation (Inbound AOI) consists of the items that identify the usage or collaboration with external stakeholders for new product, service and process or project development. This usage or collaboration includes:

Inbound AOI 1) receiving information,
Inbound AOI 2) exchanging experiences,
Inbound AOI 3) buying or using technology,
Inbound AOI 4) adopting available external knowledge and technology to internal developments,
Inbound AOI 5) jointly undertaking R&D activities.

Identification of open innovation possibilities is divided into two latent constructs: *Specific identification* and *Generic identification*. The question referred to the practices which firms use to identify ideas for a new product, service and process or project development.

Specific identification of open innovation possibilities included using trade fairs and conferences, reverse engineering, gathering information from suppliers and publications. These ways are often used when firms have a specific product, service or process in mind and are looking for more specific information on their further development and testing. It is usually performed by the organisations' engineers who have a specific knowledge in the field of telecommunications.

Specific identification of open innovation possibilities differs from generic identification as generic identification includes scanning for new ideas which is usually done by an organisation's marketing department. The generic identification of open innovation possibilities encompasses the following activities: benchmarking, quantitative data analysis, using social networks and market research studies.

Table 11.2. reports the confirmatory factor analysis for the five Innovation constructs. All constructs show high internal validity with *p values* ≥ 0.5 and CFI ≥ 0.9. NFI is greater than 0.9 for all constructs apart from Innovation revenue construct (NFI = 0.86) whose RMSEA is also greater than 0.08 (RMSEA = 0.12). Hence, Innovation revenue does not possess an excellent but a fairly good model fit according to $\chi 2/df$ (2.20) and CFI (0.91), hence it was kept in the analysis containing the proposed four items.

Table 11.2. Confirmatory factor analysis of the Innovation constructs

CFA	Innovation constructs							
	Croatia (n=88)	**$\chi 2$**	**df**	**$\chi 2/df$**	**p**	**NFI**	**CFI**	**RMSEA**
Innovation amount	4 items	0.90	1	0.90	0.34	0.99	1.00	0.00
Amount of IPR	5 items	5.15	4	1.29	0.27	0.97	0.99	0.06
Innovation revenue	4 items	6.61	3	2.20	0.09	0.86	0.91	0.12
Revenue from IPR	5 items	6.57	4	1.64	0.16	0.97	0.99	0.09
Innovation outcome	8 items	21.75	14	1.55	0.08	0.96	0.98	0.08

Source: Author's calculation.

Innovation amount is a construct composed of the amount of new products, services, projects and licences a firm had in the last four years. The construct Amount of intellectual property rights (IPR) consists of the amount of patents, topography of semiconductor products, industrial designs, trademarks and copyright a firm produced in the last four years.

Innovation revenue construct portrays the average revenue which was obtained from new products, services, processes or projects and licences in the total revenue from products, services, processes or projects and licences in the last four years. Revenue from intellectual property rights (IPR) contains five items comprising the average revenue generated from patents, topography of semiconductor products, industrial designs, trademarks and copyrights. Lastly, innovation outcome construct consists of all eight items given in the questionnaire: faster time to market (TTM) from concept to commercialization, increased number of innovation adoptions, lower unit costs, lower production costs, lower development costs,

increased technical performance, increased quality and greater number of product, service, process or project configurations.

Model fit indices for Internationalisation constructs are given in Table 11.3. All of these constructs exhibit an excellent fit according to all presented indicators ($\chi^2/df \leq 2$, *p values* $\geq$ 0.5, NFI $\geq$ 0.9, CFI $\geq$ 0.9, RMSEA $\leq$ 0.08).

Table 11.3. Confirmatory factor analysis of the Internationalisation constructs

CFA	Internationalisation constructs							
	Croatia (n=88)	**χ2**	**df**	**χ2/df**	**p**	**NFI**	**CFI**	**RMSEA**
International performance	5 items	1.25	4	0.31	0.87	0.99	1.00	0.00
Relative international financial position	4 items	0.72	2	0.36	0.70	1.00	1.00	0.00
Relative international financial growth	6 items	6.60	5	1.32	0.25	0.99	0.99	0.06
Relative international customer satisfaction	4 items	0.40	1	0.40	0.53	1.00	1.00	0.00

Source: Author's calculation.

International performance construct measures the share of exports in total sales, the share of income from foreign subsidiaries in total income, the share of income from foreign strategic alliances, the share of foreign added value in the total added value and the share of licences sold to foreign organisations.

Constructs of Relative international financial position, Relative international financial growth and Relative international customer satisfaction are based on respondents' perception of their firms' relative position compared to their closest international competitors on domestic or international market.

Relative international financial position construct is composed of the perception of firm's position compared to its competitors in the following items: total sales revenue, total market share, number of identified new markets and opportunities and total profitability.

Relative international financial growth compares firms' profit growth, market share growth, sales growth, rate of new products, services and processes or projects' success, time to break even and time to market (from concept to commercialization) with their competitors', while *Relative international customer satisfaction* compares firms' brand awareness, customer satisfaction, reliability of a new product, service and process or project and quality of a new product, service and process or project.

Table 11.4. provides an outline of the confirmatory factor analysis' model fit with respect to hypothesised construct of institutional regulatory environment. Institutional environment here focuses solely on the perception of the regulatory environment, i.e. to what extent do respondents perceive that government agencies support their product, service and process or project development in helping firms identify potential international markets, by having special projects for organisations wishing to develop a new product, service, process, by sponsoring organizations which help with a new products, service or process development, by sponsoring organizations which helps to identify potential collaborators in designing new products, services or processes and by helping firms to find new market niches.

Table 11.4. Confirmatory factor analysis of the Institutional environment

CFA	Moderators and mediators							
	Croatia (n=88)	**$\chi 2$**	**df**	**$\chi 2/df$**	**p**	**NFI**	**CFI**	**RMSEA**
Institutional regulatory environment	5 items	9.21	4	2.30	0.06	0.98	0.99	0.12

Source: Author's calculation.

Model fit indices for Institutional environment show a fairly good fit to the data. χ^2/df is between 2 and 5, *p values* ≥ 0.5, NFI ≥ 0.9, CFI ≥ 0.9, RMSEA ≤ 0.12. Similarly to previous rationale of RMSEA being inflated in small sample sizes, the construct is pertained.

Appendix 5: Exploratory factor analysis

Exploratory factor analysis was made on the five constructs: formal cooperation, Knowledge and skills of the project team: teamwork skills, managerial skills and international knowledge and Innovation new to the market. In order to distinguish groups having lower or higher properties of a particular variable, a median of the groups was identified and the sample was split in two groups. In this way there is a higher and lower intensity groups for the five identified constructs and each group exhibits similar amount of answers, the amount is approximatelly 40 answers.

a) A group above the median presents those firms with the higher level properties of formal cooperation, teamwork skills, managerial skills, international knowledge and innovation new to the market, and
b) A group below the median identifies firms with the lower levels of formal cooperation, teamwork skills, managerial skills, international knowledge and radical innovation.

When performing exploratory factor analysis, firstly Principal Component Analysis was performed based on which communalities were calculated based on eigenvalue greater than one. After Principal Component Analysis has been done, Principal Axis Factoring method of extraction was used with fixed number of factors was estracted (Costello and Osborne, 2005).

The latent construct of ***formal cooperation*** is based on the following items: patents within the non-disclosure agreements, joint project teams, regular and formal progress reports(Lichtenthaler, 2010). Kaiser-Meyer-Olkin Measure of Sampling Adequacy for formal cooperation is 0.68, while Bartlett's Test of Sphericity's *p value* is 0.00. Communalities are 0.82, 0.61 and 0.41 for patents within the non-disclosure agreements, joint project teams, regular and formal progress reports respectivelly, and the total variance explained is 61.39%. Cronbach's alpha measure of the reliability of the scale of the three items is 0.82.

Teamwork skills construct is composed of the following items: agility, commitment, flexibility and mutual understanding. Cronbach's alpha measure of the reliability of the scale of the three items is 0.91. Kaiser-Meyer-Olkin Measure of Sampling Adequacy for formal cooperation is 0.84, while Bartlett's Test of Sphericity's *p value* is 0.00. Communalities are

0.84, 0.82, 0.69 and 0.54 for agility, commitment, flexibility and mutual understanding respectivelly, and the total variance explained is 72.15%.

Managerial skills construct is composed of the following items: project management skills, prioritisation and understanding customer demands. Cronbach's alpha measure of the reliability of the scale of the three items is 0.89. Kaiser-Meyer-Olkin Measure of Sampling Adequacy for formal cooperation is 0.73, while Bartlett's Test of Sphericity's *p value* is 0.00. Communalities are 0.80, 0.80 and 0.60 for management skills, prioritisation and understanding customer demands respectivelly, and the total variance explained is 73.12%.

International knowledge construct is composed of the items: possessing good international experience and cultural understanding, contributing to organisations' global vision and possessing excellent knowledge about international market. Cronbach's alpha measure of the reliability of the scale of the three items is 0.85. Kaiser-Meyer-Olkin Measure of Sampling Adequacy for formal cooperation is 0.71, while Bartlett's Test of Sphericity's *p value* is 0.00. Communalities are 0.77, 0.73 and 0.48 for possessing good international experience and cultural understanding, contributing to organisations' global vision and possessing excellent knowledge about international market respectivelly, and the total variance explained is 65.99%.

Finally, exploratory factor analysis is done to identify the ***innovation new to the market*** construct composed of three items asking to what extent is a product, service or process an organisation develops new for the industry. It was originally composed of four items given in the literature and identified in Chapter 5.2 but due to low communality item stating that "a product, service or a process is different than others on the market" was disregarded from the analysis. Cronbach's alpha measure of the reliability of the scale of the three items is 0.87. These items are: "a product, service or a process uses technology that was not used before in the industry", "it is the first of its kind in the industry" and "it is highly innovative and completely new to the industry". Kaiser-Meyer-Olkin Measure of Sampling Adequacy for formal cooperation is 0.68, while Bartlett's Test of Sphericity's *p value* is 0.00. Communalities are 0.92, 0.75 and 0.45 for items "it is the first of its kind in the industry", "it is highly innovative and completely new to the industry" and "a product, service or a process uses technology that was not used before in the industry" respectivelly, and the total variance explained is 70.66%.

After the confirmatory and exploratory factor analyses have been explained the next section describes structural equation models and tests the hypotheses.

Appendix 6: SEM and Mediation analysis

Path analysis

In order to understand structural equation modelling, the path analysis procedure and assumptions are described firstly and structural equation models are secondly.

Path analysis was introduced by Wright in 1921 (in Meyers, Gamst and Guarino, 2013). It is based on five assumptions:

1) A relationship between variables is linear and causal and should be examined prior the analysis.
2) Errors of endogenous variables are not correlated with the variables that are predicting that variable.
3) Only a one-way causal flow is examined. This assumption is only valid for multiple regressions.
4) Variables are measured on interval or summative response scales.
5) Variables are measured without errors. Although this assumption is unrealistic but necessary for analytic approach.

Path analysis is performed either through a multiple regression analysis or through a model-fitting approach (Meyers, Gamst and Guarino, 2013, p.911). A multiple regression analysis is a partial information technique that employs a predicted *y*. A model-fitting approach is a full information technique that uses actual *y*. As a model fitting technique uses actual *y*, it shall be used to provide the meaningful results of the structural equation model's path analysis. Before the model is run, it is important to resolve the count of known and unknown variables (Meyers, Gamst and Guarino, 2013, p. 944) and constrain the path that the theory would predict with the largest coefficient of the common sense.

Structural equation modelling

Structural equation modelling is a union between confirmatory factor analysis and path analysis. Its two models, a measurement model and a structural model, are evaluated separately. Estimates are based on the maximum likelihood estimation method, while the

models are compared with the relationships (the correlations/covariance matrix) present within the actual or observed data set (Meyers, Gamst and Guarino, 2013).

Herein, the measurement model represents the degrees to which the indicator variables capture the essence of the latent factor. It is a confirmatory factor analysis for each latent variable. When identifying a factor or a latent variable, there should be at least two indicator variables measuring a construct. There should also be measures of residual variance, i.e. variance not attributed to the indicator variable which is unique to each indicator and can serve as error variance. Latent variables are not measured as an item and they do not appear in the correlation matrix nor have variances in structural equation models (Meyers, Gamst and Guarino, 2013, p. 975). They are treated as unknown elements in a model identification.

The Structural model is similar to the path analysis as it looks at the causal relationships between the variables of interests. The variables of interest are typically latent variables. If the hypothesised matrix and the one derived from the actual data are mutually consistent, then SEM can be considered a reliable explanation of the hypothesized relationship. The assumption that the variables of interest are perfectly measured as in path analysis does not have to hold in structural equation modelling (Meyers, Gamst and Guarino, 2013, p. 977) because measured variables are converted latent variables. Hence, changing a path analysis design into SEM means potential gain in the precision of the research.

The overall fit of the model to data and the accuracy of prediction differ between the path analysis and structural equation modelling. The accuracy of prediction is assessed by comparing the actual values of endogenous variables with their predicted values in terms of R^2. Moreover, inclusion of the error term (error M and error A) allows us to use actual *Y* values as the criterion variables (Meyers, Gamst and Guarino, 2013, p. 942-943). Error terms are placed on the endogenous variables. The model fit indices described previously give information about these relationships (Meyers, Gamst and Guarino, 2013, p. 975).

In order to build SEM from the path analysis the following steps need to be made:

1) at least two indicators per latent variable should be used,
2) error terms should be assigned to the endogenous variables,

3) error terms of endogenous variables account for variance not explained by exogenous variables and
4) the latent constructs should be scaled by assigning them values from indicators (1 or -1).

When reporting the results, apart from the Chi-square (χ^2) test, CFI, NFI and RMSEA which provide an estimate of the model fit for the data, R^2 is also provided as it actually depends on what is formally reported in the literature and can be used for comparison with other models.

The next section describes the structural models built given the hypothesized relationships.

In its simplest form, mediation is structured such that the three variables exhibit the following relationship (Meyers, Gamst and Guarino, 2013, p. 918):

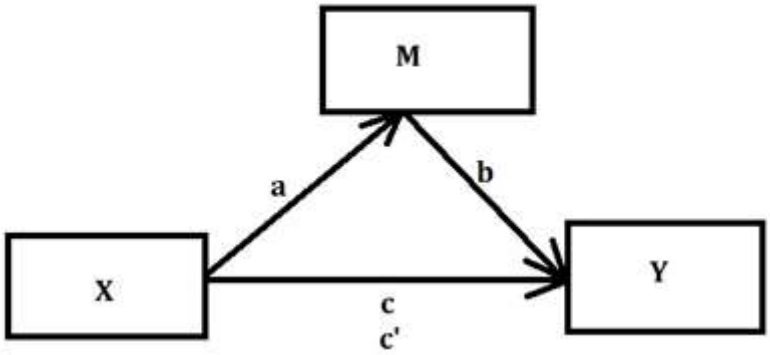

Figure 12.1. Graphical representation of the mediation effects

Source: Meyers, L.S., Gamst, G., and Guarino, A.J. (2013). *Applied Multivariate Research: Design and Interpretation*. 2nd Edition. Thousand Oaks, California, USA: Sage Publications, Inc, p. 918.

Herein, X is an exogenous variable, M is a mediator and Y is an endogenous variable. In order to make valid assumptions on the relationship between mediator variables, the following sections must hold:

1) X must statistically significant predict Y,
2) X must statistically significant predict M,
3) M must statistically significant predict Y.

Kenny (2014) proposes to follow four steps in the mediation analysis. The first step involves detecting whether the causal variable is correlated with the outcome, where Y is the criterion variable and X as a predictor (path c). Herein a possibility of mediation is examined. Secondly, examine whether the causal variable (X) is correlated with the mediator (M). Herein, path a is estimated and tested and a mediator is examined as the outcome variable. Thirdly, it the mediator (M) should affect the outcome variable (Y). Herein, path b is examined. Finally, the effect of X on Y must be inspected (path c') to prove the existence of mediation. Path c' should be zero. Kenny states that if all four of these steps are met, then the data are consistent with the hypothesis that the mediator completely mediates the relationship between the causal variable (X) and the outcome variable.

Step 1 is done in the Hypothesis 1b and 1c, while Step 2 is done in Hypothesis 1a. It is necessary to inspect the relationship between the suggested mediators, Innovation factors, and the outcome variable, Internationalisation factors. Structural equation models tests of these relationships are given in Tables 6.30., 6.31., 6.32. and 6.33., while its summary is given in Table 6.34.

In line with above mentioned mediation assumptions, significance tests between the Innovation factors (mediators) and Internationalisation factors (endogenous variable) needed to be conducted (Table 12.1., 12.2., 12.3. and 12.4.).

Table 12.1. Effect of Innovation on International performance

	Effect of Innovation on the International performance										
	Structural model			**Assessment of the structural and measurement model**							
	Path coefficients	**P value**	**R^2**	**$\chi 2$**	**p ($\chi 2$)**	**DF**	**NFI**	**CFI**	**RMSEA**		
										90% confidence interval	
Innovation amount	0.24*	0.06	0.06	25.65	0.37	24	0.92	0.99	0.03	0.00	0.09
Innovation amount in IPR	0.40***	0.00	0.16	25.06	0.80	32	0.94	1.00	0.00	0.00	0.05
Innovation revenue	0.14	0.32	0.02	30.44	0.11	22	0.89	0.97	0.07	0.00	0.12
Revenue from IPR	0.34***	0.01	0.12	28.82	0.63	32	0.94	1.00	0.00	0.00	0.07
Innovation outcome	0.19	0.11	0.04	71.34	0.08	56	0.91	0.98	0.06	0.00	0.09

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically ($p<0.05$) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Table 12.2. Effect of Innovation on International financial position

	Effect of Innovation on the Relative international financial position										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Innovation amount	0.36***	0.00	0.13	13.04	0.84	19	0.97	1.00	0.00	0.00	0.06
Innovation amount in IPR	0.28**	0.02	0.08	20.06	0.69	24	0.96	1.00	0.00	0.00	0.07
Innovation revenue	0.11	0.42	0.01	21.59	0.31	19	0.94	0.99	0.04	0.00	0.11
Revenue from IPR	0.09	0.42	0.01	21.52	0.61	24	0.96	1.00	0.00	0.00	0.08
Innovation outcome	0.16	0.16	0.02	73.31	0.01	47	0.92	0.97	0.08	0.04	0.11

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically ($p<0.05$) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Table 12.3. Effect of Innovation on International financial growth

	Effect of Innovation factors on the Relative international financial growth factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Innovation amount	0.22*	0.09	0.05	36.62	0.16	29	0.94	0.99	0.06	0.00	0.10
Innovation amount in IPR	0.18	0.15	0.03	48.85	0.08	36	0.93	0.98	0.06	0.00	0.11
Innovation revenue	0.21	0.15	0.04	38.58	0.14	30	0.93	0.98	0.06	0.00	0.10
Revenue from IPR	0.01	0.92	0.00	52.04	0.06	38	0.93	0.98	0.07	0.00	0.11
Innovation outcome	0.25**	0.05	0.06	86.26	0.04	65	0.92	0.98	0.06	0.01	0.09

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically ($p<0.05$) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Table 12.4. Effect of Innovation on International customer satisfaction

	Effect of Innovation factors on the Relative international customer satisfaction factor										
	Structural model			Assessment of the structural and measurement model							
	Path coefficients	P value	R^2	$\chi 2$	p ($\chi 2$)	DF	NFI	CFI	RMSEA		
										90% confidence interval	
Innovation amount	0.27**	0.03	0.07	11.17	0.89	18	0.97	1.00	0.00	0.00	0.04
Innovation amount in IPR	0.05	0.68	0.00	32.63	0.11	24	0.92	0.98	0.06	0.00	0.12
Innovation revenue	0.26*	0.06	0.07	13.62	0.69	17	0.95	1.00	0.00	0.00	0.08
Revenue from IPR	0.18	0.13	0.03	21.22	0.63	24	0.95	1.00	0.00	0.00	0.07
Innovation outcome	0.37***	0.00	0.14	51.38	0.27	46	0.93	0.99	0.04	0.00	0.08

Standardized coefficients are reported. If the results suggested an unacceptable fit, the models were respecified according to the modification indexes to provide a better fit with the data.

All coefficients are statistically ($p<0.05$) and practically (coefficients > 0.3) significant.

Correlations between factors were below 0.4 which shows suffient discriminant validity among the latent constructs.

* p < 0.10, ** p < 0.05, *** p < 0.01

Source: Author's calculation.

Based on 5% significance level, the summary of significant relationships between the variables of interest is given in Table 12.5.

Table 12.5. Summary of significant relationships between the Innovation and Internationalisation factors

Innovation factors	Internationalisation factors			
	International performance	Relative international financial position	Relative international financial growth	Relative international customer satisfaction
Innovation amount	-	√	-	√
Amount of IPR	√	√	-	-
Innovation revenue	-	-	-	-
Revenue from IPR	√	-	-	-
Innovation outcome	-	-	√	√

Source: Author's calculation.

After testing the significance of the relationship between Innovation factors and Internationalisation factors, further analysis shall be made only on significant relationships between the latent variables of interest.

Based on the preceding analysis, fourteen significant relationships between the independent variables, mediators and independent variables are examined (Table 12.6).

Table 12.6. Significant relationships tested in for mediation

Independent variable	Mediator	Dependent variable
Readiness for open innovation	Innovation amount	International performance
Readiness for open innovation	Amount of IPR	International performance
Readiness for open innovation	Innovation amount	Relative international financial growth
Readiness for open innovation	Innovation outcome	Relative international financial growth
Readiness for open innovation	Innovation amount	Relative international customer satisfaction
Readiness for open innovation	Innovation outcome	Relative international customer satisfaction
Inbound accomplished open innovation	Innovation revenue	Relative international customer satisfaction
Generic identification of open innovation possibilities	Innovation amount	Relative international financial position
Generic identification of open innovation possibilities	Amount of intellectual property rights	Relative international financial position
Generic identification of open innovation possibilities	Innovation amount	Relative international financial growth
Generic identification of open innovation possibilities	Innovation outcome	Relative international financial growth
Specific identification of open innovation possibilities	Amount of intellectual property rights	International performance
Specific identification of open innovation possibilities	Revenue from intellectual property rights	International performance
Specific identification of open innovation possibilities	Amount of intellectual property rights	Relative international financial position

Source: Author's representation.

Based on the factors and relationships that followed Kenny's (2014b) mediation procedure, mediation analysis was performed in IBM's statistical software package SPSS AMOS 21.0. The results of the mediation analysis are given in Table 12.7.

Table 12.7 Results of the mediation analysis

Mediation	Direct without a mediator	Direct with mediator	Indirect	R2	χ^2	DF	p (χ2)	GFI	NFI	CFI	RMSEA		
												90% confidence interval	
Generic OI_Innovation amount_Rel. inter. financial position	0.34 (0.01)	0.25 (0.04)	Yes (p=0.05)**	0.19	44.14	49	0.67	0.93	0.93	1.00	0.00	0.00	0.06
Generic OI_IPR amount_Rel. inter. financial position		0.29 (0.02)	Yes (p=0.04)**	0.15	65.04	58	0.25	0.91	0.90	0.99	0.04	0.00	0.08
Generic OI_Innovation outcome_Rel. Inter. financial growth	0.34 (0.02)	0.28 (0.06)	Not significant (p=0.39)	0.14	136.14	111	0.05	0.86	0.90	0.98	0.05	0.00	0.08
Specific OI_IPR amount_International performance	0.28 (0.04)	0.07 (0.63)	Yes (p=0.03)**	0.18	72.39	69	0.37	0.90	0.86	0.99	0.02	0.00	0.07
Specific OI_IPR amount_Rel. inter. financial position	0.30 (0.03)	0.22 (0.12)	Yes (p=0.02)**	0.12	65.46	61	0.33	0.90	0.89	0.99	0.03	0.00	0.07

Source: Author's calculation.

Hence, four mediations are significant according to the bootstrapping method. These four relationships are:

1) Generic identification of open innovation possibilities on Relative international financial position mediated through Innovation amount,
2) Generic identification of open innovation possibilities on Relative international financial position mediated through Amount of intellectual property rights,
3) Specific identification of open innovation possibilities on International performance mediated through Amount of intellectual property rights,
4) Specific identification of open innovation possibilities on Relative international financial position mediated by Amount of intellectual property rights.

The multigroup moderated mediation analysis was performed for the four significant mediation relationships.

Appendix 7: Descriptive statistics of the examined constructs

Table 13.1. Descriptive statistics of the examined constructs

Appendix 8: Path analysis of the multigroup differences

Hypothesis 2: A higher rate of formal cooperation between the firms moderates the relationship between open innovation and internationalisation through the firms' innovation performance.

Path analysis of multigroup differences for the following relationships:

1) Generic identification of open innovation possibilities on International financial position through Innovation amount

Table 14.1. Path coefficients for Generic identification of open innovation possibilities on International financial position through Innovation amount

			High fomal cooperation		**Low formal cooperation**		**Z-score**
			Estimate	P-value	Estimate	P-value	
InnoAmount	<---	GenericIdentification	0.51	0.02	0.15	0.45	-1.20
RelInternFinanPosition	<---	InnoAmount	0.43	0.02	0.09	0.64	-1.22
RelInternFinanPosition	<---	GenericIdentification	0.14	0.53	0.36	0.10	0.70
OL_2_1	<---	GenericIdentification	1.07	0.00	1.18	0.00	0.23
OL_3_1	<---	GenericIdentification	0.79	0.00	0.45	0.13	-0.94
OL_4_1	<---	GenericIdentification	0.73	0.00	0.83	0.00	0.30
INNO_Product_1	<---	InnoAmount	0.74	0.00	1.36	0.00	1.40
INNO_License_1	<---	InnoAmount	0.78	0.00	1.31	0.00	1.25
INNO_Project_1	<---	InnoAmount	0.81	0.00	1.43	0.00	1.43
RelativeInternation_Profit	<---	RelInternFinanPosition	0.90	0.00	0.83	0.00	-0.57
RelativeInternation_Mshare	<---	RelInternFinanPosition	0.94	0.00	0.92	0.00	-0.13
RelativeInternation_NewMarkets	<---	RelInternFinanPosition	0.74	0.00	0.33	0.03	-2.40**

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation.

2) Generic identification of open innovation possibilities on International financial position through the Amount of IPR

Table 14.2. Path coefficients for Generic identification of open innovation possibilities on International financial position through the Amount of IPR

			High fomal cooperation		Low formal cooperation		Z-score
			Estimate	P-value	Estimate	P - value	
InnoAmountIPR	<---	GenericIdentification	0.20	0.25	0.03	0.52	-0.94
RelInternFinanPosition	<---	AmountIPR	0.23	0.29	0.39	0.60	0.21
RelInternFinanPosition	<---	GenericIdentification	0.32	0.14	0.36	0.11	0.14
Quantitative data analysis	<---	GenericIdentification	1.01	0.00	1.22	0.01	0.44
Social networks	<---	GenericIdentification	0.78	0.00	0.45	0.13	-0.89
Market research studies	<---	GenericIdentification	0.73	0.00	0.85	0.00	0.33
INNO_Topography	<---	InnoAmountIPR	0.56	0.00	0.17	0.10	-2.54**
INNO_Trademark	<---	InnoAmountIPR	0.56	0.00	2.22	0.00	2.89***
INNO_IndDesign	<---	InnoAmountIPR	0.82	0.00	2.68	0.00	2.79***
RelativeInternation_Profit	<---	RelInternFinanPosition	0.90	0.00	0.84	0.00	-0.48
INNO_Copyright	<---	InnoAmountIPR	0.78	0.00	3.39	0.00	3.28***
RelativeInternation_NewMarkets	<---	RelInternFinanPosition	0.73	0.00	0.28	0.05	-2.76***
RelativeInternation_Mshare	<---	RelInternFinanPosition	0.94	0.00	0.93	0.00	-0.01

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation.

3) Specific identification of open innovation possibilities on International performance through the Amount of IPR.

Table 14.3. Path coefficients for Specific identification of open innovation possibilities on International performance through Amount of IPR

			High fomal cooperation		Low formal cooperation		Z-score
			Estimate	P-value	Estimate	P - value	
InnoAmountIPR	<---	SpecificIdentification	0.70	0.07	-0.06	0.40	-1.94*
InterPerformance	<---	InnoAmountIPR	0.51	0.03	1.82	0.10	1.16
InterPerformance	<---	SpecificIdentification	0.33	0.46	-0.04	0.93	-0.62
Reverse engineering	<---	SpecificIdentification	1.16	0.02	1.83	0,004	0.82
Information fom suppliers	<---	SpecificIdentification	0.56	0.04	1.31	0.00	1.63
INNO_Topography	<---	InnoAmountIPR	0.61	0.00	0.16	0.12	-2.86***
INNO_Trademark	<---	InnoAmountIPR	0.54	0.00	2.06	0.00	2.70***
INNO_IndDesign	<---	InnoAmountIPR	0.81	0.00	2.79	0.00	2.95***
INNO_Copyright	<---	InnoAmountIPR	0.77	0.00	3.31	0.00	3.23***
Internation_Subsidiary	<---	InterPerformance	0.90	0.00	0.80	0.00	-0.32
Internation_SA	<---	InterPerformance	0.91	0.00	0.93	0.00	0.06
Internation_AddValue	<---	InterPerformance	0.84	0.00	1.06	0.00	0.72
Internation_Licences	<---	InterPerformance	0.81	0.00	0.72	0.00	-0.34

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

The difference between the two models' $\chi 2$ value is 51.71 with 13 degrees of freedom and p-value of 0.00 implies that groups are different at the model level. By examining the path

coefficients given in the pairwise paramete comparison, it can be seen that the two groups differ in the paths between Specific identification of open innovation possibilities and Amount of intellectual property rights, Innovation amount in topography of semiconductor products, trademarks, industrial design and copyright.

Herein, the relationship between Specific identification of open innovation possibilities and Amount of intellectual property rights and Amount of intellectual property rights and International performance is significant for the high formal cooperation group and insignificant for the low formal cooperation group. The relationship between Specific identification of open innovation possibilities and International performance is insignificant for both groups. The interpretation suggests that formal cooperation protects the translation of specific ideas into intellectual property rights and consequently these intellectual property rights into better international performance through the higher added value of products or services.

4) Specific identification of open innovation possibilities on Relative international financial position through the Amount of IPR

Table 14.4. Path coefficients for Specific identification of open innovation possibilities on Relative international financial position through Amount of IPR

			High fomal cooperation		**Low formal cooperation**		**Z-score**
			Estimate	P-value	Estimate	P - value	
InnoAmountIPR	<---	SpecificIdentification	0.60	0.12	-0.09	0.23	-1.74*
RelInterFinPosition	<---	InnoAmountIPR	0.05	0.82	0.45	0.54	0.51
RelInterFinPosition	<---	SpecificIdentification	1.24	0.03	0.03	0.92	-1.93*
Reverse engineering	<---	SpecificIdentification	1.12	0.01	3.49	0.20	0.86
Information from suppliers	<---	SpecificIdentification	0.64	0.02	1.43	0.00	1.62
INNO_Topography	<---	InnoAmountIPR	0.58	0.00	0.16	0.10	-2.74***
INNO_Trademark	<---	InnoAmountIPR	0.55	0.00	2.04	0.00	2.73***
INNO_IndDesign	<---	InnoAmountIPR	0.82	0.00	2.73	0.00	2.97***
INNO_Copyright	<---	InnoAmountIPR	0.72	0.00	3.15	0.00	3.27***
RelativeInternation_Mshare	<---	RelInterFinPosition	0.98	0.00	0.98	0.00	-0.04
RelativeInternation_NewMarkets	<---	RelInterFinPosition	0.74	0.00	0.31	0.05	-2.43**
RelativeInternation_Profit	<---	RelInterFinPosition	0.90	0.00	0.88	0.00	-0.15

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

$\chi 2$ difference (60.03, 12 df and *p value* = 0.00) implies that groups are different at the model level. By examining the path coefficients given in the pairwise parameter comparison, the two groups differ in the paths between Specific identification of open innovation possibilities and Amount of intellectual property rights, between Specific identification of open innovation

possibilities and Relative international financial position, and Innovation amount in the topography of semiconductor products, trademarks, industrial design and copyright.

Both relationships, Specific identification of open innovation possibilities' effect on Amount of intellectual property rights and Amount of intellectual property rights' effect on Relative international financial position are insignificant for the high formal cooperation and low formal cooperation groups. However, for the high formal cooperation group the path from Specific identification of open innovation possibilities towards Relative international financial position is significant, while for the low formal cooperation group is insignificant. As in the previously moderated mediation relationship, it can be concluded that high formal cooperation is important for the relationships involving intellectual property rights as it brings the added value its outcomes.

Hypothesis 3: Knowledge and skills of the project team moderate the relationship between open innovation and internationalisation through the firms' innovation performance.

Teamwork skills

Path analysis of multigroup differences for the following relationships:

1) Generic identification of open innovation possibilities on International financial position through Innovation amount

Table 14.5. Path coefficients for Generic identification of open innovation possibilities on International financial position through Innovation amount

			High teamwork skills		**Low teamwork skills**		**Z-score**
			Estimate	P-value	Estimate	P-value	
InnoAmount	<---	GenericIdentification	0.33	0.25	0.07	0.70	-0.77
RelInternFinanPosition	<---	InnoAmount	0.30	0.11	0.37	0.12	0.21
RelInternFinanPosition	<---	GenericIdentification	0.41	0.17	0.32	0.11	-0.25
OL_2	<---	GenericIdentification	0.84	0.03	1.17	0.00	0.75
OL_3	<---	GenericIdentification	0.62	0.10	0.60	0.01	-0.05
OL_4	<---	GenericIdentification	0.93	0.03	0.90	0.00	-0.06
INNO_Product	<---	InnoAmount	1.00	0.00	1.05	0.00	0.12
INNO_License	<---	InnoAmount	1.25	0.00	0.57	0.01	-1.81*
INNO_Project	<---	InnoAmount	1.21	0.00	1.14	0.00	-0.18
RelativeInternation_Profit	<---	RelInternFinanPosition	0.96	0.00	0.92	0.00	-0.35
RelativeInternation_Mshare	<---	RelInternFinanPosition	1.01	0.00	0.96	0.00	-0.39
RelativeInternation_NewMarkets	<---	RelInternFinanPosition	0.79	0.00	0.48	0.00	-1.94*

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

2) Generic identification of open innovation possibilities on International financial position through the Amount of IPR

Table 14.6. Path coefficients for Generic identification of open innovation possibilities on International financial position through the Amount of IPR

			High teamwork skills		Low teamwork skills		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	GenericIdentification	0.38	0.14	0.31	0.04	-0.24
RelInternFinanPosition	<---	InnoAmountIPR	0.06	0.77	0.49	0.04	1.33
RelInternFinanPosition	<---	GenericIdentification	0.52	0.13	0.20	0.35	-0.81
OL_2	<---	GenericIdentification	0.85	0.02	1.09	0.00	0.58
OL_3	<---	GenericIdentification	0.65	0.10	0.58	0.01	-0.16
OL_4	<---	GenericIdentification	1.00	0.03	0.90	0.00	-0.21
INNO_Topography	<---	InnoAmountIPR	0.51	0.00	0.51	0.00	0.00
INNO_Trademark	<---	InnoAmountIPR	0.62	0.00	0.66	0.00	0.16
INNO_IndDesign	<---	InnoAmountIPR	0.89	0.00	0.82	0.00	-0.32
RelativeInternation_Profit	<---	RelInternFinanPosition	0.96	0.00	0.92	0.00	-0.36
INNO_Copyright	<---	InnoAmountIPR	1.05	0.00	0.80	0.00	-0.88
RelativeInternation_NewMarkets	<---	RelInternFinanPosition	0.76	0.00	0.48	0.00	-1.78*
RelativeInternation_Mshare	<---	RelInternFinanPosition	1.01	0.00	0.97	0.00	-0.38

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

3) Specific identification of open innovation possibilities on International performance through the Amount of IPR

Table 14.7. Path coefficients for Specific identification of open innovation possibilities on International performance through the Amount of IPR

			High teamwork skills		Low teamwork skills		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	SpecificIdentification	0.42	0.31	0.68	0.02	0.50
InterPerformance	<---	InnoAmountIPR	0.29	0.31	0.90	0.00	1.58
InterPerformance	<---	SpecificIdentification	-0.30	0.65	0.07	0.82	0.51
OL_7	<---	SpecificIdentification	2.90	0.10	1.24	0.00	-0.92
OL_8	<---	SpecificIdentification	1.83	0.01	0.98	0.01	-1.09
INNO_Topography	<---	InnoAmountIPR	0.52	0.00	0.54	0.00	0.14
INNO_Trademark	<---	InnoAmountIPR	0.65	0.00	0.66	0.00	0.03
INNO_IndDesign	<---	InnoAmountIPR	0.90	0.00	0.81	0.00	-0.38
INNO_Copyright	<---	InnoAmountIPR	1.00	0.00	0.87	0.00	-0.42
Internation_Subsidiary	<---	InterPerformance	0.94	0.00	0.90	0.00	-0.15
Internation_SA	<---	InterPerformance	1.06	0.00	0.88	0.00	-0.48
Internation_AddValue	<---	InterPerformance	0.96	0.00	1.02	0.00	0.17
Internation_Licences	<---	InterPerformance	0.67	0.00	1.07	0.00	1.34

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

4) Specific identification of open innovation possibilities on Relative international financial position through the Amount of IPR

Table 14.8. Path coefficients for Specific identification of open innovation possibilities on Relative international financial position through the Amount of IPR

			High teamwork skills		**Low teamwork skills**		**Z-score**
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	SpecificIdentification	0.35	0.30	0.63	0.02	0.63
RelInterFinPosition	<---	InnoAmountIPR	0.18	0.41	0.47	0.05	0.91
RelInterFinPosition	<---	SpecificIdentification	0.39	0.36	0.37	0.33	-0.03
OL_7	<---	SpecificIdentification	1.52	0.04	1.40	0.00	-0.13
OL_8	<---	SpecificIdentification	1.46	0.01	0.86	0.01	-0.95
INNO_Topography	<---	InnoAmountIPR	0.53	0.00	0.50	0.00	-0.18
INNO_Trademark	<---	InnoAmountIPR	0.65	0.00	0.64	0.00	-0.05
INNO_IndDesign	<---	InnoAmountIPR	0.89	0.00	0.80	0.00	-0.37
INNO_Copyright	<---	InnoAmountIPR	1.00	0.00	0.82	0.00	-0.60
RelativeInternation_Mshare	<---	RelInterFinPosition	1.04	0.00	0.99	0.00	-0.42
RelativeInternation_NewMarkets	<---	RelInterFinPosition	0.80	0.00	0.48	0.00	-1.96*
RelativeInternation_Profit	<---	RelInterFinPosition	0.97	0.00	0.92	0.00	-0.42

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

Managerial skills

1) Generic identification of open innovation possibilities on International financial position through Innovation amount

Table 14.9. Path coefficients for Generic identification of open innovation possibilities on International financial position through Innovation amount

			High managerial skills		Low managerial skills		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmount	<---	GenericIdentification	0.27	0.27	0.24	0,194	-0.11
RelInternFinanPosition	<---	InnoAmount	0.38	0.06	0.17	0,375	-0.73
RelInternFinanPosition	<---	GenericIdentification	0.23	0.36	0.38	0,066	0.48
OL_2	<---	GenericIdentification	0.77	0.04	1.12	0.00	0.83
OL_3	<---	GenericIdentification	0.60	0.10	0.67	0.00	0.18
OL_4	<---	GenericIdentification	0.76	0.05	0.91	0.00	0.36
INNO_Product	<---	InnoAmount	1.60	0.00	0.71	0.00	-1.90*
INNO_License	<---	InnoAmount	1.62	0.00	0.54	0.00	-2.34**
INNO_Project	<---	InnoAmount	1.16	0.00	1.06	0.00	-0.26
RelativeInternation_Profit	<---	RelInternFinanPosition	0.97	0.00	0.88	0.00	-0.62
RelativeInternation_Mshare	<---	RelInternFinanPosition	1.01	0.00	0.95	0.00	-0.49
RelativeInternation_NewMarkets	<---	RelInternFinanPosition	0.74	0.00	0.53	0.00	-1.35

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

2) Generic identification of open innovation possibilities on International financial position through the Amount of IPR

Table 14.10. Path coefficients for Generic identification of open innovation possibilities on International financial position through the Amount of IPR

			High managerial skills		Low managerial skills		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	GenericIdentification	0.94	0.14	0.27	0.03	-1.04
RelInternFinanPosition	<---	InnoAmountIPR	0.07	0.77	0.36	0.19	0.84
RelInternFinanPosition	<---	GenericIdentification	1.09	0.14	0.32	0.13	-1.00
OL_2	<---	GenericIdentification	0.82	0.15	1.08	0.00	0.44
OL_3	<---	GenericIdentification	1.63	0.17	0.65	0.00	-0.81
OL_4	<---	GenericIdentification	2.33	0.12	0.90	0.00	-0.94
INNO_Topography	<---	InnoAmountIPR	0.42	0.00	0.59	0.00	1.33
INNO_Trademark	<---	InnoAmountIPR	0.61	0.00	0.71	0.00	0.40
INNO_IndDesign	<---	InnoAmountIPR	0.74	0.00	1.00	0.00	1.23
RelativeInternation_Profit	<---	RelInternFinanPosition	0.97	0.00	0.89	0.00	-0.65
INNO_Copyright	<---	InnoAmountIPR	1.05	0.00	0.79	0.00	-0.90
RelativeInternation_NewMarkets	<---	RelInternFinanPosition	0.72	0.00	0.53	0.00	-1.27
RelativeInternation_Mshare	<---	RelInternFinanPosition	1.04	0.00	0.96	0.00	-0.66

Source: Author's calculation

3) Specific identification of open innovation possibilities on International performance through the Amount of IPR

Table 14.11. Path coefficients for Specific identification of open innovation possibilities on International performance through the Amount of IPR

			High managerial skills		Low managerial skills		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	SpecificIdentification	0.21	0.39	0.42	0.08	0.61
InterPerformance	<---	InnoAmountIPR	0.44	0.07	0.67	0.02	0.63
InterPerformance	<---	SpecificIdentification	0.01	0.98	0.49	0.18	1.00
OL_7	<---	SpecificIdentification	1.90	0.01	0.85	0.02	-1.38
OL_8	<---	SpecificIdentification	1.22	0.00	0.67	0.06	-1.21
INNO_Topography	<---	InnoAmountIPR	0.41	0.00	0.64	0.00	1.60
INNO_Trademark	<---	InnoAmountIPR	0.64	0.00	0.72	0.00	0.30
INNO_IndDesign	<---	InnoAmountIPR	0.80	0.00	1.02	0.00	0.89
INNO_Copyright	<---	InnoAmountIPR	1.03	0.00	0.88	0.00	-0.52
Internation_Subsidiary	<---	InterPerformance	1.09	0.00	0.84	0.00	-0.72
Internation_SA	<---	InterPerformance	1.17	0.00	0.90	0.00	-0.70
Internation_AddValue	<---	InterPerformance	1.09	0.00	0.97	0.00	-0.35
Internation_Licences	<---	InterPerformance	0.70	0.00	0.94	0.00	0.86

Source: Author's calculation

4) Specific identification of open innovation possibilities on Relative international financial position through the Amount of IPR

Table 14.12. Path coefficients for Specific identification of open innovation possibilities on Relative international financial position through the Amount of IPR

			High managerial skills		Low managerial skills		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	SpecificIdentification	0.28	0.27	0.67	0.05	0.91
RelInterFinPosition	<---	InnoAmountIPR	0.26	0.16	0.42	0.19	0.44
RelInterFinPosition	<---	SpecificIdentification	0.36	0.19	0.30	0.59	-0.09
OL_7	<---	SpecificIdentification	1.61	0.00	1.25	0.03	-0.47
OL_8	<---	SpecificIdentification	1.22	0.00	0.85	0.04	-0.70
INNO_Topography	<---	InnoAmountIPR	0.43	0.00	0.59	0.00	1.22
INNO_Trademark	<---	InnoAmountIPR	0.64	0.00	0.69	0.00	0.19
INNO_IndDesign	<---	InnoAmountIPR	0.77	0.00	1.00	0.00	0.99
INNO_Copyright	<---	InnoAmountIPR	1.01	0.00	0.81	0.00	-0.67
RelativeInternation_Mshare	<---	RelInterFinPosition	1.05	0.00	0.99	0.00	-0.41
RelativeInternation_NewMarkets	<---	RelInterFinPosition	0.76	0.00	0.52	0.00	-1.42
RelativeInternation_Profit	<---	RelInterFinPosition	0.98	0.00	0.91	0.00	-0.55

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

International knowledge

1) Generic identification of open innovation possibilities on International financial position through Innovation amount

Table 14.13. Path coefficients for Generic identification of open innovation possibilities on International financial position through Innovation amount

			High international knowledge		Low international knowledge		Z-score
			Estimate	P-value	Estimate	P-value	
Innovationamount	<---	GenIdentification	0.41	0.04	0.09	0.73	-1.02
RelInterFinPos	<---	Innovationamount	0.41	0.03	-0.02	0.92	-1.67*
RelInterFinPos	<---	GenIdentification	0.26	0.17	0.22	0.29	-0.17
OL_2	<---	GenIdentification	0.91	0.00	1.20	0.00	0.87
OL_3	<---	GenIdentification	0.67	0.01	0.70	0.01	0.07
OL_4	<---	GenIdentification	0.80	0.00	0.98	0.00	0.52
INNO_Product	<---	Innovationamount	1.20	0.00	0.74	0.00	-1.24
INNO_Project	<---	Innovationamount	1.21	0.00	0.84	0.00	-1.02
INNO_License	<---	Innovationamount	1.40	0.00	0.26	0.08	-3.24***
RelativeInternation_NewMarkets	<---	RelInterFinPos	0.64	0.00	0.52	0.00	-0.58
RelativeInternation_Mshare	<---	RelInterFinPos	1.03	0.00	1.00	0.00	-0.19
RelativeInternation_Sales	<---	RelInterFinPos	1.06	0.00	1.07	0.00	0.10

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

2) Generic identification of open innovation possibilities on International financial position through the Amount of IPR

Table 14.14. Path coefficients for Generic identification of open innovation possibilities on International financial position through the Amount of IPR

			High international knowledge		Low international knowledge		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	GenericIdentification	0.72	0.13	0.19	0.11	-1.09
RelInternFinanPosition	<---	InnoAmountIPR	0.17	0.44	0.34	0.14	0.52
RelInternFinanPosition	<---	GenericIdentification	0.83	0.16	0.27	0.12	-0.91
OL_2	<---	GenericIdentification	0.81	0.11	1.11	0.00	0.56
OL_3	<---	GenericIdentification	1.28	0.14	0.75	0.00	-0.60
OL_4	<---	GenericIdentification	1.89	0.09	0.87	0.00	-0.91
INNO_Topography	<---	InnoAmountIPR	0.64	0.00	0.42	0.00	-1.48
INNO_Trademark	<---	InnoAmountIPR	0.68	0.00	0.72	0.00	0.17
INNO_IndDesign	<---	InnoAmountIPR	0.81	0.00	0.98	0.00	0.78
RelativeInternation_Profit	<---	RelInternFinanPosition	1.08	0.00	0.81	0.00	-2.10**
INNO_Copyright	<---	InnoAmountIPR	1.27	0.00	0.56	0.00	-2.24**
RelativeInternation_NewMarkets	<---	RelInternFinanPosition	0.58	0.00	0.54	0.00	-0.25
RelativeInternation_Mshare	<---	RelInternFinanPosition	1.07	0.00	0.93	0.00	-1.17

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

3) Specific identification of open innovation possibilities on International performance through the Amount of IPR

Table 14.15. Path coefficients for Specific identification of open innovation possibilities on International performance through the Amount of IPR

			High international knowledge		Low international knowledge		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	SpecificIdentification	0.41	0.20	0.26	0.31	-0.38
InterPerformance	<---	InnoAmountIPR	0.54	0.05	0.52	0.03	-0.07
InterPerformance	<---	SpecificIdentification	-0.22	0.60	0.48	0.20	1.23
OL_7	<---	SpecificIdentification	1.82	0.03	1.27	0.00	-0.58
OL_8	<---	SpecificIdentification	1.07	0.02	1.27	0.00	0.36
INNO_Topography	<---	InnoAmountIPR	0.57	0.00	0.39	0.00	-1.24
INNO_Trademark	<---	InnoAmountIPR	0.73	0.00	0.66	0.00	-0.26
INNO_IndDesign	<---	InnoAmountIPR	0.93	0.00	0.91	0.00	-0.08
INNO_Copyright	<---	InnoAmountIPR	1.18	0.00	0.51	0.00	-2.08**
Internation_Subsidiary	<---	InterPerformance	1.29	0.00	0.45	0.00	-2.28**
Internation_SA	<---	InterPerformance	1.28	0.00	0.60	0.01	-1.74*
Internation_AddValue	<---	InterPerformance	1.24	0.00	0.77	0.00	-1.31
Internation_Licences	<---	InterPerformance	0.85	0.00	0.66	0.00	-0.69

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

4) Specific identification of open innovation possibilities on Relative international financial position through the Amount of IPR

Table 14.16. Path coefficients for Specific identification of open innovation possibilities on Relative international financial position through the Amount of IPR

			High international knowledge		Low international knowledge		Z-score
			Estimate	P-value	Estimate	P-value	
InnoAmountIPR	<---	SpecificIdentification	0.68	0.07	0.33	0.21	-0.77
RelInterFinPosition	<---	InnoAmountIPR	0.25	0.27	0.47	0.04	0.71
RelInterFinPosition	<---	SpecificIdentification	0.63	0.18	-0.16	0.66	-1.33
OL_7	<---	SpecificIdentification	1.57	0.02	1.46	0.01	-0.12
OL_8	<---	SpecificIdentification	1.12	0.02	1.32	0.00	0.34
INNO_Topography	<---	InnoAmountIPR	0.68	0.00	0.40	0.00	-1.75*
INNO_Trademark	<---	InnoAmountIPR	0.68	0.00	0.68	0.00	0.03
INNO_IndDesign	<---	InnoAmountIPR	0.82	0.00	0.94	0.00	0.54
INNO_Copyright	<---	InnoAmountIPR	1.29	0.00	0.54	0.00	-2.27**
RelativeInternation_Mshare	<---	RelInterFinPosition	1.08	0.00	0.95	0.00	-1.04
RelativeInternation_NewMarkets	<---	RelInterFinPosition	0.60	0.00	0.54	0.00	-0.36
RelativeInternation_Profit	<---	RelInterFinPosition	1.08	0.00	0.82	0.00	-2.01**

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

Hypothesis 4: Innovation which is new to the market moderates the relationship between the firm's innovation performance and internationalisation more than the innovation which is new to the firm.

Path analysis of multigroup differences for the following relationships:

1) Innovation amount and International performance

Table 14.17. Path coefficients for Innovation amount and International performance

			High innovation new to the market		**Low innovation new to the market**		**Z-score**
			Estimate	P-value	Estimate	P-value	
InternationalPerformance	<---	InnoAmount	0.57	0.04	0.13	0.45	-1.36
Internation_SA	<---	InternationalPerformance	1.00	0.00	0.97	0.00	-0.07
Internation_AddValue	<---	InternationalPerformance	0.98	0.00	1.15	0.00	0.48
Internation_Subsidiary	<---	InternationalPerformance	0.93	0.00	1.35	0.00	1.04
INNO_Product	<---	InnoAmount	1.64	0.00	0.68	0.00	-2.08**
INNO_Project	<---	InnoAmount	0.98	0.00	1.42	0.00	1.10
Internation_Licences	<---	InternationalPerformance	1.04	0.00	0.80	0.00	-0.77
INNO_License	<---	InnoAmount	1.28	0.00	0.96	0.0	-0.80

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

2) Innovation amount and Relative international financial position

Table 14.18. Path coefficients for Innovation amount and Relative international financial position

			High innovation new to the market		**Low innovation new to the market**		**Z-score**
			Estimate	P-value	Estimate	P-value	
RelInterFinPerf	<---	InnoAmount	0.45	0.05	0.31	0.06	-0.47
RelativeInternation_NewMarkets	<---	RelInterFinPerf	0.75	0.00	0.35	0.02	-2.47**
RelativeInternation_Profit	<---	RelInterFinPerf	0.94	0.00	0.90	0.00	-0.33
RelativeInternation_Mshare	<---	RelInterFinPerf	0.97	0.00	1.05	0.00	0.65
INNO_Product	<---	InnoAmount	1.58	0.00	0.69	0.00	-1.99**
INNO_Project	<---	InnoAmount	1.01	0.00	1.32	0.00	0.83
INNO_License	<---	InnoAmount	1.24	0.00	0.97	0.00	-0.68

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

3) Innovation amount and Relative international financial growth

Table 14.19. Path coefficients for Innovation amount and Relative international financial growth

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
RelInterFinPerfGrowth	<---	InnoAmount	0.09	0.39	0.05	0.36	-0.34
RelativeInternation_SalesGrowth	<---	RelInterFinPerfGrowth	1.93	0.00	4.20	0.23	0.65
RelativeInternation_MShareGrowth	<---	RelInterFinPerfGrowth	1.93	0.00	4.73	0.23	0.71
RelativeInternation_TTBE	<---	RelInterFinPerfGrowth	0.98	0.00	1.56	0.08	0.63
INNO_Product	<---	InnoAmount	1.64	0.00	0.76	0.00	-1.94*
INNO_Project	<---	InnoAmount	0.99	0.00	1.33	0.00	0.90
INNO_License	<---	InnoAmount	1.25	0.00	0.98	0.00	-0.68
RelativeInternation_ProfitGrowth	<---	RelInterFinPerfGrowth	1.95	0.00	5.09	0.23	0.74
RelativeInternation_ProductSuccess	<---	RelInterFinPerfGrowth	0.94	0.00	3.68	0.20	0.95

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

4) Innovation amount and Relative international customer satisfaction

Table 14.20. Path coefficients for Innovation amount and Relative international customer satisfaction

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
RelInterCustomerSatisf	<---	InnoAmount	0.05	0.67	0.19	0.11	0.81
RelativeInternation_Brand	<---	RelInterCustomerSatisf	0.99	0.00	0.46	0.03	-1.54
RelativeInternation_Quality	<---	RelInterCustomerSatisf	1.36	0.00	1.07	0.00	-0.85
RelativeInternation_Reliability	<---	RelInterCustomerSatisf	1.34	0.00	1.08	0.00	-0.74
INNO_Product	<---	InnoAmount	1.63	0.00	0.71	0.00	-2.00**
INNO_Project	<---	InnoAmount	1.00	0.00	1.28	0.00	0.73
INNO_License	<---	InnoAmount	1.23	0.00	0.97	0.00	-0.68

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

5) Amount of IPR and International performance

Table 14.21. Path coefficients for Amount of IPR and International performance

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
InternationalPerformance	<---	InnoAmountIPR	0.45	0.04	0.82	0.03	0.87
Internation_SA	<---	InternationalPerformance	1.06	0.00	0.97	0.00	-0.24
Internation_AddValue	<---	InternationalPerformance	1.05	0.00	1.17	0.00	0.31
Internation_Subsidiary	<---	InternationalPerformance	1.02	0.00	1.38	0.00	0.83
INNO_IndDesign	<---	InnoAmountIPR	0.86	0.00	0.83	0.00	-0.11
INNO_Topography	<---	InnoAmountIPR	0.47	0.00	0.75	0.00	1.32
INNO_Trademark	<---	InnoAmountIPR	0.59	0.00	0.97	0.00	1.13
INNO_Copyright	<---	InnoAmountIPR	0.80	0.00	1.43	0.00	1.45
Internation_Licences	<---	InternationalPerformance	1.21	0.00	0.81	0.00	-1.12

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

6) Amount of IPR and Relative international financial position

Table 14.22. Path coefficients for Amount of IPR and Relative international financial position

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
RelInterFinPosition	<---	Amount IPR	0.18	0.37	0.81	0.02	1.64
RelativeInternation_NewMarkets	<---	RelInterFinPosition	0.73	0.00	0.37	0.01	-2.22**
RelativeInternation_Profit	<---	RelInterFinPosition	0.94	0.00	0.92	0.00	-0.21
RelativeInternation_Mshare	<---	RelInterFinPosition	0.97	0.00	1.07	0.00	0.76
INNO_Topography	<---	Amount IPR	0.48	0.00	0.68	0.00	1.09
INNO_IndDesign	<---	Amount IPR	0.87	0.00	0.83	0.00	-0.13
INNO_Trademark	<---	Amount IPR	0.59	0.00	1.01	0.00	1.27
INNO_Copyright	<---	Amount IPR	0.89	0.00	1.22	0.00	0.85

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

7) Revenue from innovation and Relative international customer satisfaction

Table 14.23. Path coefficients for Revenue from innovation and Relative international customer satisfaction

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
RelInterCustomerSatisf	<---	InnoRevenue	0.08	0.66	0.25	0.08	0.76
RelativeInternation_Brand	<---	RelInterCustomerSatisf	0.96	0.00	0.46	0.03	-1.52
RelativeInternation_Quality	<---	RelInterCustomerSatisf	1.32	0.00	1.06	0.00	-0.82
RelativeInternation_Reliability	<---	RelInterCustomerSatisf	1.29	0.00	1.09	0.00	-0.63
InnoPERF_Project	<---	InnoRevenue	1.11	0.13	1.33	0.00	0.27
InnoPERF_Licence	<---	InnoRevenue	0.48	0.24	1.13	0.00	1.22
InnoPERF_Product	<---	InnoRevenue	0.61	0.16	0.42	0.18	-0.35

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

8) Revenue from IPR and International performance

Table 14.23. Path coefficients for Revenue from IPR and International performance

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
InternationalPerformance	<---	InnoRevenueIPR	0.81	0.05	0.72	0.03	-0.15
Internation_SA	<---	InternationalPerformance	1.01	0.00	0.95	0.00	-0.16
Internation_AddValue	<---	InternationalPerformance	0.97	0.00	1.12	0.00	0.44
Internation_Subsidiary	<---	InternationalPerformance	0.92	0.00	1.35	0.00	1.08
InnoPERF_IndDesign	<---	InnoRevenueIPR	0.74	0.00	0.46	0.00	-2.51**
InnoPERF_Topography	<---	InnoRevenueIPR	0.91	0.00	0.29	0.00	-6.81***
InnoPERF_Trademark	<---	InnoRevenueIPR	0.43	0.00	0.41	0.02	-0.10
InnoPERF_Copyright	<---	InnoRevenueIPR	0.44	0.00	0.54	0.00	0.79
Internation_Licences	<---	InternationalPerformance	1.06	0.00	0.77	0.00	-0.93

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

9) Innovation outcome and Relative international financial growth

Table 14.24. Path coefficients for Innovation outcome and Relative international financial growth

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
RelInterFinPerfGROWTH	<---	InnoOUT	0.13	0.20	0.03	0.44	-0.86
RelativeInternation_SalesGrowth	<---	RelInterFinPerfGROWTH	1.93	0.00	4.21	0.23	0.64
RelativeInternation_MShareGrowth	<---	RelInterFinPerfGROWTH	1.92	0.00	4.75	0.23	0.71
RelativeInternation_TTBE	<---	RelInterFinPerfGROWTH	0.99	0.00	1.39	0.07	0.50
InnoOUT_UnitCost	<---	InnoOUT	1.17	0.00	0.84	0.00	-1.10
InnoOUT_InnoAdopt	<---	InnoOUT	0.97	0.00	0.69	0.00	-1.01
InnoOUT_ProductionCost	<---	InnoOUT	1.07	0.00	0.62	0.00	-1.46
InnoOUT_DevelopCost	<---	InnoOUT	0.92	0.00	0.59	0.00	-1.19
InnoOUT_TechPerfromance	<---	InnoOUT	1.08	0.00	1.31	0.00	0.69
InnoOUT_Quality	<---	InnoOUT	1.01	0.00	1.06	0.00	0,168
InnoOUT_ProductConfig	<---	InnoOUT	0.96	0.00	0.94	0.00	-0.09
RelativeInternation_ProfitGrowth	<---	RelInterFinPerfGROWTH	1.94	0.00	5.11	0.23	0.74
RelativeInternation_ProductSuccess	<---	RelInterFinPerfGROWTH	0.99	0.00	3.45	0.20	0.92

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

10) Innovation outcome and Relative international customer satisfaction

Table 14.25. Path coefficients for Innovation outcome and Relative international customer satisfaction

			High innovation new to the market		Low innovation new to the market		Z-score
			Estimate	P-value	Estimate	P-value	
RelInterCustSatisf	<---	InnoOUT	0.11	0.32	0.35	0.01	1.31
RelativeInternation_Quality	<---	RelInterCustSatisf	1.38	0.00	1.13	0.00	-0.73
RelativeInternation_Reliability	<---	RelInterCustSatisf	1.33	0.00	1.03	0.00	-0.93
InnoOUT_UnitCost	<---	InnoOUT	1.12	0.00	0.80	0.00	-1.14
InnoOUT_InnoAdopt	<---	InnoOUT	0.94	0.00	0.75	0.00	-0.73
InnoOUT_ProductionCost	<---	InnoOUT	1.03	0.00	0.60	0.00	-1.40
InnoOUT_DevelopCost	<---	InnoOUT	0.84	0.00	0.65	0.00	-0.71
InnoOUT_TechPerfromance	<---	InnoOUT	1.05	0.00	1.24	0.00	0.68
InnoOUT_Quality	<---	InnoOUT	0.99	0.00	1.13	0.00	0.56
InnoOUT_ProductConfig	<---	InnoOUT	0.91	0.00	0.98	0.00	0.27
RelativeInternation_Brand	<---	RelInterCustSatisf	0.99	0.00	0.45	0.03	-1.59

Notes: *** p-value < 0.01; ** p-value < 0.05; * p-value < 0.10

Source: Author's calculation

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Maja Bašić was born on 8 May 1984 in Zagreb, Croatia. She attended Worksop College, United Kingdom (2000-2002). Maja holds her B.Sc. degree in Economic Analysis and Development (2008) and her Master of Business Administration degree (2012) from the University of Zagreb. Her undergraduate degree was partially completed at the Johannes Kepler Universität, Austria, where she was an exchange student.

Since November 2008 Maja works as a teaching and research assistant at the University of Zagreb, Faculty of Economics and Business, Department of International Economics. She holds tutorials in undergraduate International Business and International Entrepreneurship courses both in class and online, in Croatian and in English. Courses in English are part of the EFMD's EPAS accredited program.

Maja enjoys working in multicultural environments. She worked as a research, financial and administrative assistant in several European Commission's projects: TEMPUS Fostering Entrepreneurship in Higher Education (2009-2012; Grant holder: Full Professor Marina Dabić, Ph.D., University of Zagreb), and Leonardo da Vinci's "Transfer of Innovation – Stimulating Learning Idea-to-Market" (2012-2014), and Erasmus Network "Open Innovation" (2014-) (at the University of Zagreb led by Full Professor Marina Dabić, Ph.D.).

In 2014 Maja received the Australian Government Endeavour Research Fellowship to conduct research at the University of South Australia under the supervision of Professor Mile Terziovski, Ph.D., and the Australian National University Enterprise, under the supervision of Sarah Pearson, Ph.D. She participates in conferences and workshops related to her interest in economic development, education, innovation and internationalisation (e.g., I.S.E.O Summer School with Nobel Laureates; Erasmus teaching and research staff exchange at University of Regensburg, Germany; MEDAlics, the Research Centre for Mediterranean Relations' Academy).

Maja Bašić is a member of the Academy of International Business, MBA Croatia and the charity POZA.