Afnan Zafar

The Outsourcing Innovation Paradox

A Company's Growth Option or a Risk to R&D Capabilities

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Reviewers

Dr. Josep Llach
University of Girona
Department of Organization, Business Administration and Product Design
C/Universitat de Girona, 10
Campus Montilivi
17003 Girona
Spain

Dr. Edmund Pawlowski
Poznan University of Technology
Faculty of Engineering Management
ul. Strzelecka 11
60-965 Poznan
Poland

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Julkaisun nimike
Innovoinnin ulkoistamisen paradoksi: yrityksen kasvuvaihtoehto vai riski T&K-valmiuksiin

Tiivistelmä
Innovointi on olennaisen tärkeää tämän päivän tuotekehityksessä ja minkä tahansa yrityksen säilymiselle markkinoilla. Kilpailluilla markkinoilla yritykset etsivät innovointia tarjoavia kolmansia osapuolia kuluttajien vaatimusten täyttämiseksi. Tutkimus käsittelee innovoinnin ulkoistamisen syitä, miten yritykset suojaavat sisäisiä T&K-valmiuksiaan, innovoinnin ulkoistamiseen vaikuttavia tekijöitä ja miten kaikki nämä syyt ja tekijät vaikuttavat yrityksen suoriutumiseen. Tutkimuksen tulokset voivat auttaa asianomaisten alojen ammattilaisia selvittämään, onko tuotekehitykseen liittyvä innovoinnin ulkoistaminen tehokasta toimintaa vai onko sillä kielteisiä vaikutuksia. Tutkimukseen osallistui 112 ammattilaista 60 innovatiivisesta yrityksestä, jotka sijaitsevat 20 eri maassa. Tutkimuksessa käytettiin kvantitatiivista ja kvalitatiivista tutkimusmenetelmää.

Ensiksi tutkimus tarjoaa tietoa innovoinnin ulkoistamisesta ja sen hyödyntämisestä tuotekehityksessä. Toiseksi, tutkimus esittelee käsitteellisen mallin innovoinnin ulkoistamisen taustalla, jossa on kolme pääpilaria: innovaatiotoiminnan ulkoistaminen, tuotekehitys ja yrityksen ominaisuudet. Kolmanneksi, tutkimuksessa sovelletaan kolmea teoriaa yhdessä: ”transaktiotaloutta”, ”resurssipohjaista näkemystä” ja ”päämies-agentti teoriaa” innovoinnin ulkoistamisen paradoksin ymmärtämiseksi. Lopuksi, tutkimus esittää käytännön kontribuutiona suuntaviivoja innovointikumppanin valintaan ja osoittaa, että innovaatiotoiminnan ulkoistaminen voi hyödyttää niitä teollisuudenaloja, jotka kohtaavat kilpailua innovaatioiden puuttumisen vuoksi.

Asiasanat
Tuotekehitys, Ulkoistaminen, Innovaatiot, Sopimustutkimus, T&K, Avoin innovaatio

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Abstract

Innovation is fundamental to product development in the present age, and important to the survival of any corporate organization in the relevant market. Faced with competitive markets, companies are looking towards third-party providers for innovations in order to meet consumer demands. This research investigates the reasons for outsourcing innovations, how companies protect in-house R&D capabilities, factors affecting outsourcing innovations and how all these reasons and factors affect company performance. The results should help professionals in the respective disciplines to ascertain whether outsourcing innovations in product development is effective or has a negative impact. Surveys were conducted among 112 highly skilled professionals from 60 innovative firms situated in 20 countries around the world. The study is a triangulation of quantitative and qualitative research methods.

Firstly, the study provides knowledge about outsourcing innovations and its utilization in product development. Secondly, the study provides a conceptual model behind outsourcing innovations in product development, based on three main elements: outsourcing innovations, product development and company attitudes. Thirdly, to understand the outsourcing innovation paradox, the theory of transaction cost economics, the resource-based view and principal-agent theory are used in a single study for the first time; this is the major contribution of the study. Finally, the study provides guidelines to managers in product development departments open to innovation for selecting an innovation provider for an outsourcing partnership. It also indicates that outsourcing innovations can benefit many other industries facing competition and lacking new ideas.

Keywords

Product Development, Outsourcing, Innovations, Contract Research, R&D, Open Innovation

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I wish to thank all case organizations who participated in my research. To all the companies and professionals who participated in the surveys and interviews, I just want to express my immense gratitude to them. Without their valuable insights and time, this study would have been impossible to complete. They have discussed the latest information and concepts about the innovations, open innovations, outsourcing and product development they are using in their organizations.

I am also grateful to the funding bodies the Nissi Foundation, the University of Vaasa and Liikesivistysrahasto for financially supporting my research and publications. I am thankful to the office staff of the Graduate School who always helped me and solved issues related to everyday research requirements and travel.

There is a widely held opinion that undertaking a doctoral project is a lonely job, but my experience was very different, as I luckily enjoyed support from various channels. I always received motivation and advice from a good friend of mine, Dr Salman Saleem, a PhD graduate from the University of Vaasa. I am very thankful for his insights and taking time out his busy professional life just to listen to my weird ideas.

I am especially grateful to my family. My parents Karim and Rakhshinda, and my siblings Aqsa and Sidra. All of them supported me throughout my PhD journey with patience, endurance, jokes and phone calls in good and difficult times. Although they were always 6,000 km away from me, I always felt that they were standing beside me, which always had the effect of motivating me even more. In the course of this intensive journey, I have often been unable to fulfil my family responsibilities. But, now this doctoral journey has come to an end, I will be happy to share my free time with my awesome family.

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Afnan Zafar

Vaasa, April 2018

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General definitions

Term	Definition
Outsourcing	A mutual setting between two or more companies in which one company hires one or more companies and assigns them existing internal activity tasks (McCarthy & Anagnostou 2004).
Product	A product or a service can be anything offered in a given market that has the ability to satisfy any need or demand (Kotler et al. 2006).
Development	An extension of the theoretical or practical aspects of a concept, design, discovery or invention (Ulrich & Eppinger 2012).
Product development	The final product development process is the combination of structured methods, planned timing, predictable outcomes and short-termism (Ulrich & Eppinger 2012).
Innovation	Innovation is a process of translating an idea or invention into a tangible good or a service that creates value, for which customers will pay (Tidd & Bessant 2009).
Innovation management	It is the process of managing overall innovation covering searches, selections, implementation and capturing various phases (Tidd & Bessant 2013).
Organization	A group of people with a common goal that collectively forms a single entity (Chandra Das 2016).
Firm or company	Company and firm are synonymous terms. A commercial organization that works on the basis of making profits and selling goods or services to consumers (BD 2018).
Research and development	Research and development (referred to as R&D in the main body of the dissertation) are the fundamental instruments of growth strategies to discover and compete in new markets and to enhance the existing market share (Artz et al. 2010).
Contract research organization	"A contract research organization is an organization contracted by another company to manage and lead the company's trials, duties, and functions" (Stone 2018).

Transaction cost economics	Transaction cost theory (Coase 1937) accounts for the overall cost of outsourcing productions of goods/products/services. This includes transaction costs, searching costs, coordination costs and contracting costs. More precisely, it keeps in view all these costs, while making decisions about some project, not just market prices (Williamson 1989).
Resource-based view	Firm resources always play a key role in higher firm performance (Barney 1991: 99-120). If the resources exhibit VRIO *(valuable, rare, costly to imitate, organized to capture value → sustainable competitive advantage)* attributes, they enable the firm to gain competitive advantage (Rothaermel 2013: 91).
Principal-agent theory	It is also referred to as the principal-agent problem or agency dilemma. It is the process of one person or an entity making a decision, which can have an impact on the other person or entity, referred to as *agent* and *principal*, respectively. In such situations, the agents try to act in their best interests, which clash with the principal's interests (Schneeweiss 2003).

Abbreviations

OI	Outsourcing innovations
TCE	Transaction cost economics
RBV	Resource-based view
PAT	Principal-agent theory
IP	Intellectual property
IPRs	Intellectual property rights
CRO	Contract research organization
NPD	New product development
PD	Product development
OIP	Outsourcing innovation paradox

DEDICATION

To my eternal life coach and cheerleader, the late Mrs Azra Khanum Lodhi.

I miss our chats throughout my educational journey. She was always enthusiastic about my small achievements. She was always keen to know what I was up to even though she never understood fully, she always showed the utmost interest and gave me motivation. She was a retired senior education teacher from a girl's school. She enlightened the value of knowledge in all her grandchildren deeply. She never believed in materialistic things and she always preferred the wealth of knowledge on anything.

I will miss her on graduation day and her screams of joy and impatient hugs whenever significant success is achieved. I know she is smiling from the sky as she watches me holding my doctorate degree in my hands.

Azra Khanum Lodhi (late)

عذرا خانم لودهی

Afnan Zafar

Vaasa, January 2019

1 INTRODUCTION

Research and development are the fundamental instruments of growth strategies to discover and compete in new markets and to enhance the existing market share (Artz et al. 2010). Highly competitive markets have forced companies to improve their R&D capabilities (Yam et al. 2011). The reason behind that thought is the ever-increasing competition in markets for their established products and core technologies (Contractor et al. 2010). Thus, R&D operations are now directly connected to the company's growth strategies (Wang 2012). This not only helps to develop new products, but also enhances manufacturing processes, better market performance, improved operations and the formation of customer-oriented products, while maintaining the competitive edge of the company (Grimpe & Kaiser 2010). R&D, over many previous decades, has existed as an integral part of all successful companies, but today it is one of the vital factors in any company's growth (Bogers 2011).

R&D, in the present era, is no longer a single concept; rather, it is an umbrella for many procedures, concepts and processes (Gassmann et al. 2016). Today, product development, innovations and outsourcing knowledge fall within the remit of R&D departments in companies (Enkel et al. 2009). Product development is not a simple process, which can be started immediately before developing our required product. The product development process can only be started if there is a strong basic research and technology development. The stronger the two processes, the higher the chances of successful product development. Basic research comprises the discovery process with no deadlines, unpredictability and a longer time span, while the technology development phase is always loosely structured, difficult to plan, less predictable and covers the medium term. The final product development process is the combination of structured methods, planned timing, predictable outcomes and short-termism (Ulrich & Eppinger 2012).

Moving further towards the R&D concept, it is important to highlight the role of innovations as one of the key process for strong R&D and optimum product development outcomes (Rosenbusch et al. 2011). Innovation is a process of translating an idea or invention into a tangible good or a service that creates value, for which customers will pay. Innovations can be divided into two major categories: evolutionary innovations and revolutionary innovations (Tidd & Bessant 2009). Innovation matters, not only at the level of individual enterprise but also increasingly as the springboard for national economic growth. As Baumol pointed out, "virtually all of *the economic growth that has occurred since the*

eighteenth century is ultimately attributable to innovation" (Tidd & Bessant 2009: 5).

Additionally, there are times when every company's R&D department runs short of its own concepts, innovations and new product development techniques (Spithoven et al. 2010). This has been observed widely in the last two decades when even giant companies were unable to introduce successful products in the market, which could attract masses (Huston & Sakkab 2006). To cope with such situations, companies started to outsource knowledge and technologies from other companies in the market due to their own stagnant R&D growth (Huizingh 2011). If we investigate the overall concept of outsourcing in the last three decades, managers around the globe have clearly discovered outsourcing potentiality (Aranda et al. 2011). Outsourcing has been a potential source of competitiveness; at the beginning, the main reason for outsourcing was to lower costs by moving operations to low-cost countries in Asia and Eastern Europe (Yang et al. 2011). The outsourcing strategy should bring deeper advantages to the organizations than cost reduction: "four of the most promising opportunities for using outsourcing strategies are - focus, scale without mass, disruptive innovation, and strategic repositioning". The main problem here is that managers are unfamiliar with this concept and sometimes focused only on short-term performance (Leavy 2004).

This study connects outsourcing, product development, innovations and R&D capabilities under one roof. It explores outsourcing innovations in product development, as well as the pros and cons and the impact on the company's R&D capabilities.

1.1 Research background and motivation

Outsourcing innovations in product development is one of the key players in the R&D department of any company and later as a competitive growth factor in the market (Gassmann et al. 2010). There are many ways to outsource the required technologies and expertise. Giant production companies are now acquiring innovations from the "contract research organization" (CRO) as part of their product development process. Thus, "*contract research* can be defined as the contractually agreed, non-gratuitous and temporary performance of R&D tasks for a client by a legally and economically independent contractor where the research outcomes are transferred to the client with all specific exploitation rights upon completion of the task" (Grimpe & Kaiser 2010).

Outsourcing eases the financial stress of the parent company, resulting in less focused and the least interesting behaviour for investing in its own R&D capacity

(Grimpe & Kaiser 2010). Companies now simply assign CROs the required innovation task, depending upon consumer needs and market competition. CROs try to provide the best solutions in the form of innovations as part of product development (Contractor et al. 2010). There is a possible chance that companies will lose their uniqueness in terms of innovative product development (Arnold 2000), specifically those that are in markets with rapidly changing trends, such as telecommunications, biotechnology and molecular sciences, ICT, engineering services, chemicals and pharmaceuticals, where their products are highly dependent upon R&D (Schneider & Veugelers 2010).

Moreover, the key to the growth of R&D-oriented companies is intensive and never-ending research (Morbey 1998). Their market existence is completely dependent upon the innovations in their product development process (Ritala 2011). This is a kind of situation in which the rule of the 'survival of the fittest' applies (Chander 2015). Few research studies have previously highlighted the benefits and pitfalls of engaging CROs in various types of production areas (Lowman et al. 2012). However, there is still ample research required to identify the effects of CROs on the innovation capability of a company in terms of its product development and retaining its uniqueness in the market (Berchicci 2013). Thus, the literature revolves around areas such as outsourcing, product development, innovations and the company's R&D capabilities.

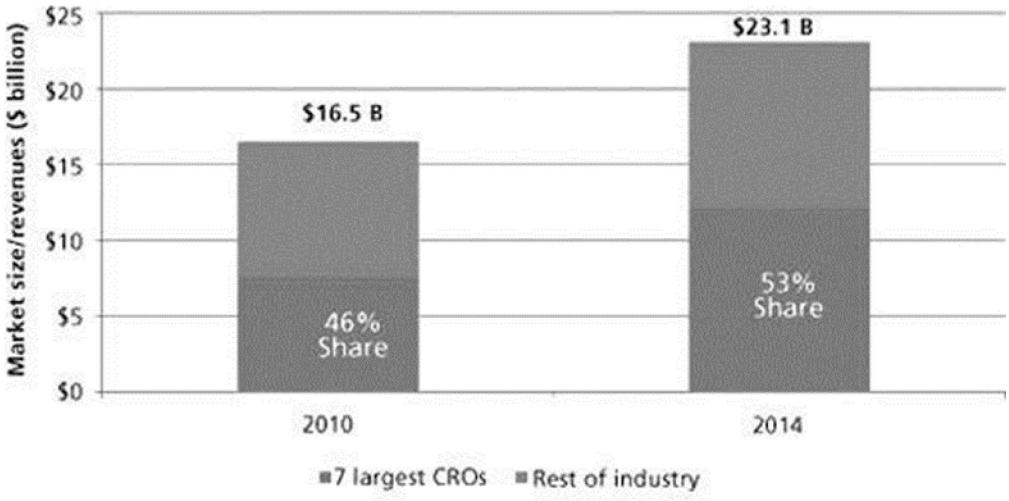
The motivation behind this study was mainly informed by the practical issues that many companies have been facing for the last two decades. Companies have tried many times to outsource innovations for product development in their R&D in order to gain competitive advantage in the market (Lee et al. 2010). During this process, they have sometimes been able to find highly innovative partners and developed successful products (Grönlund et al. 2010). But, in many cases, companies lost their intellectual advantage and millions of US dollars on such collaborations (Chesbrough 2010). Thus, keeping financial losses in mind, we should take a closer look at the outsourcing innovation market and the finances involved in the given market, which is the only way we can understand the severity of this research problem. If we ask ourselves about how many company names we are aware of, which provide such outsourcing or are CROs, it is possible that we would struggle to name more than a few companies. But, if we investigate the official data and try to identify the top outsourcing providers in the world, the results could be eye-openers for us (IAOP 2016). When we investigate the data at an international level, we can determine the top 10 IT companies, as shown in Table 1 (HfS Research Ltd. 2013), which are known as the best outsourcing providers for IT services and innovations. The companies are ranked in term of revenue in 2013:

Table 1. HfS IT services top 10, consulting and maintenance revenues

Rank	Service provider	Est. revenues 2012 (USD billions)	Market share (%)
1	IBM	56.2	9.0%
2	HP	31.5	5.0%
3	Fujitsu	29.6	4.7%
4	Accenture	24.9	4.0%
5	NTT	15.9	2.6%
6	SAP Services	15.7	2.5%
7	CSC	14.5	2.3%
8	Capgemini	13.7	2.2%
9	Oracle Services	13.2	2.1%
10	CGI (incl. Logica)	10.8	1.7%
	Top 10	**226.1**	36.2%
13	TCS	8.9	1.4%
18	Cognizant	6.4	1.0%
19	Infosys	5.8	0.9%
23	Wipro	4.3	0.7%
27	HCL	3.4	0.5%
	Total Market	**624.0**	**100.0%**
Source: HfS Research Ltd. (2013)			

IBM was the world's number one outsourcing provider in ICT, with about a 9% share of the overall market and USD 56.2 billion in revenue, in 2012. The companies behind IBM, such as HP, Fujitsu, Accenture, NTT, SAP services, CSC, Capgemini, Oracle Services and CGI, had an overall share of 36% in the international market.

Moreover, if we look at the data of another big industrial segment, that is, pharmaceuticals, the story is not much different. CROs are dominating the market (Blair 2015). The major seven CROs enjoyed a huge share of 52% of the total pharma market, worth USD 23.1 billion in 2014 (Blair 2015). The figure below shows the increase in the share of CROs from 46% to 53% in just a four-year period.



Source: *William Blair & Company, L.L.C.*

Figure 1. Comparison of the seven largest CROs and the rest of industry

When certain companies emerge as billion-dollar companies, we become acquainted with their names and assets a great deal, but do any of us know the top CROs, which are now billion-dollar companies? It is somewhat hard to name a few of them and rarely do we hear their names or get to know about those companies. Here are a few CROs, which are also billion-dollar businesses, which own part of a 53% share in the pharmaceutical industry.

Table 2. Top billion-dollar pharma CROs

Rank	Name	Market Share in %	Sales in USD	Year
1	Quintiles	16.9	2.7 bn	2007
2	Covance	9.7	1.5 bn	2007
3	Pharmaceutical Product Development Inc. (PPD)	N/A	1.6 bn	2008
4	ICON	N/A	1.5 bn	2014
5	Charles Rivers Laboratories	N/A	1.2 bn	2014
Source: Business Insights (2014)				

Table 3 and Figure 2 present key findings on these top CROs, as well as a graphical representation of the global CRO market size, in billions of US dollars, between 2008 to 2013. The market stood at USD 18 billion in 2008 and reached USD 35 billion in 2013. There is an annual 14% growth rate observable every year in just

five-year period of time. According to Figure 2, Quintiles was the leading global CRO market with a 16.9% share in 2007. This means that it had sales of USD 2.7 billion among a total of 1,100 players in the market. The top 10 players among this total of 1,100, accounted for 56.1% of the global CRO market share in 2007. At this time, CROs' attempts to expand their fragmented structure helped them to increase strategic alliances, joint ventures and different kinds of partnerships. This also helped companies to get more geographical access. Covance was the second-largest player in 2007 with a registered revenue of USD 1.5 in 2007. This equated to a share of up to 9.7% for Covance in the CRO market, the key to which was that the company expanded its business in emerging markets.

All these revenues and market shares in the CRO industry are now very noticeable. The main reason is that they are now needed by traditional R&D companies, which, in the past, believed that all research should be within the closed boundaries of companies.

Table 3. Key findings from top CROs in the world

Key findings
• The global CRO industry was valued at US 18 billion in 2008, an increase of 14% compared to 2007. The CRO market was expected to grow at an annual rate of 14% in the 2009-13 period.
• Quintiles leads the global CRO market, having accrued a market share of 19.9%, in 2007, equivalent to a scale of USD 2.7 billion. There are over 1,100 players in the industry, while the top 10 players only accounted for 56.1% of the global market in 2007.
• The fragmented structure of the CRO industry has led to an increase in strategic alliances, acquisitions, joint ventures and other partnership deals as companies attempt to expand their service offerings and geographical presence.
• Covance is the second-largest global CRO, having registered revenues of USD 1.5 billion in 2007, representing a market share of 9.7%. Covance is building global capabilities, with many clinical trials now being conducted in emerging markets.
• Biomarkers have the potential to become an integral part of clinical research after the FDA recommended their usage throughout clinical trials to demonstrate desired clinical safety.
Source: Business Insights 2014

"Business Insights estimates the global CRO market to be worth $18bn in 2008, and further growth is forecast at an annual rate of 14.0% to reach approximately $35bn in 2013. This growth is expected to be largely driven by cost containment

pressures in the global pharmaceutical industry that have encouraged R&D outsourcing" (Business Insights 2014).

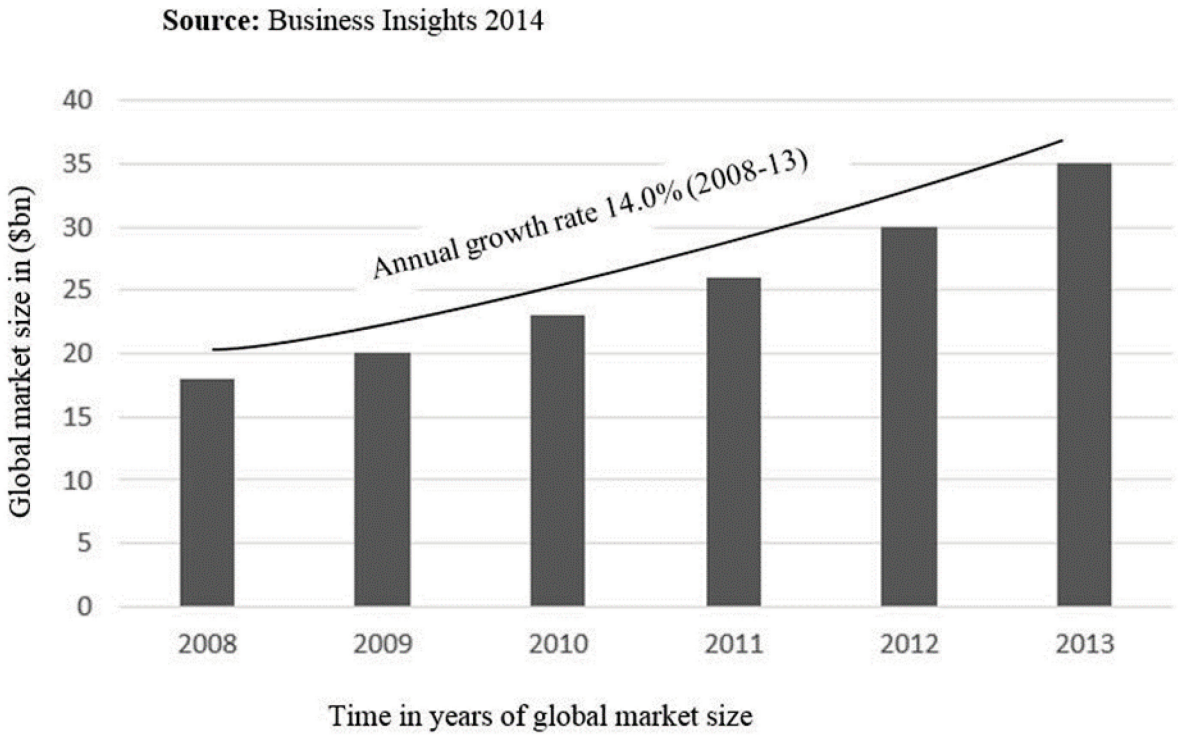


Figure 2. Graphical representation of key findings of top CROs in the world.

If we look at country-specific data, while provider names are neither that familiar nor popular either, in the UK market alone, these companies provide a total annual value of more than GBP 15 billion. According to researchers, this represents almost three quarters of the UK R&D market by value (PA Consultancy 2015). The following table 4 presents the companies that are the top outsourcing providers for the IT industry in the UK according to the report of the PA Consultancy Group, while Figure 3 shows the topmost consultancy and outsourcing providers, also in the UK.

Table 4. Top outsourcing providers for the IT industry in the UK

(%)	Company name	(%)	Company name	(%)	Company name
80	TATA Consultancy Services	73	SCC	66	IBM
77	Computacenter	71	Telefonica	65	Verizon
77	Getronics	71	Sopra Steria	64	CAPITA
74	Cognizant	71	CSC	61	AT&T
73	Capgemini	70	Tech Mahindra	61	HCL
73	hp	69	Accenture	61	FUJITSU
73	Atos	69	Wipro	58	T Systems
73	Infosys	69	CGI		
73	NIIT Technologies	68	Vodafone		
Source: PA Consultancy					

The TATA Consultancy is an Indian company, which has the top position in the chart, followed by companies such as Computacenter, Getronics and Cognizant. However, past research has never highlighted these companies, even when they were capturing a major share of the UK market as outsourcing innovation providers.

International and some national data have shown the above average levels of investment in the outsourcing innovations industry. It is nearly impossible to ignore such investments, nowadays, without systematically determining their fate. Apparently, the process looks straightforward, with a parent company investing in an outsourcing provider and obtaining the required innovation within the set timeline. But things are not that simple, as has been observed in the recent past. There are potential consequences of such huge investments because, at the end of each unsuccessful product development and after pouring huge investments into such a process, there is always an impact on a firm's own R&D capabilities in the long run (Lichtenthaler 2011). Moreover, it is also observed that weak R&D capabilities of research-oriented companies never have a positive effect on their overall performance (Parida et al. 2012). In the recent past, no such work has been carried out to investigate issues related to outsourcing innovations in product development, their relationship with the R&D capabilities of firms and overall firm

performance. All these individual motives represent the overall motivation of this research.

1.2 Research gap

Outsourcing innovations in product development seem to be very efficient in meeting market and customer demands in a short period of time; but, the question remains about whether this is really an effective strategy for any organization in the long run. If companies continue to outsource innovative technologies, what will happen to their product development innovation techniques and R&D capabilities? After several years, where would their R&D capabilities stand? Especially for any company that is heavily dependent on outsourcing innovations, as well as all the other firms involved, answers to all these questions should be of the utmost important.

This study first analyses how different factors, reasons and functions play their role in outsourcing innovations in the product development process, which involve companies' R&D departments. Secondly, the purpose of this study is to determine how these factors, reasons and roles are related to R&D capabilities and firm performance.

More specifically, this research has three objectives:

- To establish the reasons for outsourcing innovations in product development and explore the impact of those reasons on the overall firm performance.
- To determine the methods involved in the protection of R&D capabilities and analyse the effect of those methods on outsourcing innovations in product development.
- To discover macro-environmental and firm-level factors affecting outsourcing innovations in product development and explore their effect on firms' overall performance.

In previous studies, the concept of outsourcing innovations was used to describe their positive impact on product development (Nieto & Rodriguez 2011), with only a few explaining their impact on the R&D capabilities of the firm (Berchicci 2013). But this overall process has never been directly related to the performance of the newly developed product, overall firm performance and subsequent R&D capabilities of the firm (Grimpe & Kaiser 2010: 1503). This study investigates the

outsourcing innovations' impact on product development and its relation to the overall performance of newly developed product's market performance and overall firm performance. This study explores these objectives based on an extensive analysis of the viewpoint of the respondents who have been working every day in similar situations. The following section describes the research questions and later the answers to them, which in turn has helped to develop guidelines for the respondents and other companies.

1.3 Research questions

The core **research questions (RQs)** that guided this study can be stated as follows:

RQ1:

"Why do companies outsource innovation in product development and why does outsourcing affect firm performance?"

The role of outsourcing innovation in previous research showed us the benefits and risks associated with it. Some researchers focused on the benefits of such outsourcing of innovations in the past (Aranda et al. 2011). Many of them stated that a reduction of costs, fostering creativity in internal R&D, the undivided attention of the contractor, internal healthy and innovative competition, and access to public R&D funding when firms involve universities are all major benefits (Grimpe & Kaiser 2008). On the contrary, few highlighted the risks comprehensively; for example, in the case of innovation outsourcing, based on transaction cost economics (TCE), pre-contract, main contract and post-contract risks should be analysed (Teece 2010). The purpose of this research question is to identify the extent of these risks, in a well-balanced way, by developing guidelines for outsourcing of innovations. This will help us to establish the middle ground in terms of addressing this research gap and later outsourcing managers and associated industries.

RQ2:

"How do (parent) companies protect R&D capabilities and how do these protectionist motives affect outsourcing innovations in the product development process?"

Past and current research has failed to discuss innovation outsourcing effects on a company's core competences, which are directly related to the company's own

R&D. As a principle, core and unique skills should not be outsourced; in such cases, cost becomes less important when there is a question of retaining a company's core innovations within the firm (Trott & Hoecht 1999). This research question helps to establish the intensity of effects that outsourcing innovations can have on the R&D capabilities of the company and its core competences. It also draws a line between where to outsource and where to stop.

RQ3:

"How do macro-environmental and firm-level factors affect outsourcing innovations in the product development process and how are these factors related to firm performance?"

Trott and Hoecht also made some recommendations to avoid risks, such as repeat dealings with contractors, acquiring a stake in one or more third parties to be more secure, strong legal bindings, hiring an expert (to keep an eye on all infiltration issues, market developments) from a buyer organization. The above research question helps to find solutions that are more comprehensive in terms of their effects on companies' R&D capacity. This is achieved by interviews with and surveys among managers involved in the given areas of research.

1.4 Positioning of the study

There is an overlap in the different industrial management areas in the current study, such as knowledge creation as the bass of innovations, project management, strategic management, quality control and operational strategies of different companies. Outsourcing innovations in product development have been studied with reference to these areas of industrial management and focused on the targeted industrial segment. This study has interlinked with many research areas; but, specifically speaking, it overlaps the fields of R&D, product development, outsourcing and innovations.

Product development and outsourcing innovations come under the remit of R&D departments of firms. The positioning of this research project is in the middle of when the four areas of R&D, product development, outsourcing, and innovations systematically overlap with one another. There is intensive research available on all these mentioned areas and their relationship with each another in various contexts, but the positioning of this study is specific to outsourcing innovations in product development.

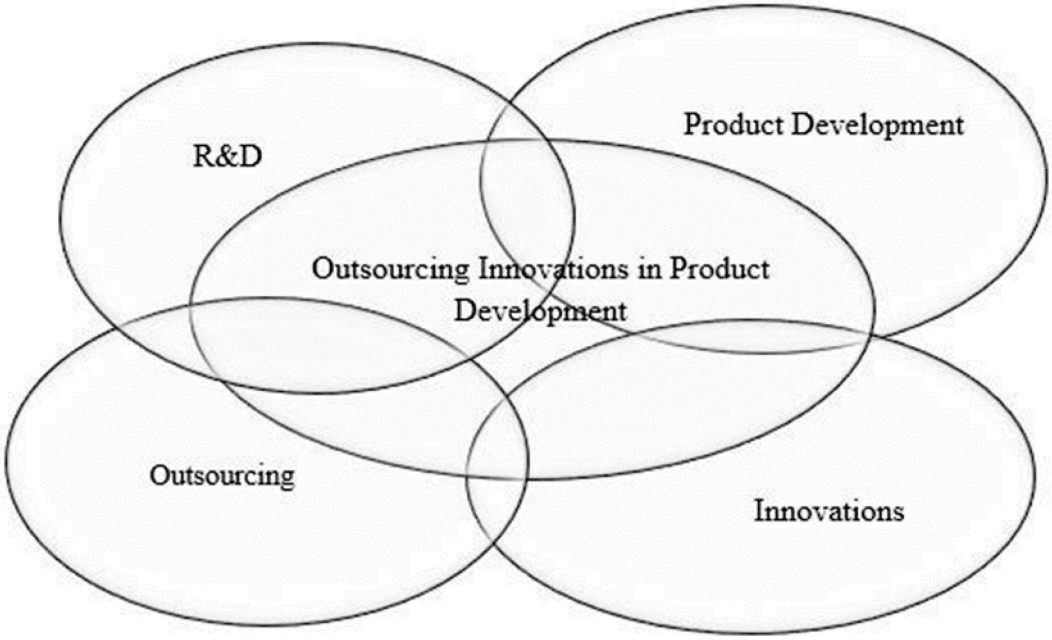


Figure 3. The positioning of the research project

1.5 Description of delimitation

The ***targeted industrial segment***s were ***intensive research-based*** companies, for example, pharmaceutical and engineering R&D-based companies, technology and innovations consultancy providers, the chemical industry, biotech and molecular biology research labs and ICT firms. Somehow, many of the above-mentioned fields are connected to each other, while ICT firms are especially heavily integrated with all of them.

Table 5. List of the most innovative industries in 2015

%	Industry	2014 volume	2013 volume	% change
5%	Aerospace and defence	62,162	63,080	-1%
12%	Automotive	153,872	152,221	1%
3%	Biotechnology	42,584	39,685	7%
1%	Cosmetics and well-being	11,017	10,197	8%
2%	Food, tobacco and brewing	26,333	21,758	21%
6%	Home appliances	71,278	71,118	0%
30%	Information technology	380,325	367,028	4%
7%	Medical devices	93,462	99,290	-6%
2%	Oil and gas	24,158	23,925	1%
9%	Pharmaceuticals	111,479	99,950	12%
9%	Semiconductors	112,625	119,099	-5%
13%	Telecommunications	161,739	153,153	6%
Source: *State of Innovation Report* (Thomson Reuters 2015)				

Table 5 shows the list of industries that were declared the most innovative industries in 2013-2014, according to the number of patents they registered. All the targeted industrial segments in this research project can also be seen in the top 12 innovative industries listed in the above Table 5 (Thomson Reuters 2015).

Another main reason for confining research to these segments was the R&D direction and strategic focus of Finland. The Academy of Finland, the main funding body for scientific research work within Finland, has been placing considerable emphasis on the ICT, biotech and pharma fields following the meltdown of Nokia. The Academy of Finland has major funding segment dedicated to R&D in the biosciences, biotechnology and the natural sciences, namely, the Research Council for Health. According to Statistics Finland's official data on the funding categories of the Academy of Finland released in 2015, as shown in Table 6, there was an increase of EUR 92 million in funding for the Academy of Finland, while all other funding organizations experienced a reduction in research finances.

Table 6. The Finnish Government's budget appropriations for R&D

	R&D funding (EUR millions)	Share of R&D funding (%)	Change from 2014 (EUR millions)	Real change from 2014 (%)
R&D funding total	2,002.5	100.0	46.9	0.6
Main ministries				
Ministry of Education and Culture	1,090.0	54.4	103.6	8.6
Ministry of Employment and Economy	617.5	30.8	-22.6	-5.2
Ministry of Agriculture and Forestry	94.7	4.7	0.3	-1.4
Ministry of Social Affairs and Health	82.4	4.1	-33.4	-30.1
Funding organizations				
Universities	578.0	28.9	0.9	-1.9
Tekes	488.2	24.4	25.1	-6.6
Academy of Finland	**415.6**	**20.6**	**92.9**	**26.5**
Govt. research institutes	256.2	12.8	-21.7	-9.4
Other, R&D funding	242.8	12.1	11.3	3.0
University Central hospitals	21.7	1.1	-9.6	-31.9
Source: Statistics Finland				

1.6 Research design of the study

Figure 4 gives an overview of the research process. As a starting point of the study, an introduction to the research topic is given. This stage illustrates the background, motivation, objectives and research questions involved in the outsourcing innovation paradox (OIP). The next step comprises theoretical work, which is based on the literature review, in terms of exploring previous case studies and related theories. It also connects the OIP with the three major theories used in this study: transaction cost economics (TCE), the resource-based view (RBV) and principal-agent theory (PAT). This theoretical work helped to develop questions, which were grouped together in the form of a research instrument. This was followed by the data collection. As the collected data were widespread, it was important to first organize and manage the data. Then the operationalization of variables was carried out, while all previous steps helped to form 10 variables at this stage. These 10 variables resulted in the development of 13 hypotheses.

Once the formation of the hypotheses was done, the testing of these hypotheses was started by analysing the organized data. IBM SPSS 24 was employed to

conduct an analysis and prepare the results. Based on the results of the analysis, all three RQs were answered at this stage. Next, in the discussion part, the interpretation and significance of the results was elaborated comprehensively. The results and discussion parts helped to highlight the theoretical and practical implications of the study. As every research study has some limitations, the limitations of the current study were next determined. Lastly, future implications of the present research were established.

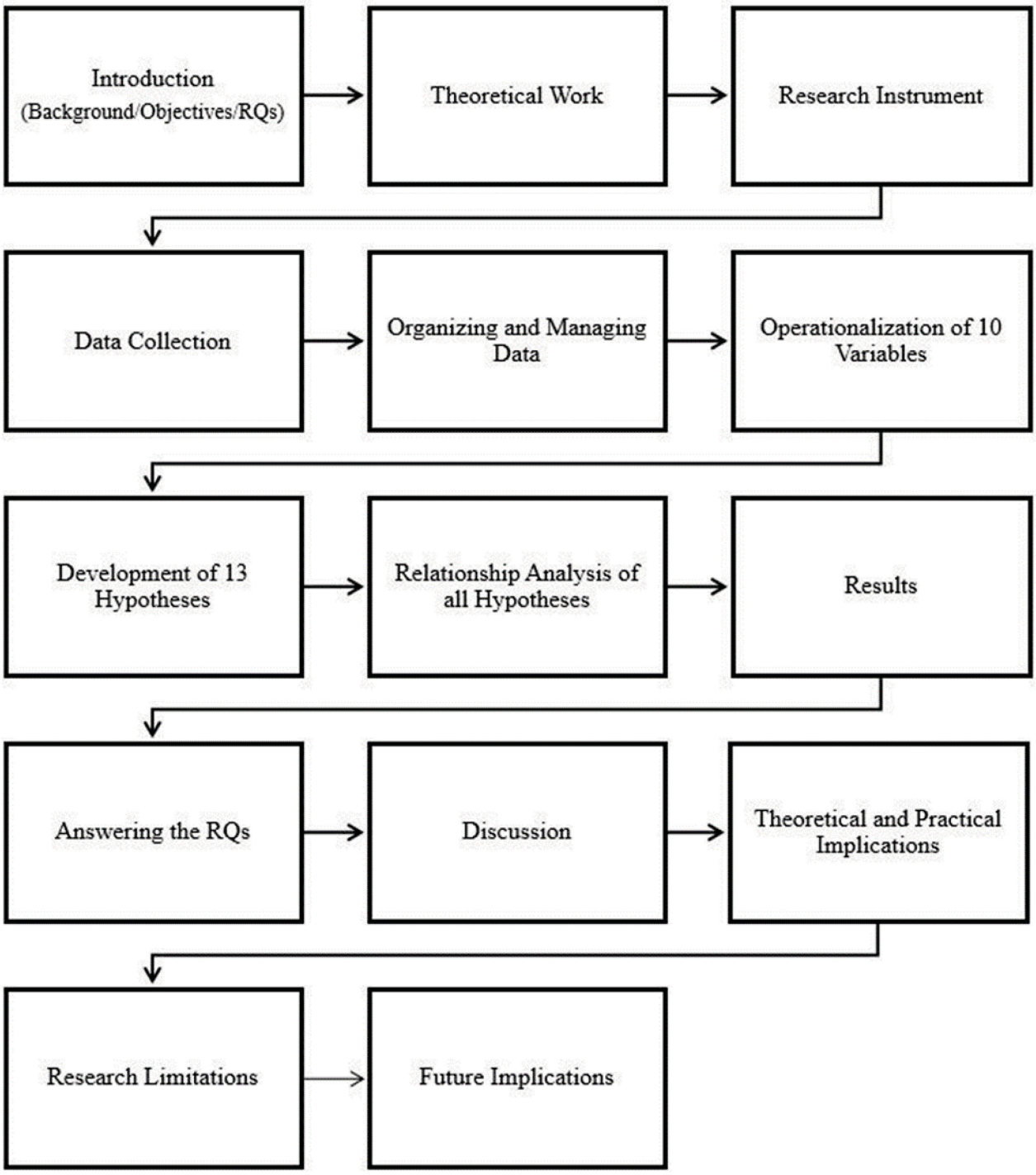


Figure 4. Overview of the research process

Research approach/reasoning

The research onion model is one of the most famous models for understanding the different types of research involved in any given project. The research onion was first introduced by Saunders et al. (2007) and defines the different stages that a researcher must go through before formulating a comprehensive methodology of research. The following figure 5 shows that the first step involves developing a research philosophy, which has various types, such as positivism, realism, interpretivism and pragmatism. The selection of a research philosophy will help a scholar to adopt a suitable methodology. The methodology can be: mono-method quantitative, mono-method qualitative, multi-method quantitative, multi-method qualitative, mixed-method simple, and mixed-method complex. Once a suitable methodology is selected, a scholar can proceed by identifying the best-possible strategy to conduct their research, which can be a survey, archival research, an experiment, an ethnography, a case study, action research, grounded theory or narrative inquiry. Depending on the nature of the project, any one of these strategies can be used or, in some cases, a combination of them can be utilized. The fourth stage represents the time horizon for a given project, which can be either cross-sectional or longitudinal. The fifth and final step represents the data collection and data analysis.

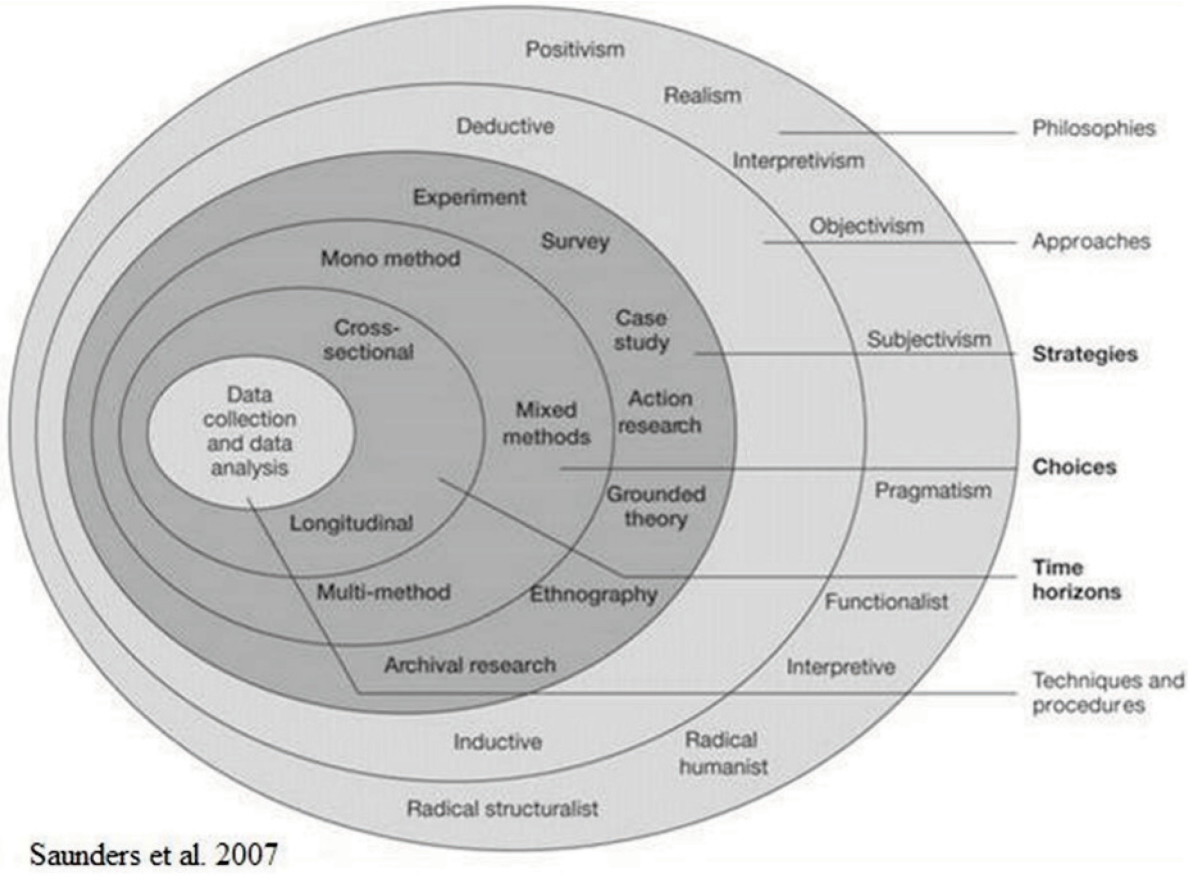


Figure 5. Research onion model by Saunders et al.

The research philosophy utilized in this study is positivism. Positivism philosophy is based on empirical evidence. The positivism doctrine was introduced by French philosopher Auguste Comte (1798-1857). According to Comte, the only authenticated the source of knowledge is scientific knowledge with measurable evidence. In this research, a ***deductive approach*** is adopted for gathering scientific knowledge. The deductive approach is based on several *theories*, such as *TCT,* the *RBV* and *PAT*. The research methodology involved is a ***mixed method*** consisting of ***quantitative and qualitative*** research approaches. The type of strategy selected for this research is a ***survey***. A self-designed electronic research instrument is used for the survey, as well as for conducting several interviews. The combination of an electronic survey and interviews helps to consolidate the data and results. The time horizon set for this research is ***cross-sectional***, involving the study and analysis of a data set of different industries and firms in different countries within the same span of time.

Table 7. Research approach to/reasoning for the study

Research model of the study	
Strategy	Survey/interview
Time horizon	Cross-sectional
Methodical choice	Quantitative and qualitative
Research approach/reasoning	Deductive
Research philosophy	Positivism
Techniques and procedures	Online data collection/face-to-face interviews, hypothesis testing
Data analysis tools	SPSS 24

Table 7 summarizes the research model for this current study. The strategy adopted for this research is a survey with additional interviews for the validation of the data linked to the results. The methodology is quantitative and the time horizon of this study is cross-sectional with a deductive research approach. After the data collection is completed with the help of a research instrument, data analysis is performed using SPSS 24.

Survey

A method or a technique for collecting information from a specified sample of people with the intention of generalizing the results to the larger population (Qualtrics 2018).

Cross-sectional time horizon

A type of study in which data are gathered on a single occasion, which can be over a period of days or weeks or months, in order to answer the specific research question or the problem (Brady & Johnston 2008).

Quantitative study

"It deals in numbers, logic, and an objective stance. This type of method focuses on numeric and unchanging data and detailed, convergent reasoning rather than divergent reasoning" (Babbie 2010).

Qualitative study

"It is the type of research method which refers to the meanings, concepts definitions, characteristics, metaphors, symbols, and description of things and not to their counts or measures" (Berg & Lune 2012).

Deductive research approach

The type of research approach in which a hypothesis (or hypotheses) is (are) developed, based on existing theories and literature and supported by a designed research strategy for hypothesis testing (Wilson 2010).

1.7 Dissertation structure

The dissertation structure consists of five main chapters, which are further divided into different parts. Each chapter covers various research process steps. The first chapter, the introduction, covers the research background, motivation, research gap, research questions, positioning of the research topic, delimitations, and research process and approach.

The second chapter, the theoretical framework of the dissertation, presents a literature review related to the research problem. It gives an overview of outsourcing, outsourcing innovations and product development, sample cases of outsourced products, trends in outsourcing innovations, company attitudes towards outsourcing innovations, consequences of outsourcing innovations, a synthesis of the conceptual framework and a hypothesized model of the OIP.

The third chapter is methodology. That describes instrument formation, data collection techniques, insights into the data set and sampling, management of data, the operationalization of 10 variables, the formation of 13 hypotheses, the analysis of data and testing the hypotheses. The fourth chapter answers the RQs and validates the study. The last chapter is the conclusion, which includes a discussion, the theoretical and managerial implications, and the limitations of the study, as well as future research possibilities.

2 THEORETICAL FRAMEWORK

2.1 An overview of outsourcing

International management is a field covering the management practices and business operations in multiple countries (BD 2016). The professionals involved in such management are familiar with different aspects of the countries where the organization is doing business. These aspects include the economic values, laws, political environment and cultural norms of these countries (BD 2016). There are various types of concepts involved in international business management, including countertrade, direct investment, franchising, multiple firms, offshoring, joint ventures, outsourcing, importing, licensing, and contract manufacturing and exporting (Dunning 2013: 179).

During the last three decades, managers around the globe have discovered the potentiality of outsourcing (Drucker 2011: 76). Outsourcing has been a potential source of competitiveness; in the beginning, the main reason for outsourcing was to lower the costs by moving operations into low-cost countries in Asia and Eastern Europe (Yang et al. 2011).

According to Leavy (2004: 20), outsourcing strategy should bring to the organization deeper advantages than cost reduction, as "four of the most promising opportunities for using outsourcing strategies - focus, scale without mass, disruptive innovation, and strategic repositioning". For Leavy, the main problem is that managers are unfamiliar with this concept and sometimes focused only on short-term performance.

The following Table 8 illustrates keys definitions from the literature in order to further the understanding of the theoretical framework:

Table 8. Definitions of important terms

Term	Definition
Outsourcing of R&D	"The outsourcing of research and development (R&D) activities has frequently been characterized as an important instrument to acquire external technological knowledge that is subsequently integrated into a firm's own knowledge base" (Grimpe & Kaiser 2010).
Outsourcing innovations	This is a strategy in which external suppliers are engaged in the (a) ideas of making new products/services and (b) developing effective strategies to bring these ideas to the given market. It is the type of process outsourcing that is more focused on the development of new products and introducing innovations (Lacity & Willcocks 2013).
Outsourcing innovations	The strategy to bring about collaborative innovation efforts and the structuring of innovation alliances (Stanko & Calantone 2010).
Outsourcing innovations	Innovation activity that is performed by using external agents (Contractor et al. 2010).
Outsourcing innovations	The process of using the most up-to-date technologies and management techniques to make firms sustainable and put them in a leadership position (Quinn 2000).
Outsourcing innovations	The process by which firms engage in outsourcing R&D, innovations or in-licensing of intellectual property (IP) (Vrande et al. 2008).
Open innovation	"It 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" (Chesbrough 2003).
Open innovation	"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).
Open innovation	Combining of outside-in and inside-out processes, while integrating inbound and outbound innovations (Gassmann & Enkel 2010).
Open innovation	It is the process of systematically performing knowledge exploration, retention, and exploitation inside and outside of an organization's boundaries throughout the innovation process (Lichtenthaler 2011).
Open innovation	"It is an old wine in new bottles and actually the collection of multiple innovation approaches, with very close approaches on one end and open approaches on the other end" (Trott & Hartmann 2009).

2.2 Outsourcing innovations and the product development process

Outsourcing is referred to as a branch of international business management, which is itself a broad term with various forms. The focus of this research project is on outsourcing with respect to innovations in the product development process. Outsourcing innovations is considered to be a core asset of the company. Firstly, it is important to familiarize ourselves with how innovations and product development processes work.

2.2.1 Defining innovations and product development

The product is something that is a result of process and development. The aim of the product or service is to deliver superior customer value (Claessens 2015). Product development and design refer to a complex process comprising different integrating processes, such as research, creating, building, innovating, inventing, designing, analysis and synthesis. The design is an interplay between what we want to achieve and how we want to achieve. This also encompasses the factor of what kinds of problems and opportunities exist in the real world (Ulrich & Eppinger 2012).

Product development is not a simple process that can be started immediately, so that we can then realize our required product. The product development process can only be started if strong basic research and technology development have been undertaken in advance. The stronger the two processes, the greater the chances of successful product development. Basic research comprises steps such as the discovery process, without setting a deadline, because it is unpredictable and centred on the long term. Meanwhile, the technology development phase is always loosely structured, difficult to plan, less predictable and focused on the medium term. The final product development process is a combination of structured methods, planned timing, predictable outcomes and short-termism (Ulrich & Eppinger 2012).

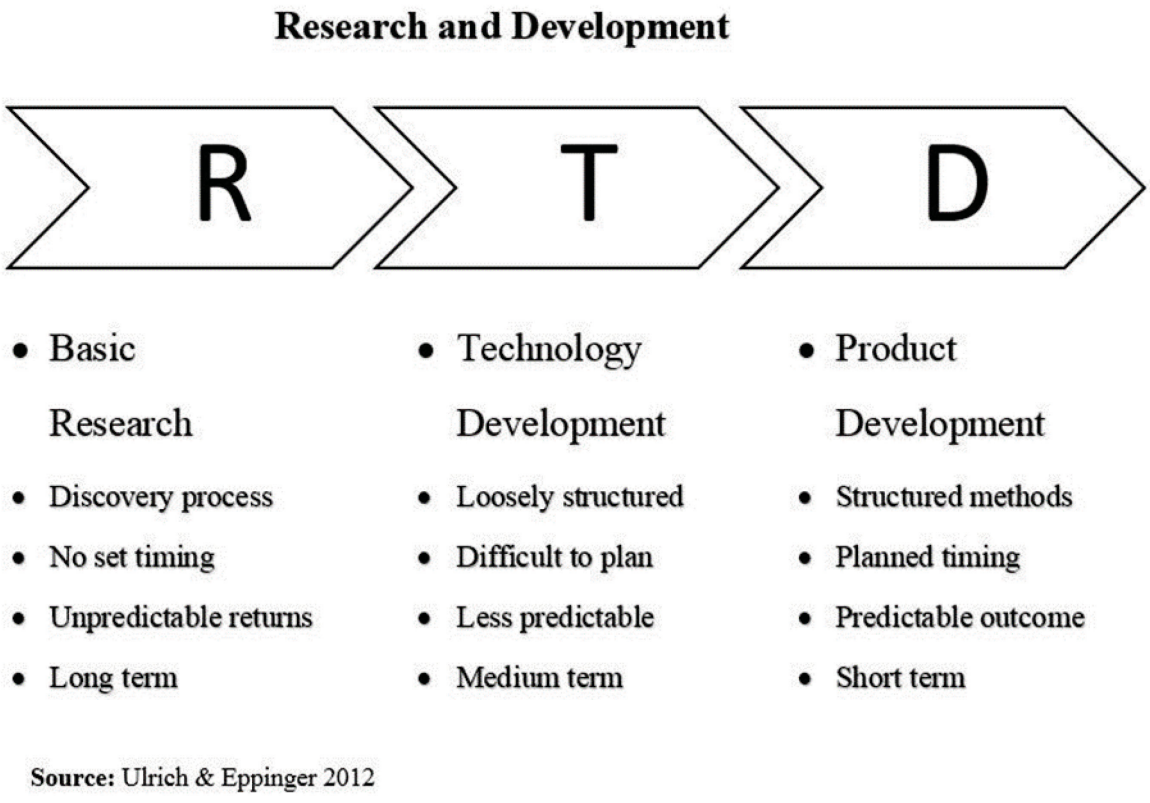


Figure 6. Phases involved in the product development process

As mentioned earlier, innovation is a process of translating an idea or invention into a good or service that creates value for which customers will pay. Innovations can be divided into two major categories: 1) evolutionary innovations and 2) revolutionary innovations.

Innovation matters, not only at the level of individual enterprises but also increasingly as the springboard for national economic growth. In a recent book, Baumol pointed out that "virtually all of the economic growth that has occurred since the eighteenth century is ultimately attributable to innovation" (Tidd & Bessant 2009: 5)

According to Statistics Canada (Tidd & Bessant 2009), the following factors characterize successful small and medium-sized enterprises (SMEs):

- Innovation is consistently found to be the most important characteristic associated with success.
- Innovative enterprises typically achieve stronger growth or are more successful than those that do not innovate.

- Enterprises that gain market share and increasing profitability are those that can innovate.

2.2.2 Difference between outsourcing in general and outsourcing innovations

Outsourcing, in general, has been widely used by various companies around the globe for the last three decades. The word *outsourcing* itself refers to finding a "source outside" of your given restrictions, such as an organization, city, country or even a continent (Investopedia 2016). According to the official Investopedia database, the process of outsourcing was started in order to make production cost-effective and to realize the best-available resources in the world. The main task for general outsourcing is to reduce unnecessary burdens on parent companies (Grimpe & Kaiser 2010). For example, Dell buys its smaller components from other companies to reduce the cost and time of production for the final product, while other companies outsource their accounting, auditing and bookkeeping to third parties to save their own time (Chesbrough 2012). The outsourcing of non-core products and services increases a company's production output vigorously. The main reason for enhanced production is that the hired entity is totally focused on the single task assigned to them. Additionally, it also lessens the burden on the human resources department of the company in the selection of new people, payrolls, health services and managing staff accordingly (Investopedia 2016).

The facts described above refer to a general definition of the outsourcing process. When we consider outsourcing innovative procedures, services and products, the overall process is no longer that simple (Nieto & Rodriguez 2011). Outsourcing innovations is the same as the outsourcing of core technologies by companies (Stanko & Calantone 2010), which can include outsourcing software, hardware, innovative engineering equipment, any unique service development, and critical steps while developing some new product in-house or any customized product to satisfy market demand. This type of outsourcing is a complicated process and can cause serious threats to a company's survival in the future (Teece 2010).

2.3 Examples of different outsourced innovations

In the literature, there are various case studies available showing the outcome of outsourced and open innovations. Before going into the detail of the examples, it will be useful to have a brief look at Chesbrough's open innovation model.

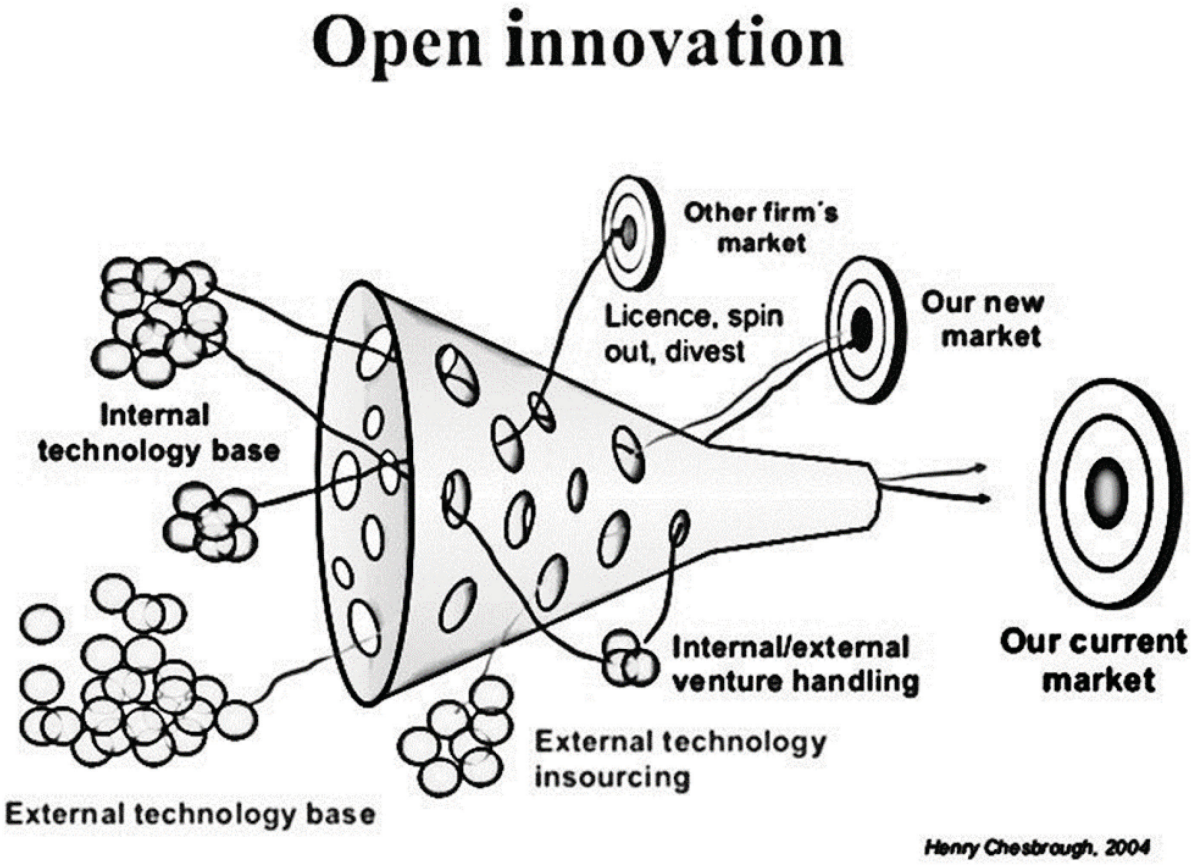


Figure 7. Chesbrough's model of open innovation

Figure 7 illustrates Chesbrough's model of open innovation, which was first described by Henry Chesbrough in his (2003) book *Open Innovation: The New Imperative for Creating and Profiting from Technology*. The concept of open innovation is opposite to the concept of closed innovation, which involves pursuing new business development and developing marketing strategies within the firm's boundaries. But Chesbrough proposed that the firm's boundaries are no longer intact and that it is very hard to innovate independently within solid firm boundaries. Rather, he described firm boundaries as porous lines by which diffusion of knowledge is possible. As Figure 15 illustrates, these lines represent the permeable boundary between internal and external technological base. The venturing of internal and external technologies helps to create and access new markets, which was only considered a dream in the closed innovation system (Chesbrough 2003).

Thus, after understanding the Chesbrough model, it will be easy to grasp the detail of the following examples, which involve similar concepts to.

Procter & Gamble (P&G) faced huge challenges in early 2000. The company was experiencing major difficulties in competing in the rapidly changing market and failing to bring any new products to the market, which would give them a competitive advantage. Thus, as a matter of principle, the company decided to outsource some R&D activities. Outsourcing R&D boosted its innovation productivity by approximately 60%, resulting in USD 10 billion in revenue and over 400 new products. Today, 50% of P&G's innovations are dependent on external innovation providers (Huston & Sakkab 2006).

Unilever offers an important example of organizational innovation. While growing, the company faced huge operational problems. The reason behind these problems was the significant growth in the 24 countries in which it operated, all of which had different operating systems. In 2005, the company decided to outsource a central ERP system from specialized IT company to integrate operations in all 24 countries. This outsourced IT-based ERP system led to USD 700 million in annual savings on operational activities (Tepic, Fortuin & Saris 2013).

Acer is another example of successful outsourcing innovations implementation. In 2000, Acer decided to outsource those areas where the company was finding it difficult to manage and innovate. This move helped Acer to achieve higher growth and sales. Due to outsourcing in different segments, it has now a workforce of about 6,800 employees which is less than a 10th of the size of its largest competitor in the market (Honi, Tsang & Chu 2000).

JM Family Enterprises is an automotive corporation. The company mainly deals in vehicle distribution, processing, financial services and technology products. When the company outsourced its main hardware and software systems, it saved around USD 8.2 billion because it believed that the outsourcing provider was able to perform all related processes more efficiently that it could (Beath & Ross 2006).

2.4 Trends in outsourcing innovations

Outsourcing innovations has been an ever-changing trend in the past two decades. Companies keep adapting various techniques, strategies and methods to outsource innovations according to their best interests (Gassmann et al. 2010). Sometimes, it has worked out very well; but, in some cases, the success rates have been very low (Cui et al. 2012).

The phenomenon of outsourcing innovations is adopted by many different types of industries, of which the most prominent are involved in pharmaceuticals, ICT,

engineering services and biosciences (Drucker 2014). The most prominent actors in outsourcing innovations in the last two decades have obviously been the pharmaceutical and ICT sectors (Lowman et al. 2012). The pharmaceutical industry has invested billions of US dollars to outsource R&D in different forms. Outsourcing innovations today is an integral part of the pharmaceutical product development process (Jungmittag 2013). Although, overall, for many decades, the outsourcing industry had traditionally been working in different ways, in the last few years, pharmaceutical R&D outsourcing has become highly visible due to its uniqueness. There are many reasons to explain this trend in the R&D segment of the pharmaceutical industry, such as price pressures, mergers, the flexibility of resources, and better knowledge of available CROs in the market. This diversion of strategy was mainly because of the huge globalization effect and higher regulatory requirements. Multinational companies (MNCs) not only use smaller innovation providers and medium-sized CROs, but also enter into contracts with larger biotech companies. Due to all these open innovation trends in the pharmaceutical sector, CROs have started to become global key players in providing innovations and product development processes. But, the fact is that all these measures applied to the overall process have not always resulted in success. This situation has made companies think how this process could be used to achieve the best results in which risks and benefits could be shared by both partners. A strategy that will address both sides of the picture ultimately helps to create value and durable innovations (Schuhmacher, Hinder & Gassmann 2016).

Schuhmacher et al. (2016) discussed various requirements and enablers that can be used to build a model for outsourcing innovations by huge pharmaceutical companies. This small number of requirements, or keys to success, includes innovation risk management, innovation creativity, diversity, innovation-based organization integration and excellence in project management. The requirements can be enabled by alliance management, outsourcing strategy, globalization, long-term commitment and project management, respectively (Schuhmacher et al. 2016). These were the trends that were followed in the pharmaceutical sector and many others in previous decades.

The ICT sector is another industry that has gone through various transformations in the past two decades. It has followed different trends in order to keep updating itself with the relentless pace of change (Cardona et al. 2013). Companies have tried different models and techniques to create value in their innovations. In general, enablers of effective innovation trends in companies relate to strategic vision, culture and a sense of willingness in the given industry. In turn, innovating or outsourcing innovations implicate the DNA of the organization. Furthermore, it is important that innovation methods that any company are using are aligned

with the company's overall strategy. Companies have tried to create dynamic capability trends in order to cope with the changing market environment (Teece 2009).

Additionally, in early 2000, it was observed that companies had made huge investments in India and China for outsourcing innovations in product development (Lee et al. 2012). But matters shifted within the next 10 years, when MNCs started to invest more in Eastern Europe and Australia for outsourcing innovations. The main reason for the change in this trend, as mentioned by many companies, was that they lost huge sums and were unable to acquire the required level of quality innovations (Tafti 2005). Many changed this trend due to the leakage of information and issues relating to intellectual property rights (IPRs) (Contractor et al. 2010).

2.5 Companies' attitudes towards outsourcing innovations

The success of any firm in the present era is directly related to the number of innovations it is introducing to the market (Gunday et al. 2011). Innovation in the product development process is a key to capturing a major market share and competing with another firm in the market (Teece 2010). Nevertheless, due to the ever-changing unpredictability of markets and consumer behaviours, most companies are unable to spend significant resources on innovations in product development through their own R&D departments (Dodgson 2018). This is one of the major reasons why companies are now outsourcing technologies to third-party innovation-producing companies (Gawer & Cusumano 2014).

Many companies have focused on acquiring their innovation skills from external innovation suppliers in the market. The implementation of this strategy can be helpful in lowering the costs of their innovation cycles by 60-90% (Brian 2000). As the world is now a global village, many MNCs, in their product development processes, are open to any potential supplier in the market that can be helpful to them in innovating according to their needs. Among some of the visible examples are the manufacturing giants Boeing, Aerospatiale, Newport News, Ford, AT&T, GTE, Mobil and Enron (Linder 2004).

In contrast to all these benefits, the risks are associated with the outsourcing of innovations to external suppliers. The risk of compromising on a patent due to information leakage is a real threat to these outsourcing processes. Trott and Hoecht (1999) analysed these risks in the technology-intensive sector, where, sometimes, the leakage of information had even been done unconsciously by

CROs. In some technology-related sectors, the supplier's fees to realize any kind of innovation for the customer company are nearly equal to the wage costs that a customer company would have to spend on its own R&D team in order to innovate in product development internally (Linder 2004). American companies are facing another problem today: for cost-effective reasons, they started outsourcing R&D to India, China and Eastern European countries, but now the main issue they face is related to IPRs. There are now concerns about R&D breeding centres abroad with the same types of secure systems and techniques as you would expect in R&D departments in the US (Chesbrough 2006). The answer to this problem is always ambiguous. In the same way, companies sometimes wish to outsource a part of their product development process, but they do not have sufficient financial support, internal hierarchy consent and time to identify a suitable outsourcing company (Trott & Hartmann 2009).

One under-researched area in the outsourcing of innovation concerns models, on the one hand, that promote benefits and, on the other, that are associated with risks. There should be some common ground or mixed guidelines available, which would be more suitable. This would provide clear directions to managers involved in such outsourcing processes (Harland Knight, Lamming & Walker 2005).

2.5.1 Perspectives towards outsourcing innovations in product development

It is described above that outsourcing innovations always comes with benefits and risks. But, when we talk about outsourcing innovations specifically in product development, there is no difference. There are many positive and negative effects associated with outsourcing innovations in product development (Vrande et al. 2009). Many companies have different attitudes towards outsourcing innovations. On the one hand, there is a belief in outsourcing complete products to CROs and marketing them with a few or no changes (Munsch 2016). On the other hand, many companies just outsource a few innovative steps during product development (Trott & Hartmann 2009).

Similarly, there are companies that consider outsourcing innovations as a game changer, while others consider that it poses a threat to their own R&D capabilities (Berchicci 2013). These attitudes vary from company to company for different reasons. The main reason for outsourcing in the past was cost-effectiveness; in other words, the positive attitude among companies towards outsourcing innovations in product development was to save money and make profits from a such strategy (Gassmann et al. 2010). In turn, many companies were successful but there were also many others who lost a fortune (Huizingh 2011: 4). These

companies did not save much money; sometimes, they even spent more money than usual and later suffered with regard to their own R&D capabilities (Parida et al. 2012). Thus, the attitude towards outsourcing innovations in product development varied widely in past (Lichtenthaler 2011). The main reason for those losses was the lack of standard guidelines for handling outsourcing of innovations (Lee et al. 2010).

2.5.2 Analysing company orientations towards outsourcing innovations

Previously, there were no set measures or tools to gauge the attitude of a company towards outsourcing innovations. The probable explanation for this was that each case of outsourcing innovations widely differed from others (West & Bogers 2014). But a few relationships have been developed by some researchers to analyse the overall process (Gunday et al. 2011). These analyses have somewhat helped to shape our understanding of outsourcing innovations and high-end R&D capabilities (Gassmann et al. 2010).

The effects of innovations and outsourcing innovations have been analysed in the past with the help of statistical methods (Arbussà & Llach 2018). The innovative performance of the firm has a significant relation with various types of innovation. Innovative performance also has a significant relationship with product innovation, organizational innovation and marketing innovation. It has a non-significant relationship with process innovation. This was also analysed in a way whereby innovative performance had a positive effect on market performance and production performance (Gunday et al. 2011: 662-676).

Companies' attitudes towards the selection of outsourcing provider, based on a six-factor model, were also analysed. Three factors have a significant effect and the other three factors have a non-significant effect on the selection of outsourcing providers. There was a statistically significant relationship observed between the performance attitude of the firm and three of the factors: the flexibility of the innovation provider, technological resources of the innovation provider, and its previous relationship with the firm. There was also observed a non-significant firm performance attitude towards the reputation of the innovation provider, the policy of the innovation provider on IPRs, and the cost-effectiveness of the provider (Zafar & Kantola 2018).

2.5.3 Differences in company approach towards outsourcing in product development

It was mentioned earlier that we can see that every company behaves in its own way when we study outsourcing innovations in product development. Some companies are highly dependent on outsourcing innovations, while some are traditional companies that do not rely so much on innovations (Dahlander & Gann 2010). But the companies that are highly dependent on the open innovation environment and outsourcing innovations, in one way or another, represent the focus of this research. Many researchers have described the attitudes of companies towards outsourcing innovations, explaining their reasons in different studies, which highlight the variations in these attitudes. Some of the key reasons described by researchers in the literature are as follows:

Type and sector of the organization

This is highly relevant to the determination of the company's attitude towards outsourcing innovations. The specific type of company, whose core technology is its competitive advantage in the market, will not able to survive with a stagnant attitude towards outsourcing innovations (Velu & Chander 2015). Another important factor is the sector to which sector a company belongs (Drucker 2014). Examples of such companies and sectors are as follows: the pharmaceutical industry, biosciences, ICT, engineering services, the chemical industry, the automotive industry, financial services and logistics.

Size of organization and market share

Today, SMEs and MNCs are both highly focused on innovations (Malecki 2011); however, company size and market share are important reasons affecting companies' attitudes towards outsourcing innovations in product development (Huizingh 2011). The bigger the size and market share of the company, the more positive its attitudes towards outsourcing innovations. This is mainly because, once the company has a higher market share, it then becomes a major challenge to maintain that share in the market (Berry 2014). To maintain the same or a higher share of the market, companies try to bring about more innovations and value creation in the market.

Differences based on the laws of the country where the company is based

It has been observed in many cases that, while companies have a positive attitude towards outsourcing innovations in product development, sometimes, the laws of the country in which a given company is doing business can affect this attitude

(Mclean et al. 2012). Some countries have very strong laws to protect IPRs and support innovations and outsourcing, while other countries are not facilitative in their attitude towards the overall process (Straus 2007). So, these factors are important in determining companies' attitude towards outsourcing innovations.

The dependency of the organization on innovations

Many companies are solely dependent on innovations (Wang 2012). The survival of these companies is directly proportional to excellent innovations. But, for some companies, either their business is not solely related to innovations or they already have major and long-lasting innovation in the market (Sof et al. 2010). This factor also affects the company's attitude towards outsourcing innovations in product development. The higher the dependency on innovations, the more positive the attitude towards outsourcing innovations in product development (Belussi et al. 2010).

2.6 The consequences of outsourcing innovations in product development

Every strategy that any company adopts or rejects always leads to some consequences. Sometimes, if the strategy is well crafted, it can lead to positive consequences and higher profits (Grant 2016: 241). But it is not always the case because, occasionally, the consequences are negative and can even lead to the downfall of the business (Christensen 2013: 77). Adopting the strategy of outsourcing innovations in product development is a similar case. If the strategy is strong enough and implemented correctly, it can help to make sky-high profits (Hung & Chou 2013). But there have also been cases in the past in which the wrong strategy and a lack of proper implementation caused companies to lose millions (Christensen 2013: 97). These positive and negative effects of outsourcing innovations influence the company in both the short and the long term. Both (long- and short-term) types of effects are harmful, but long-term effects are always related to the survival of the company in the market in the coming decades (Lichtenthaler 2011). The following considers the influence of outsourcing innovations based on the literature on the firm's long-term performance, R&D capabilities and overall industry.

2.6.1 Influence of outsourcing innovations on the performance of the company

In the literature, there are many studies analysing the outsourcing effects on the performance of the company (Kroes & Ghosh 2010). But there are not so many studies that specifically explain the outsourcing innovation relationship with firm performance in the long run (Hung & Chou 2013). Some studies also consider the types of innovations and their effects on firm performance (Gunday et al. 2011), but these relationships do not explain the various factors involved in outsourcing innovations and in turn their impact on firm performance. But many qualitative studies have suggested that outsourcing innovations can have damaging effects on firms' own R&D departments, which can ultimately lead to reduced firm performance (Yam et al. 2011).

2.6.2 Influence of outsourcing innovations on the R&D capabilities of the company

Some qualitative studies suggest that a high dependency on outsourcing innovations without any intact strategy always leads to weakening R&D capabilities (Gemunden et al. 2007). Some managers have suggested in previous studies that a high dependency on CROs makes the parent company lazy in relation to building its core technologies (Enkel et al. 2009). This could be very profitable in the short term; but, in the long run, it could pose a serious threat to the company's own R&D capabilities (Hamdouch 2010).

2.6.3 Influence of outsourcing innovations on the overall market

An industry is made up of various firms and, if these firms start to follow a specific trend, they ultimately influence the overall industry trend somehow (Ili et al. 2010). The outsourcing innovations trend has really taken over many industrial segments (Chesbrough 2010). Industries are truly reshaping themselves because of outsourcing innovations (Hunter & Stephens 2010). Contract research providers have become key players in innovative industries (Gianiodis et al. 2010). As mentioned in the introduction, CROs themselves have become billion-dollar companies in the last 10 years or so. Historically, industries always reshaped themselves in one way or another; but this type of reshaping is directly connected to the parent company's own R&D (Spithoven et al. 2010). It is now critical to explore the dynamics of this new influence on the industry.

2.7 Outsourcing innovations and scientific research theories

Researchers have used different theories in various studies to understand and explain the role of open innovation in product development and firm performance. The most prominently used theories are TCE and the RBV, while a small number of general outsourcing-related studies also use PAT. The following is an explanation of these three theories in connection with outsourcing innovations.

2.7.1 TCE

This is also known as transaction cost theory. It states that the goal of an organization is to minimize the costs of exchanging resources in the environment and the costs of managing these inside the organization. The sources of transaction costs are *environmental uncertainty and bounded rationality, opportunism and small numbers, risk and specific assets*.

TCE (Coase 1937) accounts for the overall cost of outsourcing the production of goods, products and services. This includes transaction costs, searching costs, coordination costs and contracting costs. More precisely, all these costs should be borne in mind while making decisions concerning some project, rather than just market prices (Williamson 1989). All partner companies involved in outsourcing innovations are always likely to reduce transaction costs during each partnership. Companies try to manage the sources of transaction costs in such a way that this does not affect their product development times and costs. When the parent company is in the specific market, there is always environmental uncertainty because there are hundreds of available contract R&D providers. Environmental uncertainty always involves bounded rationality because you can only manage every piece of information up to a certain limit. On the other hand, if the company is dealing with fewer outsourcing providers over a long period time and those providers make an agreement with each other to raise the prices of the products or services that they are providing to the parent company, this is what is called opportunism. The parent company has no option left but to invest more in such a transaction to keep production running. The sources of risk and specific assets represent the opposite side of the story if the parent company has entered into an agreement to buy some innovations from the provider at a set price, but later decides to buy them at lower costs. In this situation, the outsourcing provider that has already invested a lot in specialized innovation has no choice left but to lower its prices. All these transaction cost resources are related to product performance and firm performance directly. How well these transaction costs are managed determines the effect on product development and firm performance.

2.7.2 RBV

This states that firm resources always play a key role in higher firm performance (Barney 1991: 99-120). If the resources exhibit VRIO *(valuable, rare, costly to imitate, organized to capture value → sustainable competitive advantage)* attributes, this enables the firm to gain competitive advantage (Rothaermel 2013: 91).

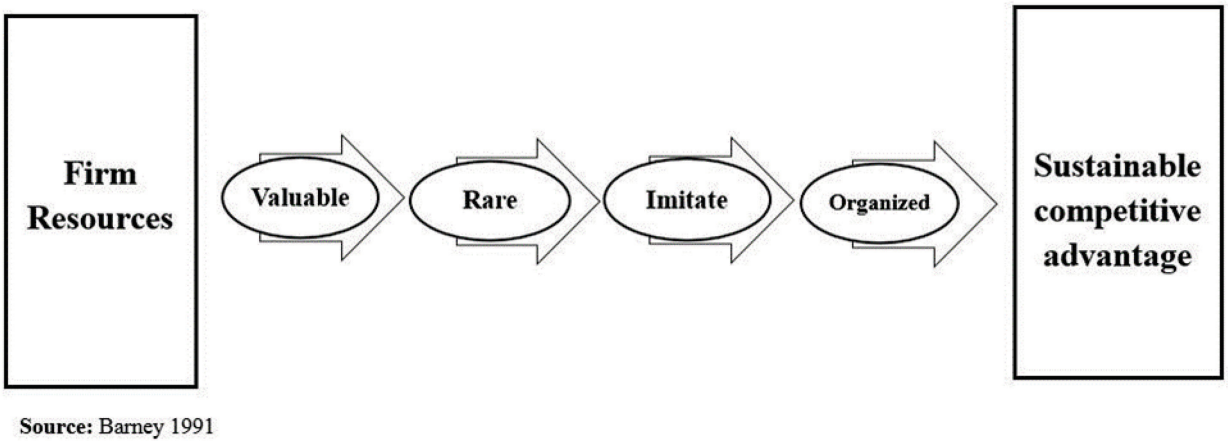


Figure 8. VRIO attributes of the RBV

According to the RBV approach, firms should always look inside the organization to find the resources that can give them a competitive advantage in the market, rather than looking for a competitive environment (Barney 1991). This means that the RBV relies on tangible and intangible resources, which must be heterogeneous and immobile. These resources should have VRIO attributes and facilitate competitive advantage (Rothaermel 2013: 91). RBV proponents claim that it is always more feasible to explore external opportunities by using the existing resources within a company in a new way. The RBV model always allows for existing resources to help realize higher performance for a firm. This means that the RBV model always promotes trust in the firm's own capabilities and resources. It also affirms the belief that relying on existing resources can affect external opportunities and firm growth.

2.7.3 PAT

This is referred to as the principal-agent problem or agency dilemma. It refers to the process of a person or an entity making a decision, which can have an impact

on the other person or entity, referred to as *agent* and *principal*, respectively (Schneeweiss 2003). In such situations, agents try to act in their own best interests, which clash with principals' interests (Jensen & Michael 1976).

The main problem with a principal-agent view starts with information asymmetry, which means that one party has better information than the other. This asymmetry always creates an imbalance in decision-making power, which later harms the company's overall performance in many ways. It is always difficult to gauge the agent's performance in terms of the principal's interests. In many cases, the principal is sufficiently concerned about any kind of cheating and exploitation by the agent. When the agent deviates from the principal, the major interests are referred to as agency costs (Jensen & Michael 1976). This theory can be applied to inside and outside the organization while performing outsourcing innovations. The parent company acts as a principal while outsourcing providers act as agents. It is always important for the parent company to ensure that the provider is following the former's interests at each step. But, in most cases, it is very hard to determine whether the parent company (principal) has the same expertise in the specific field as the provider (agent) (Olawale & Garwe 2010).

When we talk about inside the company, it is also observable that many outsourcing managers (agents) in the parent company are under huge pressure and influence from higher management (principal). In many cases, agents know the best situation and strategy, but the principal enforces their own vision for many reasons (costs, short-term productivity targets etc.) (Bamberg & Spremann 2012). If the internal situation in the R&D department (agents) is highly intact and protected, it will able to deal positively with the CRO's country environment, the pros and cons of outsourcing innovations, CRO viability and market trends. Compromises in the case of any of these can lead to a possible impact on the growth of the parent company (principal).

These three theories are widely used in many disciplines to explain different problems in various contexts. Research has contributed a great deal to all these theories. TCT has been involved in many outsourcing studies, as it helps to explain transaction costs, coordination costs and contracting costs (Teece 2010). It has been observed in the literature that environmental uncertainty has no effect on transaction costs; thus, there is no reduction in the propensity to engage in contract research (Grimpe & Kaiser 2008). The same study also found that an increase in R&D or an increase in the contract is directly related to innovation performance and connected to the RBV (Grimpe & Kaiser 2008). The excessive contracting problem can dilute the company's resources for R&D. This explains the gains and pains of such a contracting process in the light of TCT and the RBV

(Grimpe & Kaiser 2008). PAT has also been applied in the literature, especially in studies on SMEs and family enterprises. The conflict between principal and agent has a great impact on company strategies and growth. The theory has successfully explained agent costs, as well as the firm's financial growth and decision-making powers in many family enterprise businesses (Lubatkin et al. 2001). PAT has also been used to compare firm performance between family- and non-family-owned businesses (Schulze et al. 2003). These studies have found that the agency problem is possibly less serious in the case of family enterprises, compared to non-family firms (Chrisman et al. 2004).

Thus, TCE, the RBV and PAT have been used by different researchers in many studies found in the literature in various contexts. But, in this research project, these three theories are used together in the context of outsourcing innovations in product development for the first time. It is also important to note that these three theories are applied to 11 major industrial segments (as explained in the methodology section below) in this study because of the common dependency on outsourcing innovations in product development. These theories help to gain a better understanding of the overall outsourcing innovation process in product development and, in turn, its impact on the R&D capabilities of the firm.

2.8 Synthesis of the conceptual framework

After reviewing all the major aspects of outsourcing innovations reported in the literature and the three theories connected with the research problem, it is now possible to synthesize the conceptual framework of this study. This research interlinks the literature from several management fields and theories to achieve the required research objectives. The relevant management theories provide a basic background to the study and help to build up the research instrument as a starting point. Although the literature is quite rich in terms of outsourcing, product development and innovations, no precise study is available to explain outsourcing innovations in product development and its subsequent impact on a firm's overall capabilities. Figure 8 illustrates the conceptual framework of this study in brief. The overall concept of the OIP in this study is built around three separate pillars: outsourcing innovations, product development and company attitudes.

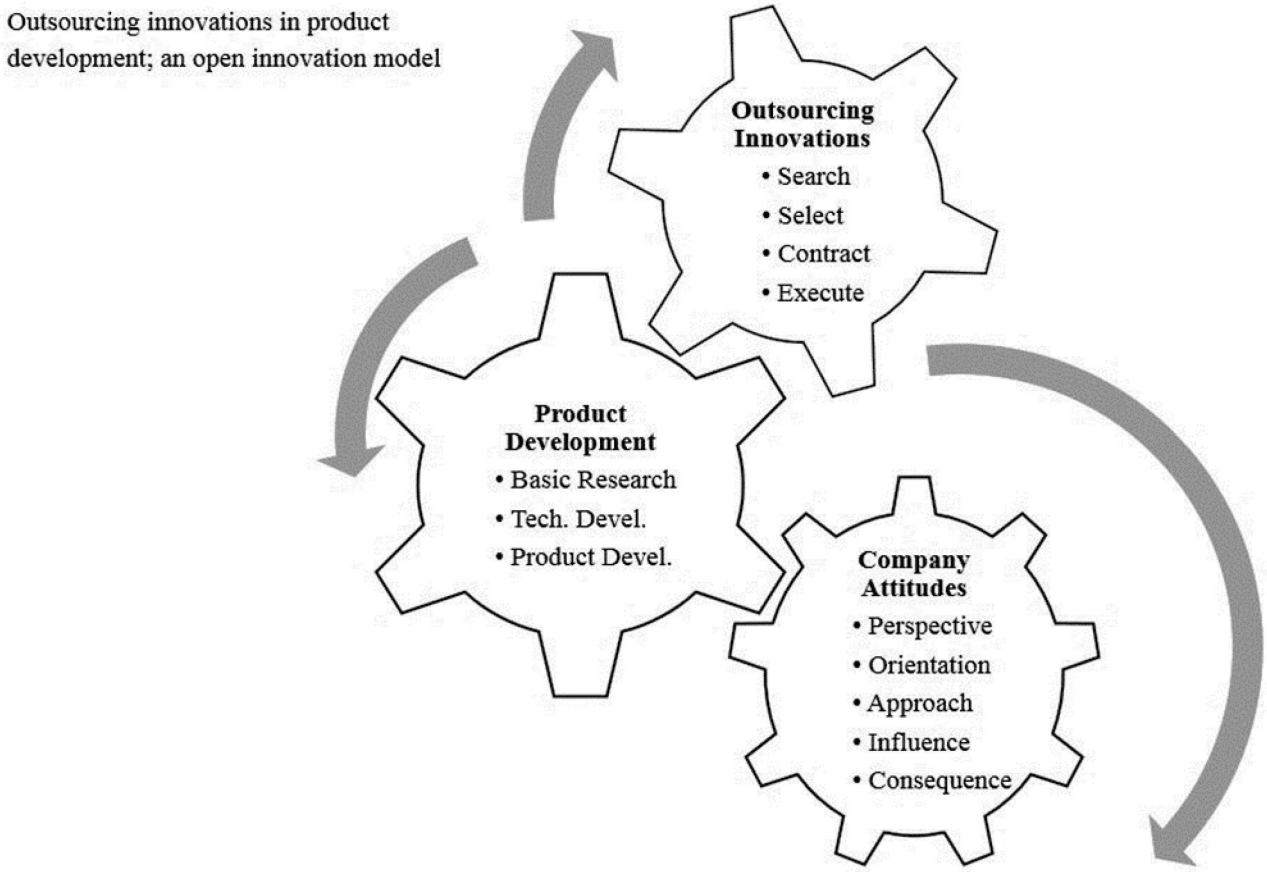


Figure 9. Synthesis of the conceptual framework

Figure 9 summarizes the substeps of each pillar. The **first pillar** is outsourcing innovations, which has further four phases: searching for available providers in the market, selecting the most suitable one, entering into a contract and executing the contract commitments (for a detailed explanation, see 2.5).

The **second pillar** is product development by the parent company in collaboration with the provider, which always encompasses a three-step process of basic research, technology development and product development (Ulrich & Eppinger 2012). All these steps always remain crucial parts of product development either when in-house or when dependent on open innovation.

The **third pillar** is in the form of collective company attitudes towards outsourcing innovations or connecting and developing a concept that is always decisive. The company's perspective, orientation, approach and influence always lead to consequences (Huston & Sakkab 2006). The greater the adaptability of all of these towards open innovation, the better the expected results.

Figure 10 gives an overview of the theoretical and conceptual frameworks. The figure 10 illustrates how the three main concepts of this dissertation are connected to the literature, three theories and the development of the research instrument. On the front end, we can see the three main concepts of outsourcing innovations, product development and company attitudes. But, on the back end, these three concepts are connected to three theories (TCE, RBV, PAT) and provide a strong base for a customized research instrument for data collection in the next stage. All of the three front concepts and back ends are closely connected with each other.

Starting from the first circle, Figure 10 shows the theoretical and conceptual framework synthesis process that is connected to other three circles, each of which contains one major concept. The topmost circle contains outsourcing innovations, which comprise searching, selecting, contracting and execution. Finding a suitable outsourcing partner that fits your innovative requirements and company culture is the hardest task to achieve (Berchicci 2013). The middle circle contains product development concepts, which comprise the three major steps of basic research, technology development and product development. All of the product development steps and the process have been explained above in detail in the same chapter. The last circle is designated for company attitudes, such as the company perspective for outsourcing innovations, the company orientation, the approach towards open innovation, the influence of different factors, and the consequences of such outsourcing innovations on company performance.

The study further establishes the deeper connection between the three major pillars of the conceptual framework and the three theories used. It is very important to note that the core of the three theories (TCE, RBV, PAT) are closely interwoven with each of the three major concepts involved in this study. The first concept of **outsourcing innovations** is all about transactions within the company's different units and with the third-party outsourcing provider. TCE plays a key role when dealing with transaction costs, given that every company involved in such innovative contracting wishes to keep transaction costs to a minimum. One aspect of keeping transaction costs to a minimum is that, during such outsourcing innovation provider contracts, there should be strict rules about keeping IPRs protected on both sides (Huizingh 2011). Leakage of information from any side of a collaboration not only damages the credibility of the two partners involved, but also increases transaction costs (Greenhalgh & Rogers 2010). Thus, rather than profiting the organization, this will result in huge financial failure when developing new products and its R&D capabilities (Contractor et al. 2010).

Additionally, outsourcing innovations is mostly pursued when companies are unable to come up with new innovative ideas. This contrasts with the RBV, which always emphasizes tapping into the company's own resources first (Rothaermel 2013). This study elaborates the connection between outsourcing innovations and the impact on R&D capabilities of the parent firm. The RBV is directly connected with in-house R&D capabilities of firms, which means that each firm has to first look into the available resources and how to use them in the best way for company growth (Barney 1991). Spending company resources on outsourcing the R&D, which could be managed in-house with slightly more efforts, is the core of the RBV. This viewpoint also compels organizations, when outsourcing innovations is unavoidable, to do this, while managing these acquired resources in the best possible way by paying attention to VRIO attributes (Grimpe & Kaiser 2008).

Moreover, the importance of PAT to outsourcing innovations cannot be ignored. Many SMEs and even MNCs are governed by powerful principals who mostly decide when to outsource or not. In many cases, they are not even expert enough to decide about such huge strategic decisions (Schneeweiss 2003). These decisions can cost companies a fortune and also damage their market reputation. Thus, when making a decision about outsourcing innovations, PAT should be borne in mind by both the principal and the agent.

The second concept of **product development** plays another main role involved in this study, which comprises basic research, technology development and product development in the end (Ulrich & Eppinger 2012). All of these stages are closely connected with TCE because, when a product is developed in-house or involved help from an external innovation provider, transaction costs are always associated with both. The RBV is also closely connected to product development, first utilizing the best of your R&D and conducting basic research in the parent company are the right ways to follow the RBV. Companies should make sure they have done their homework regarding basic research and technology development before they move onto finding innovative partners in the market (Stanko & Calantone 2011). Even when they are able to find external partners, which can help them to develop new products, the RBV is an important player (Rothaermel 2013). Similarly, PAT also plays a role when entering into collaboration for the purposes of product development. If PAT is applied in the best-possible way, this means giving a value to the thoughts and decisions of both principal and agent. In turn, the decisions that are taken in line with PAT can be considered to be more balanced.

The third and last major concept of **company attitudes** is also widely associated with the three theories. Company attitudes involve TCE in terms of how the

company deals with all transactions within and outside it. TCE directly influences the company's perspectives, orientation in the market and approach, as well as consequences related to outsourcing innovations in product development. Company attitudes also reflect the RBV because attitudes of the company vary, depending on the resources available or which resources exhibit VRIO attributes or not. Similarly, PAT helps to explain company attitudes. The principal's and the agent's individual and collective decisions have always influenced the company perceptive about outsourcing innovations in product development.

Therefore, in summary, three of the front-end concepts are connected to the three academic theories involved in the study. The roles that these three concepts and theories have played provided a strong basis on which to build the research instrument, which later helped in carrying out the surveys and interviews for data collection. Thus, the three pillars of the outsourcing innovation concept are tightly entangled with the three theories involved in this study. Taken together, they provide a robust starting point for quantitative and qualitative research in the form of the comprehensive research instrument.

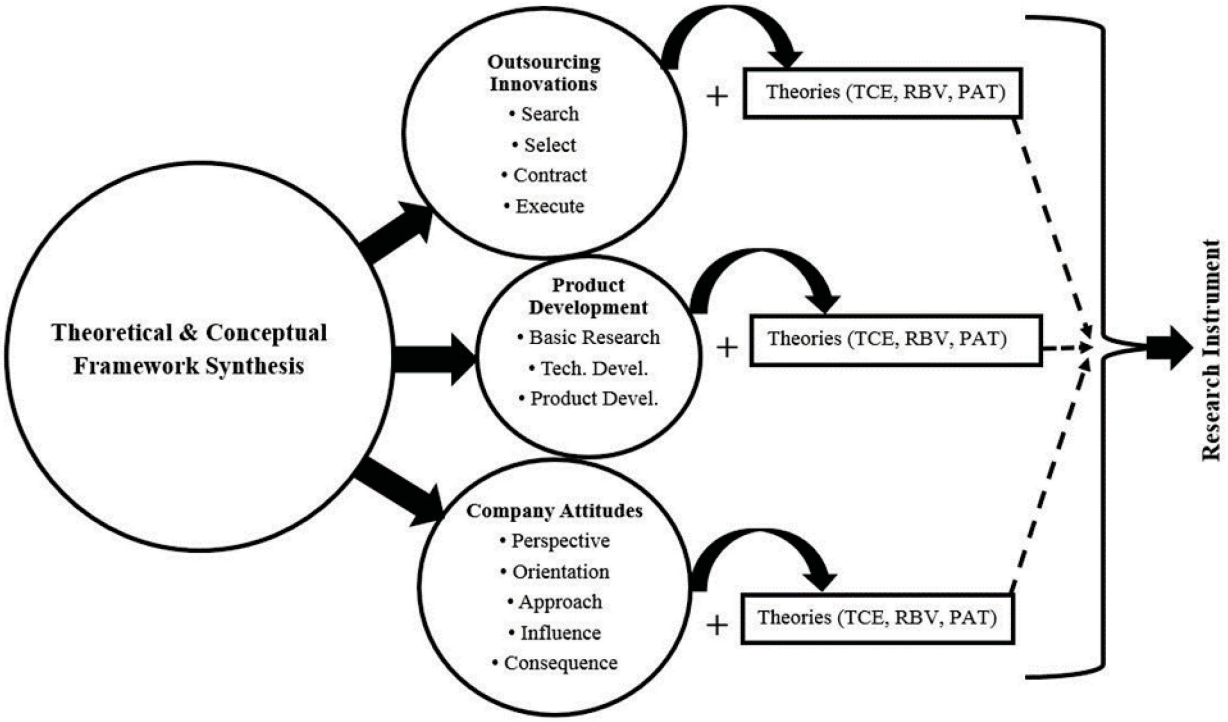


Figure 10. Overview of the theoretical and conceptual framework synthesis

3 METHODOLOGY

This chapter describes the overall methodology adopted in this research. The section considers the development of the research instrument based on the theoretical framework, data collection methods from specified industrial segments, organizing and managing the collected data, the operationalization of 10 variables from the managed data, the development of 13 hypotheses from a different combination of variables, and a relationship analysis of all proposed hypotheses. Additionally, this chapter includes the instrument description in detail, the sampling process, and insights about the firms and respondents involved in the project.

3.1 Instrument description

Figure 10 in the previous chapter presented the strong basis on which the research instrument for this project was built. The self-designed instrument, as attached in the Appendix, comprises four parts as follows:

- **Section I** Personal and Company Information of the Respondent
- **Section II** Reasons for Outsourcing Innovations in the Product Development Process
- **Section III** Effects of Outsourcing Innovations in the Product Development Process on the Company's Own R&D Capabilities
- **Section IV** Solutions to Keep the Company's R&D Capabilities Intact

Section I helped to obtain complete information about the respondent's personal details and their firm, including personal name and country of the respondent, along with the company name. This part also explored the number of years of experience of each respondent in their current organization and his/her overall experience in the industry, the level of education, and the number of R&D projects he/she was involved in during the last five years. The data collected from this part also gave us information about companies or firms, such as how many years they have been present in their industry or market, the number of employees they have in their organization, their total revenue in previous years and the percentage of total revenue spending on R&D. The data collected from this section helped to validate the reliability of this study.

The remaining three sections were designed in such a way that maximum data related to three research questions could be gathered. Once the data collection was

ended, copious information and insights about the research problem were made available. These data were organized and managed in order to build strong variables for further analysis. The following is a detailed description of the next three sections in the research instrument.

Section II was developed in order to obtain comprehensive information from respondents to explain the reasons for outsourcing innovations in product development. Questions and their possible multiple-choice answers were designed on the basis of the outsourcing innovation literature. There were also open spaces provided in the survey form, so that respondents could freely write down their own views about any specific question. This portion covered topics such as the widespread outsourcing trend in the market, outsourcing innovations leading to an increase in the firm's overall performance, cost-effectiveness, a firm's lack of required technology, outsourcing as the ultimate need, whether the firm has adequate human resources, and the role of outsourcing innovations in speeding up the product development process. Other topics included whether or not managers believe that outsourcing innovations is always a viable strategy for the company's future, the company's long-term R&D planning, why the R&D department is unable to compete in the current market pace, and the impact of the focus of the company on other departments (sales and marketing etc.). Moreover, the respondents were about how well they knew the present situation, as well as whether outsourcing innovations was pursued because there are no other options or if such decisions were only in the hands of top management.

Section III mainly focused on the measures that companies adopt to protect their R&D capabilities. This portion also gathered comprehensive information regarding these protectionist motives and their impact on outsourcing innovations in product development. The insights were collected from professionals with the help of questions asking about the extent to which the pros and cons of outsourcing innovations should be evaluated before pursuing this strategy, what type of outsourcing innovations they prefer and its effects on their own R&D. Data were gathered about various protectionist motives by asking whether or not the full outsourcing of innovations in the product development process weakened in-house R&D capabilities, whether the outsourcing of selected phases of innovation in product development and keeping core competences represent a viable strategy, and for opinions about instances of the partial/full outsourcing of innovations in product development. This section also invited the direct views from professionals about different ideas, such as the extent to which they believe outsourcing innovations do not affect their company's own R&D capabilities and how important it is to protect the company's core competence through strict policies,

as well their opinions on how outsourcing core competence can be a threat to a company's IP and how complicated the process of outsourcing R&D is.

Although **Section IV** broadly referred to "solutions to keep the company's R&D capabilities intact", this portion also covered many different aspects of this research. These aspects include macro-environmental and firm-level factors, which could possibly affect outsourcing innovations in product development and in turn the firm's overall performance. The insights were elicited in the form of closed questions on a scale from 1-7, which allowed the respondents to quantify how far they agreed with the provided statement. The statements were designed to invite opinions on many important points such as the proactivity of the R&D department in avoiding the outsourcing of innovations, alignment with the current market situation, outsourcing supportive innovations and keeping the core competence intact. Feedback was collected about the most important factors that should be kept in mind when selecting outsourcing providers, which included the following: the provider must have a good reputation in the industry in terms of R&D; flexibility to adjust to the changing needs of the company; the status of technological resources; the provider's long-term relationship with the parent company; the cultural and institutional differences between provider and parent company. Other factors included the provider country's policy on IPRs, the provider's own policies on IPRs, the cost-effectiveness of the provider, and protection of the company's core competences. In turn, all these questions helped to gain insights about the macro-environmental and firm-level factors influencing outsourcing innovations in product development.

In all the sections and subsections in the questionnaire were open spaces so that respondents could write down any other reasons and thoughts, other than the prescribed options. These open spaces supported the overall process of data collection as they gave respondents the freedom to express their personal viewpoints and experiences about outsourcing innovations in the product development process. Due to the wide range of questions, significant amounts of data were collected in each section and, as the data unfolded, it was observed that what had been collected in each section had a healthy overlap. That is why it was important to organize the collected data, as will be explained in detail later on in this chapter.

The self-designed instrument sought to examine the outsourcing of innovations in the product development process. The main theme of the developed tool was to examine why companies outsource innovations in product development, how these reasons for outsourcing affect firm performance, the protectionist motives of the company and how they affect outsourcing innovations, and the role of macro-

environmental and firm-level factors in outsourcing innovations and the company's overall performance. The instrument was also proven to be very helpful in obtaining insights into the success rate of such (outsourcing innovation-based) products developed by companies, the extent of outsourcing innovations utilized by the company in its innovative developmental techniques, the dependency of companies on outsourcing innovations, and the current capability of innovative product development in the firm.

The overall mixed-method research approach was focused on the outsourcing innovation process and its impact on the R&D capabilities of the company. The respondents had the option to complete the survey anonymously, acknowledging their company's potentially strict policies on IPRs. All the feedback and answers were neither correct nor incorrect, but solely reflected each respondent's opinion. The questions were mostly multiple choice and opinions were expressed on a Likert-type scale from 1 (strongly disagree) to 7 (strongly agree), while open-ended questions were asked to gain practical and free insights from the respondents. Only a few questions were asked on the scale of average, good, very good, excellent and do not know. For further details, see the Appendix.

Additionally, up to 10 interviews were conducted in person and on the phone using selective parts of the same questionnaire to elicit deeper inside views about the overall process. The interviews were helpful in validating the results, while we compared these interviews with the already collected data. This provided us with a true cross-validation of our results and additional insights into the outsourcing innovations process. Due to strict company policies, all the responses were kept completely confidential and have only been or will only be used for academic research.

It is also worth mentioning at this point that the construction of the questionnaire was highly dependent upon the aforementioned three theories, the literature review, the research gaps and the practical issues raised by previous researchers. The data collected via these questions in the research instrument provided strong grounds for the formation of variables at a later stage. Figure 11 illustrates the interlink between the theoretical work, the research instrument and the variables

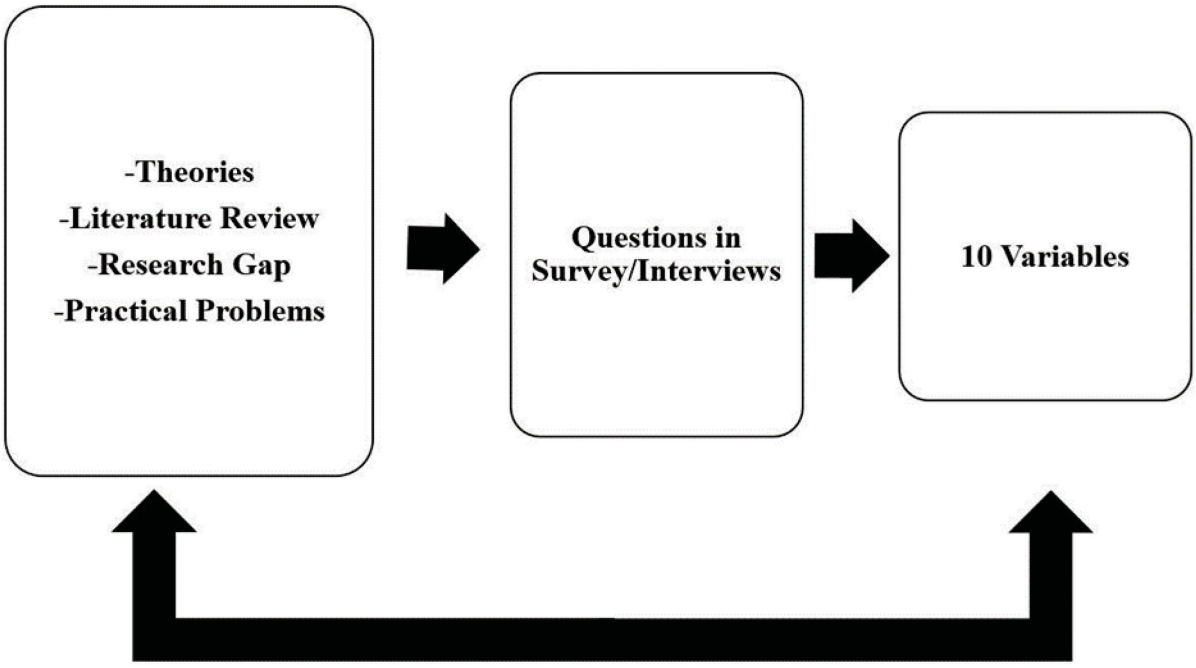


Figure 11. Summary of the operationalization of variables

3.2 Insights from the data set and sampling

After the full description of the research instrument and how the data were collected, this segment examines the insights from the data set. A population sample of industrial segments, which were reliant on the outsourcing of innovations in the process of product development, was selected for this project. The main industrial sectors covered in this research were as follows: ICT, the pharmaceutical industry, biosciences, the chemical industry, and engineering services. A small number of segments, such as financial services, robotics, logistics, the automotive industry and the telecommunications industry, also participated in the research project. The collected data comprised different types of organizations: some were completely dependent on outsourcing innovations while others were partially receiving help from CROs, depending on the level of production. There were also a few companies working as an outsourcing provider in a few segments while outsourcing innovations in other segments of their company. A small number of managers and engineers involved in the survey also had working experience in both types of organizations (parent and provider companies).

In this research, the main data set consists of those companies that were heavily dependent on the outsourcing of innovations in the last decade, as well as

companies that were not especially successful in the recent past as a result of acquiring such innovative measures. The data collected from 20 countries around the world and the sampling frame consisted of a random selection of 260 professionals. Thus, the ***unit of analysis*** is a respondent (employee, scientist, manager, professional, researcher) and a ***sampling unit*** is his/her respective company. The final realized sample consisted of 112 usable questionnaires, representing a 43% response rate. The final data set comprises about 60 different companies and 112 respondents (note that, in a few cases, more than one employee from the same firm participated in this research project consecutively). These were the origin countries of the respondents who participated in this study: ***Finland, Sweden, Denmark, Germany, Spain, Netherlands, Switzerland, Cyprus, USA, Canada, the UK, Singapore, Malaysia, Taiwan, India, Pakistan, UAE, KSA, Oman and Egypt.***

3.2.1 Insights from participating firms

The collected data provide comprehensive information regarding each involved firm. This information comprises the number of years that the firm has been in the industry/market, the number of employees in the firm, the industrial segment to which the firm belongs, the total revenue of the firm and the budget spent on R&D in recent years.

The data also give insights into how many years each firm has spent in the respective industry. The following table gives the percentage representation of all the firms with respect to the number of years of experience in their industry.

Table 9. Number of years of the firms in the respective industry

Number of years of the firms in the respective industry	
No. of years	**Percentage of firms**
<10	28.3%
10 to 20	15.9%
20 to 30	8.8%
30+	46.9%

Table 9 shows the percentage of firms and the number of years in the respective market. The data show that about 46.9% of firms have been doing business in their respective industry for more than 30 years. The data also indicate that about 8.8%

of firms have from 20 to 30 years 15.9% firms have 10 to 20 years and around 28.3% firms have less than 10 years of experience in the respective industry. This insight clearly confirms the comprehensiveness and authenticity of the data collected by the self-designed instrument.

The data also provide valuable information regarding the number of employees per firm. About 42.5% of firms have more than 500 employees, 4.4% firms have between 300 and 500, 11.5% of firms have between 200 and 300, 14.2% firms have between 100 and 200, and 27.4% firms have less than 100 at the time of the collection of data. The data clearly point to the significant number of employees working in the participating companies at the time of collecting data from these firms. The high number of employees also emphasized the reliability of the company in terms of employment and the trust among its highly professional staff. Table 10 below offers a percentage representation of the number of employees in the all participating firms.

Table 10. Data on the number of employees in firms

Number of employees in firms	
Number of employees	**Percentage of firms**
<100	27.4%
<200	14.2%
<300	11.5%
<500	4.4%
>500	42.5%

The research covers a wide variety of industries. The collected data are divided into 11 groups of respondents based on the type of industrial segment. Some segments are grouped, based on similar or comparable industrial specialities. The data are divided into two major segments and nine smaller segments. The biggest segment comprises 48 respondents from the pharmaceutical industry, followed by a segment comprising 23 respondents from the ICT industry. Then, there are nine relatively smaller segments. The third segment comprises six respondents from the life sciences industry, the fourth segment also has six respondents, who belong to the financial services industry, and the fifth segment has five respondents from the chemical industry. Meanwhile, the sixth segment has three respondents from the robotics industry, the seventh segment has three respondents from the logistics industry, the eighth segment has two respondents from the automotive industry, the ninth segment has two respondents from the telecommunications industry and the 10th segment has 11 respondents from engineering services. The engineering

services segment is a broader segment compared to all the above segments and includes firms in the following areas: construction equipment, material handling, crystallization services, plastic engineering, papermaking equipment, electric lighting engineering and marine energy systems. Another three respondents included in this research come from the aerospace, airline and education/legal services industries; these are mentioned under the miscellaneous group. The reason for the inclusion of these respondent firms is their high dependency on outsourcing innovations in the development of their products and services (Thomson Reuters 2015).

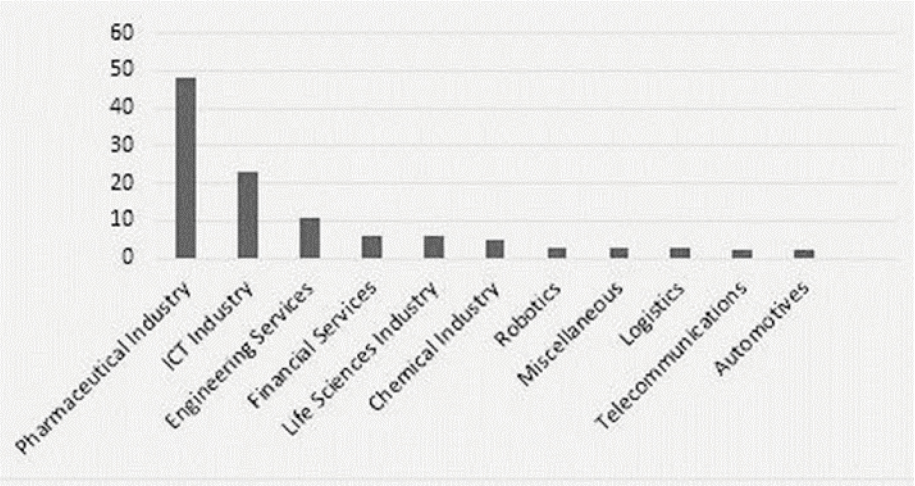


Figure 12. Industrial segment by respondent and industry

The figure 12 is a graphical representation of the division of the collected data into various segments. The y-axis shows the number of respondents and the x-axis shows the name of the segment they belong to. The bars in the histogram also confirm that the major focus of research is on the pharmaceutical, ICT, engineering services and biosciences industries. The main reason for focusing on these industrial segments is that these segments are major contributors to outsourcing innovations in the product development process within the international outsourcing innovation market (Elmquist 2009).

3.2.2 Financial insights from participating firms

The revenue of the participating firms varies greatly, ranging from a few million US dollars to USD 8 billion The annual spending on R&D is directly proportional to the total revenue of the firm. However, in some cases, companies spend less according to their total revenue, and vice versa. Respondents included in the given

research provided information on the total revenue of their present firms for the period from 2015 to 2017. All revenue was received in various currencies and converted into US dollars. It is also important to note that not all respondents provided this information (27 out of 112 respondents did not do so, due to confidentiality and other unknown reasons). As the data were very wide-ranging, they were divided into eight groups, as described in the following table 11.

Table 11. Firms' total revenue in 2015-2017 (in USD)

No.	Name of the group	No. of respondents in the group
1	Less than 1 million	25
2	1 to 10 million	18
3	More than 10 to 50 million	9
4	More than 50 to 100 million	11
5	More than 100 to 500 million	4
6	More than 500 million to 1 billion	6
7	More than 1 billion to 10 billion	6
8	More than 10 billion	6

When delving further into the collected data, the total spending of firms on innovations in the product development process was revealed. Again, only 67 respondents out of 112 answered this question, due to the respective firm's confidentiality policy. As the data were very widespread, they were divided into eight subgroups as follows:

Table 12. Firms' spending on innovations and product development in 2015-2017 (in USD)

No	Name of the group	No. of respondents in the group
1	Less than 1 million	31
2	1 to 10 million	18
3	More than 10 to 50 million	6
4	More than 50 to 100 million	5
5	More than 100 to 500 million	0
6	More than 500 million to 1 billion	1
7	More than 1 billion to 10 billion	5
8	More than 10 billion	1

A deeper understanding of the firm's total revenue and spending on R&D is given in the following histogram:

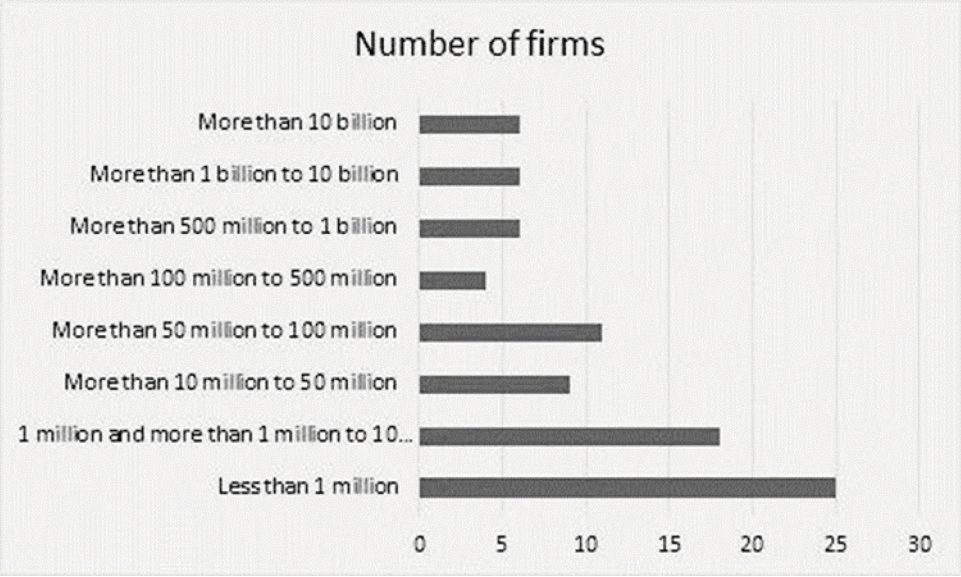


Figure 13. Firms' total revenue in 2015-2017

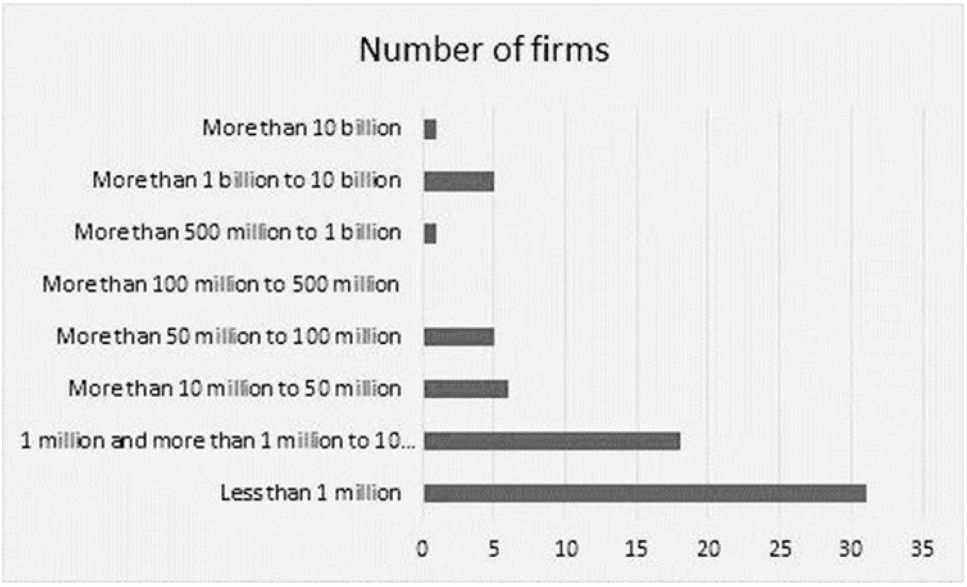


Figure 14. Total amount spent on or allocated to innovation in product development in 2015-2017

A close analysis of the above two graphs offers a clear and comprehensive understanding of the relationship between total revenue and spending on innovations in the product development process. Both graphs show nearly similar trends. The higher the level of total revenue, the higher the spending and vice versa. This finding is comparable to that reported in the work of Hall and Lerner (2010).

These financial data also validate the comprehensive approach to this research, as they depict the participation of companies with less than USD 1 million and those with more than USD 10 billion in terms of revenue and spending. These statistics are helpful in building a solid hypothesis, relationships and research guidelines for outsourcing innovations in the product development process and its impact on companies' R&D capabilities.

3.2.3 Performance insights into products developed in-house or outsourced

The data also show the performance of the products developed by the participating firms. Product development data were collected separately for in-house and outsourced developed products. The performance of products has been rated on a scale of average, good, very good, excellent and do not know. At this point, the insights onto the performance are shown below. The relationship between in-

house and outsourced products and other factors will be explored in the analysis sections.

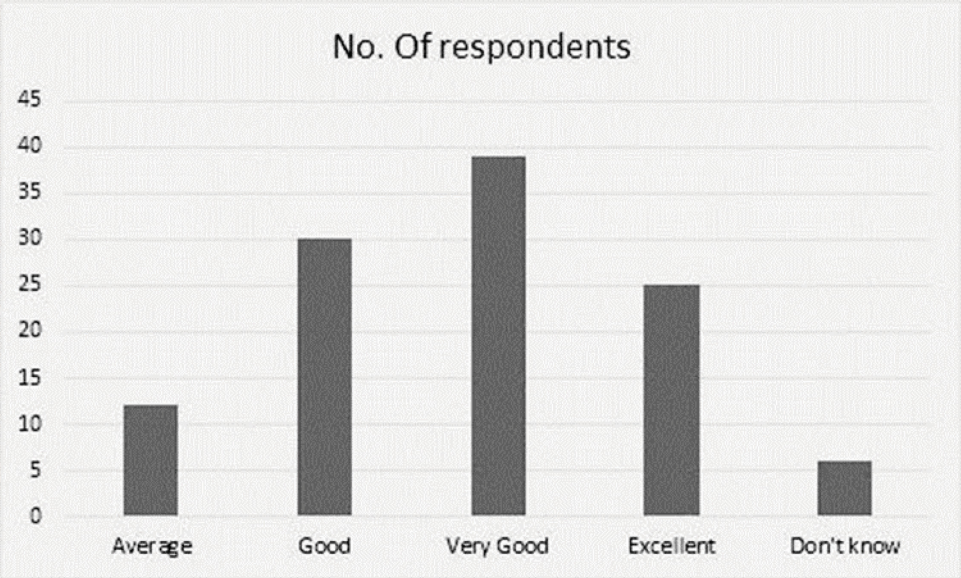


Figure 15. Performance of products developed in-house

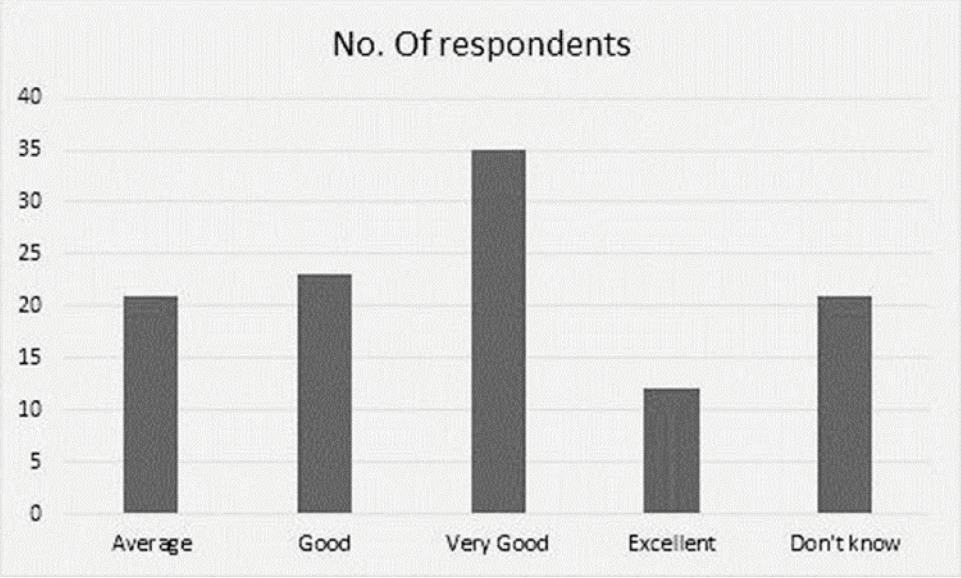


Figure 16. Performance of developed products dependent on outsourcing

The above two graphs shown a very close connection between both cases, but an in-depth analysis offers many different angles from which to study from these data.

In both of the above scenarios, according to the respondents, the performance of both types of products (in-house and outsourced) has been very good, as shown in the middle of two graphs. However, all other options have widely varied results.

10.6% of respondents believed that their in-house products' performance was average, while 18.6% believed that the outsourced innovative products performed better. On the contrary, about 8% of respondents said that their in-house innovative products performed better than outsourced innovative products in the market. In a similar pattern, about 11.5% respondents said that their in-house products performed better than outsourced innovative products. The two graphical patterns depict respondents' beliefs about in-house and outsourcing-dependent products. There is a slightly higher belief in the products that were developed in-house compared to the products developed with the help of outsourcing providers. An in-depth statistical analysis of their relationship with other contributing factors is presented in the following parts of this dissertation.

3.2.4 Insights into respondents

The research instrument also collected information about respondents. All the respondents were from R&D departments of companies and associated, to some extent, with innovations and the product development process. The respondents were from different levels of the hierarchy in their organization, such as managers, technical support personnel, project researchers and senior employees in their respective professional departments.

The respondents were well experienced and had expertise in their respective fields. About 58.4% of respondents had up to five years, 21.2% of respondents had up to 10 years and another 20.4% had over 10 years of experience.

Table 13. Experience of respondents in their present firm

No	Experience in years	Percentage of employees
1	<1	7.1%
2	1 to 5	51.3%
3	6 to 10	21.2%
4	>10	20.4%

The experience of the respondents in their current companies is shown in Table 12, but the collected data also show their overall experience in the industry. About 34.5% of respondents had up to five years, 26.5% of respondents had up to 10 years and another 38.9% have over 10 years of experience. The following table 14 sets out this information:

Table 14. The overall experience of the respondents in industry

No	Experience in years	Percentage of employees
1	<1	3.5%
2	1 to 5	31%
3	6 to 10	26.5%
4	>10	38.9%

A comparison of Tables 13 and 14 shows that the respondents had a protracted affiliation with outsourcing innovations in the product development process, as well as work experience in an open innovation environment. The data collection process took about a year time and the main reason was to find the most suitable respondents. These respondents had direct experience in the overall process of outsourcing innovations in international and national markets.

The instrument also helped to collect data on individual qualifications. Around 45 respondents had a bachelor's degree, 53 had a master's degree or an MPhil, seven had a PhD, five had postdoctoral degrees and two had received other forms of technical education in their respective field among the 112 respondents.

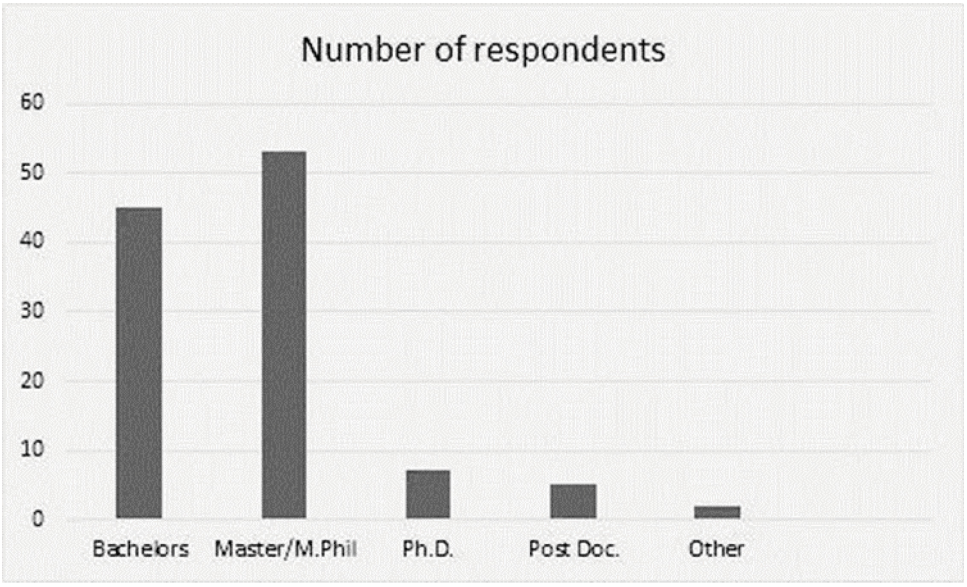


Figure 17. Level of education of respondents

Information on education and overall experience in the industry and in the current company is critical, as it enhances the validity and relevance of the collected data. This comprehensive nature of this information about respondents is directly reflected in the results of this research.

The research instrument also asked all respondents about their contribution to outsourcing innovations in product development. The only way to measure this parameter was the number of product or service development projects in which they were or are involved at the time of the interview. The relevant question specifically asked about the projects they had been involved in over the last five years. About 45 respondents answered this question out of 112 respondents; the others did not answer because of their own company privacy policies. The collected data have been grouped together into five subgroups on the bases of the number of projects respondents had participated in versus the number of respondents. These groups are: respondents who did not participate in any project, and participation in one to 10 projects, 10 to 30 projects, 30 to 50 projects and 50 to 100 projects. The aforementioned 45 respondents had altogether participated in 458 projects as the main researcher or by offering technical support to that specific project. The below graph comprehensively shows the data from these projects with respect to the number of respondents.

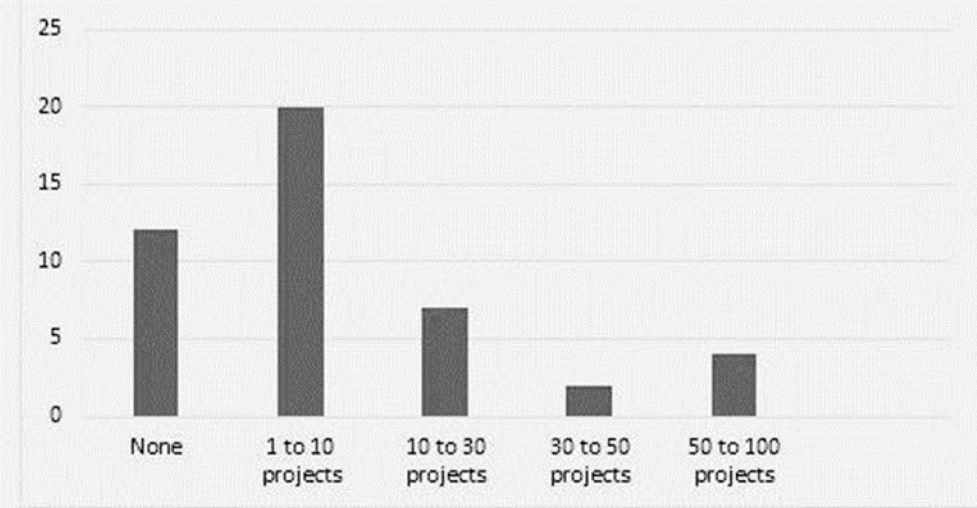


Figure 18. Participation in outsourcing projects during the last five years

The graphs shown that, out of 45 respondents, 12 had not participated in any innovation project that led to product development and the entry of a new product in the market. About 20 respondents had participated in one to 10 projects and seven respondents had participated in 10 to 30 innovation-based projects. Two respondents had participated in 30 to 50 projects, while four respondents had participated in 50 to 100 innovation-based projects in the last five years. The reported data show that respondents had altogether participated in 458 projects. These statistics show the level of experience and insights of the respondents involved in this research project.

3.3 Organizing and managing the data

The previous section presented the full details about the collected data and their reliability. After exploring and understanding the widespread data, it was important to first organize and manage the data before going further into any kind of analysis. The collected data from all four sections were regrouped in the best-possible way, such that it could help to create suitable variables. The data were regrouped based on their similarity and nature, with a view to answering all three research questions. As the overall data from the surveys and interviews comprised approximately 1,200 A4 pages, the first filtering of the data was carried out by repeatedly reviewing the data, while keeping in view the theoretical framework and research questions. The main themes were identified after the filtering of data, with data on similar characteristics grouped together in Microsoft Excel spreadsheets. Excel tools and formulas were utilized for mean, mode and median, as well as to identify various relevant trends in the collected data. Then, based on relevance, the data were merged together to form 10 solid separate groups. Full

details about these 10 groups are described in the next part concerning the operationalization of variables.

3.4 Operationalization of variables

As described earlier, the research instrument was divided into four main sections. The first part provided information regarding the respondent and his/her company, as well as its performance. The second, third and fourth parts provided data that were used to answer the three research questions collectively. The second part of the survey, as described earlier, elicited different opinions from professionals. The reasons suggested in the instrument were based on the case studies of different companies, the problems faced by them and the literature on outsourcing innovations in the product development process.

There were 31 questions altogether in the instrument. The first nine questions were purely based on information about the company and the respondent as described in detail above. The remaining 22 questions were focused on the overall process of outsourcing innovations in product development. Some questions also had subdivisions, for example, Question 14 had five subdivisions, Question 17 had six subdivisions, Question 20 had four subdivisions and Question 31 had 10 subdivisions. For a detailed overview, the instrument can be found in the Appendix of this dissertation.

The data collected from the answers to the aforementioned 22 questions were grouped together, based on their relevance with others, as briefly described in the above section on organizing and managing data. The relevance was determined according to the literature used and the nature of the research questions. The grouping of the data, which was also aligned with the theoretical framework, led to the formation of many variables. Total groups were formed from the overall collected data and each group provided data after answering many relevant questions. Each group formed one variable separately. Table 15 shows the number of variables, and their group description and abbreviation.

Table 15. Description of variables and their abbreviations.

No.	Description	Abbreviations
Variable 1	Performance of outsourced product	(P_{OP})
Variable 2	Market/industry trend with respect to outsourcing innovations	(MT_{OI})
Variable 3	Misc. reasons for outsourcing	(R_O)
Variable 4	Protection of in-house R&D	($P_{R\&D}$)
Variable 5	Supporting outsourcing arguments	(S_{OA})
Variable 6	CRO reputation/characteristics/viability for overall outsourcing process	($CRO_{Ch.}$)
Variable 7	Outsourcing providers/hosts/partner country environment characteristics and their influence on the overall process	($OP_{Envir.}$)
Variable 8	Evaluation of the pros and cons of outsourcing innovations as a whole	($E_{P\&C}$)
Variable 9	Cost-effectiveness as the main reason for outsourcing innovations	(CE_{OI})
Variable 10	Speeding up the new product development process	(S_{PD})

Thus, to summarize, the variables described in Table 15 were extracted from the collected data using the research instrument. All the questions in the research instrument were designed using the theoretical framework. The connection between the theoretical framework, the research instrument and the variables are described in Figure 11. These tangible variables were formed by statistically grouping the instrument data together. The SPSS function **Compute Variables** was used in the formation of these tangible variables.

3.5 Hypotheses development

Having described the research instrument, the insights into and management of data, and the operationalization of 10 variables in the above sections, we now look at the development of hypotheses. The building of hypotheses has been closely associated with the literature and collected data because these are the two main sources of the variable formation. The following are the 13 best combinations formed between the 10 variables, which are relatable to the literature and research questions:

H_1: The performance of outsourced product is directly proportional to the CRO characteristics and viability of the overall outsourcing process

H_2: The performance of outsourced product is directly proportional to the reasons for outsourcing

H_3: The performance of outsourced product is directly proportional to the pros and cons of outsourcing innovations as a whole

H_4: The protection of in-house R&D is directly proportional to the characteristics of outsourcing providers/hosts/partner country environment and their influence on the overall process

H_5: CRO reputation/characteristics/viability for overall outsourcing process is/are directly proportional to Protection of in-house R&D

H_6: The pros and cons of outsourcing innovations is directly proportional to the protection of in-house R&D

H_7: The performance of outsourced product is directly proportional to cost-effectiveness as the main reason for outsourcing innovations

H_8: The performance of outsourced product is directly proportional to speeding up the new product development process

H_9: CRO reputation/characteristics/viability for overall outsourcing process is/are directly proportional to the industry/market trend with respect to outsourcing innovations

H_{10}: The performance of outsourced product is directly proportional to the protection of in-house R&D

H_{11}: The performance of outsourced product is directly proportional to the characteristics of outsourcing providers/hosts/partner country environment and their influence on the overall process

H_{12}: The protection of in-house R&D is directly proportional to cost-effectiveness as the main reason for outsourcing innovations

H_{13}: The performance of outsourced product is directly proportional to supporting outsourcing arguments for outsourcing innovations

To gain a deeper understanding of 13 proposed hypotheses, it is important to relate them to the theoretical framework. Three of the front-end concepts shown in

Figure 10 are connected to the three academic theories involved in this study and associated hypotheses. The outsourcing innovation concept is explained by the three main theories, which were discussed in the theoretical framework chapter. This concept played a role in the building of all 13 hypotheses in many different ways. All the formed hypotheses are, to some extent, connected to outsourcing innovations and extracted from the three theories. The hypotheses from H_1 to H_{13} address the associated concepts of outsourcing innovations, such as the performance of outsourced product, outsourcing provider reputation, the reasons for outsourcing, pros and cons of outsourcing innovations, protecting in-house R&D from the effects of excessive outsourcing innovations, the provider's host country environment, cost-effectiveness of adopting this way of innovating and speeding up the overall product development process. Thus, the outsourcing innovation concept is tightly entangled with the three theories involved in this study and all hypotheses.

The second product development concept is also closely associated with the aforementioned theories and five hypotheses (H_5, H_6, H_8, H_{10}, H_{12}). The hypotheses related to the protection of in-house R&D for product development, CRO reputation in the selection process for collaboration on product development, evaluating the pros and cons before entering into a collaborative contract for product development, speeding up the new product development process, performance of the developed product built with help of a CRO, and the cost-effectiveness of product development are intertwined with the second concept of product development.

The third main concept concerns company attitudes towards the overall process of outsourcing innovations and product development. The company's perspectives, approach, orientation and influence, as well as their consequences, are all connected from the back end to the literature and theories. This collectively formed various hypotheses in this study, including H_1, H_2, H_4, H_5, H_7, H_9, H_{11}, H_{12} and H_{13}. Thus, company attitudes are related to the performance of outsourced product, the reasons for outsourcing innovations, the innovation provider reputation in the market, the protection of in-house R&D, the country environment of the provider towards collaborations, the cost-effectiveness impact on the company's business, the trend of outsourcing innovations in the given market, and supporting arguments within and outside the company about outsourcing innovations. All these hypotheses, literature and theories are attached to the back end of company attitudes.

To summarize the overall relationship between 10 variables and how they are connected to form 13 hypotheses, Figure 19 shows the relationships between

different variables and the proposed hypothesis in graphic form. It is interesting to observe how the performance of outsourcing product (P_{OP}) is a determining factor in eight of the purposed hypotheses, while protection of in-house R&D ($P_{R\&D}$) can be found in five hypotheses. This highlights the potentiality of the performance of outsourcing product and the protection of in-house R&D for overall firm performance, which will be explained in the next chapters.

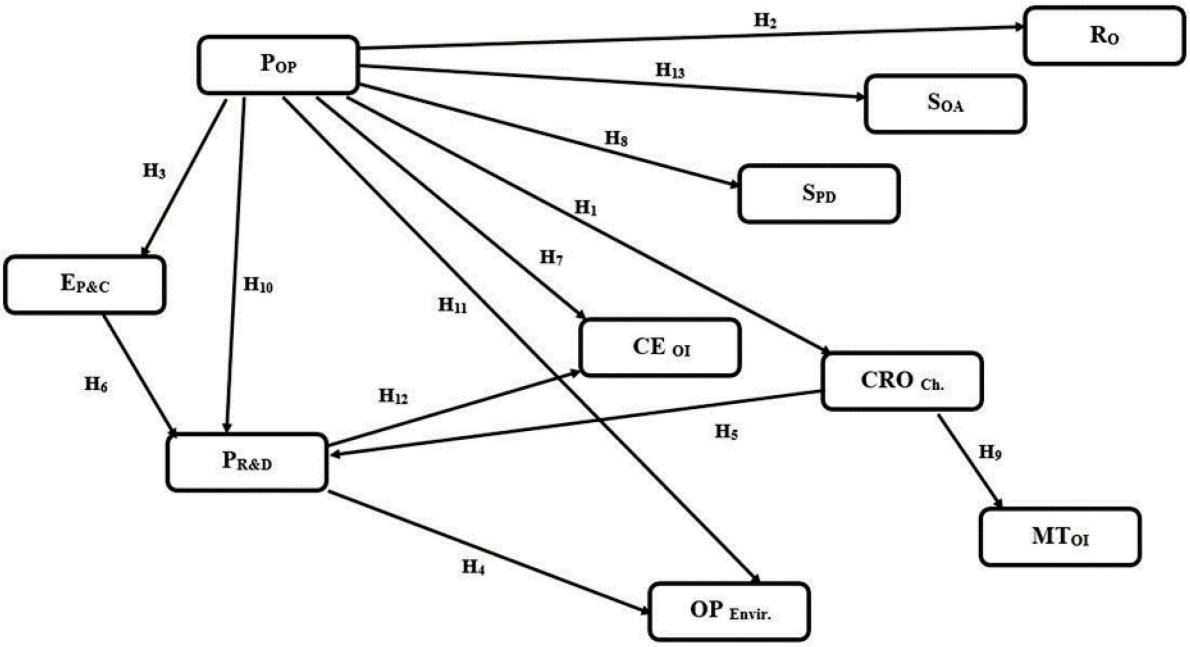


Figure 19. Research framework and hypotheses

3.6 Relationship analysis of the hypotheses

This the most important step in the methodology, where statistical data, innovative product development data and practical opinions of managers of the firms directly dealing with product development and R&D departments were compared with the 13 proposed hypotheses. With the help of this comparison, we are able to validate whether or not managers' practical opinions are supported by the statistical data.

To test the hypotheses, we made intensive use of SPSS 24 in this study for analysing the relationships between different variables. The testing was carried out by using the SPSS function **Correlation-Bivariate**. By using various combinations of variables, the hypotheses were either accepted or rejected based on the significance of their relationships. The statistically significant relationships

helped to validate the hypotheses by SPSS. The analysis and description methods used in this study replicated the correlation methods of Andy Fields (2009).

Table 16. Hypotheses and their significance levels

No.	Hypotheses	Sig.	Results
1	**H_1:** The performance of outsourced product is directly proportional to the CRO characteristics and viability of the overall outsourcing process	0.01**	**Accepted**
2	**H_2:** The performance of outsourced product is directly proportional to the reasons for outsourcing	0.01**	**Accepted**
3	**H_3:** The performance of outsourced product is directly proportional to the pros and cons of outsourcing innovations as a whole	0.01**	**Accepted**
4	**H_4:** The protection of in-house R&D is directly proportional to the characteristics of outsourcing providers/hosts/partner country environment and their influence on the overall process	0.01**	**Accepted**
5	**H_5:** CRO reputation/characteristics/viability for overall outsourcing process is/are directly proportional to Protection of in-house R&D	0.01**	**Accepted**
6	**H_6:** The pros and cons of outsourcing innovations is directly proportional to the protection of in-house R&D	0.01**	**Accepted**
7	**H_7:** The performance of outsourced product is directly proportional to cost-effectiveness as the main reason for outsourcing innovations	0.01**	**Accepted**
8	**H_8:** The performance of outsourced product is directly proportional to speeding up the new product development process	0.01**	**Accepted**
9	**H_9:** CRO reputation/characteristics/viability for overall outsourcing process is/are directly proportional to the industry/market trend with respect to outsourcing innovations	0.05*	**Accepted**
10	**H_{10}:** The performance of outsourced product is directly proportional to the protection of in-house R&D	0.05*	**Accepted**
11	**H_{11}:** The performance of outsourced product is directly proportional to the characteristics of outsourcing providers/hosts/partner country environment and their influence on the overall process	0.339	**Rejected**
12	**H_{12}:** The protection of in-house R&D is directly proportional to cost-effectiveness as the main reason for outsourcing innovations	0.173	**Rejected**
13	**H_{13}:** The performance of outsourced product is directly proportional to supporting outsourcing arguments for outsourcing innovations	0.01**	**Accepted**

For nine hypotheses, the relationship is significant at the 0.01 level (two-tailed). However, in two hypotheses, the relationship is significant at the 0.05 level (two-tailed), while two are statistically non-significant.

Table 16 provides details about the hypotheses in terms of their respective significance and whether they can be accepted or rejected information. It can be seen that 11 hypotheses have a statistically significant relationship, which strongly leads to the acceptance of those hypotheses. But there are also two hypotheses that have statistically non-significant relationships, which leads to the rejection of those two hypotheses.

Table 17. Details of the statistical analysis of variables and their relationships

No.	Hypothesis	Variable and relationship	N (no. of respondents)	Pearson correlation	Sig. (two-tailed)	Correlation significance	Results
1	H_1	$P_{OP} \propto CRO_{Ch.}$	112	0.267^{**}	0.004	0.01^{**}	**Accepted**
2	H_2	$P_{OP} \propto R_O$	112	0.282^{**}	0.003	0.01^{**}	**Accepted**
3	H_3	$P_{OP} \propto E_{P\&C}$	112	0.270^{**}	0.004	0.01^{**}	**Accepted**
4	H_4	$P_{R\&D} \propto OP_{Envir.}$	112	0.500^{**}	0.000	0.01^{**}	**Accepted**
5	H_5	$CRO_{Ch.} \propto P_{R\&D}$	112	0.495^{**}	0.000	0.01^{**}	**Accepted**
6	H_6	$E_{P\&C} \propto P_{R\&D}$	112	0.537^{**}	0.000	0.01^{**}	**Accepted**
7	H_7	$P_{OP} \propto CE_{OI}$	112	0.422^{**}	0.000	0.01^{**}	**Accepted**
8	H_8	$P_{OP} \propto S_{PD}$	112	0.434^{**}	0.000	0.01^{**}	**Accepted**
9	H_9	$CRO_{Ch.} \propto MT_{OI}$	112	0.212^{**}	0.025	0.05^{*}	**Accepted**
10	H_{10}	$P_{OP} \propto P_{R\&D}$	112	0.202^{**}	0.032	0.05^{*}	**Accepted**
11	H_{11}	$P_{OP} \propto OP_{Envir.}$	112	0.091	0.339	Non-sig.	**Rejected**
12	H_{12}	$P_{R\&D} \propto CE_{OI}$	112	0.130	0.173	Non-sig.	**Rejected**
13	H_{13}	$P_{OP} \propto S_{OA}$	112	0.343^{**}	0.000	0.01^{**}	**Accepted**

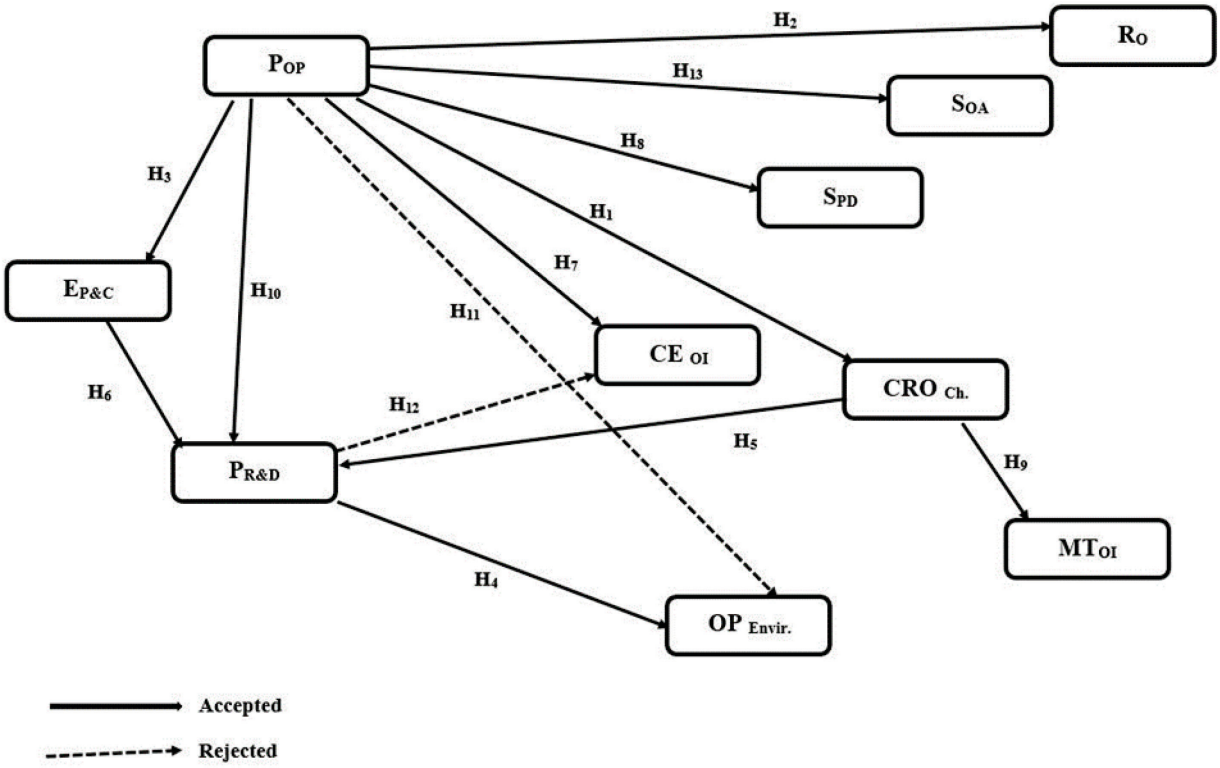


Figure 20. Description of hypothesis testing analysis

Figure 20 presents a summary of the relationships among the 10 tangible variables in the form of 13 hypotheses. The solid lines show the positive relationships and the accepted hypotheses, while the dotted line shows the negative relationships and the rejected hypotheses.

4 RESULTS

The collected data have been analysed using the SPSS statistical software (version 24). The computed variables from the data were run against each other to check the relationship between them based on the proposed hypotheses (Fields 2009). Furthermore, a visual inspection of the histograms, pie charts, tables and bar charts have shown that the data are approximately normally distributed. To test the hypotheses from H_1 to H_{13}, the Pearson function has been run among the variables in different patterns. The relationship between the variables on which the hypotheses were based has shown highly significant ($^{*}p<0.05$, $^{**}p<0.01$) two-tailed results. The independent tests performed for all hypotheses are given in Table 16.

The results in Table 17 show that the Pearson correlation value when testing H_1 against P_{OP} with CRO $_{Ch.}$ is 0.267^{**}, with a significance (two-tailed) of 0.004. The relationship significance for H_1 is 0.01^{**}. This means that the performance of outsourced product is directly proportional to CRO reputation/ characteristics/viability (r=.267, p<.01). Therefore, H_1 is supported. As we can see in Table 17, for P_{OP} and R_O, the Pearson correlation value is 0.282^{*}, with a significance of 0.003 and a relationship significance is 0.01^{**}. Hence, H_2 is supported, which means the performance of the outsourced product is positively related to the reasons provided in the data (r=.282, p<.01). H_3 is also supported because the P_{OP} and $E_{P\&C}$ have a Pearson correlation value of 0.270^{**}, a two-tailed significance of 0.004 and a relationship significance of 0.01^{**}. H_3 examines the relationship between the performance of the outsourced product and the pros and cons of outsourcing innovations (r=.270, p<.01). The relationship was highly significant, which means the performance of outsourced product is always dependent on the positive and negative effects associated with outsourcing innovations.

The hypotheses H_4, H_5, H_6, H_7 and H_8 established a relationship between P_{OP}, $P_{R\&D}$, CRO $_{Ch.}$, $OP_{Envir.}$, $E_{P\&C}$, $CE_{OI,}$ and S_{PD}. The values and relationship patterns are shown in Table 17 above. The Pearson correlation values for H_4, H_5, H_6, H_7 and H_8 are 0.500^{**}, 0.495^{**}, 0.537^{**} 0.422^{**} and 0.434^{**}, respectively. Five of them have a two-tailed relationship significance of 0.001^{**}. Therefore, H_4, H_5, H_6, H_7 and H_8 are supported. H_4 shows as positive relationship between the protection of in-house R&D capabilities ($P_{R\&D}$) and the outsourcing provider's country environment characteristics (OP $_{Envir.)}$ (r=.500, p<.01). Pearson correlation confirms the highly significant relationship. H_5 predicts a positive relationship between CRO reputation (CRO $_{Ch.}$) and the protection of in-house R&D capabilities ($P_{R\&D}$) (r=.495, p<.01). As we can see from Table 17, a significant relationship

exists between them, thus supporting H_5. Further, H_6 also has a significant relationship between its variables, showing that the protection of in-house R&D ($P_{R\&D}$) is related with the pros and cons of outsourcing ($E_{P\&C}$) innovations (r=.537, p<.01). The study found a significant positive relationship between the performance of outsourced product (P_{OP}) with the cost-effectiveness of outsourcing innovations (CE_{OI}); thus, H_7 is supported (r=.422, p<.01). As we can see in Table 17, the study also found a positive relationship between the performance of outsourced product (P_{OP}) and speedy new product development (S_{PD}) (r=.434, p<.01). Therefore, H_8 is accepted. In the case of H_9, CRO reputation ($CRO_{Ch.}$) and the industry market trend for outsourcing innovations (MT_{OI}) has a positive relationship (r=.212, p<.05), while, for H_{10}, the performance of outsourced product (P_{OP}) and protection of in-house R&D ($P_{R\&D}$) has a positive relationship (r=.202, p<.05); hence, H_9 and H_{10} are supported. The Pearson correlation values for H_{11} and H_{12} are 0.091 and 0.130, respectively, both showing non-significant relationships. In the case of H_{11}, the relationship between the performance of outsourced product (P_{OP}) and outsourcing providers' environment characteristics ($OP_{Envir.}$) is non-significant; thus, H_{11} is rejected (r=.091, p>.01). The relationship between the protection of in-house R&D ($P_{R\&D}$) and cost-effectiveness in outsourcing (CE_{OI}) has a non-significant relationship (r=.130, p>.01); thus, H_{12} is also rejected. There is a positive relationship between the performance of outsourced product (P_{OP}) and the supporting arguments for outsourcing (S_{OA}) (r=.343, p<.01); thus, H_{13} is accepted.

4.1 Answering the research questions

The supported hypotheses from H_1 to H_{10} and H_{13} have answered all the proposed research questions of the current research in many ways. While H_{11} and H_{13} are rejected, they can still provide insights that are helpful to understanding the overall process.

The **first research question** stated:

Why do companies outsource innovations in product development and how do these reasons for outsourcing affect firm performance?

The close observation of all the hypotheses helped to answer the first research question; but, specifically speaking, H_1, H_2, H_3, H_7, H_8, H_{10}, and H_{13} explained it theoretically and statistically. Companies outsource because every company wants to improve their newly developed products' performance in the given market

(Gunday et al. 2011); this statement is also aligned with the RBV. These hypotheses demonstrate a significant relationship (*0.01****)* with the performance of outsourced product, as developed by outsourcing innovations, with many reasons for outsourcing, such as CRO reputation, the overall rationale for outsourcing, the pros and cons of outsourcing, outsourcing providers' host country environment for business, cost-effectiveness, the speedy process of product development, protecting in-house R&D, and supporting arguments for outsourcing innovations. The hypotheses are based on related variables, which were extracted from the literature and the collected data provided by specialized professionals in the outsourcing innovation field. The strong relationship between the performance of new product in the market with CRO reputation, the overall rationale of outsourcing innovations, the pro and cons of outsourcing innovations, outsourcing providers' home country environment, cost-effectiveness, speeding up the product development process, supporting arguments of outsourcing innovations, and the protection of the (parent) company's R&D capabilities answered this first research question. The firm's performance is highly dependent on the performance of innovative products developed by the company (Artz et al. 2010), which is connected to the RBV. There may be hundreds of other factors informing the performance measurement of the company (Ortega 2010), but a technology-based innovative company's success is always based on its innovative new product development, which can also be explained by the RBV (Camison & Lopez 2014). Hence, the research provides an empirically verified answer to the first question by highlighting the reasons for outsourcing in the form of a variable and their highly significant impact on product performance and, in turn, firm performance. Figure 21 summarizes the answer to RQ1.

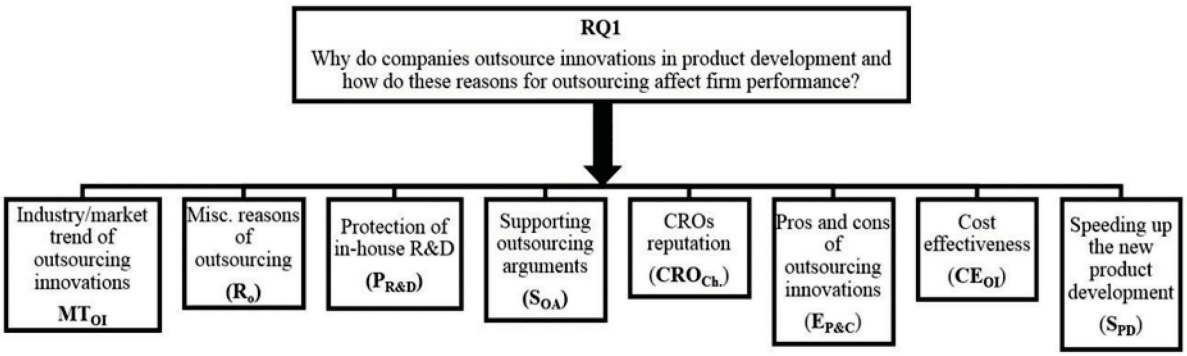


Figure 21. The relationship between firm performance and reasons for outsourcing innovations

The **second research question** stated:

How do (parent) companies protect R&D capabilities and how do these protectionist motives affect outsourcing innovations in the product development process?

The protection of in-house R&D capabilities is always a challenge for all companies in the global village of technology (Asakawa & Som 2008). The RBV also suggests that a company's own resources should be prioritized in order to gain the maximum benefits. The protection of IPRs is a major concern for all companies participating in the outsourcing innovation process (Chesbrough & Schwartz 2015). As one respondent with over 10 years of experience in the open innovation environment said in his interview, during this project's data collection: *"The direction of the R&D strategy is tied closely to the strategic direction of the company. IP is an asset that could be a lifeline in technology-driven companies."* The hypotheses H_4, H_5, H_6 and H_{10} are based on the protection of in-house R&D ($P_{R\&D}$) and its relationship with other protectionist motives. These protectionist motives include the outsourcing provider's characteristics, CRO reputation, the pros and cons of outsourcing innovations and the performance of outsourced product. The parent company's R&D capabilities has a significant relationship *(0.01**)* with protectionist motives, as described in Table 16. The more the control of these protectionist motives is lost, the greater the threats to in-house R&D capabilities (Gassmann & Zedtwitz 1999). The companies that participated in this research had lost huge amounts of money by not embracing the aforementioned

protectionist motives, either overall or individually. Similar losses have also been reported in previous research (Czarnitzki & Toole 2011). *An experienced senior R&D officer, while being interviewed, referred to the loss of a huge investment, where they had outsourced material testing to a third-party laboratory for the development of a new product. Due to the lenient contract in place and trust in the provider, the company did not embrace protectionist motives. In turn, key information was leaked and a significant product development process had to be ceased.* This made the company's R&D capabilities vulnerable in the long run. Indeed, many companies stated that they had experienced similar situations at the time of data collection because of weak decisions made in the past about IPRs (Keupp et al. 2010). *Another manager also mentioned the loss of significant finances in a similar situation; but, in that case, he clearly explained that he had already warned the board of directors about this possible threat. That said, as the Chair of the board of directors was also one of the owners, he decided to cooperate with an outsourcing provider with weak standard operating procedures (SOPs), resulting in a huge economic shock to the firm.* This specific case directly validates the quantitative analysis and is aligned with PAT.

The instrument was designed, based on theoretical work, involved a long list of motives and factors. The research not only answered this question, but also narrowed down the motives with a significant relationship with the product development process. Weak decisions concerning these motives have harmed many firms' own R&D capabilities and weakened their future product development capabilities. *Many managers and senior researchers in innovative companies confirmed that weak contracts and loosely designed collaborations always undermine the firm's R&D capabilities. One scientist, from an MNC in the EU, discussed the closing of a major research centre and the firing of many scientists because of a weak contract with the outsourcing provider.* Those companies who had strong protectionist motives had performed well within their own R&D-based new product development or outsourcing-based innovative product development. In the interviews, many managers expressed the opinion that the company should protect its own R&D capabilities. Even if this somehow has a negative effect on the overall outsourcing innovation process, the respondents emphasized balanced and scrutinized open innovation contracts. Core technology for any company is the key to success in the long run (Kim et al. 2016). The research explained this question theoretically, as well as validated it statistically with a two-tailed significant relationship *(0.01** and 0.05**)*. Figure 22 summarizes the answer to RQ2.

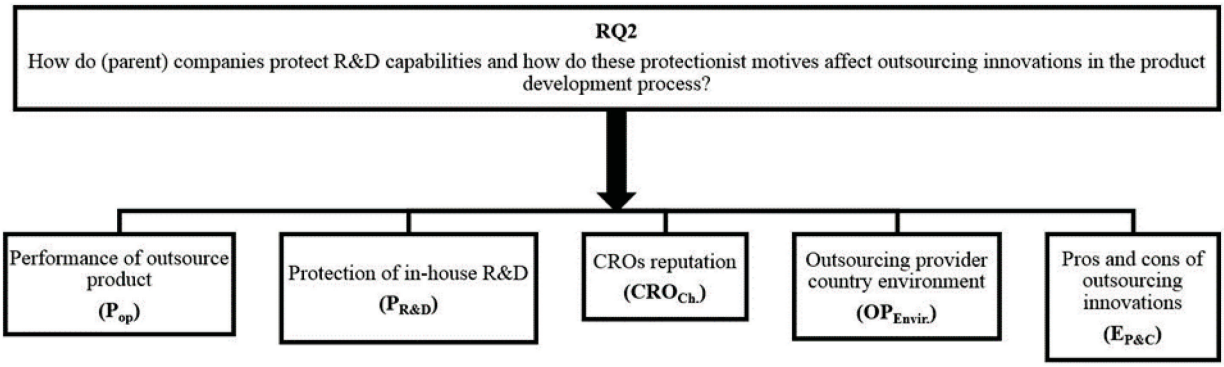


Figure 22. The relationship between outsourcing innovations in product development and the protectionist motives of companies

The **third and last research question** stated:

"How are macro-environmental and firm-level factors affecting outsourcing innovations in the product development process and how are these factors related to firm performance?"

The research question covers the overall factors affecting firm performance and how these identified factors are connected to the firm's overall performance in the long run. Hypotheses H_1 to H_{10}, to some extent, provide an answer to this research question. As we already mentioned above, the innovative firm's performance is always highly dependent on the performance of its innovative research products (Rosenbusch et al. 2011). Therefore, hypotheses H_1, H_2, H_3, H_7, H_8, H_9 and H_{13} are based directly on the performance of outsourced product (P_{OP}). As the performance of outsourced product directly affects the performance of the company, this is a vital factor, which plays a role in the company's overall performance in the macro-environment (Jimenez & Sanz-Valle 2011). The performance of outsourced product is significantly related to other variables, as described in Table 16 above, such as CRO reputation, the reasons for outsourcing, the pros and cons of outsourcing, cost-effectiveness, speeding up the product development process and the performance of in-house R&D capabilities. The significant relationship means that all these variables, based on macro-environmental and firm-level factors, indirectly affect its performance. Figure 23 below summarizes the validated relationships *(0.01** and 0.05**)*.

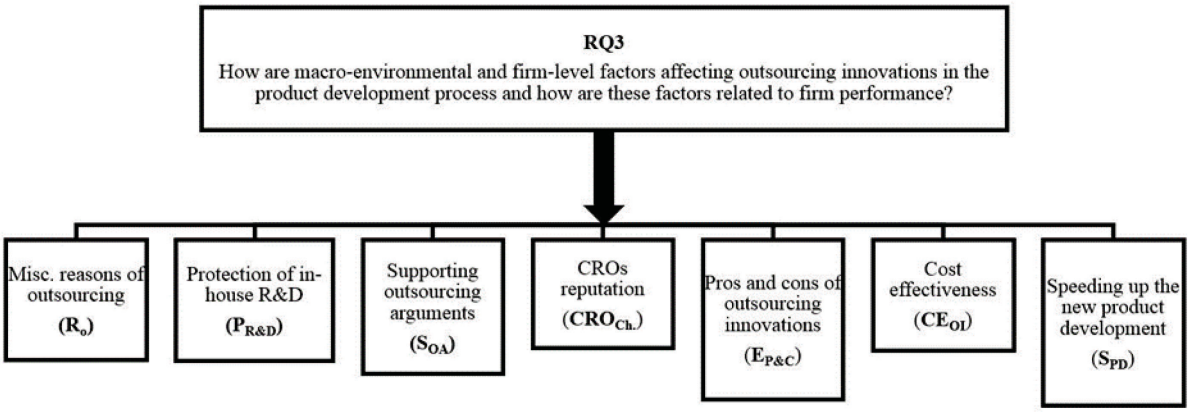


Figure 23. Macro-environmental factors, outsourcing innovations in the product development process and firm performance.

The figure 23 provides an answer to the third and last research question. It describes the relationship between firm performance, outsourced product performance and seven variables. All these variables represent various factors and parameters that have an impact on product performance and in turn firm performance.

Two hypotheses, H_{11} and H_{12}, have been rejected. The rejection of both these hypotheses can be explained because of the change in the dimensions of outsourcing innovations in the present era, compared to previous decades. Outsourcing provider characteristics cannot guarantee that outsourced products will always perform well in the market and later enhance the respective company's overall performance (Almirall & Masanell 2010). The rejection of H_{11} shows that the firm's perceptions had genuinely changed at the time of data collection, compared to a decade ago, when the characteristics of providers used to play key roles in firm performance. Cost-effectiveness was the main reason for outsourcing innovations in the past (Huizingh 2011), but H_{12}'s rejection proves that cost-effectiveness can weaken the protection of the R&D capabilities of the parent company.

Table 18. Summary of the research questions and their answers

RQ1	Why do companies outsource innovations in product development and how do these reasons for outsourcing affect firm performance?
Answer	**Why:** Industry/market trend of outsourcing innovations, protection of in-house R&D, supporting arguments for outsourcing innovations inside the firm, CRO reputation in the given market, evaluation of the pros and cons of outsourcing innovations, cost-effectiveness, speedy new product development, miscellaneous reasons for outsourcing innovations. **How:** All of these have a highly significant impact on the performance of product developed by outsourcing innovations, which in turn directly affects the firm's overall performance (Table 17).[1]
RQ2	How do (parent) companies protect R&D capabilities and how do these protectionist motives affect outsourcing innovations in the product development process?
Answer	**How:** Protectionist motives, protection of in-house R&D, CRO reputation considered before a partnership entered into, evaluation of favourability of the CRO country environment for respective business, case-specific evaluation of the pros and cons of outsourcing innovations. **How:** Strict scrutiny of these protectionist motives helps to improve the product development process; on the other hand, losing control of these motives affects the quality of outsourcing innovation partnerships, resulting in product development failures (Table 17).
RQ3	How are macro-environmental and firm-level factors affecting outsourcing innovations in the product development process and how are these factors related to firm performance?
Answer	**How:** Macro-environmental and firm-level factors, speedy product development, cost-effectiveness, the evaluation of pros and cons, CRO reputation in the given market, supporting arguments for outsourcing innovations, protection of in-house R&D, miscellaneous reasons for outsourcing innovations. **How:** All these have a significant relationship with product performance, which directly affects the firm's overall performance (Table 17).

4.2 Reliability and validation of results

In an earlier chapter, insights from the data set and sampling were clearly provided. The data provided these insights into about the 60 participating firms, such as the number of years they have been doing business in the given industrial

[1] It is very important to highlight the fact that any successful product, developed in-house or based on outsourcing innovations, always has a positive impact on the firm's overall performance. This claim is validated in many studies, such as by Huizingh (2011) Artz et al. (2010) and Jimenez and Sanz-Valle (2011).

segments, the number of employees, compliance with the study's targeted industrial segments, yearly turnover and the amount spent on R&D. The data also collected solid information about respondents' personal experience in the overall industry and the firm in question. The selected respondents were relevant to this research problem, while their professional contribution was related to outsourcing innovations. Besides this, the survey form also provided free space for open-ended questions, so that all respondents were able to provide extra information or simply state what was on their mind about the research problem.

The statistics on the firms and respondents comprehensively validate the reliability of the current study. Around 56% of firms have been doing business in areas related to the research for more than 20 years. It is also important to note that around 65% of respondents have experience in the targeted industrial segments of this study.

Statistical analysis involved the verification and validation of 11 proposed hypotheses. These hypotheses were proposed following a review of the literature and previous case studies. The collected data from surveys and interviews were tested in SPSS 24. The statistical analysis results supported the hypotheses. Thus, the study has been validated three times (literature/theories, surveys, interviews) and contributed to the theories involved.

The study has been both internally and externally validated. Internally, all the variables are causally related to each other in the form of 13 hypotheses. Internal validity has been achieved in this study by developing the best-possible research instrument from the literature, standardized instructions while collecting the data, extracting variables from the collected data, and counterbalancing and eliminating the investigator effects. Answering the research questions with the help of 13 hypotheses, as well as how they are related to theoretical concepts, confirms the internal validation of the study. The results and managerial implications, to be discussed in the next chapter, underlines the strength of the external validation, which has been achieved by effective random sampling from the optimally natural settings. Although the study was conducted in 11 major industrial segments, its findings can be effectively applied to other settings and different populations.

5 CONCLUSION

This chapter discusses the overall research project, its managerial and theoretical implications, its limitations and the prospects for future research.

5.1 Discussion of the results

The study has examined the relationship between 10 variables. The research instrument was informed by the literature and resulted in the development of 10 tangible variables on the basis of the data collected using the self-designed survey form. The research elaborated how the outsourcing innovation process works in firms, which factors affect the overall process and how these factors affect firm performance. In answering the proposed research questions, it was established that there are multiple reasons and factors affecting outsourcing innovations in different ways. To the best of our knowledge, this is the first study of its own kind to have effectively and comprehensively investigated outsourcing innovations in product development process.

The results of the 13 hypotheses were presented in the previous section in Table 17. A total of 11 hypotheses was accepted due to having a highly significant relationship while two hypotheses were rejected due to the non-significant relationship between the given variables. $\mathbf{H_1}$ proposed that the performance of product (P_{OP}), developed by outsourcing innovations, was highly dependent on the reputation of the partner company, the flexibility of the provider, having the latest technological skills, a long-term relationship with the provider, the provider's strict policy on IPRs, the cost-effectiveness of the provider, and the protection of core competences by the parent company ($CRO_{Ch.}$). This means that any company ignoring these factors or compromising on any of them will possibly experience the poor performance of its product, developed by outsourcing innovations, and in turn the company's overall performance. Many respondents also shared their own personal experiences about how they have compromised on these factors, which had a negative impact on the performance of newly innovative product. Indeed, many companies have lost millions of US dollars due to the leakage of their core technology.

The study explored, in the case of $\mathbf{H_2}$, how the performance of outsourced innovative product (P_{OP}) was also closely related to reasons for outsourcing (R_O). There were several reasons for this: some reasons affected it more, while others affected it less. The miscellaneous reasons for outsourcing (R_O) comprised four main reasons, which were cost-effectiveness, speeding up the new product development process, the company's lack of necessary technology and a shortage

of human resources or competence. The first two were the key reasons highlighted by most of the respondents. The latter two, as reported by managers, were slightly less important to them. As a result, these reasons affected the performance of outsourced innovative product, which later leads to the company's performance being reduced overall. The analysis of data also revealed that, although these were the reasons why companies outsource innovations, this does not mean that this is the best way to develop a successful product. In several cases reported by managers participating in the study, companies end up losing millions. The most likely explanation for those losses is that there are no set guidelines or SOP for outsourcing innovations defined within companies. Criteria changes from case to case and from provider to provider, which often leads to companies losing significant amounts of money.

H_3 explains the relationship between the performance of product, developed via outsourcing innovation, and the evaluation of the pros and cons of the overall outsourcing innovation process. The analysis showed that the performance of product is directly dependent on the evaluation of pros and cons, the outsourcing of selected phases of innovation in product development, keeping core competences intact, and the role of the partial and full outsourcing of innovations. According to many respondents, the evaluation of these pros and cons should be made before entering into any collaborative contract. In many cases, ignoring these evaluations has in turn resulted in IPRs being compromised. Due to such bad experiences, few managers supported this statement in interviews: *"Never outsource innovative product if you have the possibility to survive without it."*

The protection of in-house R&D also decides the future of any research- and innovation-based company (Bogers 2011). **H_4** explains the relationship between the protection of in-house R&D ($P_{R\&D}$) and outsourcing providers' characteristics ($OP_{Envir.}$). The highly significant relationship between these two variables is evident in many facts. The protection of in-house R&D comprised many subcriteria, which included: the effect of the complete outsourcing of innovation in the product development process on the parent company's R&D capabilities; the impact of outsourcing core competences on the company's own R&D capabilities, the level of the threat posed by outsourcing innovations to R&D; the outsourcing of innovation impact is always a dilemma; proactive measures for in-house R&D capabilities; and the effect of keeping all core competences intact. The collective opinions attained by all criteria had a significant relation with cultural differences between two partnering companies, the institutional difference between them, the laws related to IPRs in the provider country, and the policies of the innovation provider on IPRs. Compromising any of these criteria can negatively affect the company's R&D capabilities in the long run. As a manager from a reputable MNC

put it in his own words: *"Data leakage, copying of data, exposing of data and partial outsourcing can cause leakage of data too. Outsourcing providers fail to understand SOPs while cooperating. So, always check the reliability and credibility of the provider whom you are sharing your data with".*

CRO reputation, characteristics and viability in relation to the overall outsourcing process (CRO $_{Ch.}$) encompassed the provider's individual reputation, the flexibility of the provider, the level of technical skills of the provider, the provider-parent company relationship, the cost-effectiveness of the provider, and the commitment of provider to the protection of core competences in the partner companies. $\mathbf{H_5}$ shows a significant relation between these described characteristics ($CRO_{Ch.}$) and the protection of in-house R&D capabilities ($P_{R\&D}$). This means that, if we ignore these factors when selecting CROs, the in-house R&D of the parent company will always be compromised (Bertrand 2009). One scientist from a reputable organization commented on the importance of viability to the overall process as follows: *"When a co-relation is built up between the two partners, there must be mutual working and transferring of knowledge and technology required between them."* This means that outscoring innovations should be communicated on a single safe platform.

The study also revealed, in the form of $\mathbf{H_6}$, that compromising the evaluation process concerning the pros and cons of outsourcing innovations ($E_{P\&C}$) always leads to harmful effects on the company's own in-house R&D capabilities ($P_{R\&D}$). Likewise, ignoring one or more of the necessary evaluation steps always leads companies to lose in-house R&D capabilities in the short term or in the long run (Calantone et al. 2002). In the past, losses have been so high that some research labs lost their whole core capability, as reported by a few participant researchers in the study, which aligns with previous studies (Chesbrough 2010). An outsourcing manager from a renowned MNC summarized the risk to R&D capabilities as follows: *"Outsourcing can be useful if discrete parts of the development project are subcontracted. But the company doing the outsourcing must understand what has been developed and own the informal IP (know- how). Outsourcing is generally an abdication of responsibility and de-risking in the short term but losing control in the longer term."*

The performance of outsourced product (P_{OP}) had a significant relationship with the cost-effectiveness of outsourcing innovations (CE_{OI}). This significant relationship validated $\mathbf{H_7}$, which means that the performance of the firm is also related to the cost-effectiveness of outsourcing innovations. As described earlier, the performance of a product, developed via outsourcing innovations, has a direct impact on overall firm performance (Belderbos et al. 2004). On the other hand,

the study uniquely demonstrates that this is not the only factor behind the firm's successful selection of CROs, as suggested in many studies in the past (Gassmann et al. 2010). This selection procedure was summarized by another senior manager with about 20 years of experience in outsourcing innovations at different levels: *"Gain broader insights, avoid getting stuck in trenches of circular thinking (looking at the same ideas over and over), Learning from other industries. Avoid being the next big failure ('my customers want a faster horse!', to paraphrase Mr Ford). Many, many viable reasons exist for outsourcing innovations. HOWEVER, they should never, ever be fully outsourced but be properly and effectively anchored to internal work to guarantee good ideas and development are picked up and pushed to market readiness."*

There was also evidence of the dependency of a firm's performance (P_{OP}) on the speediness of the overall product development process (S_{PD}). Acceptance of $\mathbf{H_8}$ means that any CROs, which can speed up the outsourcing innovation process, can facilitate the quick launch of a product in the market. This leads to improved firm performance in the market as it is dependent on the performance of the outsourced innovative product (Berchicci 2013). *Approximately 70% of total respondents explained in their interviews that companies want to speed up the overall process and ensure the quick launch of a product in the market as one of the main reasons for outsourcing innovations.*

CRO characteristics (CRO $_{Ch.}$) comprised the follows: good reputation in the market, flexibility, technological skills, relationship with the parent company, cost-effectiveness, the provider's own policies and its country's laws on IPRs. All of them are connected to widespread outsourcing innovations in the industry (MT_{OI}), leading roles of CROs in the industry and the viability of the outsourcing innovation strategy in facilitating the parent company's survival. The significant relationship between the two variables indicates that $\mathbf{H_9}$ is supported. The better the CRO characteristics, the stronger the market trend for outsourcing innovations (Contractor et al. 2010). In interviews, 53% of respondents validated this claim in their feedback.

The study has highlighted another important point, in contrast to previous studies. It is believed by many researchers that outsourcing innovations always helps to grow the overall R&D capabilities of parent companies (Dahlander & Gann 2010). Nevertheless, this study showed that the performance of the firm (P_{OP}) is very high when the company is able to keep its in-house R&D capabilities intact ($P_{R\&D}$); thus, $\mathbf{H_{10}}$ is supported. Protection encompasses the following issues: the full outsourcing of innovation always weakens in-house R&D capabilities; outsourcing core competence is always a threat to in-house capabilities; proactive R&D is

required to avoid the outsourcing of innovations the in product development process; core competences should also be kept intact in any collaboration with CROs (Grimpe & Kaiser 2010). The following comments was made by a researcher in his interview for this research project: *"Sometimes, we can also get our employees trained by an outsourcing innovation provider for the required technology. This helps sometimes, but it should not make the organization dependent because it can weaken in-house R&D."*

The performance of outsourced product (P_{OP}) has a significant relation with the supporting arguments for outsourcing innovations (S_{OA}). The performance of product, developed in the course of outsourcing innovations, was considered to be the key factor in firm performance. Hence, a significant relationship between the two variables validated $\mathbf{H_{13}}$. The stronger the supporting arguments, the higher the firm performance (Cheng & Huizingh 2014).

Inconsistencies were also observed in the two hypotheses. The performance of outsourced product (P_{OP}) and outsourcing provider characteristics ($OP_{Envir.}$) have a non- significant relationship. This means that $\mathbf{H_{11}}$ is rejected, which means the performance of outsourced product is not directly impacted by the cultural differences between providers and the parent company, the institutional differences between the two partners, the laws of the provider's country on IPRs, and the provider's own policies on IPRs. The previous literature has shown that these factors impact outsourced product performance and in turn the company's overall performance (Nieto & Rodriguez 2011); however, rejecting this claim in the current research, implicates many possible explanations. The most important explanation for this inconsistency is that data were widespread in different types of markets, from Asia to Europe, Europe to the US, and even within Asia, i.e., South Asia and Central Asia have somewhat different opinions about outsourcing innovations (Sofka & Grimpe 2010). This factor is the most probable explanation for this inconsistency (Gianiodis et al. 2010).

The protection of in-house R&D ($P_{R\&D}$) and the cost-effectiveness of outsourcing innovations (CE_{OI}) have a non-significant relation. This non-significant relation rejects $\mathbf{H_{12}}$, which shows the rejection of the old school of thought. It is believed that outsourcing cost-effective product does not have a negative impact on in-house R&D (Grimpe & Kaiser 2010). This study rejects the belief and research that consider this to be a new approach to this old thought, rather than considering it as an inconsistency. In light of the many negative experiences and leakages of information in the past, managers now believe that cost-effectiveness does not always have a positive effect on the in-house R&D of the parent company.

5.2 Theoretical implications

In this study, TCE, the RBV and PAT are used together for the first time to address outsourcing innovations in the product development process. It explains how these three theories can be used consecutively to address this problem, which has never been done before in the literature.

The research presented in this study was conducted to explore the outsourcing innovation process and its impact on a firm's R&D capabilities. This has helped to develop an understanding about why companies outsource innovations, using a combined view of TCE, RBV and PAT perspectives. The three theories were used together to determine a firm's attitudes towards outsourcing innovations, as well as create a mechanism for combining them. It is also important to note that all the variables used to test the hypotheses in this research project were built with the help of the three theories. The variables helped to test the hypotheses, which in turn answered the research questions. This emphasized the importance of all three theories. TCE, the RBV and PAT have been employed for decades to explain management problems. This study has specifically highlighted that every firm should analyse its own available in-house R&D resources, based on the RBV, and later make decisions about which innovation activities should be outsourced to CROs, based on TCE. The decision- making in these stages, which is affected by principals and agents, is identified by PAT.

The effects of outsourcing innovations on the R&D capabilities of firms also have theoretical implications. R&D capabilities directly influence firm performance; indeed, this study has determined that the reasons for outsourcing, the protection of in-house R&D, CRO reputation, analysing the pros and cons of outsourcing innovations, the cost-effectiveness of the CRO, and speedy product development have a direct impact on the R&D capability of the firm. These factors were determined based on TCE, the RBV and PAT. The highly significant relationships between these defined variables explained the role of the RBV when utilizing the firm's own R&D resources. Decisions to ignore in-house R&D capabilities were identified, based on TCE and PAT.

There is another implication related to the transaction costs associated with outsourcing innovations. In the past, it was believed that outsourcing was undertaken to reduce transaction costs. But this study used TCE and explained that cost-effectiveness has a non-significant relation with strong in-house R&D capabilities. This fact supports TCE, in that, if outsourcing innovations is purely pursued in order to reduce transaction costs, then doing so can never strengthen the R&D capabilities of any firm. Thus, it is important to carry out an intensive

analysis of the pros and cons of outsourcing innovations, while keeping in view all aspects and not just transaction costs alone.

The study findings have also revealed that all three theories should be used with caution because, in many instances, they can be contradictory when explaining complex contracts between firms and the limitations of their R&D capabilities. This can clearly be seen in the rejection of H_{11} and H_{12}. This can be observed due to the complexity of the outsourcing innovations process, compared to a simple outsourcing process.

The study has also provided knowledge of outsourcing innovations in project management, knowledge creation, innovation management, operation strategy, business improvement and strategic management. Outsourcing innovations can be employed in many ways, as a result of this current research project. Besides that, outsourcing innovations in product development methods can possibly be applied to other similar management areas, which are not within the scope of this research. These concepts may be utilized in other industrial segments using similar patterns.

Finally, the study has also presented an OIP model, shown in Figure 24, which contributes to the development of previous open innovation concepts. **The OIP model** is very close to Chesbrough's open innovation model (Figure 7).

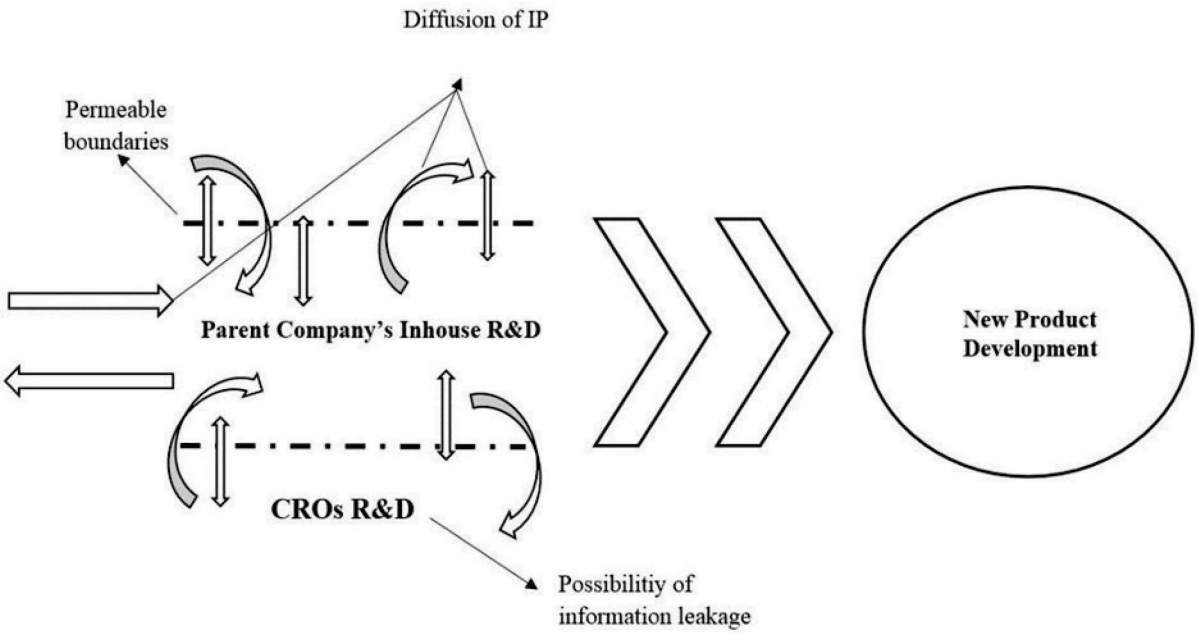


Figure 24. The proposed OIP model

There are permeable walls between the in-house R&D of the parent company and the R&D departments of innovation providers in the OIP model. These two are major players in developing new products. Thus, outsourcing innovations is an open-ended process that involves the R&D of both parent and provider companies. There is also the fact that the exposure of R&D to partner companies affects the parent company's R&D capabilities. Figure 24 illustrates the core of the OIP model. The model shows how the in-house R&D boundaries are permeable in relation to external knowledge, whereby there is an open flow of knowledge between the parent and provider companies' R&D departments. This open flow of knowledge is still not that open in outsourcing innovations because there are many set standard procedures, which both collaborative partners have to follow. But, compared to closed in-house product development, the model is very interactive. Due to the joint knowledge flow between two R&D departments in different companies and various external sources, a new product is developed. This product development is different from traditional product development because its production involves the outsourcing of innovations from external partners in an open knowledge exchange environment. There is another important observation related to the leakage of information and IP, in that parent companies, to some extent, always blame leakage of IP on third-party innovation providers. But the model shows that this is not always the case in such an open knowledge flow model as both partners can facilitate the leakage of IP. This can be explained in many ways, for instance, due to a new corporate culture or many key scientists and

professionals constantly changing their organizations (and, while doing so, it is impossible for any company to contain knowledge within its walls). Therefore, in some cases, if the parent company's scientists take up employment in other company or, in extreme cases, the innovation provider, then there is truly a chance of the leakage of IP.

To some degree, the open innovation model of Chesbrough and the core of the OIP model are similar with regard to the flow of information, albeit with different end points. In the Chesbrough model, the discovery of a new market, which is different from the existing market, is one of the final end points; but, in this study, new product development is the end point when employing an outsourcing innovation strategy. The introduction of a newly developed product can take place in the existing market or find a new market. In this way, the OIP model extends the already existing concepts, while offering different end results.

5.3 Managerial implications

The purpose of this research is to reduce the research gap in previous studies and set out strong managerial implications based on current research. This study has been based on three main research questions, which have been answered by testing 13 hypotheses. These hypotheses show different relationships between10 variables, which were developed from the literature and collected data. The answers to the research questions were later transformed into tangible managerial implications in the industry.

Today, managers, as well as academics, recognize the importance of innovation and outsourcing innovations in the product development process (Lichtenthaler 2011). Due to increased demand and competition concerning the introduction of innovative products for customers in respective markets, managers need to understand which methods, techniques and strategies should be adopted. These strategies should satisfy companies' end customers for their developed product and improve their overall performance. The study comprehensively sheds light on the overall process of outsourcing innovations and its impact on the company's own R&D capabilities.

The study indicates that CRO reputation, characteristics and viability are critical factors if we want the best performance from the outsourced product. The improved performance of outsourced product always has positive effects on firm performance. Consequently, managers involved in outsourcing innovations should direct more of their attention towards CRO characteristics related to reputation and viability when developing partnership contracts.

The reasons for outsourcing innovations have a significant relationship with outsourced product performance and in turn firm performance. This study suggests that managers and professionals involved in this process should comprehensively evaluate all reasons for outsourcing innovations before entering into any type of R&D outsourcing. The same strategy applies to the overall evaluation of the pros or cons of outsourcing innovations. Failure to pre-evaluate the reasons, pros and cons of outsourcing innovations always leads to reduced performance of the newly developed product.

In addition, this study emphasizes the importance of protecting in-house R&D, as well as explored the impact of the provider country's environment for R&D, CRO reputation and viability, the case-specific evaluation of the pros and cons concerning the overall process, and the performance of the outsourced product in the market. A significant impact has been observed in all of these cases on the protection of R&D capabilities. The managers and companies facing a threat to their own in-house R&D capabilities should develop an outsourcing SOP model around these mentioned criteria to keep R&D capabilities intact.

Most parts of this research have revolved around the performance of outsourced product and firm performance. The study confirms the significant dependency of firm performance on the cost-effectiveness of outsourcing innovations, speedy product development, the intact nature of the in-house R&D department and supporting arguments for outsourcing innovations. This means that, if managers want to improve firm performance, their contracts for outsourcing innovations should cover all these stated angles.

Moreover, in the present era, outsourcing innovations and acquiring R&D technical support are observed as a market trend by some researchers (Gassmann et al. 2010). This study suggests that, while following this market trend maintains a focus on CRO reputation and flexibility in the given market, many managers simply try to follow the general trend in order to acquire technical support. This is because everyone is doing the same thing in the market, but this is not always suitable for every firm. The study emphasizes that CRO reputation and flexibility should always be evaluated when entering into each contract.

Managers and professionals involved in R&D-based firms need to be trained, motivated and rewarded for developing partnerships that help them to generate safe benefits, while keeping the parent company's R&D capabilities intact. Rewarding and training strategies should be focused on the above-mentioned parameters. If these strategies are planned and implemented, this will enhance firm performance and growth. The study also provides strong empirical support

for developing sustainable outsourcing innovation strategies in the product development process.

5.4 Limitations of the research

Every research topic related to innovations and product development has a wide variety of implications for the highly innovative world in which we now live in. Besides these implications, there are also certain limitations to every research idea. Some of these limitations can be related to the collection of our data and interpreting our results, while some are related to the research design. The following limitations were acknowledged while conducting the overall research.

One potential shortcoming in the study was common method bias. There was a single research instrument used for the collection of data from various segments of industry and professionals. Thus, the strength of relationships between all 10 variables, which were formed from theories and the collected data, may be somewhat inflated.

Although the sample was deemed acceptable, a larger sample would have given more possibilities to run powerful analyses. Due to sample limitations, the study was not able to measure non-response bias, which is a potential threat to the validity of the results. Many people clearly wanted to participate; but, due to the strict IP policy of firms and somewhat protracted nature of permission procedures for participating in this novel research, they decided not to respond.

Although the focus of this research was to analyse outsourcing innovations in the product development process and its impact on the R&D capabilities of the firm, from the parent firm's point of view, we did not consecutively analyse the CRO perspectives at this stage. But there were respondents who had worked for both types of firms (parent companies and CROs) in their careers. This is one of the important constraints in the research.

The R&D department in a company always comprises various subdivisions and segments. We only focused on outsourcing innovations, the product development segment and the collaboration between them. Therefore, the current research has not been able to determine, at this stage, to what extent outsourcing innovations affects other divisions of the R&D department in the given company.

Outsourcing innovations is not contained in a specific geographical area. Whenever this type of outsourcing is done, it is always influenced by geopolitical situations and cultural factors. In this research, we covered a total of 20 countries.

These were widespread in Europe, South Asia, Central Asia and the US; but, studying these regions in a single piece of research was somewhat challenging.

5.5 Future research prospects

The current research was limited to outsourcing innovations from the parent company's viewpoint, as well as its impact on the parent company's R&D capabilities in the long run. During the research, the future of CROs and third-party outsourcing providers was considered. Future work should solely examine the CRO approach towards the entire outsourcing innovation process. If parent companies decide to completely return to in-house product development, where will CROs stand?

Future research should also seek to separately examine developing countries and developed countries. Different research instruments should be prepared in order to measure and analyse outsourcing innovations in both segments. The reason behind this statement is that both would be expected to involve many different constraints and approaches in addressing this problem.

There is also the possibility for future researchers to carry out case studies of renowned companies based on a similar problem. How are companies, managers and researchers are tackling this problem within the company? What types of strategies are they following when entering into a contract for research and outsourcing innovations. The comparison of such case studies could provide a deeper understanding of this research gap.

One experienced researcher and manager of an innovative company summarized the entirety of this research in a few words at the end of the interview: *"The research topic is quite polarizing. This isn't a game of black and white, but rather many, many shades of grey."* Given that this single statement emphasizes the prospects of this research topic, future research could replicate this study in other contexts or apply it to a specific industry to further uncover the hidden shades of grey.

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Appendix

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A Survey on the Dilemma of Outsourcing Innovation: A Company's Growth Option or a Risk to R&D Capabilities

Dear respondent,

Thank you for taking the time out to consider this survey.

I am a doctoral researcher in the Production Department at the University of Vaasa, Finland. I am conducting a research project that examines the outsourcing of innovations in product and service development process.

The main theme of the project is to examine how and why companies outsource innovations for product development and the associated benefits and risks for these organizations.

The research will focus on the open innovation process and its impact on the R&D capabilities of organizations. The results will provide guidelines, regarding the handling of the overall process in an optimum way, to managers involved in outsourcing innovations.

You are requested to take 10 to 15 minutes out of your busy schedule to complete this questionnaire, which comprises four parts. Please complete all the parts in full and bear in mind that no answer is correct or incorrect but solely reflects your opinion. All the responses will be completely confidential and only used for academic research.

Your response is of the utmost importance to me in completing this research. If you have any questions, and/or would like to receive the findings of this research, please feel free to contact me.

Thank you so much in advance for your time and help.

Contact information:

Project researcher: Afnan Zafar Doctoral researcher at the University of Vaasa Address: University of Vaasa, PO Box 700, FI-65101 Vaasa, Finland afnan.zafar@uva.fi	Project supervisor Professor Jussi Kantola, Doctor of Technology, PhD Address: University of Vaasa, PO Box 700, FI-65101 Vaasa, Finland jussi.kantola@uva.fi

Outsourcing Innovations in Product Development Processes

Section I

Personal and Company Information (Confidential)

Organization name: _____

Respondent's full name: _____

Contact details for correspondent: _____

(email or phone)

Country of respondent: _____

In the following part of Section I, the questions asked are about you. Please tick the appropriate answer.

1. Your experience in the organization

□ <1 year □ 1 to 5 years □ 6 to 10 years □ More than 10 years

2. Your overall experience in the industry

□ <1 year □ 1 to 5 years □ 6 to 10 years □ More than 10 years

3. Your level of education at present

□ Bachelor degree □ Master's degree/MPhil □ PhD □ Postdoc □ Other

4. How many outsourcing innovations/R&D/product or service development projects were you involved in during the last 5 years?

□ Approximately _____

In the following part of Section I, we are interested in learning about your company. Please tick the appropriate answer.

5. From how many years has your organization been operating in the industry?

□ <10 □ 10-20 □ 20-30 □ 30+

6. To which industry does your firm belong? Please select the appropriate box

□ ICT industry □ Pharmaceutical industry

□ Biotechnology □ Chemical industry

7. Number of employees in the organization

□<100 □<200 □ <300 □<500 □ 500+

8. Firm's total revenue in 2015-16

□ _____

9. Total amount spent on or allocated to innovation in product development in the last 10 years

□ Approximately _____

10. Performance of your *in-house* new product developed in the last 10 years

□ Average □ Good □ Very good □ Excellent □ Don't know

11. Performance of our *outsourced* new product developed in the last 10 years

□ Average □ Good □ Very good □ Excellent □ Don't know

Section II

Reasons of Outsourcing Innovations in Product Development

The following statements are designed to help us understand your perception as to why companies outsource innovations in the product development process. Please circle the appropriate number to indicate how much you agree or disagree with each statement.

1=Strongly disagree, 2=disagree, 3=somewhat disagree, 4=neither disagree nor agree, 5=somewhat agree, 6=agree, 7=strongly agree

12. In your industry, outsourcing innovations in product development is now widespread

1 2 3 4 5 6 7

13. Outsourcing innovations in the product development process leads to an increase in the firm's performance

1 2 3 4 5 6 7

14. Outsourcing innovations in product Development is done because of (you can select more than one option)

□ Cost-effective reasons

1 2 3 4 5 6 7

□ Company lacks required technology

1 2 3 4 5 6 7

□ Company does not have adequate human resources/competence

1 2 3 4 5 6 7

□ Speed up the new product development process

1 2 3 4 5 6 7

□ Other reasons

_____

_____

_____
_____
_____
_____
_____

You believe that contract research organizations or outsourcing providers are now leading the industry

1 2 3 4 5 6 7

15. The long-term adoption of outsourcing innovations in the product development process is a viable strategy for a company's survival

1 2 3 4 5 6 7

16. Your company outsources innovations in the product development process for following reasons (you can select more than one option)

- Company's R&D long-term planning is weak
- At present, the R&D department is very weak and faces difficulties in competing in the market
- Company is focusing on other departments (i.e., sales and marketing, manufacturing and production) and is less focused on R&D, which can be readily outsourced
- It knows the present situation very well and is implementing new plans to tackle the issues related to outsourcing innovations
- It knows the present situation but does not have any strategy to tackle the issue
- Decision by higher management (CEO/GM/MD/owners/directors)

17. Any other reasons for outsourcing?

_____
_____
_____

Section III

Effects of Outsourcing of Innovations in the Product Development Process on the Company's Own R&D Capabilities

The following statements are designed to help us understand your perception about the effects of outsourcing innovations in the product development process on the company's own R&D capabilities. Based on your observation and opinion, please circle the appropriate number to rate the extent to which you agree or disagree with each statement.

1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=neither disagree nor agree, 5=somewhat agree, 6=agree, 7=strongly agree

18. In your opinion, the pros and cons of outsourcing innovations should be evaluated frequently

1 2 3 4 5 6 7

19. Type of outsourcing and its effects

- Full outsourcing of innovation in the product development process weakens in-house R&D capabilities

1 2 3 4 5 6 7

- Outsourcing selected phases of innovation in product development and keeping core competences in-house is a viable strategy

1 2 3 4 5 6 7

- In a few instances, partial or even full outsourcing of innovations in product development neither weakens nor strengthens in-house R&D

1 2 3 4 5 6 7

- Any other type? Please specify

-

_____

_____

20. In my view, outsourcing innovations in product development does not affect the company's own R&D capabilities

1 2 3 4 5 6 7

21. Protecting the company's core competence through strict policies and procedures is important for the company

1 2 3 4 5 6 7

22. In your opinion, outsourcing core competence is a threat to the company's intellectual property, and the threat to our company's intellectual property is high

1 2 3 4 5 6 7

23. In your own opinion, outsourcing R&D is a threat to the company's R&D capabilities

1 2 3 4 5 6 7

24. In my view, outsourcing innovations in product development is always a dilemma for the company's overall strategy

1 2 3 4 5 6 7

Section IV

Solutions to Keep the Company's R&D Capabilities intact

The following statements are designed to help us understand your perception about the best-possible solutions to keep the company's R&D capabilities intact and competitive in the industry, with respect to the outsourcing of innovations in the product development process. Based on your observation and opinion, please circle the appropriate number to rate the extent to which you agree or disagree with each statement.

1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=neither disagree nor agree, 5=somewhat agree, 6=agree, 7=strongly agree

25. Progressive or proactive R&D is required to avoid outsourcing of innovations in the product development process

1 2 3 4 5 6 7

26. To be aligned with industry trends, the company should support the outsourcing of innovations in product development

1 2 3 4 5 6 7

27. In your opinion, it is better to outsource supportive innovations

1 2 3 4 5 6 7

28. In your opinion, it is better to keep the company's core competences and own R&D capabilities intact

1 2 3 4 5 6 7

29. What are the most important factors in your view in the selection of contract research organizations or outsourcing providers (you can select more than one option)?

a) The provider must have a good reputation in the industry in terms of R&D

1 2 3 4 5 6 7

b) The provider must be flexible in adjusting to the changing needs of the company

1 2 3 4 5 6 7

c) The provider should have up-to-date technological resources

1 2 3 4 5 6 7

d) The provider must have a long-term relationship with your company

1 2 3 4 5 6 7

e) There must be no huge cultural differences between providers and your company

1 2 3 4 5 6 7

f) There must be no huge institutional differences between providers and your company

1 2 3 4 5 6 7

g) The *provider country* should have strict policies on intellectual property rights

1 2 3 4 5 6 7

h) The *provider itself* should have strict policies on intellectual property rights and leakage of information

1 2 3 4 5 6 7

i) The provider should be cost-effective

1 2 3 4 5 6 7

j) Protection of core competences and the company's R&D is the most important factor

1 2 3 4 5 6 7

30. Do you have anything else to say about the overall process?

_____
_____
_____
_____
_____
_____
_____

(You have completed the survey - thank you for your feedback)