



NTNU – Trondheim
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Developing and protecting intellectual property in virtual projects

Trade secret protection in
Telecommunications

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Project Management

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Summary

This thesis is intended to develop a comprehensive understanding of how trade secrets can be used as a means to protect knowledge developed through projects conducted in the telecommunications sector. At the same time, the study explores which mechanisms should be employed to regulate access and utilization of trade secrets when their disclosure is inevitable to accomplish project requirements. Telecommunication firms are large and globally distributed organizations whose business operations rely upon interoperability and close collaboration with different parties. This suggests that conducting virtual projects crossing national and cultural boundaries, and sharing information for future survival and development, are common practices within this industry.

Research around intellectual property issues in the area of project management in general has been poorly developed. At the same time, studies have been conducted towards patenting as a means to protect technological knowledge in telecommunications whilst trade secrets have not been contemplated by the academia. The purpose of the investigation is to contribute to a certain degree with new knowledge as a basis for future studies in the field. In order to achieve this, an extensive literature review of the three relevant theories to the study is carried out: trade secret protection, virtual project literature and intellectual property rights in telecommunications. The empirical data collected through interviews and document analysis serve as a basis for assessing the results of the literature study.

This thesis is mainly divided into 4 sections. In the first section, the *methodology* of the study is widely described, which follows a qualitative approach. The research design is explicated including a brief discussion of how the research questions were defined. The data collection process is also presented along with the interview guide model, the narratives from the interviews conducted and the document analysis as a supplementary method. Reliability and validity issues of the study are described in the last part of this section.

The second section illustrates the *literature study* of this thesis. The theoretical framework is built upon three different approaches associated with the previously mentioned theories. Literature review on the topic of trade secrets as a means to protect intellectual property is presented, comprising the role of trade secrets in virtual projects and common protection mechanisms. Factors affecting trade secret protection when working along with collaborative partners in a virtual project setting are outlined. Theory that discusses the core issues of intellectual property rights in telecommunications is also presented. Finally, the main



findings from the literature are summarized in a proposed theoretical model which revolves around the life cycle of the project. A distinction between shared and created information that is or might be catalogued as a trade secret is described in the model.

The third section introduces the *data analysis* of the investigation. It is based on literature findings and the empirical part encompassing 3 interviews and document analysis. Experiences from practitioners and important issues found in the document analysis are presented in order to elaborate an empirical basis for the discussion. Furthermore, implications encountered between theory and practice are exposed discussing differences, similarities and new contributions.

The fourth and last section of this thesis includes the *discussion chapter and the concluding remarks*. The information presented in the discussion is based on the empirical and theoretical findings, and is classified in two parts. Factors regulating trade secret disclosure before, during and after project execution constitute the first part of the discussion. Trade secret as an instrument to secure future innovations in telecommunications represents the second part of the discussion. An enhanced model is illustrated covering the results from this chapter.

This model comprises factors influencing the protection of confidential information considered as trade secret across the life cycle of the project, and evaluates the extent to which trade secrets can be used to secure future innovations developed along with collaborative partners within a virtual project setting. Limitations of the study and suggestions for further research are also addressed. This section ends with the conclusions of the study, where the problem statement is revisited in order to examine to what extent the research questions have been answered throughout the course of this thesis.



Preface

This master thesis is the final assignment of my master studies in Project Management at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway. This thesis was written in the department of Industrial Economics and Technology Management (IØT) during the spring semester of 2012.

Personally, I feel really satisfied for having conducted my investigation in a largely unexplored area within the field of project management: *intellectual property*. This study is carried out in the telecommunications sector and focuses on trade secret as a mechanism for regulating technical knowledge that is developed and shared in a virtual project setting. Throughout the course of this thesis, I found the subjects discussed both challenging and fascinating and I believe that my contribution might encourage further academic research in the field.

I would like to express my gratitude to my academic supervisor, professor Bjørn Otto Elvenes, for his guidance and support during this thesis. I truly appreciate his valuable knowledge, his large collection of literature and his personal thoughts that helped me shape the focus of my research. I would like to thank Haakon Gjems and Magnus Hakvåg for facilitating the empirical data collection for this thesis. They also provided me with enriching experiences around intellectual property issues in practice. I also want to thank the interviewees for their time and contribution in my research.

Last but not least, I would like to thank my parents, Gildardo and Luz Nelly; my sister, Ana Maria; and my significant other, Anne: without your constant support and advice this thesis would not have been possible. Thank you for always believing in me.

NTNU, 9.June 2012.

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List of Abbreviations

IP	Intellectual Property
IPRs	Intellectual Property Rights
ICTs	Information and Communication Technologies
KMS	Knowledge Management System
CoPs	Communities of Practice
GDTs	Geographical Dispersed Teams
TRIPS	Trade-Related Aspects of Intellectual Property Rights
NDA	Non-Disclosure Agreement
TSPPs	Trade Secret Protection Procedures
ARs	Trade Secret Access Restriction Procedures
HPs	Trade Secret Handling Procedures
NCA	Non-Compete Agreement
APs	Assignment Provisions





1. Introduction

Over the last 30 years, project management has become an indispensable factor that determines the success of an organization. In today's competitive business environment, organizations necessitate dynamic and effective processes in order to provide solutions aligned with customer requirements. Owing to the development of information and communication technologies, firms have achieved substantial levels of internationalization that allow them managing business activities in a global market place.

This indicates that conducting project activities in a virtual setting across national, cultural and legal boundaries constitutes a common exercise, which has attracted increasingly attention both in academic circles and in business practice. Results from my specialization paper, which purpose was to explore the main components affecting project performance in geographically dispersed organizations, illustrate that knowledge management is considered as an essential aspect towards project success over a virtual environment.

Knowledge represents a valuable and intangible resource that also serves as a vehicle to attain a competitive advantage. Therefore, it is important to develop integrated security programs aimed at protecting and promoting that knowledge wherein intellectual property plays a prominent role. The objective of this thesis is to uncover further insight in the field of knowledge management as a continuation from my previous research, by focusing on intellectual property development in a virtual project setting. For this purpose, the study explores trade secrets as mechanisms to protect intellectual property in telecommunications, considering technological knowledge and partner collaboration in particular. The industrial sector selected for this thesis is the telecommunications sector as most telecommunications firms are geographically dispersed organizations, which suggests that they conduct virtual project activities on a regular basis. In addition, I feel rewarded culminating my master studies with this thesis that associates part of my technical background in telecommunications with project management and intellectual property.

Despite of the fact that research around intellectual property issues in the area of project management has been poorly developed and the majority of studies have been directed towards patenting as a means to secure technological knowledge in telecommunications, this thesis is intended to contribute with new knowledge as a foundation for future studies regarding sharing and protection of trade secrets within this industrial sector.



The research follows a qualitative approach and consists of an extensive literature review of the three theories relevant to the investigation: trade secret protection, virtual project literature and intellectual property rights in telecommunications. The empirical data is collected through 3 interviews and document analysis. The results from the literature analysis are synthesized in a proposed model covering factors influencing the protection of trade secrets before, during and after project execution. This model also examines the extent to which trade secrets can be used as instruments to secure technological knowledge developed in virtual project setting.

The empirical findings discussed in the fourth chapter illuminate the subjective meanings of the phenomenon being studied in this thesis. As a result, the theoretical model is improved with such data and illustrated in the discussion chapter. This model aims to address the problem statement of this investigation by providing answers to the research questions. The methodology chapter presents a broad explanation of how these questions were defined including the background of the research process.

I became aware of the great importance of intellectual property in project management through discussions with practitioners and intellectual property researchers from NTNU. Despite of the limitations and challenges encountered during the investigation, I believe that my thesis provides a new perspective when it comes to formulate intellectual property initiatives in telecommunications and my contribution might encourage further academic research in the field.



2 Methodology

This chapter describes the methodology used in my thesis. First, the research design is presented including the research questions of the study and their relevance in the investigation. The choice of method and the research process used in my investigation are also discussed. After that, I introduce the data collection process which explains the kind of data my thesis is based on, how such data has been acquired and the challenges faced during said process. Reliability and validity issues of the study will be presented in the last part of the chapter.

2.1 Research design

Maylor and Blackmon (2005) define research as a “*systematic process that includes defining, designing, doing and describing an investigation into a research problem*”. The authors associate this process with problem identification including delimitation and context definition, understanding the relevant information to address the problem, collecting information and interpreting said information within the context in which it is involved. Finding the problem statement and the research questions for my master thesis was a difficult undertaking. I decided to continue working on *knowledge management in virtual projects* which was the topic developed on my specialization project from last semester. Then, I received multiple suggestions from my supervisor and one of them caught my attention: the idea of relating intellectual property in a virtual project setting as a mechanism to secure knowledge. This seemed really interesting and challenging.

I started reading some books and articles about intellectual property in order to become acquainted with the topic, particularly in technology business since my notion was to combine this study with my technical background in telecommunications. After having analyzed the role of intellectual property in high-tech industries, I decided to direct my investigation towards trade secret protection as I found the topic both fascinating and crucial for maintaining a competitive advantage in the industry. This was an investigative approach, trying to understand and describe the problem being studied. Then, I tried to gather information associated with intellectual property within project management but I experienced difficulties due to the small number of studies covering this topic.

Yin (2008) claims that the research design contemplates a linear but iterative process involving recurrence. Figure 1 illustrates the research process where 6 stages can be identified: *plan, design, prepare, collect, analyze and share*. This process implies that as

more information is collected and analyzed, the research questions become more defined (from a broad to a narrow perspective).

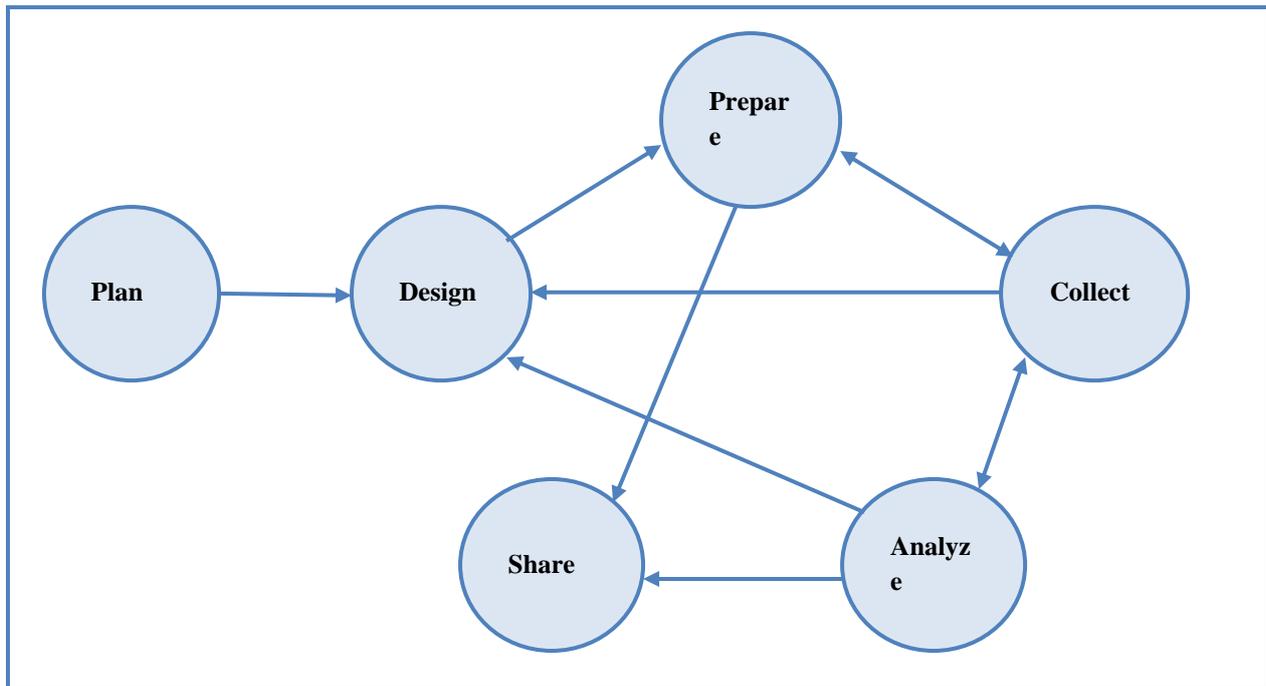


Figure 1. Research process (Adapted from Yin (2008))

I made use of the model depicted above to elaborate the problem statement of my thesis. At the conception a research plan was designed and then the information was collected and analyzed. Limitations and contributions encountered from the literature were discussed which regularly changed the path of the research design. This is a repetitive and iterative process as mentioned before; it is possible to re define the problem statement when collecting or analyzing more information. At this stage I visualized my research as a two-stage process comprising of a literature study and an empirical investigation afterwards.

I defined my research questions when all the relevant documentation had been revised. A proposal was sent to my supervisor for approval and after receiving his feedback, the research questions were improved. These are as follows:

How do telecommunication firms that conduct virtual project activities along with collaborative partners implement intellectual property practices aimed at securing information considered as trade secrets before, during and after project executions?



How, and to what extent, does trade secrecy constitute a feasible alternative to substitute or complement patents in the telecommunications sector to secure technological innovations developed along with collaborative partners in a virtual project setting?

The first question focuses on how organizations involved in the telecommunication industry secure information regarded as a trade secret when conducting project activities in collaboration with virtual teams and other participating firms. The idea is also to identify organizational practices aimed at protecting trade secrets before, during and after project execution. I might argue that disclosing technical knowledge considered as trade secrets when collaborating with other firms is, under certain circumstances, crucial to accomplish project requirements. Then, it becomes important to implement initiatives aimed at handling trade secret disclosure in the proper way.

The second question was derived from the literature review in the telecommunications field. According to the analysis carried out, the telecommunications industry is dominated by patents when it comes to protecting technical knowledge. Therefore, one of my objectives is to understand why patents are widely used and how trade secrets might represent a feasible alternative to complement or substitute patents in future innovations. At the same time, it is intended to investigate how the jointly intellectual property (IP) ownership issue can be ameliorated when working along with collaborative partners. It should be noted that virtual project theory and collaboration plays an important role here since much of these innovations are developed by means of projects crossing national and cultural boundaries.

The theoretical analysis of my thesis embraces 3 separated but interconnected theories: trade secret protection, virtual project literature and Intellectual Property Rights in telecommunications. This means that a new theory will be developed and might constitute the foundation for future investigations. Hart (1998) points out that in academic research, the objective is not to reproduce previous studies but to make a new contribution, no matter how small, so as to reach a better understanding of the world we live in. The author stresses the importance of *demonstrating originality* as the ability to do something that no one has done previously. I might argue that my study comprises, to some extent, some sort of originality owing to the fact that no one, as far as I could notice, has already investigated trade secret protection in virtual projects conducted within the telecommunications industry. Even though my thesis is based on an existing set of theories and ideas, it does not replicate what other scholars have already done. The interrelation of the 3 theories previously mentioned is a

difficult but challenging task that represents a creative manner to investigate the phenomenon described along with the context in which it is involved. Figure 2 presents map associations in definitions of originality.

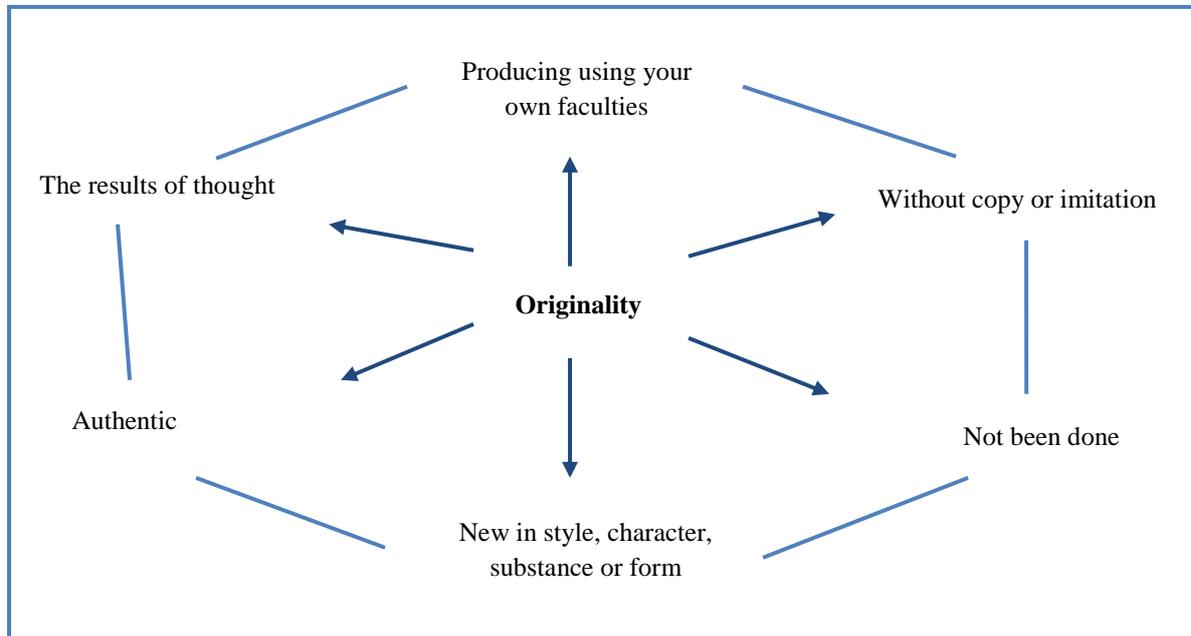


Figure 2. Map associations in definitions of originality (Hart, 1998)

In addition, Phillips and Pugh (1994) classify nine definitions of originality where the following ones are associated with my investigation:

1. *“Using already known ideas, practices or approaches but with a new interpretation;*
2. *Creating new synthesis that has not been done before;*
3. *Looking at areas that people in the discipline have not looked at before;*
4. *Adding to knowledge in a way that has not previously been done before”*

One of the purposes of this chapter is to create and explain methodologies and approaches so as to attain this within a scientific framework. As mentioned before, previous studies were analyzed to understand the relevant theories on my thesis. Then, new interpretations were reached by combining the three theories and the results are illustrated in a proposed theoretical model which is improved thanks to the empirical data collected. Despite that the relevant theories discussed on this thesis are different; they can be combined as they are based on the same paradigm of perception of reality. New insight was created that led to the elaboration of an interview guide based on trade secret protection in within a virtual project



setting in telecommunications, considering partner collaboration. This constitutes a new research area within knowledge protection in project management. Therefore, the purpose of my thesis is to contribute to a certain degree with new knowledge as a basis for future studies.

2.1.1 Choice of method

A qualitative approach has been selected as the research method for this thesis. Fosset *et al* (2002) provide the following definition of a qualitative research: “*a broad umbrella term for research methodologies that describe and explain person’s experiences, behaviors, interactions and social contexts without the use of statistical procedures or quantification*”. The authors argue that the participant perspectives in the research process should be represented in an authentic manner along with the interpretations made from the information collected. In addition, the findings must be coherent in such a way that they accommodate the data and the social context in which they were acquired.

Qualitative research is largely done through observations, documents and the implementation of interviews (Yin, 2008). After having finished the literature review, which constitutes the basis of my investigation, I started developing an interview guide which is focused on semi-structured interviews. This choice was made because Bryman and Bell (2011) underlines that the interviewee has a great deal of flexibility in how to respond to the questions covered in the interview guide. This implies that it is possible to discuss in more detail particular issues that might be interesting for the investigation. In addition to the interviews, some documents provided by the interviewees were analyzed.

Fosset *et al* (2002) indicate that it is crucial to deal with the issues of *congruence, appropriateness and adequacy* when it comes to present and interpret the findings in a qualitative study. A detailed description of the methods used including an explanation of the way the study was carried out along with the researcher’s reasoning, must be done. This chapter aims to satisfy these requirements. The data collected through practice illuminates the subjective meanings of the phenomenon being studied and serves as a basis for evaluating the results of the literature study. It is important, thus, to have a robust interview guide involving all the relevant topics that are congruent with the research questions.

2.1.1.1 Interview guide

The interview guide was developed based on the results of the literature study as earlier mentioned. It consists of three sequential blocks: *trade secret as a means to protect intellectual property, trade secret protection in a collaborative project setting and*

intellectual property rights in telecommunications. There is also an additional question associated with trade secret strategy which was discussed only with people involved in IP strategy. The interview guide can be found in the last section of this thesis (Appendix A1).

Figure 3 illustrates the model implemented to construct the interview guide which includes the 3 blocks and their main characteristics. The interview guide was developed in such a way that it corresponds to the literature study flow, that is, the first topics related to trade secret understanding and protection mechanisms are included within the first block. The second block incorporates collaborative work in project activities and virtual project literature. Intellectual property practices in telecommunications are comprised in the third block, making a comparison between patents and trade secrets across different perspectives. It should however be emphasized that the term *collaborative setting* was implemented in the second block as telecommunication firms rely to a large extent on close collaboration with different organisms. Therefore, questions regarding trade secret protection in a collaborative setting were formulated and subsequently the discussion revolved around virtual projects. Finally, trade secrets within the IP strategy are discussed. It should be noted that the structure of the interview guide was subject to several modifications as I received recommendations from my supervisor.

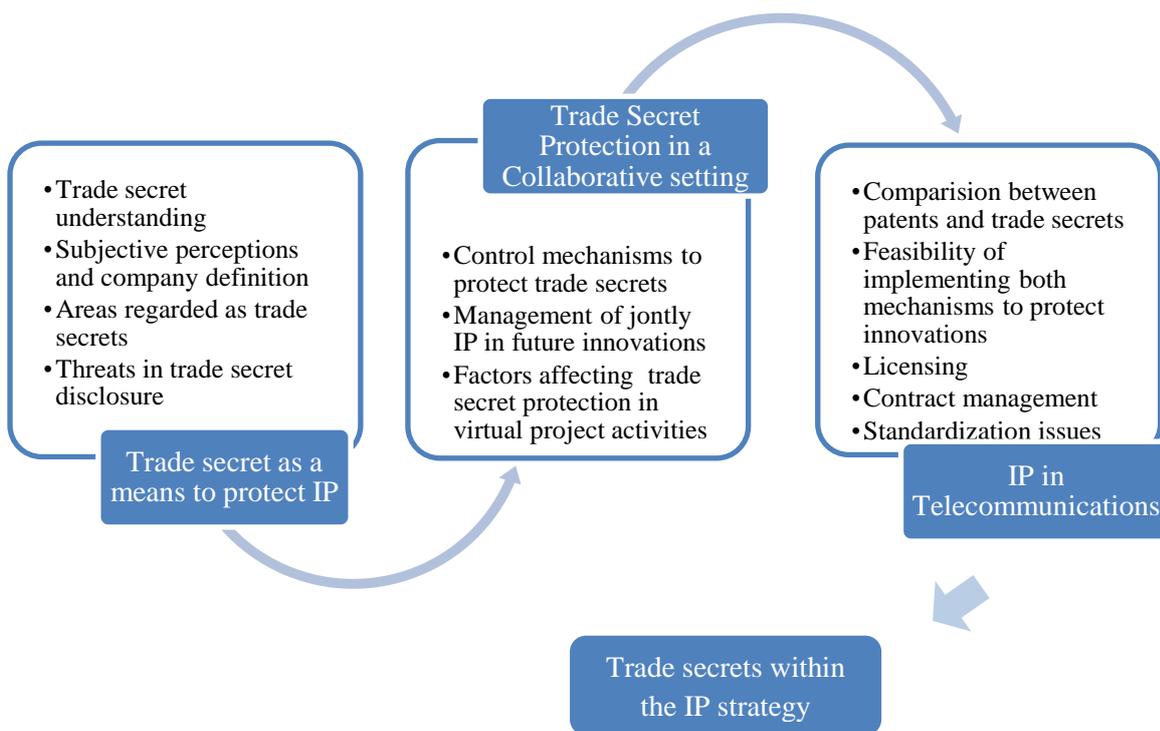


Figure 3. Interview guide model



2.1.2 Research design process

A research process can be perceived as a project with four main stages: project definition, project design, project execution and project description (Maylor and Blackmon, 2005). The table 1 shows the characteristics of these stages.

Stage	Major outputs	Form
1. Project Definition	Research topic, research problem, research questions	Project proposal
2. Project Design	Methods for gathering and analyzing evidence and testing knowledge claims	Research design
3. Project Execution	Knowledge claims, evidence, analysis and interpretation	Findings
4. Project Description	New knowledge	Project report

Table 1. The four stages of the research process (Maylor and Blackmon, 2005)

The research process of my investigation followed, to some extent, the sequential model previously discussed. In the project definition stage, the problem statement was formulated along with the research questions. I then wrote a two-page document describing the presentation of my thesis. When my supervisor approved my thesis proposal, I started discussing the theoretical background of my thesis and after that, I developed an interview guide and decided to collect empirical data by conducting semi-structured interviews in order to attain reliability and to test the results against the theoretical findings. The project execution stage has to do with analyzing and interpreting my findings which are described in the data analysis and discussion chapters respectively. The results of my study provide new knowledge associated with intellectual property in project management, particularly in virtual project activities conducted in the telecommunication sector. It must be noted that limitations of the study and suggestions for further research are described as well.

The next section provides, in more detail, a discussion about the data collection process that includes literature review, interviews and document analysis. Challenges encountered in such process are also discussed.

2.2 Data collection

The data gathering process consists of an exhaustive literature study and empirical material acquired through interviews and document analysis. It must be noted that the results of the literature study were used to develop the interview guide that constitutes the backbone of the qualitative research. In this section, the literature process and the narratives from the interviews are presented. In the last part it will be discussed how the documents provided by the interviewees were analyzed.

2.2.1 Literature study

According to Hart (1998), a literature study comprises the selection of accessible documents related to the topic which include information written from a particular perspective to attain certain objectives, and the manner the topic is being investigated including the proper assessment of these documents compared to the research problem being proposed. Tjora (2010) presents a similar argument with respect to literature analysis and stresses that all theoretical documents have been written in a definite time and place with their own purposes. As a result, the documents selected in a literature study possess their own specific intentions and its level of generalization is considered low. This represents one of the major limitations in literature studies.

My supervisor provided me with valuable literature within the field of trade secrets and intellectual property rights in the technology business. More information was gathered thanks to the databases available at NTNU. As the study progressed the research questions got narrower and redefined. Since my investigation encompasses three different but interconnected theories, one of the biggest challenges consists of finding correlations between these theories after having analyzed each theory separately. Issues like incompatibility between theories, conflicts associated with theory and practice and different perspectives may emanate.

When searching for relevant literature I realized that there is not a clear differentiation between the terms “*virtual projects*” and “*dispersed projects*” nor between the terms “*virtual teams*” and “*geographical dispersed teams*”. In my thesis, I assume that virtual projects and dispersed projects and also virtual teams and geographically dispersed teams symbolize identical interpretation respectively.

The theoretical background presented in this thesis illustrates the analysis of the literature. After selecting and reading all the theories relevant to my study, I gathered the concepts I



considered relevant from each scholar and started writing my analysis. Authors with similar approaches were discussed and compared against opposing theories. It is important to gain knowledge from previous studies in order to create a solid insight, but at the same time it becomes essential to apply a critical perspective. Therefore, I tried to express my personal reflections right after discussing the main concepts including the relationships encountered among the three theories relevant in the study.

A theoretical model is proposed which covers the results from the literature review and it is intended to add new contributions to the literature. The model is improved thanks to the results obtained from the interviews and the analysis of documents. This is described in the discussion chapter.

2.2.1 Interviews

Bryman and Bell (2007) point out that the interview constitutes the most commonly used method in qualitative studies. The authors recognize that the process of interviewing, the transcriptions of interviews and the analysis of the results are, to some extent, time consuming; however there is a great benefit because such procedure can be more readily adapted into the researchers' personal lives. An interview guide was developed as explained before which follows the recommendations of Bryman and Bell (2007) allowing some flexibility when asking questions to the interviewees. The interviews were conducted on a semi-structured manner since it becomes easier to understand the interviewees' perceptions by adjusting the interview questions according to the answers provided in real time. In addition, this interview process permits the interview to flow in a flexible mode between the two parties.

It was planned to conduct more than three interviews but, due to time constraints and problems in finding people involved in IPRs within telecommunications, it was not possible to interview the amount of people I had foreseen. Analyses of some documents given by two of the interviewees were used as a supplementary method in the research. It is important to explain how the narratives are constructed for each interview, thus, the manner in which the interviews were developed and the challenges faced are described as follows:

[Interviewee 1] Interviewee 1 is an Intellectual property manager with broad experience of IP strategy in Telecommunications. He works in a Norwegian consultancy firm that assists organizations in designing and implementing solutions to issues related to Intellectual



property rights. In addition, this person has relevant knowledge about IP in project management. I sent via email my thesis proposal and two weeks after I got a reply. Interviewee 1 stated that the topic was interesting since the company works with trade secrets as a complement to patenting and other forms of IPR. The organization is located in Oslo, so it was difficult to conduct a personal interview but the good thing was that I had to travel to Oslo within those days, and I suggested having a meeting on his office. Unfortunately interviewee 1 had a busy schedule during the time I was in Oslo, and he agreed to give a formal phone interview within one week. I proposed to meet on Skype since it becomes easier to take notes and the quality signal is sometimes much better than that of the mobile network. Interviewee 1 provided me with his Skype account and I called him right before the interview was about to start. He was experiencing problems with his Skype account therefore we conducted a normal phone interview. I started writing as much information as I could remember but after having discussed the first four questions, Interviewee 1 said that the problems with his Skype account had been solved which made possible the use of tape recorder. The interview turned out to last for one and a half hour instead of the one I had expected. At the end, I was really satisfied with the interviewee's contribution in my research. Right after the interview was finished I wrote a seven-page long document containing the transcription of what had been discussed and then I sent this document to Interviewee 1 for comments.

[Interviewee 2] Interviewee 2 has more than 20 years of professional experience as legal advisor in public and private organizations. One of his specialties has to do with IP management within international research contracts and since virtual project activities span across cultural and geographical dimensions, the management of international contracts becomes an important issue in my investigation. Interviewee 2 currently holds a position as a legal advisor for a higher education institution in Norway. Despite that Interviewee 2 does not have extensive experience about IP in telecommunications, he has been involved in managing of IP in collaborative research projects. I contacted Interviewee 2 by email as a suggestion from my supervisor. He replied right away and accepted helping me on the investigation as he was intrigued by the topic. His office is located in Trondheim, so I was able to conduct a face-to-face interview. Interviewee 2 has extensive knowledge within IPRs, so, I tried to collect a substantial amount of information by asking general questions about trade secrets in particular. After this, I started the formal interview which was prolonged much more than any of us had foreseen. The interview lasted for two hours; a long time,



especially since we do not discuss some aspects related to IPRs in telecommunications. The conversation became friendly from the first moment but I experienced problems with data acquisition as I was not allowed to record such data. Interviewee 2 felt more comfortable without the use of tape recorder, so, I tried to take notes of all that was discussed during the interview. As soon as the interview was finished, I came back to my study desk at NTNU and started writing a document trying to remember as much as possible. Then, the document was sent to Interviewee 2 for comments.

[Interviewee 3] Interviewee 3 works for a prestigious Norwegian law firm that is currently positioned as one of the leading firms in intellectual property law. This person has extensive experience in IPR strategy within telecommunications and has also provided advice in projects with respect to the purchase and sale of IPRs. After having seen my thesis proposal and after having presented myself, she agreed to participate in a formal phone interview since she lives in Oslo. Initially the idea was to provide interviewee 3 an overview of topics to be discussed in the interview. I finished the interview guide two weeks after my conversation with interviewee 3 and I sent it out by email. I decided to make a phone call to arrange the interview and I left a voicemail suggesting a tentative date for the interview as she was occupied at that time. One week later I was able to contact interviewee 3. She said that she had been really busy during those days and we agreed to hold a formal phone interview that day. As with interviewee 2, it was not possible to have recordings of the data, so, I relied on my notes once more. The block corresponding to IP in telecommunications and IP strategy was discussed in more detail due to the broad experience this person has within those areas. Valuable information was acquired during the interview that lasted for 1 and a half hour. When the phone interview was finished, I sat down immediately and wrote a five-page document including my notes and all that I could remember from the interview. The document was sent to interviewee 3 for comments and she replied 2 hours after I had sent the file. She made a few corrections and added some information that I could not capture with my notes. The next section describes the analysis of documents as complementary method for the qualitative research.

2.2.2 Document analysis

Documents such as personal documents, official documents from public and private organizations and mass media outputs are recognized as valid sources for construction of empirical material in a qualitative research. (Bryman and Bell, 2007; Yin, 2008). On one

hand, some relevant documents relating to IPR issues in project management were provided by interviewee 1. On the other hand, the implementation of IPR within telecommunications was discussed in some documents given by interviewee 3.

2.3 Reliability and validity

Yin (2008) recognizes reliability and validity as key elements when assessing the quality of the results in a qualitative research. The following section aims to describe reliability and validity issues of my research by using the following framework from Harvey and Blackmon (2007):

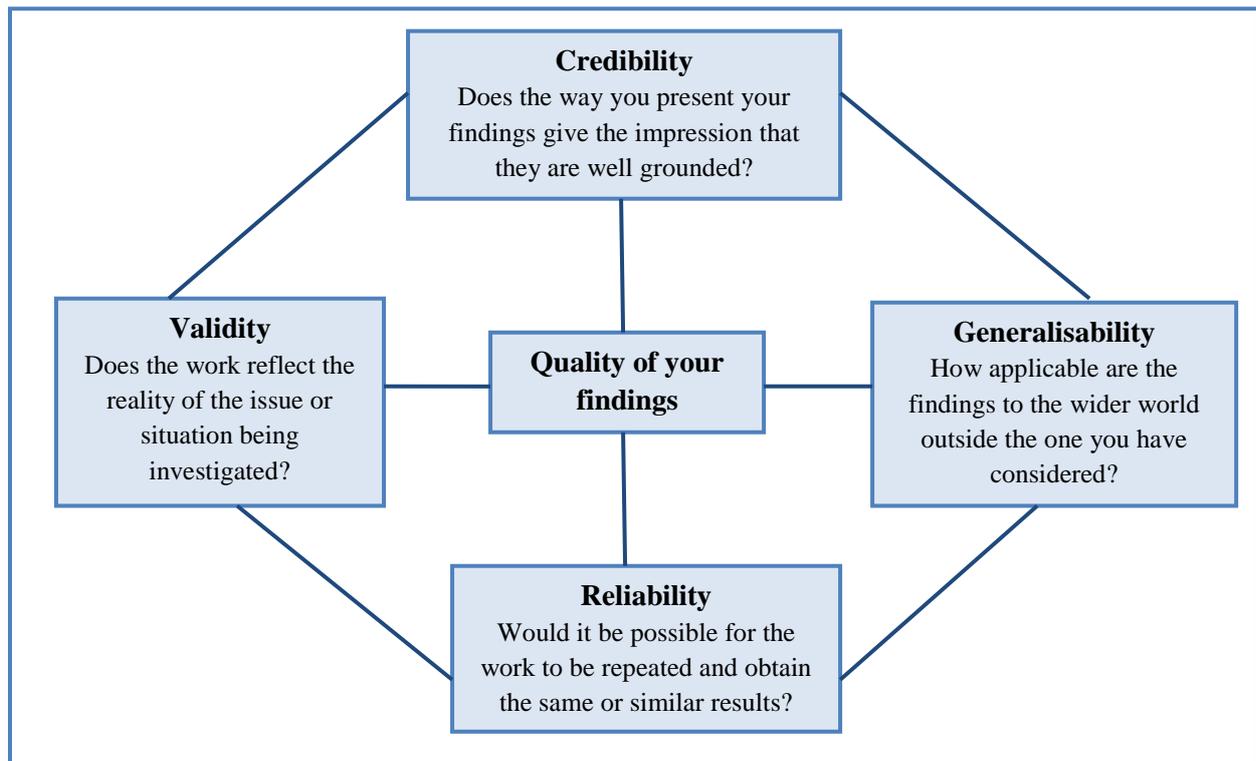


Figure 4. A framework for assessing the quality of qualitative research (Harvey and Blackmon, 2005)

The likelihood that another researcher would have obtained the same or similar results using the same research method is, to some extent, low. This is because of the context-sensitive nature of a qualitative study where situations, people and dynamics change as time progresses and for that reason, the perceptions from the people interviewed and the analysis of documents rely upon the context. The reliability process is also known as replicability and since it is quite unlikely to replicate my study, I try to document my methodological process in this chapter and provide a solid explanation of how my data were collected.



I secured reliability by elaborating an interview guide which was approved by my supervisor. The questions were also sent to the interviewees before each interview so that they became acquainted with the concepts to be discussed. During the interview I use tape recorders or took notes when recording was not an option. After conducting the interviews I elaborated the transcriptions of what had been discussed and sent them to the people interviewed for comments and improvements.

Harvey and Blackmon (2007) define validity as “*the extent to which you have captured the underlying truth of the situation and not been misled by particular influences*”. Yin (2008) states that researchers must secure *reliability, construct validity, internal validity and external validity* in order to guarantee that the study is well constructed. When it comes to secure internal validity, which is the definition of validity given by Harvey and Blackmon, I tried to maintain a *chain of evidence* making my conclusions based on previous knowledge. In other words, the conclusions from my literature review represent the starting point of my qualitative research. Construct validity refers to the correct implementation of the operational measures for the issues being studied (Yin, 2008). In order to use the adequate measures in my study I started analyzing previous research to see how the issues my research was focused on had been defined and analyzed by other scholars, and then I made use of theoretical models as a starting point. At the same time, I tried to use as many data sources as possible but I experienced problems trying to collect such data because it was difficult to recruit people involved in IPRs in telecommunications. I began conducting interviews within the first week of May.

The degree to which the results from this study are generalized is not easy to illustrate. Yin (2008) associates the term *generalization* with external validity. The research is directed towards trade secret protection in virtual projects conducted within the telecommunications sector encompassing a literature study, 3 interviews and document analysis. I might argue that if there is a level of generalization it can be applicable to organizations involved in telecommunications and also standard-based firms embedded in the technology business such as IT. However, due to the small size of the sample (3 companies studied) the findings from my research might be unrepresentative. On the other hand, the people interviewed based their answers on experiences and insights from a multitude of projects, increasing the probability that the empirical data are relevant for more than one organization and one context.



It must be noted the importance of assessing the credibility of any qualitative study. Harvey and Blackmon (2007) argue that credibility can be attained by presenting evidence supporting the results of the study including examination from multiple data sources. In the chapters corresponding to the data analysis and the discussion I, thus, present the findings of my research making a comparison between theory and practice, identifying key pieces of data and providing suggestions for further investigation.

2.4 Summary

This chapter presents the methodology used in my thesis. The research design is explicated including a brief discussion of how the research questions were defined and their relevance in the investigation. Then, the research method which follows a qualitative approach is described. The data gathering process was also presented along with the challenges faced during said process. It encompasses an exhaustive literature study and empirical material including semi-structured interviews and document analysis as a supplementary method. The interview guide model is then illustrated which was built upon three sequential blocks: trade secret as a means to protect intellectual property, trade secret protection in a collaborative setting and intellectual property rights in telecommunications.

It is important to explain how the narratives were constructed for each interview, thus, the manner in which the interviews were developed and the challenges faced are also described. Reliability and validity issues of the study are outlined in the last part of this chapter.



3 Theoretical Background

As Tjora (2010) indicates, the utilization of documents (e.g. journals, papers, books, reports) constitutes an essential part in most research projects. Therefore the literature review presented on my thesis comprises a deep analysis of the three theoretical fields relevant to the investigation: trade secret protection, virtual project literature and intellectual property rights in the telecommunications sector. However, as explained in the methodology chapter, I experienced difficulties when attempting to examine the role that intellectual property plays in project management, particularly in virtual projects. According to the literature available, intellectual property has been poorly related to a virtual project setting. In all the databases and literature used for my research I could not find any scholar covering this topic.

At the same time, research has been directed towards patent development in telecommunications whilst trade secret protection within this industrial sector has not been contemplated by academic circles. I might argue that patents play an important role when securing technical innovations since the literature analyzed was focused on the technical field. This represents challenges when it comes to associate the main concepts of these theories in the elaboration of my theoretical background. In order to create a solid insight, the literature study is conducted in such a way that all the three theories are interrelated resulting in new theory that might become the basis for further studies in the field.

The theoretical background is divided in three sections. To begin with, the concept of trade secret is defined and the role of trade secrecy in virtual projects is explored emphasizing on the importance of capturing and protecting knowledge. The impact that trade secrets play in today's globalized business is also presented including the common ways of protecting trade secrets from employees and third parties. Finally, factors influencing trade secret protection will be described, especially in a virtual project setting.

The next section discusses the intellectual property rights in the telecommunications sector. First, the conflict between intellectual property and standardization is discussed. These concepts symbolize different connotation. Then, the study explores why patents are employed as the main mechanisms for protecting technological knowledge in telecommunications. In this section, advantages and disadvantages of using patents and trade secrets will be discussed including the feasibility of implementing both mechanisms in combination to protect IP. This section ends with a brief overview of the current patent system. The third and final section provides suggestions for developing trade secret practices within the organization

incorporating the most important findings from the literature study. For this purpose, a theoretical model is proposed and explained. This model comprises factors influencing the protection of confidential information considered as trade secret across the life cycle of the project, and evaluates the extent to which trade secrets can be used to secure future innovations developed along with collaborative partners within a virtual project setting.

As previously stated, the theoretical background is built upon 3 different approaches wherein each one of them adds its contribution to the investigation and the relations encountered are analyzed. Figure 5 exhibits the theoretical framework to be utilized. Nevertheless, it must be noted that challenges might arise due to incompatibility between theories, different perspectives and conflicts between theory and practice.

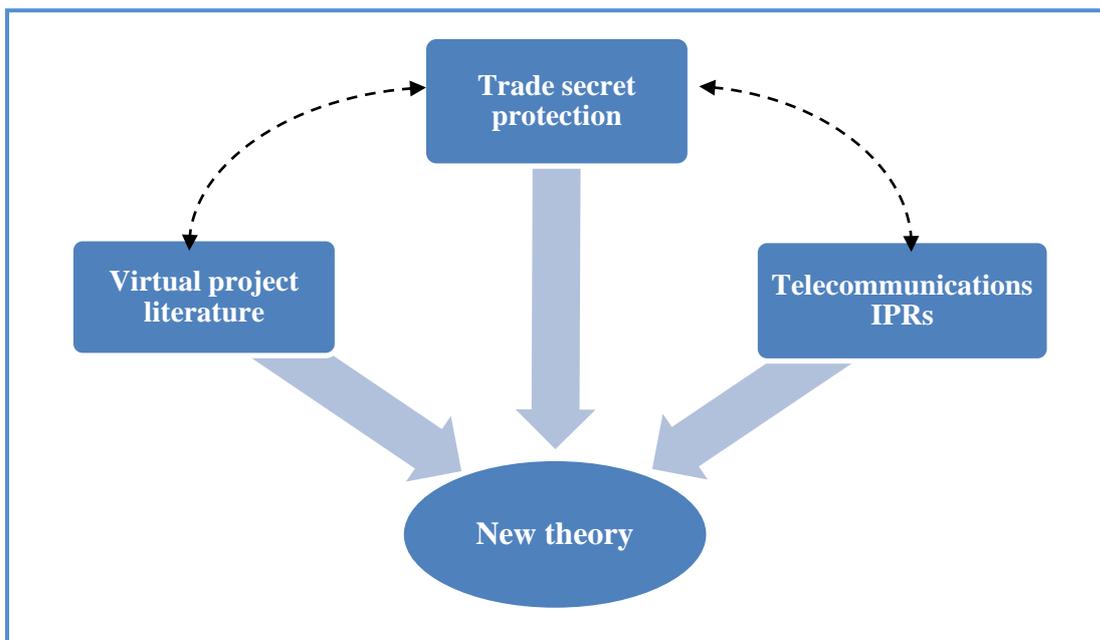


Figure 5. Theoretical framework

3.1 Trade Secret as a means to protect Intellectual Property

The World Intellectual Property Organization defines Intellectual property as “*the broadly creations of the human mind such as inventions, literary and artistic works, and symbols, names, images, and designs used in commerce*” (WIPO, 2012). The purpose of intellectual property is clearly indicated by Yang (2008) as the protection of the interests of inventors by providing them intellectual property rights to their creations. Various mechanisms to protect intellectual property can be encountered such as trademarks, copyrights, industrial designs, patents and trade secrets.



Trade secrets are recognized as instruments to secure intellectual property; they are, without doubt, a creation of the mind. But at the same time, trade secrets might be perceived outside the limits of the IP system because the information cannot be divulged in exchange of protection. That is why the heading of this section can be seen in two different perspectives and might be contradictory.

In high technology industries, firms make use of trade secrets as one of the several mechanisms to secure intellectual property (Hemphill, 2004; Hannah, 2005). One suitable alternative to protect valuable information that confers competitive advantage might be the utilization of trade secrets when it is not recommendable to file for a patent owing to weak patent systems or imminent risks associated with disclosing. At the same time, we might argue that a patent can be surrounded by trade secrets making it very difficult to understand and apply without access to such trade secrets. This is because a patent rarely covers an entire product or service. The production of the whole product might involve several patents, extensive tacit knowledge and information that cannot be disclosed through patents or other means.

It is important to discuss henceforth what a trade secret is and what kind of information is cataloged as a trade secret for this investigation. The next section presents briefly the definition of the concept and the development of trade secrecy starting in the industrialized era.

3.1.1 Trade secret definition and history

A trade secret can be defined as valuable information that: the holder strives to maintain secret, is not generally known and provides a source of competitive advantage over competitors (Butterworth-Heinemann, 2008). It is worth noting that, in accordance with Liebeskind (1996), trade secrets represent a form of organizational knowledge that is critical for modern organizations so as to attain success in their business activities and become the differentiators in the industry. Since the industrial sector selected for this study, the telecommunications sector, is embedded in the technology business, information categorized as a trade secret will be associated with technological knowledge such as proprietary technological inventions gained through project executions. However, it is worth noting that trade secrets as such are not only limited to technological issues.

In regards to the historical development of trade secrets starting in the industrial revolution, Jedediah Strutt was recognized for being the first individual whose knowledge related to the

use of new British textile technology in 1783 was protected by utilizing trade secrets (Parker, 2008). Since then, there has been a considerable interest on the implementation of trade secrets to secure intellectual property across different industries. Due to the development of information and communication technologies over the last 30 years, the use of trade secrets has attracted increasingly attention in business practice as a mechanism for protecting IP.

However, Hailing (2008) stresses some characteristics affiliated with technological and business information considered as trade secrets in this contemporary era: it is *intangible, diverse and changeable*. Consequently, organizations must be prepared to face disturbances on their internal and external environments, and then formulate trade secret strategies flexible enough to adjust to the requirements of the marketplace. Along with the importance of trade secret protection in recent years, there is also a common tendency in organizations of conducting project activities across functional, cultural and geographical dimensions.

In some industries like telecommunications, the market nature forces competitors to maintain collaborative linkages, particularly with regards to technology infrastructure and customer service across networks. This implies that the utilization of trade secrets might vary from what we find in more atomistic industries. It is difficult, for instance, to agree upon standards that will benefit all the entities within a network if each one kept part of their knowledge as a trade secret. In order to promote standardization and technological development in telecommunications, it is inevitable to disclose certain technical knowledge. The key point here is to find a balancing act between the standardization process and the IPRs of the organization.

Figure 6 illustrates the development of trade secrets emphasizing on the globalization of economies, particularly in the contemporary era wherein innumerable firms manage business activities in a global marketplace (Cavusgil, *et al* 2008). The next section presents virtual project literature focused on knowledge management and the common challenges encountered. Correlations amongst trade secrets and virtual projects where knowledge management becomes paramount are also described.

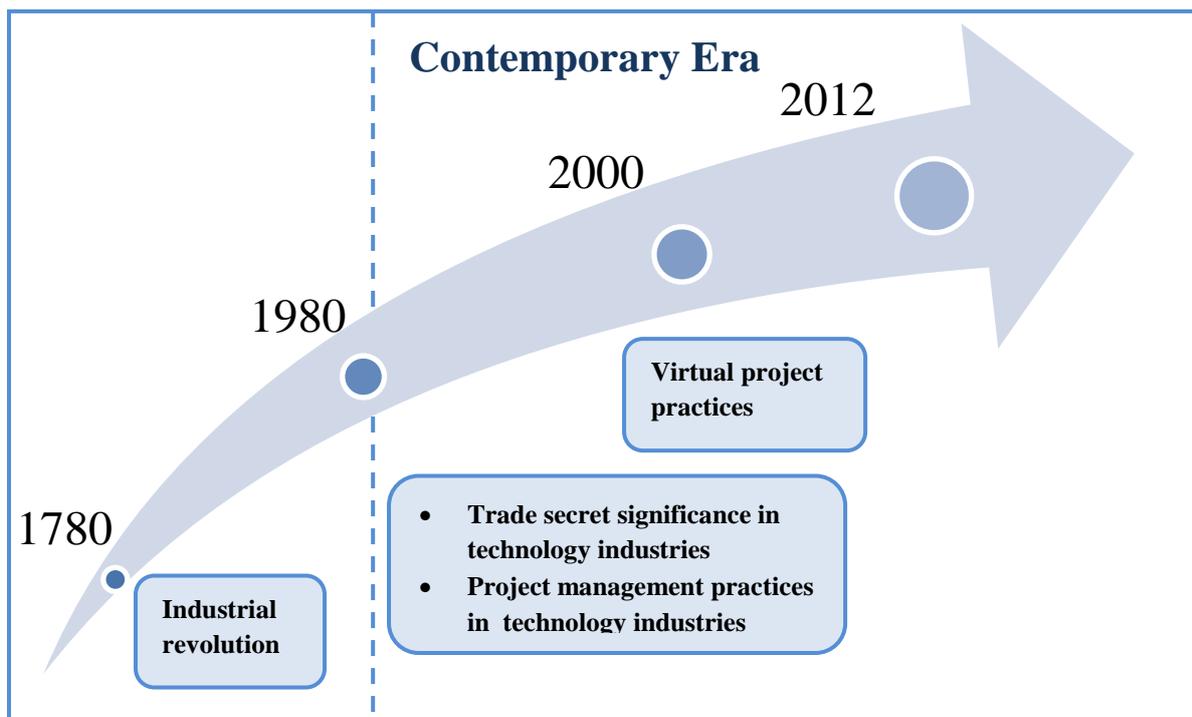


Figure 6. Trade secret development starting from the industrial revolution.

3.1.2 The role of trade secrets in virtual projects

In figure 6, the arrow portrays the trade secret timeline history and development, starting from the industrial revolution. As can be seen, trade secret implementation and project practices in the technology business became more important when firms started managing business operations in a global marketplace. Cavusgil, *et al* (2008) classify this global phase as contemporary era. However it must be said that trade secrets have been a matter of concern for companies, even before, when collaborating with third parties since this gives direct or indirect access to possible trade secrets.

Few years later it was possible to conduct virtual project activities thanks to the rapid development of information and communication technologies (ICTs) (e.g. Alavi and Tiwana 2002; Kotlasrky and Oshri, 2005; Boh *et al*, 2007). The knowledge resulting from project executions is valuable and, in some cases, represents the key asset to achieve competitive advantage. Then, it needs to be secured in such a way that employees and external entities become acquainted with the organization's trade secret protection measures. Globalization and ICTs creates new challenges at this point, for example different legislation across nations

and the problem of controlling shared information. Issues related to jointly owned IP might arise in a collaborative setting. This will be discussed in further sections.

3.1.2.1 Knowledge management in virtual projects

In today's complex, global and dynamic environments technology organizations conduct a considerable number of project activities in different geographical areas. This has led to the establishment of geographical dispersed teams (GDTs) as the new form of work structures (Alavi and Tiwana, 2002). It is worth noting that GDTs might comprise employees working in teams around the world without members from other firms, and also these teams might contain participants from many organizations. Owing to the necessity of integrating diverse expertise across sites, knowledge management is now recognized as a crucial issue to succeed in virtual project activities. For instance, some researchers (e.g. Alavi and Tiwana, 2002; Oliver and Kandadi, 2006; Siakas, Georgiadou and Balstrup, 2010) claim that improving virtual project performance requires the implementation of adequate knowledge management initiatives.

Virtual project activities span across geographical, functional and cultural dimensions. This makes the implementation of knowledge management processes more difficult than in projects conducted in a traditional fashion. One of the main characteristics of virtual collaboration is the lack of face-to face interactions which may constitute a matter of concern when it comes to reach adequate levels of trust among team members (Hoegel, Muetheland and Gemuenden, 2011). As a result, organizations rely upon information and communication technologies as an avenue to interlink different locations in a coordinated manner. Boh *et al* (2007) state that more coordination mechanisms must be employed to maintain organizational ties between virtual members and the parent organization in order to employ adequate knowledge management initiatives.

On the other hand, Alavi and Tiwana, (2002) argue that virtual teams experience problems on task coordination, as it tends to be more interdependent, and deficiencies in *open information sharing* affecting the normal flow of knowledge. The authors also recognize *insufficient mutual understanding* as a negative factor in virtual knowledge management. In addition, Corso *et al* (2009) portrays the importance of having a dynamic knowledge management system (KMS) that fits dispersed workers' needs. It is worth noting that cultural differences represent another barrier for knowledge sharing as pointed out by Siakas *et al* (2010). These scholars stress the importance of integrating different cultural values into the knowledge



management system which, in turn, will lead to improve the communication among virtual team members.

The communities of practice (CoPs) are considered crucial elements of knowledge management in virtual environments (Griffith, 2001; Oliver and Kandadi, 2006; Siakas and Georgiadou, 2006). As Siakas and Georgiadou (2006) states, it is crucial to have a common network for sharing knowledge supported by robust ICTs in order to integrate expertise across sites. However, certain levels of commitment and trust among members are required to learn from each other responsibly, otherwise people will be reluctant to share their expertise and will not perceive the social network as an opportunity but as an imminent threat of knowledge theft. It should be noted as well that *executive commitment* is essential in order to succeed in the application of knowledge management initiatives within the virtual team (Oliver and Kandadi, 2006). Executives are responsible for communicating and transmitting the significance of knowledge sharing. The following table summarizes the main challenges confronting knowledge management in virtual projects.

Obstacle	Feasible Solution	Scholar
centralized Knowledge	Develop social networks such as CoPs to integrate expertise across sites. Use robust and secured ICTs	Alawi and Tiwana (2002) Siakas and Georgiadou (2006)
Inadequate knowledge management initiatives	Formulate knowledge management initiatives with high degree of flexibility.	Corso et al (2009)
Ineffective teamwork performance	Reach certain levels of trust among members. Use robust ICTs	Alawi and Tiwana (2002)
Weak organizational ties	ICTs must be strong enough to maintain communication links	Boh <i>et al</i> (2007)
Cultural differences	Integrate cultural values into the knowledge management initiatives. Become familiar with CoPs	Siakas <i>et al</i> (2006)
Management issues	Top and middle management support is crucial for knowledge integration. They are responsible for communicating the significance of knowledge sharing to the GDTs	Oliver and Kandadi (2006)

Table 2. Challenges affecting knowledge management in virtual projects



3.1.2.2 *Capture valuable knowledge and protect it*

As stated before, the project management literature provides substantial information concerning knowledge management but it is deficient when it comes to intellectual property practices. It should be noted that the knowledge management process must contemplate not only capturing, retaining and disseminate knowledge within the dispersed organization but also the development of integrated and dynamic security programs aimed at protecting that knowledge including its commercial use.

This applies particularly when said knowledge has a considerable *economic value* to the involved organizations; a value that usually decreases as soon as competitors get access to the same information. In addition, sharing this knowledge with others gives them an advantage given that they do not need to carry the development costs. Technology organizations provide the working environments to boost their employees' creativity and capturing intellectual property rights constitutes a primordial factor (Maurer and Zugelder, 2000).

At the same time, it is important to highlight that a large part of this knowledge is developed through projects which means that after project completion, the organization must evaluate to what extent that acquired knowledge represents a new competitive advantage and warrants trade secret protection. Another issue has to do with the ownership, share and protection of new knowledge when projects are executed with other participating firms. In order to overcome this problem, it is important to maintain what Griffith *et al* (2003) define as *synergy levels*. In section 3.1.4 we will discuss this issue in more detail.

Having dispersed members implies more coordination mechanisms between internal and external entities to maintain organizational ties that contribute to robust knowledge management strategies (Boh *et al*, 2007). Therefore it becomes more difficult to manage trade secret protection when individuals conduct project activities on a virtual setting. To complement this argument, Butterworth-Heinemann (2008) indicates that working along with *outsiders* such as contractors, distributors, collaborative partners and the like, represents a higher threat over trade secret disclosure than to those firms who possess their own workforce.

Since dispersed members are located beyond the boundaries of the organization, they might be associated as an *outsider group* from a contractual and security point of view. The security program, thus, directed towards protecting trade secrets must consider several factors that will be discussed in further sections. This generates various potential problems and/or



challenges in the project management practices. But at the same time, dispersed members might be highly involved in the organization's project activities and perceived as an *insider* group.

One of the reasons for collaborating with other organizations is to get access to their knowledge which is required for solving specific problems, but this creates a dilemma when it comes to trade secret protection. On one hand, the organization strives for securing its trade secrets / valuable knowledge. On the other hand, rejecting to share can produce negative effects on the capacity of developing the solution which, in turn, leads to undermine the quality of the solution.

3.1.2.3 Importance of trade secrets in a business environment

The globalization of economies and the highly competitive markets have increased the significance of trade secret protection as safeguard mechanisms for valuable business or technological information that provides advantage over competitors (WIPO, 2002; Rajkowski, 2010). The research study performed by Drahos (1997) and based entirely on theoretical analysis, affirms that the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) facilitated the globalization of intellectual property rights in order to support the multinational organizations interested in global security programs. The author argues as well that trade secret protection is embraced in the TRIPS agreement as a recognized standard of protection.

Nevertheless, Hemphill (2004) portrays that trade secrecy does not receive enough international protection under the TRIPS agreement. For that reason, the author points out that executive commitment and effective trade secret strategy formulation can be seen as reliable mechanisms to protect key assets from employees and third parties. This argument is also accentuated by other researches including Maurer and Zugelder (2000), Hannah (2006) and Butterworth-Heinemann (2008). It can be argued that these authors discuss trade secret theory from the inventor / creator point of view.

However, it should be clarified that it is difficult to obtain a balance between the interests of the inventor and the interest of the society when trade secrets are used as a form of IP. Providing trade secrets the same protection without any disclosure would be against the nature of IP systems. Therefore, trade secrets are protected by law and business practices in several nations, but not as a part of an IP system.



Having discussed the relevance of trade secrecy in today's business, now it is time to look at some clear examples that evidence how trade secret misappropriation paradoxically enhanced industrial development and personal benefit. To begin with, Ben-Atar (2004) provides an interesting historical research of the industrialization process of the United States wherein the theft of trade secrets affiliated with mechanical and scientific innovations from Europe during the 17th and 18th century, became the basis of nation's industrial growth. After becoming the leader amongst the industrialized nations, the United States started developing its intellectual property system to protect its industrial innovations (Ben-Atar, 2004).

What would have happened if the European inventors from the 17th and 18th century had developed a strong intellectual property system to secure their trade secrets from the United States? Would the pace of industrialization have been the same? This shows us how trade secret disclosure contributed to position the United States as the main technology exporter. These kinds of arguments have been used to clarify the reason why developing nations might not be interested in strong IP protection.

On the other hand, Butterworth-Heinemann (2008) describes how Toshiba gained a position in the market by illicitly appropriating trade secrets from Lexar Media. A non-disclose agreement was signed between the two firms which allowed Toshiba access to Lexar's intellectual property. However, Toshiba disclosed Lexar's trade secrets while working along with other subsidiaries which led to improve its product line for its own benefit. Although Toshiba was charged with a considerable amount of money, Lexar's competitive advantage was at stake. The author underlines that the strengths and weaknesses of Lexar were exposed due to the presence of Toshiba executives in the board of directors of the firm.

In addition, Rajkowski, (2010) concludes that, after analyzing the New Zealand and German trade secret protection approaches, there is a considerable risk when employees that are involved in the board of directors leave the organization since they have access to trade secret information such as strategic development and customer management. Owing to the fact that the organization does not own its employees, this will be always a challenge that can only partially be covered by non-IP-laws such as employment laws, laws about competition, personal freedom laws, and so forth.

The technology business is constantly affected from trade secret theft making intellectual property as one of the top priorities for executives. According to this, having a non-disclosure



agreement is not a solid safeguard. As a result, Hannah (2006) and Butterworth-Heinemann (2008) acknowledge executive commitment as a crucial factor

The cases mentioned above illustrate the importance of employing robust trade secret protection measures to shun their misappropriation. At the same time, it must be taken into consideration that too strong protection might, to some extent, impede collaboration and joint value creation for instance, in a virtual project environment. It is essential to become familiar with the common ways of protecting trade secrets. In the next section it will be discussed commonly used agreements and the dilemma concerning whether or not disclose technology on virtual project activities.

3.1.3 Protecting trade secrets from employees and third parties

The literature provides a wide range of information related to this theme. The protection of trade secrets is mainly an executive concern given that most of the trade secret divulgence comes from current and former employees (Hannah, 2006; Hailing 2008). However, it is worth noting that, as Butterworth-Heinemann (2008) states, the principal entities involved in trade secret theft includes employees as well as contractors or business partners (e.g. Toshiba-Lexar dispute). The following sections will explore common agreements that are used in the technology business to protect trade secret disclosure.

3.1.3.1 Non-Disclosure agreements

According to Maurer and Zugelder (2000), in a non-disclosure agreement (NDA) “*an employee is obligated not to divulge his employer’s trade secrets, whether or not the use or disclosure of such trade secrets are prohibited or restricted by an explicit contract*”. On the other hand, Butterworth-Heinemann (2008) presents a broader definition of the concept. The author incorporates the term *intercompany agreements* to examine trade secret protection within two or more organizations, and indicates that these types of agreements are the most commonly used ones in the technology business. In this context it is responsibility of the involved parties to employ adequate control mechanisms.

In regards to intercompany agreements, Butterworth-Heinemann (2008) classifies them in *Mutual and Unilateral NDAs*. In mutual NDAs, trade secret information is being disclosed by both parties on an equal manner (e.g. between business partners). But once the organization discloses trade secrets to *outsiders* which are obligated to protect that information, unilateral NDAs are used.

Within this category of agreements, Hannah (2005) gives an interesting analysis of two types of *Trade Secret Protection Procedures* (TSPPs) employed by organizations to protect trade secrets from disclosure by employees: *Trade Secret Access Restriction Procedures* (ARs) and *Trade Secret Handling Procedures* (HPs). The author argues that, after having conducted his research in two high-technology firms, employees feel more comfortable and committed to protect trade secrets with HPs than with ARPs. This is given that the implementation of HPs establishes the necessary rules to control trade secrets when employees are allowed to get access to them. In contrast, ARs restrict employees not only to use trade secret information but also the access to certain information or areas of the organization.

When employees develop higher levels of trust towards their employers, they are more likely to feel obligated to protect trade secrets (Hannah, 2005; Hannah 2006). In other words, employees who gain access to trade secret information by means of HPs, recognize that they play an important role in the company. Thus, HPs have a positive impact on the protection of trade secrets by employees. When it comes to virtual project environment, it would be more difficult to reach the levels of trust required to utilize HPs as a safeguard mechanism since employees are geographically dispersed.

To overcome this issue, Alawi and Tiwana (2002) and Boh *et al* (2007) argue that robust information and communication technologies are needed to strengthen the organizational ties between the parent organization and the virtual team. Here, it is important to make a distinction between *disclosure by accident* and *disclosure by intent*. Robust ICT infrastructures can prevent disclosure by accident avoiding employees getting access to specific information. However, it is difficult to manage both ARs and HPs when project members are dispersed; they can present opportunistic behaviors and divulgate trade secrets for their own benefit (disclosure by intent). Then, we might argue that ICTs become ineffective regarding disclosure by intent.

When GDTs span across organizations this problem presents higher repercussions. For example, would it be the involved employees or their employers responsible for signing the confidentiality agreements? Who would be responsible if the agreement is infringed? *Non-Compete Agreements* might be a better solution to secure trade secrets in virtual project activities. This concept is discussed further in the following section



3.1.3.2 *Non-Compete Agreements*

Hannah (2006) indicates that, Non-Compete Agreements (NCAs), also known as restrictive covenants, “*restrict the companies, geographical areas and industrial sectors employees can work following the termination of their employment*”. This type of agreements must have a reasonable scope or duration which is difficult to address. Another issue is related to the trade secret protection law since it varies across nations and, in some cases, within the same country (Butterworth-Heinemann, 2008; Hailing, 2008). Therefore, NCAs’ implementation in some countries provides employees better compensations from their employers than in other states.

A clear example of the previous argument can be seen in the study carried out by Haling (2008), directed towards the improvement of the trade secret protection system in China. The author suggests that the legislation of NCAs must be improved, and at the same time the employee’s obligation of confidentiality regarding trade secrets must be explained in detail. The author also stresses the importance of improving *employment relationships*. Up to date, the employment contact law in China is not clear enough in respect to NCAs which must incorporate fair compensation, equitable duration and protected benefits for ex-employees (Hailing, 2008). Other issues regarding NCAs which are difficult to manage are the content and legal justification, the ability and willingness to comply and the ability to enforce them.

According to Alien and Katz (1995), the *project engineer* represents the principal form of engineering types whose work activities are executed over different organizations. This means that after project completion, many of these skilled individuals leave the company taking with them valuable knowledge that might be considered as a trade secret. Thus, NCAs provide a reasonable safeguard mechanism. In the context of virtual project work, wherein geographically dispersed employees’ expertise is integrated to accomplish project requirements (Alawi and Tiwana, 2002), it seems to be challenging to control employees’ obligations to protect trade secrets during project activities or after finalization. It must be guaranteed that any invention or idea conceived by employees, particularly by project engineers, while working for the company, belong to that company as such. The following section presents how an organization can handle this issue accordingly.

3.1.3.3 *Assignment provisions*

The Assignment Provisions (APs) indicate that “*any ideas employees come up with in the course of their employment, legally belong to their employees*” (Hannah, 2007). In other



words, the employer provides the proper working environment to stimulate the creativity of their employees and it becomes crucial to implement APs, known also as *assignment of inventions agreements*, so as to ensure that the employer has all rights to inventions created by employees during an assigned project. It is worth noting that the employer can own the manifestation of the knowledge and not the knowledge per se. This involves for instance customer databases, technical diagrams, network algorithms and the like.

On the other hand, that these types of employee agreements do not cover employee's inventions that are created outside the scope of work including own general knowledge or experience gained through time (Maurer and Zugelder, 2000; Butterworth-Heinemann, 2008). This constitutes a matter of concern given that there might be zones which are difficult to address (*gray zones*) in a proper manner. It is clear that the organization must adopt all the necessary measures to protect trade secrets and demonstrate their economic advantage over competitors. However employees' understanding of trade secret procedures cannot be left aside. As Hannah (2006) states, employees who are more acquainted with said procedures are keen to concede the possession of their ideas making a smoothly implementation of APs. The author also proposes to reward people for the ideas conceived and implemented via financial or any other incentives like recognitions. The table illustrated below presents the most important concepts discussed on this section:

Non-Disclosure Agreements	Non-Compete Agreements	Assignment Provisions
<ul style="list-style-type: none"> • Employees and third parties obliged not to disclose trade secrets. • <i>Intercompany agreements</i> between 2 or more organizations. • Trade secret protection procedures (TSPPs). • Difficult to manage on a virtual project setting. 	<ul style="list-style-type: none"> • Restrict organizations and geographical areas employees can work after termination of employment. • Issue: trade secret law changes across countries. • Fair compensation to employees difficult to reach. • Diverse expertise across sites makes them cumbersome. 	<ul style="list-style-type: none"> • Employer's rights over inventions created by employees during assigned work. • Do not cover people's own inventions outside the scope of work. • Vital contribution from executives to transmit the importance of trade secrecy towards their employees.

Table 3. Commonly used agreements to protect trade secrets



The following section examines the dilemma whether technology disclosure represents good business opportunities emphasizing on trade secret protection when working in conjunction with collaborative partners in a virtual project setting.

3.1.4 Disclosing technology: is it a wise choice?

Due to the globalization era and the rapid development of information and communication technologies, organizations maintain more collaborative linkages than before with different parties involved in their business activities as contractors, partners, customers, suppliers, employees working beyond the physical boundaries of the company, and so on. This implies that disclosure of confidential information considered as a trade secret, to some extent, is essential to produce goods and services aligned with market needs (Hailing, 2008).

With respect to virtual project collaboration, disclosing technology can be beneficial on the assumption that the organization requires trade secret information from collaborative partners or vice versa in order to succeed in virtual project activities. Griffith *et al* (2003) portrays that certain levels of *synergy* must be attained amongst virtual team members in order to generate potential knowledge that is not possible to achieve individually. This concept also might apply to collaborative partners whose knowledge might be valuable in project executions and without said knowledge it would be impossible to reach the objectives agreed. Consequently, potential knowledge considered a trade secret might be utilized as a vehicle for project success.

Solid selection criteria must be used before entering in virtual project collaboration to guarantee that the organization merely cooperate with third parties and people reasonable trustworthy. It is worth noting that it becomes paramount to address not only newcomers in the proper way, but also current employees and departing employees. For instance, in a virtual project setting, industrial espionage constitutes a major risk as valuable information is transmitted across vast distances through lines that are not fully controlled by the participating organizations. The organization, thus, must have contracts in place so as to ensure that all the involved parties in the project activities understand how the information should be managed along with the consequences attributed to breaching the confidentiality clauses.

On the other hand, we might argue that the trade secret strategy must encompass the life-cycle of the project, this means, carrying out pre-project activities that prevent *outsiders* from getting access as previously discussed, regulating access during collaboration (handling trade secrets in use) and regulating use after project completion.

Figure 7 exhibits the synergy definition where collaborative partners and virtual team members interact to produce the desired outcome. According to Butterworth-Heinemann (2008), the organization must implement *careful contracting* measures particularly for large and complex projects and thus be able to select the most suitable IP strategy, maintain long lasting relationships with third parties and mitigate risks associated to the project activities. For instance, frequent collaboration seems to decrease opportunism whilst *one-off relations* might enhance opportunistic behavior.

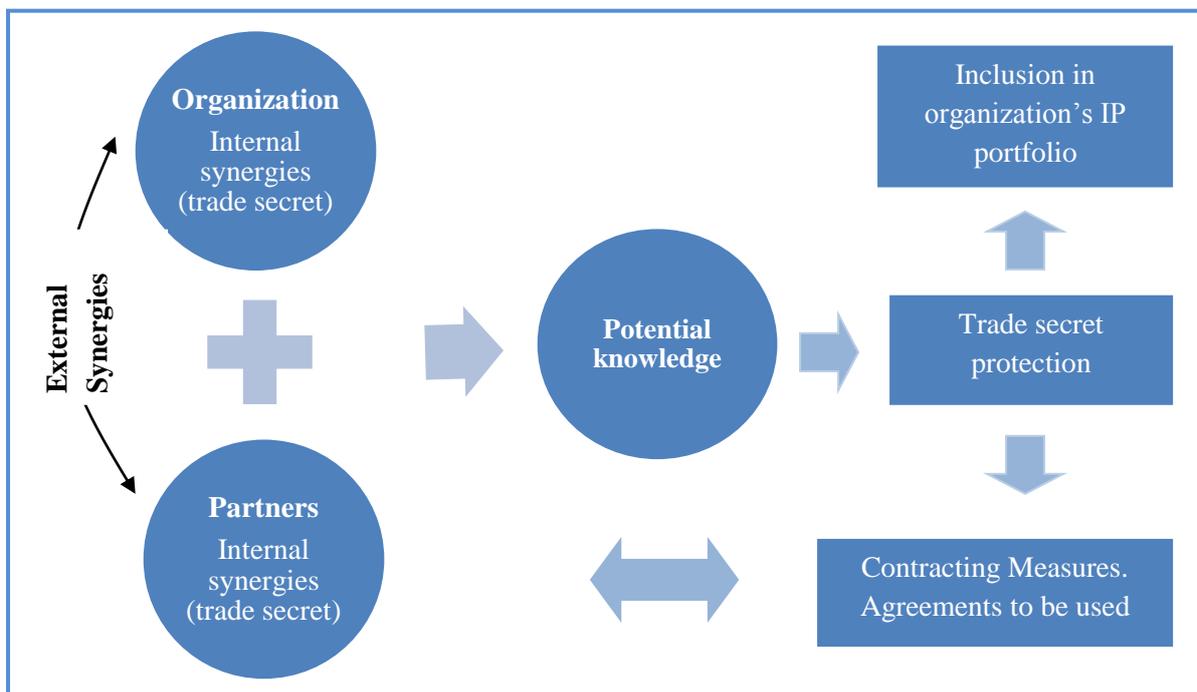


Figure 7. Synergy interactions generating potential knowledge

Another issue that must be taken into account when considering trade secret disclosure in project executions is the one related to IP ownership. Butterworth-Heinemann (2008) portrays the importance of *avoiding jointly owned IP* because it is difficult to allocate within the interested parties on an equitable manner. It is worth noting that if no agreements or regulations are in place it becomes *jointly developed IP*. The author, thus, recommends assigning all IP gained in the project to one party whilst the other party might evaluate its use



by means of license grants. Here it is crucial to have contracts in place with all the partners involved in the project activities so that they transfer all the IP that they develop for the organization.

It must be noted that there is also possible to assign rights to future innovations to both participating firms within a defined scope of work that is based on project and individual objectives. Gollin (2008) recognizes five possible allocations when working in cooperation and independently. As can be seen in both extremes of the figure 8 (A and E), either the organization or the third party owns all IP gained within the scope of work. In agreements B and D, each party possesses creations made by their employees within the scope of work and either party owns IP rights arising from the collaborative creation. Nevertheless, we might claim that in this collaborative setting it is difficult to operate as clear-cut as the model illustrates, with perceived gray zones or areas of misunderstandings between the involved parties.

The author stresses that the last agreement (C) is the fairest one given that both parties hold their own creations and at the same time they own joint innovations. We might argue that, even though it seems reasonable to employ the latter agreement, owning joint creations can generate conflicts between the parties involved in the project in terms of exclusivity and fair allocation. Gollin (2008) proposes implementing licensing as a mechanism to ameliorate this issue. This is a potential problem that might be covered by a contract or any other kind of agreement.

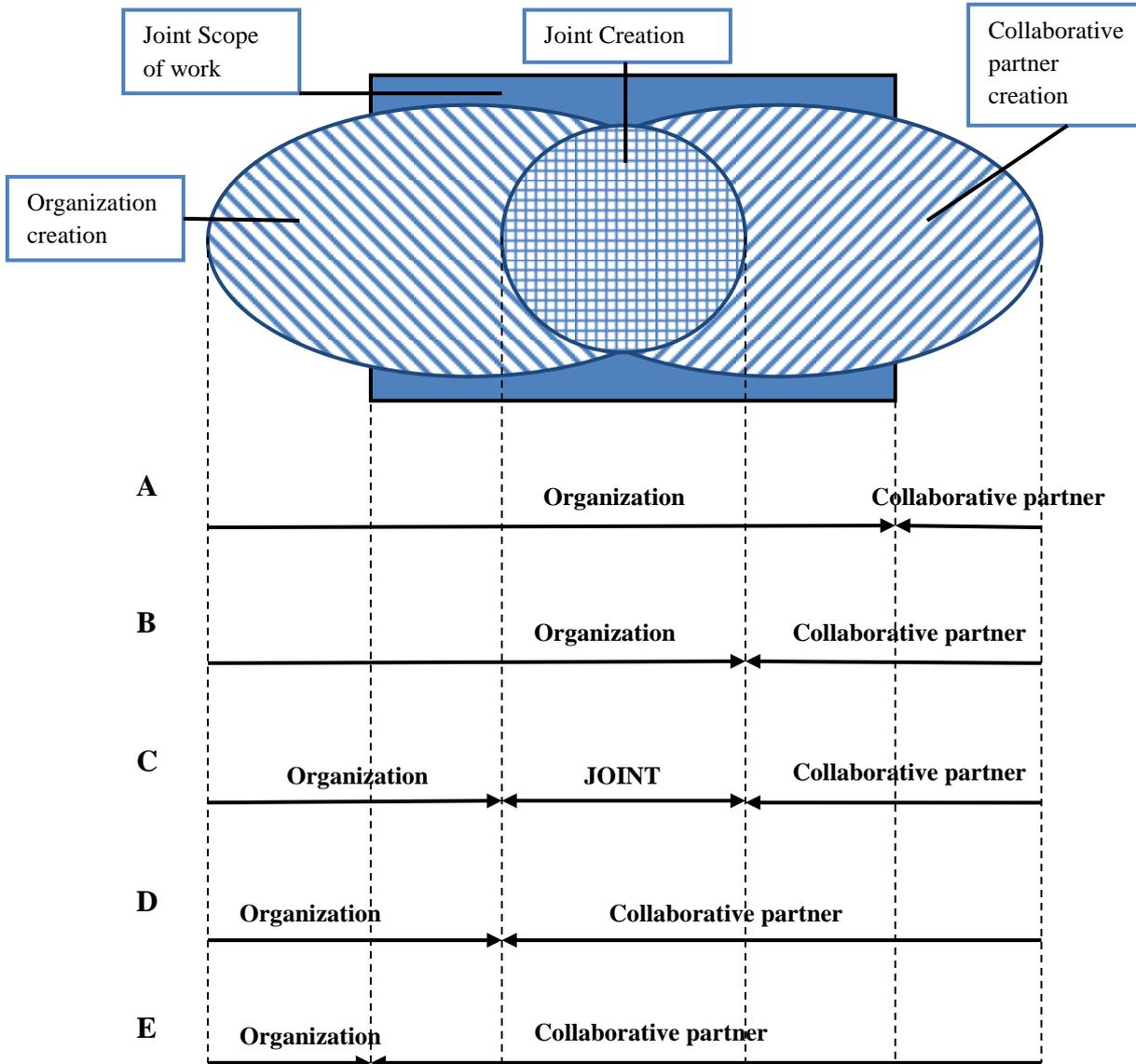


Figure 8. Allocating rights for future innovations. (Adapted from Golling (2008))

On the other hand, core technologies and proprietary technological inventions considered as trade secrets constitute a competitive advantage for organizations (e.g. Hannah, 2005; Butterworth-Heinemann, 2008; Hailing, 2008; Harshwardhan and Keshri, 2008), and their misappropriation might cause terrible repercussions in terms of economic power and status loss in the industry. This becomes more problematic in situations where the information is made available to third parties outside the collaboration. For that reason there is a common interest of employing all the necessary efforts to maintain trade secrets away from external entities including collaborative partners. If disclosing trade secrets is inevitable to achieve



the desired outcome, then the issue is more about regulating their access and utilization within the project activities and after completion.

As discussed in the previous sections, dispersed workers can be cataloged as an *outsider* group owing to the fact that they conduct project activities across functional, cultural and geographical dimensions. Executives should evaluate the degree to which trade secret disclosure can be a wise choice over a virtual project environment wherein organizational ties are difficult to maintain (Boh *et al*, 2007). For instance, opportunistic behaviors may arise amongst members that might lead to IP theft.

As can be seen, protecting trade secret information embraces a considerable amount of factors that must be addressed by organizations in order to establish appropriate security programs. The next section is intended to describe those factors by focusing on virtual project theory.

3.1.5 Factors influencing trade secret protection in virtual projects

According to the findings from previous sections, securing trade secrets represents great challenges for executives, particularly when employees work on a virtual basis. In addition, trade secret law protects only against misappropriation, varies from jurisdiction to jurisdiction across countries and, in some cases within the same country as in the case of the United States (Hemphill, 2004; Butterworth-Heinemann, 2008). Therefore, in order to implement an integrated security program, organizations cannot rely purely upon trade secret law; they should be conscious of the factors described below and proceed accordingly.

Executive commitment: Many scholars (Maurer and Zugelder, 2000; Hemphill, 2004; Hannah, 2006; Butterworth-Heinemann, 2008) recognize the essential role executives play in the protection of trade secrets. They are responsible of transmitting the implications of the IP security program to the different units of the organization, emphasizing the importance of trade secrets as valuable and vulnerable assets that represent a competitive advantage. When it comes to virtual projects, Oliver and Kandadi (2006) argue that managers must maintain solid *communication channels* between dispersed employees to facilitate the normal flow of knowledge, and draw upon the term “*evangelization*” to describe the organizational culture process required for this purpose. It is clear then, that knowledge integration in virtual teams and its protection are basically a managerial issue.



Besides, when working within a GDT, each member act as a representative for his/her organization with respect to both technical and managerial issues. Then, GDT members must have multicultural and multidisciplinary understanding.

Dynamic IP security programs: It should be noted that the security program must be flexible enough to face disturbances in the external environment and adjust to the market conditions (Hemphill, 2004; Butterworth-Heinemann, 2008). The authors propose to identify as well internal points of resistance and risks involved in order to respond to unforeseen changes efficiently. At the same time, Corso *et al* (2009) portray the importance of dynamic knowledge management processes among dispersed workers which cannot be executed systematically. The knowledge management initiatives are constantly changing and adapting according to the employees' needs. This means that authoritarian knowledge security measures and rigid knowledge processes probably will prove to be insufficient and in some instances even contra productive in today's global complex, and virtual environments.

Departing employees: Hannah (2006) and Butterworth-Heinemann, (2008) agree that departing employees often leave companies taking with them trade secrets. It becomes crucial to address employees' exit process carefully. For this purpose, Maurer and Zugelder, (2000) suggest the following steps: departing employees must be aware of their obligation of protecting ex-employers' trade secrets, they must return all confidential documentation belonging to the company, and it is wise to ask for information concerning employee's new employer because some employees are hired by competitors owing to their trade secret knowledge.

The problem escalates, for instance, when employees are geographically dispersed making the traditional control mechanisms, to some extent, useless. On the other hand, it must be emphasized that the guidelines mentioned above might not function as planned when hiring temporal employees such as consultants.

Newcomers: Organizations must also take the necessary measures when hiring new employees. Otherwise, As Maurer and Zugelder (2000) state, they might risk acquiring trade secrets through "*naive hiring practices*". Thus, the authors argue that the following criteria could mitigate this matter: get acquainted with the future employees' NDAs or NCAs agreements, clarify trade secret protection policies, and have documentation proving that the prospective employee comprehends said policies. In regards to whether to protect or disclose trade secret information of former employers, Hannah (2007) concludes that, after having



conducting interviews in two firms involved in the high-technology industry, newcomers are less likely to divulge information considered as a trade secret of their former employer. It is worth noting that when entering into a virtual project with other participating firms, the organization is not formally hiring people. They are still employed by the collaborating firm. Besides, some members might be self-employed as independent contractors or consultants. This creates a quite messy picture with several opportunities to make mistakes in the process of handling trade secrets.

Cultural issues: Hannah (2007) portrays the importance of organizational and industry cultures when it comes to protect or share trade secrets. It should be noted that this concept is derived from executive commitment; managers are accountable for providing training and education on trade secrecy towards their employees. As a consequence, every organization has its own trade secret protection beliefs which differ across industries and societies as well. Butterworth-Heinemann (2008) provides an excellent example of this argument when discussing the IP theft involving Shangai Maple and Citroen. The European company alleged that Shangai Maple made improper use of Citroen's core technologies to produce certain models. Nevertheless, an engineer from the Chinese company's research unit perceived the apparent "*borrowing*" IP as the rule.

It is worth mentioning that cultural differences (e.g. organizational, societal) affect collaboration and knowledge integration among virtual team members (Siakas, Georgiadou and Balstrup, 2010). The trade secret strategy seen from a virtual perspective should encompass mechanisms aimed at integrating different cultural values. However, this is a really demanding activity in practice. When applicable, trade secret issues should be part of meetings wherein members can meet face-to-face.

Trust: As previously studied, Hannah (2006) stresses the importance of developing higher levels trust towards employees since they would feel more obligated to protect company's trade secrets. In a virtual project setting, Sonderegger (2009) highlights that workers from different locations must rely on information and communication technologies to reach shared understanding and proper levels of trust.

On the other hand, it is also important to indicate that organizations whose long-term relationships with third parties are based on trust feel more secure when trade secret disclosure is agreed. This implies that selecting collaborative partners based on trust might become more important than taking IP into account.



Costs: The organization should also be conscious of the costs associated with protecting trade secrets. Hemphill (2004) classifies said costs in two categories: the costs incurred in implementing the security program within the organization, and the costs of monitoring *insiders* and *outsiders* who attempt to violate the security system. Furthermore, these costs arise when employees are located outside the physical boundaries of the organization inasmuch as the dispersion of work increases, generating higher coordination costs (Boh et al, 2007). Firms should address this issue when formulating trade secret strategies.

Having discussed the relevant theory related to trade secrecy as a means to secure intellectual property as well as its implications in virtual projects, now it is time to analyze the intellectual property rights in the telecommunications sector. As noted above in the introduction of this chapter, patenting has been widely investigated as the principal mechanism to protect technological knowledge in telecommunications, and the following section is intended to analyze this issue, including the conflict between standardization and intellectual property. The feasibility of implementing trade secret protection to complement or substitute patents will be explored along with recommendations for improving trade secret protection. The following table provides a brief overview of the concepts discussed in this section:

Factor	Description	Scholar
Executive commitment	Managers responsible for communicating importance of trade secrecy to the organization.	Maurer and Zugelder (2000), Hemphill (2004), Hannah, (2006) Oliver and Kandadi (2006) Butterworth-Heinemann (2008),
Dynamic IP Security Program	Flexibility needed in IP security programs and in knowledge management initiatives	Butterworth-Heinemann (2008), Hemphill (2004) Corso <i>et al</i> (2009)
Departing Employees	Careful address exit processes. Difficult to manage when workers are geographically dispersed.	Mauren and Zugelder (2000), Hannah (2006), Butterworth-Heinemann (2008),
Newcomers	Be aware of hiring processes. Avoid <i>naive hiring practices</i> . It depends on the situation	Maurer and Zugelder (2000), Hannah (2007)
Cultural Issues	Organizational, industry and societal cultures are notably different. Important to integrate cultural values	Hannah (2007), Siakas <i>et al</i> (2010)



Trust	Employees feel more obligated to protect trade secrets when a high level of trust is reached. Maintain long-term relationships with key parties.	Hannah (2006) Sonderegger (2009)
Costs	Costs attributed to trade secret protection programs. They tend to increase in virtual project settings.	Hemphil (2004) Boh <i>et al</i> (2007)

Table 4. Factors affecting trade secret protection in a virtual project setting

3.2 The telecommunications sector

With the rapidly development of communication and information technologies the telecommunications industry has achieved substantial levels of internationalization. This has led to categorize telecommunication firms as large, globally distributed organizations whose business operations rely upon interoperability among different operators and close collaboration with contractors. Due to these constant interactions in which said parties are involved, intellectual property theft is more likely to occur within this industrial sector and therefore it is crucial to develop integrated security programs (Butterworth-Heinemann, 2008). At the same time, interoperability is difficult to attain if different technologies are protected through trade secrets. This might suggest that sharing *technological secrets* is a common practice in this industry. Licensing patents and collaboration agreements might be used for this purpose.

To supplement the previous idea, Bekkers *et al* (2002) argue that the world-wide liberalization has dramatically increased the relevance of Intellectual Property Rights (IPRs) in the telecommunications industry as well as the demand for international communications where standards play an important role. It could be argued that trade secrets either must support existing standards or can be converted into new standards in order to be considered as essential assets. If this is not fulfilled, then *non-technical secrets* might be more valuable within this industry. The following section aims to discuss the issues mentioned above in more detail.

3.2.1 Intellectual property rights in telecommunications

In the telecommunications industry, firms possessing essential *complementary assets* and *strong appropriability* in terms of intellectual property rights are considered to be in excellent position in comparison with their key competitors (He *et al*, 2006). However, it should be



emphasized that it is complex for organizations leveraging complementary assets and at the same time developing intellectual property rights. A company, for instance, might decide to disclose information in order to promote standards in the industry while keeping as trade secrets information that constitutes a competitive advantage such as production processes based on said standards.

The study conducted by He *et al* (2006) in the mobile telecommunications industry, provides an interesting analysis concerning appropriability and complementary assets. On the first place they recognize Motorola as the firm with enviable position in the market until the 1990s, owing to its strong intellectual property portfolio (patents) and its complementary assets ownership. But when firms like Nokia, Ericsson and Samsung leveraged complementary assets and exploited Motorola's technological knowledge, Motorola's response strategy became ineffective losing its leadership position. The authors conclude that, after having carried out qualitative studies and quantitative analysis of US patents awarded to these four companies between 1976 and 2004, Ericsson Samsung and Nokia acquired valuable external knowledge by citing Motorola's patents.

After that, Ericsson, Nokia and Samsung developed strong IP position and started citing each others' patents resulting in new technology developments. The authors argue that Motorola did not make good use of its own patents to boost innovation. Moreover, the firm failed in scanning the new technological changes made by its competitors. The results of this investigation suggests that, although the patenting system allowed the diffusion and promotion of technologies, the disclosure of proprietary technological inventions weakened Motorola's competitive advantage in the mobile telecommunications industry. This is a good example of the difference between creating protectable creations of the mind and the capacity of exploiting these creations in the marketplace alone or in collaboration with other firms.

To what extent would be feasible to implement trade secrets as a mean to secure intellectual property in this context? What would have been the consequences in terms of market positioning and flow of knowledge? It might be viable to consider trade secret protection for firms already dominating the market like Motorola, but for small companies and start-ups it might not be very feasible. Customers are not so keen on investing on technology protected by trade secrets and developed by a firm that can go bankruptcy or that can be bought by a competitor. In this case, licensing provides a better protection in said circumstances.



On the other hand, *Cross licensing* constitutes another concept that needs close attention when it comes to IPRs in telecommunications. In accordance with Bekkers *et al* (2002), a cross licensing agreement allows the IPRs owner to get access to technological information that could be difficult to obtain otherwise, and rejecting any financial compensation. This implies that said agreements might represent a strategic decision inasmuch as the organization holding IPRs can establish its own rules allowing the access to technological information from other firms and thus, imposing the market structure in the industry.

When it comes to patent and trade secret licensing, Jorda (2007) stresses that license agreements are nowadays the common mechanisms for technology transfer. The author acknowledges that patents and trade secrets can complement each other and the implementation of *hybrid licenses* constitutes the best manner of reaching *potent exclusivity*. Whilst patents protect inventions, trade secrets secure collateral know-how. It is possible to concede both patent and trade secret licenses and we might argue that their implementation has different repercussions in terms of costs, revenues, market positioning and commercialization. Then, it is difficult to say which alternative provides better benefits when licensing is agreed.

As explained at the beginning of this section, telecommunications' products and services are based on *standards* as a means to interconnect national and international networks, and to achieve interoperability; however, as Park *et al* (1998) state, the dispute between Intellectual property and standardization has increased considerably. As a result, mechanisms intended to harmonize this relationship must be employed. The following section discussed said problem thoroughly.

3.2.2 Conflict between Intellectual property and standardization

Lea and Shurmer (1995) indicate that Standardization and IPRs are directed towards the same purpose: "*to ensure that society benefits from innovation*". The authors, on the other hand, recognize that these two concepts imply different interpretation as IPRs are *producer-oriented*, granting exclusive ownership to technological innovations, whereas standardization relies more on customer requirements and is in a constant pursuit of reaching a common platform to integrate different products and services.

The same argument is discussed by Park *et al* (1998). Whilst the authors define standardization as a *centrifugal force* for disseminating technology in the society, they

describe IPR as a *centripetal force* for protecting technological innovations. This relationship is depicted in the figure 9 as follows:

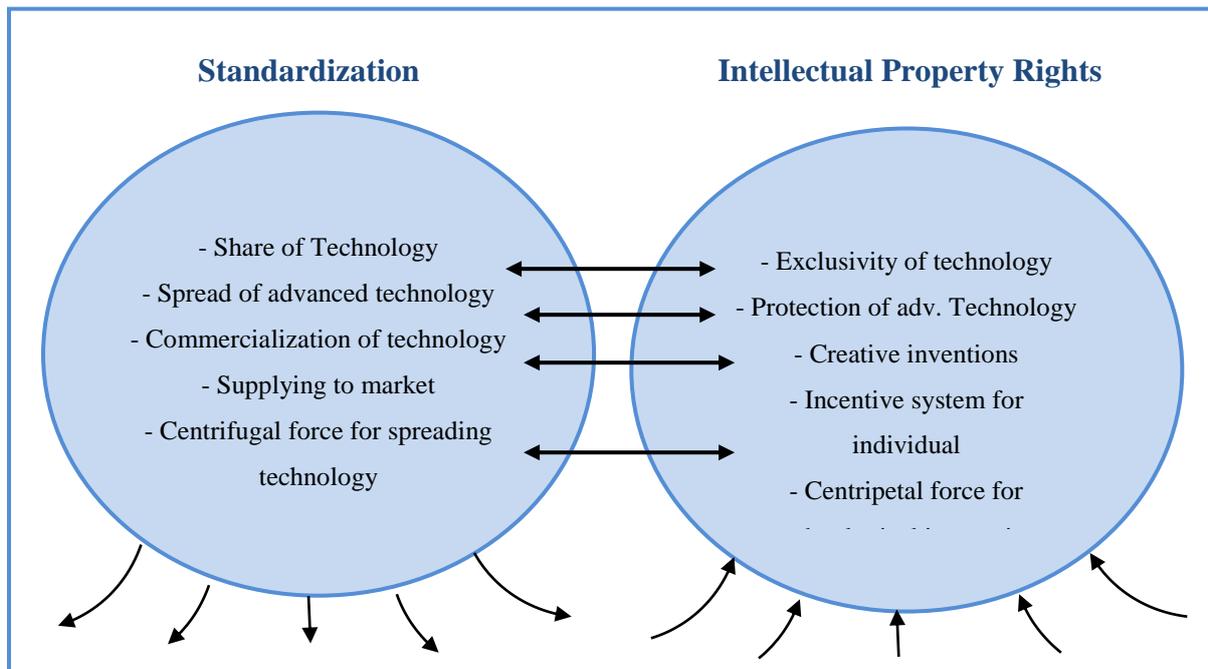


Figure 9. Relationship between standardization and Intellectual Property Rights (adapted from Park *et al*, 1998)

The example described by Lea and Shurmer (1995) explores the extent to which the “*all or nothing nature*” of the dispute between IPRs and standardization can hamper industrial progress. Several manufacturers were not able to connect their products to the System/370 mainframe CPUs owned by IBM. The firm rejected to divulgate essential information related to such system because it was “*proprietary*”. However, IBM was forced to release the required information and accused of monopoly abuse. It can be concluded from this case that, according to Park *et al* (1998), exclusive IPRs weaken service quality creating monopoly price and monopoly supply instead of legitimate market competition. To overcome the issues which arose as a result of this never-ending dispute, Lea and Shurmer (1995) suggest implementing *IPR licensing* on a “*fair, reasonable and non-discriminatory terms and conditions*”.

A company for example might have several reasons to choose trade secrets such as increasing own profits and market positioning, as well as impeding competitors to get access to technology that might to some extent improve their revenues even if this decreases the earnings of the company holding the trade secret.



As can be seen from the IBM case, special attention must be given to IPR holders that jeopardize the development of standards. It is fundamental to establish adequate measures to ameliorate the relationship between standardization and IPRs in the telecommunications industry through IP security programs that protect and at the same time promote technological inventions.

Although IPRs and standards are often in disagreement, Bekkers *et al* (2002) portray the importance of incorporating IPRs to secure telecommunication standards. The authors put forward the following reasons describing why IPRs are commonly used in telecommunication standards:

- *“The high R&D investments and patent intensity in this sector.*
- *The development into a truly open, world-wide market for standardized equipment.*
- *Telecommunications standards are most often compatibility standards, requiring that interfaces are described in a very detailed and conscientious way.*
- *The fact that most standards are based on proposals that are developed by manufacturers.”*

The authors argue as well that acquisition of *essential IPRs*, which is protected knowledge required for a product that must satisfy the standard specifications, will contribute to achieve a competitive advantage. Their investigation, based on an exhaustively analysis of patents considered as essential IPRs in the GSM technology, shows that Motorola built up a strong position in the industry by having a wide portfolio of essential IPRs and employing cross-license agreements (previously discussed on section 3.2.1) with a number of firms in the market whose IPRs were useful to Motorola. These arguments suggest that each product or service might be protected by patents and trade secrets as long as the interfaces are standardized and, thus, ensuring interoperability. The issue here is not whether to standardize or protect but when and where it is recommendable.

Over a trade secret approach, we might say that trade secrets work in such a way that allows access to critical technologies that must be developed on a *synergistic* manner in order to attain commercial success. For instance, it is viable for organizations in the telecommunications sector to cooperate in new technology developments and at the same time compete on the market with different products based on these technologies.



Several standardization organizations such as International Telecommunication Union (ITU), European Telecommunications standards (ETSI), American National Standards Institute (ANSI) and the like, have created IPR policies and guidelines associated with standardization. However, due to social and cultural factors, said organizations have diverse approaches when it comes to deal with the conflicts between IPRs and standardization (Park *et al.*, 1998). In respect to virtual project work, it can be said that the execution of telecommunication projects across geographical and cultural dimensions might be affected by distinct standards norms and IPRs policies that are more enforceable in some countries than in others. As a result, depending on the standard organization chosen, the product or service delivered either would reach good IPR protection (personal benefit), or would promote technology development improving compatibility (common benefit).

It can be concluded that, in accordance with Lea and Shurmer (1995), a coordinated international approach is needed in order to ameliorate the balance between IPRs and standardization. Furthermore, it is crucial to secure proprietary technological inventions in telecommunications and at the same time it becomes clear that the standardization process requires close attention. In the next section, a comparison between patenting and trade secrets as forms of intellectual property will be described, and also an overview of the current patent system will be presented.

3.2.3 Patenting as the principal form of intellectual property

The literature reviewed does not provide clear reasons indicating why the contemporary telecommunications industry presents a substantial patent intensity. Scholars like Bekkers *et al.* (2002) argue that the strong patent licensing strategy of Motorola at the beginning of 1990 in regards to GSM technology increased the consciousness of firms about securing innovations through patents. Another explanation might rely on the number of patents. In telecommunications is rather unlikely to develop advanced products without infringing upon someone's IP. Then, organizations are forced to cross-license technologies from each other and in order to do this, the firms involved must have patents to trade, that is, a strong motivator to patent. But why don't consider implementing trade secret to secure intellectual property in Telecommunications? Advantages and disadvantages between patents and trade secrets will be explored in the following section.



3.2.3.1 Patents vs. Trade secrets: is there a sole winner?

One of the great benefits of trade secrets is that they do not disclose technology; they are valuable as long as the information remains secret. In contrast, patents are public (reveal company's knowledge to competitors) and have a regular duration of 20 years (Hannah, 2005; Hannah, 2006; Butterworth-Heinemann, 2008; WIPO, 2012). Another issue with patents is stressed by Maurer and Zugelder (2000) regarding acquisition time. It takes approximately two years for a patent to be granted, and this time, sometimes, is larger than the *life-cycle* of the products created in the high-tech industry.

Moreover, Friedman et al (1991) identify three scenarios where trade secrets prevail over patents: On the first scenario, when innovations tend to increase steadily it is not recommendable to file for a patent. Second, when the expected duration of the trade secret exceeds the immovable life of the patent, and third, when executives consider that the threshold to be granted a patent will not be fulfilled by the invention.

On the other hand, it must be noted that, as studied in the previous sections, organizations should have all the mechanisms in place to protect trade secrets given that once disclosed they are lost forever. In addition, the degree of trade secret protection varies from jurisdiction to jurisdiction and is significantly weak in comparison with that of patents (Hemphill, 2004; WIPO, 2012). For that reason, patents are easier to enforce than trade secrets. The protection of trade secrets, thus, is attained by managers instead of legal procedures.

Reverse engineering constitutes a matter of concern when protecting innovations by using trade secrets. Chikofsky and Cross (1990) provide the following definition of the term: “analyzing a subject system to identify its current components and their dependencies, and to extract and create system abstractions”. In other words, reverse engineering consists of discovering how a specific device works by looking at its structure and operation. It is important to evaluate to what extend reverse engineering can be implemented in the innovation before selecting the protection method. When reverse engineering is imminent, it is justifiable to file a patent. Even though reverse engineering might be illegal in some jurisdictions, it might be very difficult to prove.

When it comes to costs, Lerner (1999) proved statistically that smaller, less positioned firms utilized trade secrets much more than bigger and more positioned organizations owing to the fact that both direct and indirect costs associated with patenting are considerably large. This investigation analyzed a sample of 350 manufacturing firms and was aimed at examining the



importance of trade secrets compared to other forms of IP. To complement this argument, Butterworth-Heinemann (2008) and WIPO (2012) recognize that patent filings are costly. However, as Hemphil (2004) stresses, trade secrets implies expenses likewise. The organization should be aware of the costs associated with keeping the information confidential.

There is evidence supporting the view that the implementation of trade secrets and patents in combination provides an additional benefit to become the *sole winner* as stated by Jorda (2007). Bulut and Moschini (2006) also reach this conclusion by using their probabilistic model to analyze R&D projects and the correlation between patents and trade secrets. The authors emphasize on the random duration of trade secret domination in the market since firms might reverse engineer the technological invention. The patent system might be complemented, to some extent, with trade secret protection but, unfortunately, the literature does not provide information related to trade secrecy in the telecommunications industry and this idea cannot be discussed more thoroughly.

There are advantages and disadvantages when using patents or trade secrets. High probability of reverse engineering implies patent protection. At the same time, if it is easy to find similar methods of producing the same functionality of the invention, patents might not be valuable. We might say that if we consider production processes as a trade secret is, in some situations, easier to enforce than securing the final outcome (invention) as such.

It would be valuable to study the repercussions of trade secrets in this industry that is currently dominated by patents. As mentioned before, one issue with patenting is that there are a huge amount of awarded patents with meticulous inventive steps that it is almost impossible to develop technological products or services without violating owner's rights. That might explain the popularity of cross-licensing agreements. In the next section it will be analyzed why the current patent system is losing credibility and what might constitute a reasonable solution. In addition, a comparative table has been elaborated whereby the main concepts concerning trade secrets and patents are exposed.



Trade secrets	Patents
<ul style="list-style-type: none"> • Do not disclose technology. • Protected as long as the information remains secret. • Have immediate effect. • Once disclosed, lost forever. • Be aware of reverse engineering. • Costs associated with keeping information confidential. 	<ul style="list-style-type: none"> • Patents are public. • Regular duration of 20 years. • To be granted a patent, it takes aprox. 2 years. • Stronger enforcement. • Filing patents are costly. • Provide legal monopoly for 20 years.

Table 5. Comparison between trade secrets and patents.

3.2.3.2 Current Patent system. Is it jeopardizing innovation and progress?

Some scholars (Jaffe and Lerner, 2004; Bessen and Meurer, 2008) argue that patents, rather than promoting scientific progress, are endangering innovation and economic growth. Both authors, who base their results on an exhaustive analysis of the patent system in the United States, agree that third parties responsible for awarding patents (e.g. United States Patents and Trademark Office, PTO) lack of solid and efficient patent examination processes. This means that the innovation system is at stake because of bad patent granting.

As an example, Jaffe and Lerner (2004) describe the inconsistency of the patent validity procedure by citing the litigation between Amazon and Barnesandnoble. Amazon granted a “silly patent” about a website purchase method where a customer, whose information was previously stored in a database, was able to make purchases *by using a single click of a mouse*. Barnesandnoble.com was sued by Amazon indicating that the B&N’s “Express Lane” purchasing violated the patent. It is evident that said patent was invalid but it was difficult to prove otherwise. Taking a broader point of view over this argument, it might be said that the patent system awards several patents for the wrong sort of things.

Patent disputes involving telecommunication companies have also put innovation at risk. NTP, A Virginia-based patent holding company, alleged patents infringement against Research In Motion (RIM), the company that sells blackberries, and threatened to disappear the Blackberry wireless e-mail device (RIM, 2012). While RIM agreed to pay around US\$ 612

million, the PTO had already examined the case and was about to reach the conclusion that the patents RIM was accused of violating, were not even valid (Jaffe and Lerner, 2004).

As can be seen from the previous cases, there is evidence showing poor patent quality, particularly in the US. It should be noted that He *et al* (2006) indentify the *USPTO* as the entity with the biggest compilation of telecommunication patents in the world. Therefore, it could be assumed that any other organization responsible of grating patents might have the same problems when it comes to examine patent validity. For example, Elsmore (2009) conducts a deep analysis of the European Patent Office (EPO) and concludes that the European patent system is awarding a substantial amount of *low-quality patents* given that the system lacks of solid examination procedures.

In order to overcome issues related to patenting, Jaffe and Lerner (2004) and Elsmore (2009) propose to reform the patent system and guarantee an effective patent validity process in the United States and in Europe respectively. Resources must be allocated towards the examination and re-examination procedures of granted patents. On the other hand, Yang (2008) portrays the importance of developing an International IP environment due to the inconsistency of the global IP system. However, it becomes cumbersome to reach consensus in the patent system across nations. Patents are conceded through many different organizations affected by cultural, social and legal doctrines.

Now, the question that needs to be answered here is: *Would it be feasible to employ trade secrets as a vehicle to complement or substitute patents?* According to the findings from the literature discussed up to this point, trade secret protection, to some extent, might also be contemplated as an alternative to for intellectual property improvement in the telecommunications industry. Information that provides competitive advantage such as core knowledge and certain exclusive technological inventions, where the likelihood of reverse engineering is minimal, might be secured through trade secrets. At the same time, the standardization process requires the dissemination of technology in order to attain interoperability. IPR licensing can be utilized to share technological information that becomes essential to a particular standard; in this case, patenting is a better option as well as the *hybrid licenses* discussed by Jorda (2007).

Despite that the virtual project literature does not give information about trade secret implementation, it can be concluded that intellectual property is related to project management theory, especially in the knowledge management processes. Common factors



affecting virtual project work, collaboration and trade secret practices have been identified and related. It is assumed that telecommunications firms conduct virtual project activities owing to the global environment in which they operate. In the last part of this literature review, suggestions for developing trade secret strategies will be discussed incorporating the main findings of the investigation.

3.3 Trade secrets within the IP strategy

As Hemphill (2004) indicates, the formulation of IP/trade secret strategies is a complex and challenging endeavor. It must be noted that it becomes more difficult to manage in a virtual project setting since more coordination mechanisms are needed among geographically dispersed members and the parent organization (Boh *et al*, 2007). We have seen that the integration of diverse expertise across sites is a common factor in virtual projects where the knowledge management system (KMS) plays an important role. Then, social networks such as *communities of practice (CoPs)* can be utilized as a vehicle to enhance knowledge integration as indicated in the beginning of the chapter.

This suggests that securing valuable knowledge gained through virtual project executions constitutes an essential part in any knowledge management initiative. The proposed theoretical model, which is illustrated in figure 10, is based on this literature study and has been elaborated to provide suggestions that might help project managers and executives mitigate the impact of difficulties attributed to secure knowledge that represents a competitive advantage and warrants, to some extent, trade secret protection. To begin with, the synergies between the organization and the third parties are clearly identified. After project completion the organization should evaluate the extent to which the technical knowledge developed in the project can be secured as a trade secret.

One might argue that the trade secret strategy varies with the life-cycle of the project as previously discussed. Thus, mechanisms aimed at regulating trade secret disclosure before, during and after project executions are exposed including the standardization issue in telecommunications. A distinction between shared information and created information that is or might be cataloged as trade secrets is described. Collaboration among participating firms in virtual projects not only implies control mechanisms when trade secret disclosure is agreed but also the protection of future innovations created through collaborative work.

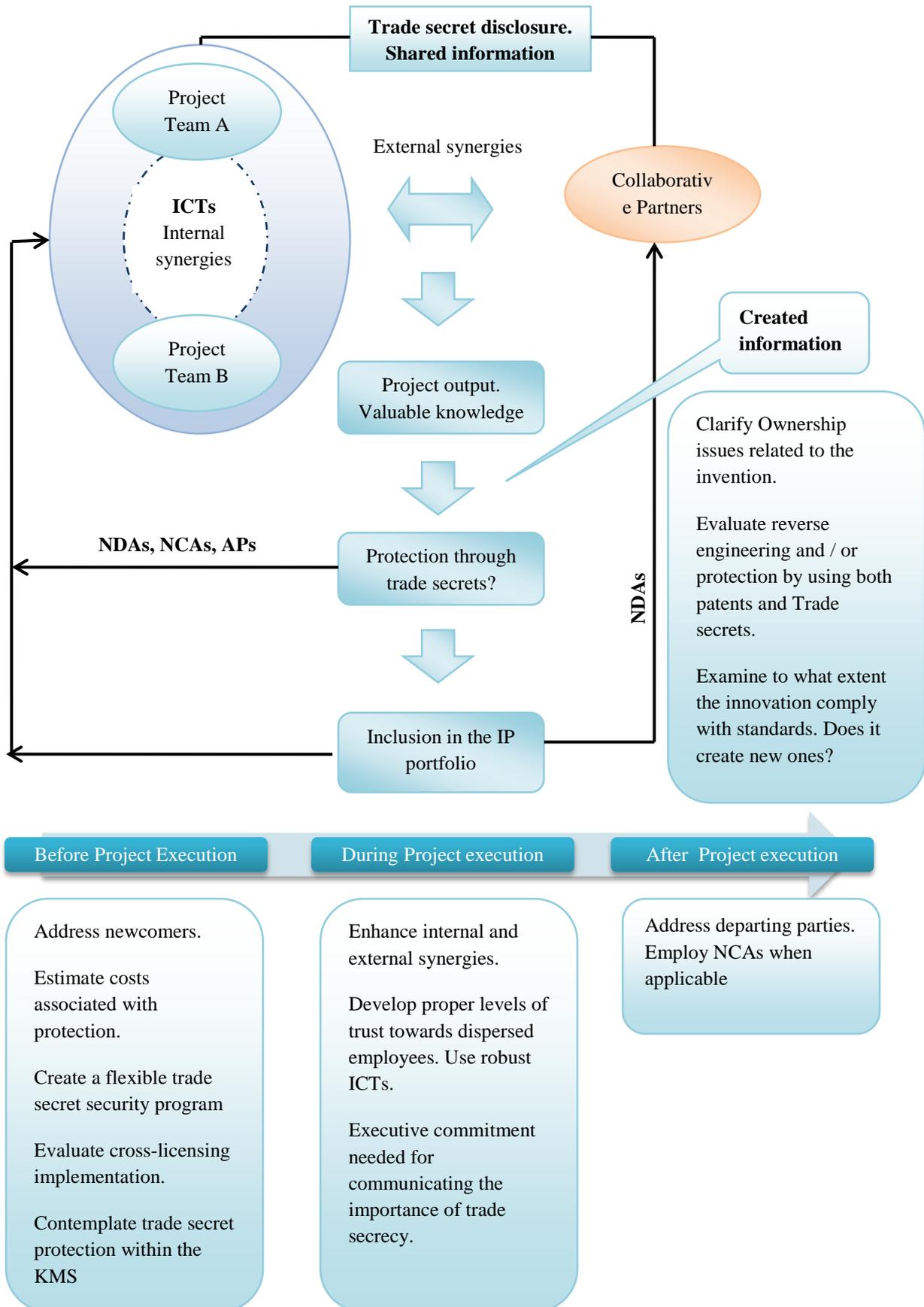


Figure 10. Proposed model for sharing trade secrets and protecting knowledge developed through projects.



3.4 Summary

This chapter illustrates the literature study of this thesis. As was explained, the theoretical framework comprises a deep analysis of the three theories relevant to the investigation: trade secret protection, virtual project literature and intellectual property rights in telecommunications. Each approach adds its contribution to the investigation and the relations encountered are described throughout the course of this chapter. The theoretical background is divided in three sections in order to provide a better elucidation of the core issues discussed in this chapter.

Section 3.1 presents the literature review regarding trade secrets as a means to protect intellectual property. The introduction of the concept of trade secret is described including the trade secret timeline history and development, starting from the industrial revolution, along with the role of trade secrets in virtual projects. Since trade secrets are associated with the knowledge processes within the organization, theory about knowledge management in virtual projects is presented emphasizing the challenges confronting virtual group members. Table 2 summarizes these obstacles. The relevance of trade secrets in today's business is also discussed encompassing some examples of how trade secret misappropriation paradoxically enhanced industrial development.

Subsequently, common agreements that are used in the technology business to protect trade secret disclosure are presented and their implementation in a virtual project setting is discussed. Telecommunications firms rely upon close collaboration with other firms, therefore it is also important to observe to what extent disclosing technology is a wise choice in this context. The concept of jointly owned IP is presented across different points of view. Finally, the findings from this section are illustrated in table 4, which includes factors affecting trade secret protection when working along with collaborative partners in a virtual project setting,

Section 3.2 presents theory related to intellectual property rights in the telecommunications sector. Issues around complementary assets and appropriability in telecommunications are exposed by citing the study conducted by He *et al* (2006). The implementation of cross-licensing is discussed as it constitutes a common practice in this industrial sector. Standards play an important role in telecommunications as mechanisms to attain interoperability. While disclosing technical information is inevitable to promote standardization, it is also important to ensure ownership of technological innovations. This has provoked a dispute between IPRs



and standardization which is addressed in this section. Then, the study examines why patents are employed as the main mechanisms for protecting technological knowledge in telecommunications. Furthermore, advantages and disadvantages of using patents and trade secrets are discussed including the feasibility of implementing both mechanisms in combination to protect IP. This section ends with a brief overview of the current patent system where the main conclusion implies that more effective patent validity processes are needed.

Section 3.3 provides suggestions for developing trade secret practices within the organization incorporating the most important findings from the literature study. For this purpose, a theoretical model is proposed and depicted in the figure 10. This model comprises factors influencing the protection of confidential information considered as trade secret across the life cycle of the project, and evaluates the extent to which trade secrets can be used to secure future innovations developed along with collaborative partners within a virtual project setting.



4 Data Analysis

This chapter constitutes the data analysis of my investigation. Its construction is based on the results from the literature study, the interviews conducted and the document analysis. The implications encountered between the theory and practice are explained discussing similarities, differences and new contributions. The results will be presented following the same order of the interview guide, that is, issues associated with trade secret as a mean to protect intellectual property will be discussed on the first place. After this, the protection of trade secrets when collaborating with other firms in a virtual project setting and the intellectual property rights in telecommunications, are described. The last part of the chapter studies formulation of IP/ trade secret strategy.

4.1 Trade secret as a means to protect intellectual property

Both the literature study and the qualitative research including interviews and document analysis show that information catalogued as a trade secret must have commercial value to the holder which must ensure that said information is kept secret. For this thesis as indicated in the previous chapter, information such as technological knowledge and proprietary technological innovations is considered as a trade secret because the research is focused on virtual projects carried out along with collaborating firms in the technology business, particularly within telecommunications; and also because telecommunications firms rely upon interoperability among different parties (e.g. collaborative partners, contractors, suppliers, competitors) where sharing technological information is, under certain circumstances, fundamental to accomplish project requirements.

With respect to areas that can be regarded as trade secrets, interviewee 1 stated that any information that proves to have substantial value to the organization should be kept confidential and this involves not only technical knowledge but also business information. Interviewee 2 and Interviewee 3 coincided with what had been said by interviewee 1, but they stressed that information secured through trade secrets is valuable as long as it promotes the business of the organization. In addition, they suggested that trade secret protection might increase market positioning by not allowing competitors obtaining information that they might consider valuable to improve their revenues.

When it comes to trade secret protection mechanisms, the results from the literature study shows that the commonly used agreements are as follows:



- *Non-disclosure Agreements (NDAs)*,
- *Non-Compete Agreements (NCAs)*
- *Assignment Provisions (APs)*.

Despite that the people interviewed recognized such agreements as valid protection mechanisms, they described other relevant issues that are not found in the literature and that must be taken into consideration when securing information as a trade secret. To begin with, Interviewee 1 portrayed the importance of having a formal system in place in which each trade secret is *defined*; it has to be described in a *clear way*. Therefore, he indicated that it is essential to inform all parties involved in the project such as employees, managers and collaborative partners what a trade secret is and implement all the required mechanisms to maintain it secret. On the other hand, Interviewee 1 underlined that the employer must have all rights to inventions developed by employees in a specific project, and as an employee, you must be able to differentiate between your personal skills and your employer's trade secrets but as discussed in the literature, there are *gray zones* that are difficult to address. The use of APs can, to some extent, alleviate this issue.

Interviewee 1 recognized NDAs as mechanisms for regulating trade secret disclosure. Data from documents provided by this person illustrates that it is usual to use NDAs when disclosing confidential information to third parties, and the scope of the definition should be stated in such a way that all parties involved have a common understanding of what is being shared along with the consequences they face if the information is disclosed. These documents indicate that there is not a standard NDA since it depends on the project characteristics. In the case of virtual project collaboration NDAs must be tailor made according to the attributes dispersed member have. These NDAs might include clauses regulating disclosure due to opportunistic behaviors or, in other words, disclosure by intent. NCAs were also mentioned by interviewee 1 but since the trade secret law differs across nations and within the same country as in the case of the US, it becomes difficult to provide fair compensations. This concept goes aligned with the theory analyzed.

According to interviewee 2, NDAs represent the most common way of protecting trade secrets. For instance, he mentioned that large organizations have their specific NDA models which can be *mutual* or *unilateral* NDAs, as mentioned in the previous chapter. Mutual NDAs are employed in a collaborative project setting because there is normally a two-way information exchange that is required to produce the service or solution aligned with



customer needs. The same agreement might be applicable to virtual projects characterized by the integration of diverse expertise across sites and organizations. On the other hand, interviewee 2 argued that mutual NDAs might be, to some extent, dangerous. For instance, in a collaborative project work in telecommunications, he provided the following example:

“I might say that I do not want any trade secret from my collaborative partner relating to network configuration as it is quite difficult for me to know what the network routing algorithm is which might be identical to the one the other organization implements on its network.”

Agreements such as NDAs, joint venture agreements cross-license agreements or any other agreement that contains confidentiality clauses can be used as protection mechanisms to protect trade secrets, according to what interviewee 3 mentioned. Despite that the trade secret law varies across nations, she said that it does not constitute a big issue. The concept of IPR is understood in a large similar way, particularly in the western world.

Scholars like Hannah (2008) and Hailing (2008) indicate that employees represent the principal group responsible for divulgence of trade secrets. This argument is reinforced by the interviews conducted and the document analysis. Interview 1 suggested that employees, including newcomers, current and departing employees, represent a bigger threat because sometimes they might think that trade secrets constitute part of their personal skills. In contrast, it becomes easier to control disclosed information when working in collaboration with other firms owing that both parties know which information is catalogued as trade secrets and which trade secrets are being exchanged. This is accomplished through formal procedures (previously discussed) used before disclosing information to participating firms in the project activities.

Due to the high turnover rate in the telecommunications industry, interviewee 2 argued that employees, also including new, current and departing employees, are more likely to disclose trade secrets. This issue escalates if employees conduct project activities on a virtual basis since more coordination mechanisms are required. This frequent change of personnel represents a considerable threat and therefore the organization must take the necessary precautions when sharing trade secrets with their employees. Interviewee 3 underlined that software developers represent the bigger threat. She added:



“They are almost facing an ethical dilemma regarding information sharing, and it is not always out of bad will or even negligence, but the eagerness to find technical solutions and sharing thoughts with other developers.”

In the literature review, it was suggested including integrated and dynamic security practices aimed at protecting and commercializing knowledge gained through project executions in the knowledge management system of the organization. However, the qualitative data analyzed on this thesis does not show evidence supporting this concept. Trade secret protection is not contemplated in the knowledge management system but contained in the IP strategy. Having discussed general aspects of trade secrecy, now it is time to see the connotations of trade secret protection when working with collaborative partners in a virtual project setting.

4.2 Trade secret protection in a collaborative setting

It is clear that disclosing confidential information considered trade secret is, to some extent, necessary when working in collaborative projects with other firms and even more in industries like telecommunications, whose business operations rely upon collaborative linkages among different entities. This means that mechanisms for controlling shared information during project execution must be in place but also it is worth noting that innovations generated after project completion require good protection as well. In other words, securing shared information is as important as securing created information. The global market of telecommunications is expanding rapidly suggesting that firms operating within this sector are geographically dispersed and, hence, conduct virtual project activities. As it was discussed in the literature review, virtual project teams experience problems attributed to knowledge integration and at the same time, factors affecting trade secret protection in a virtual setting, were identified. It must be mentioned that, According to analysis of theories related to knowledge management in virtual projects and trade secret protection, knowledge management and trade secret protection are influenced by common factors discussed below.

This section aims to compare the results from the qualitative study with the literature review addressing issues such as factors affecting trade secret protection in virtual project activities and the management of jointly IP in future innovations (created knowledge). Interviewee 1 argued that the organization acquires costs associated with protecting trade secrets, but these are *organizational costs* which is the attention required in the organization for protecting trade secrets. If employees are located outside the physical boundaries of the organization, he



stated that such costs increase, supporting the theoretical arguments from scholars like Hemphill (2004) and Boh *et al.*, (2007) focused on trade secrets and virtual project theory respectively.

Interviewee 1 also identified *trust* as an important factor. It has to do more with *organizational culture* which varies across firms, industries and societies. It is crucial that executives ensure that their employees have a good understanding of trade secrets. When it comes to working along with other industrial partners, interviewee 1 stressed one more time the importance of having a clear and specific definition of what kind of information is considered as a trade secret. His experience as an IP manager consultant for telecommunications firms has shown that identifying and defining trade secrets is rather complicated. Data gathered from interviewee 2, interviewee 3 and from documents given by interviewee 1 and interviewee 3 agree on this point which is not so emphasized on the literature.

The description of the information to be protected as a trade secret needs to be clearly explained and detailed as Interview 2 stressed. The implementation of formal documents stating the term and conditions of the trade secret to be disclosed and the signature of employees and collaborative partners involved in project activities are essential parts in any agreement. Keeping information secret constitutes a huge challenge for interviewee 2, and the involvement of more people and organizations, makes this more cumbersome and risky. He commented that additional risks arise when the project is organized as a virtual project because it cannot be guaranteed that people that rely merely on ICTs make proper use of regulation mechanisms for trade secret protection. As discussed on the theoretical background, ICTs might become ineffective when employees behave opportunistically and disclose information for their own benefit. People working on a virtual basis, thus, must understand and put in practice protection mechanisms to keep information secret as Interviewee 2 suggested. Each member acts, to some extent, as a representative of his/her organization not only with regards to technical but also managerial issues. Then, multicultural and multidisciplinary understanding is crucial along with executive commitment.

For interviewee 3, there are three factors to be taken into account concerning how trade secrets are protected in practice: the *culture within the organization* about trade secrets, the *system safety* and the *degree of awareness*. She stressed that people involved in the business environment have not a clear understanding of what a trade secret is.



In a collaborative project setting, Interviewee 1 and interviewee 2 portrayed the importance of understanding the background from each party before entering in collaboration. The organization must acknowledge what background is relevant to the collaboration and the level of familiarity employees have about trade secrets before starting project activities with participating firms. Working in collaborative projects in a virtual project environment makes this issue even more relevant and difficult to handle. For instance, in a particular technical area one might have a patent application and certain trade secrets that cannot be shared, and this must be clearly understood by employees, including virtual team members, and partners. Besides, Interviewee 2 indicated that one of the challenges in collaborative projects is the partner selection process implying that solid selection criteria must be used before entering into collaboration in order to work with organizations reasonably trustworthy.

When it comes to the management of jointly IP, different perceptions were found within the interviewed people. Interviewee 1 affirmed that it is hard to own a trade secret together with another organization given that it is difficult to agree how to handle said trade secret and allocate rights on an equitable manner. Having 2 organizations that are allowed to share trade secrets with their employees, partners and any other entity, constitutes a bigger threat. He underlined that this problem has bigger repercussions when working on a virtual basis owing to the dispersion of work that makes difficult to control trade secret information. Data analyzed in the documents given by interviewee 1 are aligned with the same idea. What have been discussed here supports the view of Butterworth-Heinemann (2008) since the authors recommend to avoid jointly owned of IP by assigning all IP gained in the project to one party while the other party might evaluate the utilization of licensing agreements.

On the other hand, interviewee 2 mentioned that it is possible to handle jointly ownership in practice. As a legal advisor with broad experience in public and private organizations, he has worked with contracts that provide clauses to this issue. Interviewee 3 mentioned that both parties involved in the collaborative work must be aware of what information is being shared and the implementation of joint ownership agreements is a common practice. As it was discussed on the literature, one of the reasons for working with geographically dispersed employees and collaborating with other organizations is to get access to specific knowledge needed for project success. This concept is what Griffith *et al* (2003) define as *synergy interactions*. Then, According to interviewee 2 and interviewee 3, it is common to implement a *joint ownership agreement* of the product or solution to be developed where trade secrets might represent one of the mechanisms to protect IP.



Gollin (2008) confirms this argument because, according to his model directed towards allocating rights for future innovations, it is feasible to have five possible right allocations where joint ownership agreements are considered the fairest ones in comparison with those agreements assigning all IP gained to just one party. The next section presents the results of IP in telecommunications based on the theoretical results that will be tested against the qualitative data obtained.

4.3 Intellectual Property in Telecommunications

According to the literature study, the telecommunications sector presents a substantial patent intensity when it comes to secure technological innovations. At the same time, studies have been directed towards patent development while trade secret protection within this industrial sector has not been contemplated by academic circles. This section is intended to determine to what extent it is possible to implement trade secrets as protection mechanisms in telecommunications, particularly when it is required to secure technological knowledge. The findings from the qualitative analysis will be compared with the literature review including issues associated with standardization, licensing and contract management.

Interviewee 1 pointed out that patents are commonly used in telecommunications because the information is revealed and this is a condition to achieve interoperability between the different parties involved in the firm's operations. But on the other hand, he acknowledged that patents can work along with trade secrets in telecommunications. He said the following:

“It is because everything is shown, if you are producing some chemicals or plastics for example, you can keep parts of the production process as trade secrets but you cannot do that with mobile phones or software since everything can be re-engineered. You much easier observe how the product or service behaves. In telecommunications, everything is standardized because you are going to interconnect with others. So, in that way is harder to keep something secret, then you have to patent if you want to have the ownership or you have to move faster and secure lots of customers. But it is mixture between trade secrets and patents. I do not think telecom is much more intense than biotech where you need in a large degree patents to secure financing earlier.”

It can be seen that standards play an important role in telecommunications and it could be argued that, as discussed in the literature, trade secrets must support existing standards or create new standards in order to be considered as essential assets. Otherwise, non-technical



secrets might represent a higher economic value. Data analyzed from documents provided by interviewee 3 illustrate that technical knowledge can be secured as trade secrets as long as they do not represent *obvious technical solutions* such as technical processes. An assumption concerning this concept was made on the literature which is now confirmed; if production processes are considered as a trade secret it might be easier to enforce them than securing the final outcome.

For Interviewee 1 one of the main advantages of using patents is that the organization does not have to maintain information secret, however filing patents are costly and some countries do not have organizations responsible for granting patents. In addition, he argued that innovations may have higher protection in some patent systems than in others due to cultural, social and legal principles. On this matter, interviewee 3 agreed with interviewee 1 and stated that legally enforcing a patent is much easier than legally enforcing a trade secret. As can be noted, the literature study and the qualitative data collected on this subject recognized the same factors when comparing patents with trade secrets.

Reverse engineering endangers technical knowledge protected by trade secrets, as indicated by Interviewee 1 and by the documents given by interviewee 3. For instance, if certain innovation is kept secret and somebody deciphers how it works by making use of reverse engineering and then it is feasible to file for a patent, the organization might not notice when the innovation was discovered. This suggests, as Interviewee 1 commented, that the measures an organization should implement to protect trade secrets must be strong enough to face disturbances in the external environment and constantly adjust to unforeseen changes. New customers' requirements, market trends, competitor monitoring and the like must be contemplated. Corso *et al* (2009) argue that dynamic knowledge management processes among virtual teams are needed to improve project performance and therefore, as discussed in the literature, authoritarian security measures and rigid knowledge processes might be contra productive when it comes to conduct project activities in today's global and complex environments.

Within the telecommunications field, Interviewee 2 stated that patenting constitutes a better mechanism to protect IP because both collaboration and competition are required to succeed in projects directed towards technological developments. That is why, as he commented, it is common to use *cross-licensing* agreements as they allow access to technological information that cannot be obtained otherwise. This is also accentuated by interviewee 3. She added:



“Cross-licensing is a common practice when the company conducts projects along with industrial partners in telecommunications since it maximizes the potential utilization of technical knowledge between the two parties.”

As can be seen, interviewee 1, interviewee 2 and interviewee 3 provided the same arguments with respect to advantages and disadvantages of patents in comparison with trade secrets.

The qualitative data analyzed illustrate that it is possible to utilize of patents and trade secrets in combination to protect IP in telecommunications, which is something that has not been discussed by the academia. As I said in the beginning of the previous chapter, I could not find any scholar covering this concept within this industrial sector. All the people interviewed agreed on the common implementation of both trade secrets and patents to protect intellectual property in telecommunications. The Norwegian consultancy firm, in which interviewee 1 works in, assists organizations in indentifying items that are possible to keep secret and also other issues that can be patented within the same product or service. Interviewee 1 commented that is very usual to use these protection mechanisms in combination to protect IP in telecommunications, not only in the strategic field but also in regards to technical knowledge. For instance, he said that it is possible to find trade secrets associated with network configurations designed to prevent network conflicts such as overloading or saturations. On the other hand, particular details in the products like embedded software might also be protected by using trade secrets. Despite that Interviewee 2 does not have so much experience concerning IP in telecommunications; he stressed the importance of having both patents and trade secrets to protect technical knowledge. The telecommunications industry presents a substantial patent intensity, however, in addition to patents, organizations should have mechanisms like trade secrets to protect know-how or core knowledge.

Interviewee 3 has extensive experience in IPR in telecommunications as mentioned in the methodology chapter. With respect to the implementation of patents and trade secrets in combination, she agrees with interviewee 1 and interviewee 2:

“We always recommend using patents and trade secrets in combination, if possible, because you do not want to reveal more information through a patent than necessary and that trade secret may constitute a further competitive advantage.”

In telecommunications, interviewee 3 stated that certain parts of the software and the integration layers can be protected through trade secrets. She recognized that much of this

knowledge is developed through project activities across national, functional and cultural borders. Therefore the project managers must be skilled at handling IPR over a global context. In the literature analysis, there is evidence supporting the view that patents and trade secrets can complement each other in order to protect technical knowledge, as exposed by Bulut and Moschini (2006) and Jorda (2007). Even though these authors based their findings on studies conducted in areas that are not related to the telecommunications, this can be now confirmed for this industrial sector thanks to the qualitative data collected. It is wise to file for a patent but at the same time the organization must keep secret information that confers a competitive advantage. A supposition was made in the literature analysis concerning the utilization of patents and trade secrets. It was argued that a patent might be surrounded by trade secrets making it very difficult to understand and apply without access to such trade secrets, but the qualitative study does not provide information about the likelihood of surrounding patents by trade secrets. This might be considered as a suggestion for further research.

Contracting when trade secrets are licensed is an important issue that must be analyzed in this section. It is very common to license patents and trade secrets in telecommunications, according to the people interviewed. When licensing is agreed, interviewee 1 highlighted that it constitutes a package (e.g. drawings, trademarks, software) and not just patents or trade secrets. He commented on useful mechanisms, identified as *patent pools*, that allow access to patents but not to trade secrets. He said:

“In telecommunications, for instance, the patent pools for embedded technology or Bluetooth allow access only to patents and not the trade secrets or anything else. This means that you have to develop the software yourself.”

As it was previously studied, Butterworth-Heinemann (2008) emphasize on having *careful contracting measures*, particularly for large and complex projects. For interview 1, the detailed way of how the information will be kept secret constitutes the most important part in any contract. Interviewee 2 stated that the contracts become a primordial factor when handling trade secrets, and even more when international contracts are used inasmuch as they are difficult to exercise. He added:

“International collaboration is more frequent these days, then you have to develop contracts that cover you, and this is even more important in industries involved in



global and rapidly changing environments like telecommunications. Different agreements handling this issue are needed.”

Interviewee 3 underlined three relevant factors to be considered in contracts. On the first place, *confidentiality* represents the most important issue, secondly documenting what the trade secret is and which control mechanisms will be utilized to protect that trade secret. This idea coincides with that of interviewee 1. Last but not least, consequences related to breaching the contract must be clearly stated in the contract and understood by both parties.

Scholars as Lea and Shurmer (2005), Park *et al*, (1998) and Bekkers *et al*, (2006) argue that it is fundamental to establish adequate measures to ameliorate the never-ending dispute between IPRs and standardization in telecommunications. This means that organizations should contemplate security programs that protect and at the same time promote technological inventions. Awarding IPR licenses on a “*fair, reasonable and non-discriminatory terms and conditions*”, as suggested by Lea and Shurmer (1995), represents one possible solution. Although only interviewee 3 commented on this issue amongst the persons interviewed, the data collected illustrate an interesting approach. She mentioned that a balancing act between the different stakeholders in the telecommunications market and the political party responsible for driving the standardization processes must be reached. On one side, the *open source movement* has led to a considerable technical development but on the other side, organizations need a safe and stable IPR-environment for promoting their business. She stated as a conclusion:

“This is an area of interesting development. I consider that the balance to be attained has to be between three parts: the telecommunications market, the politic bodies and the technical developers’ movement.”

It can be argued that, according to what has been discussed in the theory, telecommunications firms might decide to disclose information in order to promote standards in the industry and keeping as trade secrets information that constitutes a competitive advantage such as technical processes based on such standards. Hence, the conflict between IPRs and standardization might be, to some extent, mitigated. The next section discusses trade secret issues when formulating IP strategies.

4.4 Trade secrets within the IP strategy

Information classified as a trade secret over this globalized era has the following characteristics as mentioned by Hailing (2008): *it is intangible, diverse and changeable*. This represents complex and challenging endeavors for executives and project managers when it comes to design IP strategies, and such endeavors become more cumbersome when project activities span across geographical, functional and cultural dimensions. The proposed theoretical model to protect shared and created knowledge is the basis for the next chapter and incorporates the relevant findings from the literature review with the assumption that the management of trade secret varies with the life-cycle of the project. In other words, the model is intended to provide suggestions for developing IP strategies before, during and after project activities.

This topic was discussed with Interviewee 1 and Interviewee 3 because they have experience in IPR strategy in telecommunication and help customers to develop IPR strategies. Interviewee 1 stated that the main factors to be taken into account when formulating IP strategies are the process the organization put in place to define what a trade secret is, who will own and have the ownership of that trade secret and which control mechanisms will be used to defend that ownership. It should be mentioning that trade secrets conform one part of the IP strategy and the other part corresponds to IPRs such as copyrights, patents, designs and trademarks. As commented by interviewee 3, trade secrets are involved in the firm strategy. When discussed factors influencing the IP strategy, particularly in trade secrets, she agreed with interviewee 1. She underlined the following:

“It is important to define what area should be secured as a trade secret, document it and have a solid protection system in place.”

Data acquired in the documents given by interviewee 3 suggest that certain criteria must be considered within the strategy when it comes to protect IPR as trade secrets. The organization needs to evaluate to what extent technical solution can be re-engineered, for example, do not protect *obvious technical solutions* as trade secrets. If it is difficult to prove patent infringement, it might be advisable to keep the information secret, particularly with technical processes as earlier mentioned. Finally, a conscious business strategy is required aimed at securing confidentiality. The latter argument is also stressed by interviewee 1.



4.5 Summary

This chapter exhibits the qualitative research of this thesis. It is based on literature findings and the empirical part encompassing 3 semi-structured interviews and document analysis. The results are presented following the same order of the interview guide, that is, issues associated with trade secret as a mean to protect intellectual property are mentioned. After this, the protection of trade secrets when collaborating with other firms in a virtual project setting and the intellectual property rights in telecommunications, are described. The last part of the chapter discusses trade secrets within the IP strategy. Experiences from practitioners and important issues found in the documents are analyzed in order to elaborate an empirical basis for the discussion. A comparison between theory and practice is described, identifying key pieces of data and discussing similarities and differences. The results from this chapter along with the theoretical model proposed in the literature study represent the basis for the discussion chapter.

5 Discussion

The managing of trade secrets is a demanding undertaking for telecommunications firms as could be seen in the previous chapter. Such organizations are embedded in global and rapidly changing environments where collaboration with other parties becomes fundamental and suggests sharing technological information to succeed in project activities, as a common practice. When the information is categorized as trade secrets and its disclosure is inevitable to achieve the desired outcome; then the issue is more about regulating their access and utilization before, during project activities and after completion. At the same time, knowledge acquired through projects might represent a competitive advantage that requires good protection mechanisms. This means that collaboration among participating firms in project activities not only implies control mechanisms when trade secret disclosure is agreed but also the protection of future innovations created in a collaborative setting.

It is worth mentioning that telecommunications firms execute virtual projects owing to the global environment in which they operate and, thus, a substantial amount of the future innovations are developed by means of projects crossing national and cultural boundaries. I stress the important role virtual teams play in today's business; they are becoming the new forms of work structures in accordance with Alawi and Tiwana (2002). As previously discussed, the theoretical analysis of my thesis comprises three separated but interconnected theories: trade secret protection, virtual project literature and IPRs in telecommunications. New interpretations were attained by combining these three theories and comparing the results with the empirical data collected.

Handling trade secrets according to the phase of the project, that is, before, during and after virtual project activities as illustrated in the proposed theoretical model, constitutes one of the main contributions of the research. The information presented on this chapter is structured in a similar way. The results obtained in the study will be presented by discussing factors affecting trade secret protection and taking into consideration the phase of the project. On this part I try to find an answer to the first research question:

How do telecommunication firms that conduct virtual project activities along with collaborative partners implement intellectual property practices aimed at securing information considered as trade secrets before, during and after project executions?



After having examined mechanisms regulating trade secret disclosure (shared information), the discussion will study the implications of trade secret as an instrument to protect future innovations in telecommunications. It is aimed at investigating the extent to which knowledge developed through virtual projects in particular (created information) can be secured as a trade secret. Therefore, the second research question will be answered:

How, and to what extent, does trade secrecy constitute a feasible alternative to substitute or complement patents in the telecommunications sector in order to secure technological innovations developed along with collaborative partners in a virtual project setting?

The proposed theoretical model will be improved according to the practical and theoretical results presented. It compiles the key pieces of data that will be discussed on this chapter. Limitations of the study and suggestions for further research will be mentioned as well.

5.1 Trade secret protection before project execution

As it was studied earlier, the qualitative data analyzed and the literature study entail that information secured as a trade secret must have an economic value to the organization holding that secret. At the same time, the organization must ensure that the information is kept secret which is something difficult to reach and even more when firms are geographically dispersed. Before conducting virtual project activities it is important to know to what extent the information will be shared between virtual teams and collaborative partners. It is crucial to have a *clear and detailed definition* of what kind of information is considered a trade secret, according to the empirical data collected. While the interviewees emphasized on this issue on a large degree, the theories analyzed do not accentuate its significance.

Another interesting point identified in the interviews is that in a collaborative project setting, all parties involved must acknowledge what *background* is relevant to the collaboration before starting project activities. Furthermore, the organization must recognize the level of familiarity employees have about trade secrets, for instance, certain information can be disclosed to the collaborative partner in order to accomplish project requirements but some information is not allowed to share. This must be clearly understood by employees that will work on the project, and the implementation of formal documents stating the terms and conditions of the trade secret to be disclosed including the signature of employees and collaborative partners are essential parts in any agreement.

When it comes to agreements to protect trade secrets, three commonly used agreements were found in the literature: Non-Disclosure agreements (NDAs), Non-Compete Agreements (NCAs) and Assignment Provisions (APs). As was mentioned by the interviewees, telecommunication firms make use of non-standard NDAs since they must be customized in accordance with the project characteristics. On this context, I argue that controlling NDAs when conducting project activities in different geographical areas is an arduous task due to the nature of the virtual environment in which members are embedded. They might present opportunistic behaviors disclosing information for their own benefit. The implementation of NCAs might ameliorate this issue to some extent and this will be discussed in more detail in further sections. The empirical data implies that mutual NDAs are employed in a collaborative setting as there is a normally two-way information exchange required to develop the innovation aligned with customer needs. In addition, the firms involved in the collaboration are aware of which information is catalogued as a trade secret and which trade secrets are being exchanged.

As interviewee 1 mentioned, the employer must have all rights to inventions developed by employees during the course of the project. Employees should differentiate between common knowledge and company's trade secrets, and the utilization of APs constitutes a good alternative. It is important that dispersed workers understand this issue before that any project activity takes place, nevertheless, as discussed previously in section 3.1.3.3, there are *gray zones* that are difficult to manage. It is worth noting that in situations wherein temporal employees are hired (e.g. consultants or independent contractors) such agreements might not function as planned, meaning that the organization must find other regulation mechanisms. This creates a quite messy panorama in the process of handling trade secrets.

It is clear that the organization acquires costs when handling trade secrets, as was seen in the theoretical background of this thesis. Interviewee 1 mentioned that these costs are more like *organizational costs* which tend to increase as employees carry out virtual project activities. I argue that the organization should make an estimation of the cost attributed with the protection of trade secrets on a virtual project setting, taking into account aspects such as the turnover rate, cultural differences among virtual members and the level of trust towards participating firms in the project. The latter implies that solid selection criteria must be used before entering in collaboration in order to work with organizations reasonably trustworthy.



Corso *et al* (2007) emphasizes on the significance of having dynamic knowledge management processes among dispersed members as a mechanism to improve project performance. At the same time, I would argue that protecting that knowledge becomes a primordial factor when it comes to promote the business of the organization and necessitates *dynamic security practices* that should be included in the knowledge management system (KMS) of the organization. Although the theoretical findings and the empirical data do not present clear evidence supporting this view, I suggest incorporating control mechanisms to secure valuable knowledge within the KMS in order to increase the awareness around IP issues in the field of project management.

The measures employed to protect trade secrets, thus, should be flexible enough to deal with disturbances in the external environment facilitating adaptations to unforeseen changes. *Contracting* represents another issue that needs close attention before project execution. On a virtual and collaborative project perspective, contracts become important in trade secret disclosure and even more when project activities are conducted beyond national and legal boundaries where international contracts must be used. As interviewee 3 commented, the confidentiality clauses and the consequences related to breaching the contract must be clearly stated and understood by both parties. It is worth noting that contracts are context-specific; they rely upon the requirements of the project. These requirements are more demanding when the dispersion of work augments and the firm operates in the telecommunications field given that it faces increasingly chaotic environments. The following section presents the discussion of trade secret protection during project execution.

5.2 Trade secret protection during project execution

The results from the previous chapter show that *employees* constitute the bigger threat when it comes to trade secret disclosure. In telecommunications, there is a high turnover rate and the frequent change of personnel becomes a problem that requires close attention. I argue that the organization must take all the necessary precautions when regulating information considered as a trade secret towards virtual members in particular. But how can one ensure that people that merely rely on ICTs to conduct project activities make proper use of said information? As the theory and the empirical analysis suggests, the importance of developing higher levels of trust is a crucial aspect where the organizational culture plays an important role. I mentioned that robust ICTs can prevent disclosure by accident through regulation mechanisms that impede access to specific information. However, I might claim that ICTs



become ineffective regarding disclosure by intent. For instance, it is difficult to recognize if the confidentiality agreement has been breached when people work geographically dispersed.

It was argued that identifying and defining trade secrets constitutes a challenging mission for *executives*. They are responsible for transmitting the importance of trade secret protection to the different units of the organization, including virtual teams. Trade secrets represent a form of organizational knowledge that is critical for organizations so as to attain a competitive advantage in the industry. This means that executives must be skilled at handling trade secrets during project activities with the purpose of reaching a good level of awareness within the organization about how the information should be shared and which regulation mechanisms will be used to protect trade secrets. It is worth remembering that in a virtual project setting, each virtual member behaves as a representative of the organization in both technical and managerial fields, thus, I would think that dispersed workers must be prepared to face multicultural and multidisciplinary environments. A designated electronic area to regulate information access (e.g. a secured server) should be created where such information is kept confidential and shared among virtual members when allowed. Security represents an issue in this context, hence, the individual responsible for preventing and monitoring unauthorized access needs to be a trusted person within the virtual team and highly skilled in IT so as to guarantee reliable security levels.

Owing to the necessity of integrating diverse expertise across sites, certain projects cannot be executed on a specific geographical area. Lately, the establishment of geographical dispersed teams is, to some extent, essential to achieve success. Griffith *et al* (2003) indicate that solid *synergy levels* must be attained amongst virtual members in order to generate potential knowledge. At the same time, I argue that, during project activities, synergy levels must be developed along with collaborative parties whose knowledge is needed for project execution. In the telecommunications sector, for instance, this is more important as both collaboration and competition are required for creating technological developments that promote standards in the industry. The next section discusses some control mechanisms to be taken into account regarding trade secret disclosure after project completion.

5.3 Trade secret protection after project execution

When the project life-cycle reaches its end, both the employees and the participating firms must return all the confidential information utilized in the project. Before starting any project activity, it is crucial to have contracts in place with all the parties involved so that they clearly



understand the terms and conditions of the information to be disclosed as earlier stated. If the virtual team is disintegrated after project completion and some employees leave the company, I argue that the NCAs provide a reasonable safeguard mechanism. However, the trade secret law provides better compensations for dispersed employees in some places than in others since it is rather distinct across nations. Despite that the concept of IPR is comprehended in a similar manner in the western world as said by interviewee 3, it becomes a matter of concern when project activities span across cultural and social dimensions. For instance, which mechanisms can be implemented to guarantee that NCAs in the US and in China will provide equitable compensations to employees within the geographically dispersed organization?. In addition, these agreements must have a reasonable duration which is difficult to address. Once again, I argue that such agreements might be applicable under certain circumstances. When temporal employees such as consultants or independent contractors are hired for the execution of a particular project, NCAs might become ineffective.

The security measures an organization employ to protect trade secrets after project completion rely upon control mechanisms used before and during project execution. In other words, as long as the organization make the proper decisions regarding trade secret protection before and during project activities, the management of trade secrets after project close-out will not represent a big concern. This phase is more important when it comes to protect knowledge developed in the project (created information). After having discussed key aspects affecting trade secret disclosure in the project life-cycle, the next section aims to present the extent to which future technological innovations can be secured through trade secrets in the telecommunications sector.

5.4 Securing future innovations in telecommunications

Telecommunications firms are characterized as large and globally distributed organizations whose operations are based on interoperability among different organisms where standards become fundamental. This suggests, in my opinion, that projects directed towards technological developments are commonly conducted in collaboration with other companies. At the same time, complying with existing standards requires the implementation of protection mechanisms that permit disclosing information over a safe IPR environment. This might explain why patenting constitute the principal mechanism to protect IP within this industrial sector.

The results from the literature study and the empirical data illustrate that it is possible to handle jointly IP ownership of the future innovations to be developed. Joint ownership agreements are widely used in telecommunications, however said agreements might function under certain conditions. As interviewee 1 mentioned, having 2 organizations that are allowed to share trade secrets constitutes a bigger threat and even more when working on a virtual basis. I argue that allocating IPRs on an equitable manner is not an easy task, therefore, the organization should evaluate on the first place to what extent it is recommendable to own a trade secret with another firm. It might be wiser assigning all the ownership of the trade secret to the organization while the other party might consider acquiring a license agreement. In addition, I might claim that in this collaborative setting it is difficult to operate as clear-cut as Gollin (2008) describes on his model directed towards assigning rights for future innovations, with perceived gray zones or areas of misunderstandings between the involved parties.

It was discussed in the previous chapter that it is common to implement *cross-licensing* agreements in telecommunications instead of receiving financial compensations that might be obtained for instance with patenting or trade secret licensing. Furthermore, a cross-licensing agreement allows the IPR holder access to valuable technological information from other firms and this might be consider a strategic move. Interviewee 3 stated that cross-licensing is a common practice because it maximizes the utilization of technical knowledge in the collaborative project setting. Then, the development of future innovations in telecommunications implies that disclosing technical information to participating firms in the project is in some cases, inevitable. I argue that cooperation between firms in telecommunications can be possible for developing new technologies and at the same time the firms participating in the collaboration might compete on the market with products based on said technologies.

The feasibility of employing patents and trade secrets in combination to protect technological knowledge in telecommunications constitutes one of the main contributions of my study. Although the literature does not provide evidence supporting this argument, the empirical data collected indicates that the protection of technological innovations in telecommunications is built upon a mixture of patents and trade secrets. I might suppose that trade secrets cannot substitute patents in telecommunications because of the nature of this industry, where disseminating technology is crucial in order to comply with standardization. Upon this, a question arises: to what extent do trade secrets complement patents in the



telecommunications sector as mechanisms to protect technological innovations? Despite that patents provide a legal monopoly for 20 years and have better legal protection than trade secrets, organizations should not reveal information that may confer a competitive advantage through a particular patent. The extent to which it is suitable to file for a patent, keep the information confidential or combining these two to protect IP in telecommunications depends on certain aspects to be discussed below.

Reverse engineering represents an issue when securing innovations as trade secrets. It becomes easier to decipher how the product or service behaves in the telecommunications sector than in other industries because of the extensive collaboration with different organisms. Therefore, I argue that technological knowledge developed throughout virtual project activities where the likelihood of reverse engineering is minimal, might be secured as a trade secret. The qualitative study confirmed what had been assumed in the literature study regarding this issue. Non-obvious technical solutions can be secured by means of trade secrets such as *technical processes* which might be, to some extent, easier to enforce than securing the final outcome. If the organization contemplates the implementation of trade secrets to protect IP, then I deduce that such technical knowledge must support existing standards or create new standards within the industry. The empirical data analyzed suggests that, in the telecommunications field, network configurations and particular details on the products like embedded software can be protected through trade secrets. Another interesting point that needs further discussion relies on the current patent systems. Patents are conceded by many different organizations affected by cultural, social and legal principles. I argue that it is important to reach an international patent system with solid examination procedures in order to award patents accordingly. If it is difficult to prove patent infringement, then it might be recommendable to keep the information secret.

Jorda (2007) states that patents and trade secrets can complement each other and the implementation of agreements covering both methods can be used. The qualitative analysis demonstrates that it is common to license patents and trade secrets in telecommunications where the implementation of *patent pools* becomes paramount for regulating information disclosure. As a result, it is feasible to allow access to patents but not to trade secrets. For instance, an organization might reveal information through patents for promoting technology in the industry and in the society while keeping confidential information that represents a further competitive advantage. As previously discussed, it is clear that mechanisms intended to harmonize the relationship between standardization and IPRs in telecommunications

should be employed. However, this is difficult to accomplish, particularly when projects are conducted across geographical and cultural dimensions affected by distinct standard organizations and IPRs policies. I argue that coordinated approach must be attained between the organisms within the telecommunications market and the political bodies responsible for driving the standardization process. Firms might decide to disclose information to comply with standards and keeping secret information that represents a competitive advantage such as *technical process based on said standards*.

I deduce, according to the findings from this investigation, that telecommunication firms should not favor patents over trade secrets when it comes to evaluate IP protection of future innovations. The implementation of both mechanisms might be essential to attain *exclusivity* in the market. If the organization is capable of discovering synergies among patents and trade secrets, on one hand, the contribution towards technical development and standardization might be a feasible, and on the other hand, a safe and stable IPR environment within the organization might be developed. The next section presents the proposed theoretical model incorporating the key pieces of data discussed on this chapter.

5.5 Improved theoretical model

After careful analysis of the information presented on this thesis, this section is aimed at illustrating the proposed theoretical model which was developed in chapter 3 and including the results from this chapter. Assumptions regarding handling trade secrets in a virtual project setting and IP in telecommunications were corroborated with the empirical data collected. As mentioned in the methodology chapter, finding correlations between the three theories relevant to the study represented one of the biggest challenges I experienced throughout this investigation. My personal reflections were expressed after discussing theories as an initiation point for the qualitative research.

As has been discussed, managing confidential information in project activities implies control mechanisms when trade secret disclosure is agreed between the collaborative parties and the virtual members including practices assessing to what extent technological innovations developed through projects can be secured as trade secrets. Before project execution, the organization must have a clear definition of what kind of information is considered as trade secret, that is, which information can be shared in the project and which information must be kept confidential. Employees must have a high degree of awareness about trade secrets and the implementation of good contracting measures and formal documents stating the terms and



conditions of the information to be disclosed can ameliorate this issue. On the other hand, the organization should formulate dynamic security practices and include them within the KMS of the organization. Last but not least, an estimation of the organizational costs incurred when protecting trade secrets must be carried out.

During project execution, the organizational culture plays an important role as well as the utilization of secured ICTs. Executive commitment is needed on this phase in order to implement effective mechanisms to protect trade secrets, emphasizing on the multicultural and multidisciplinary environment dispersed members are involved. In addition, the development of synergies among virtual members and collaborative partners, whose knowledge is needed for project activities, is essential to generate potential knowledge. When the project culminates, employees must return all confidential information, and as I previously discussed, the measures taken for protecting trade secrets before and during project execution are the most important ones when it comes to manage shared information.

In telecommunications, securing created information gained through projects such as technological innovations, requires protection mechanisms that facilitate standardization and a stable IPRs environment at the same time. Therefore, I claim that patents and trade secrets cannot be seen in isolation from each other. Factors like reverse engineering, the complexity of the solution to be protected and the quality of the patent system might indicate to what extent patents and trade secrets can be used in combination as a means to reach exclusivity in the market. The improved model illustrates the core issues discussed on this chapter and is depicted in the figure 11. The next sections discuss the limitation of the study and the suggestions for further research respectively.

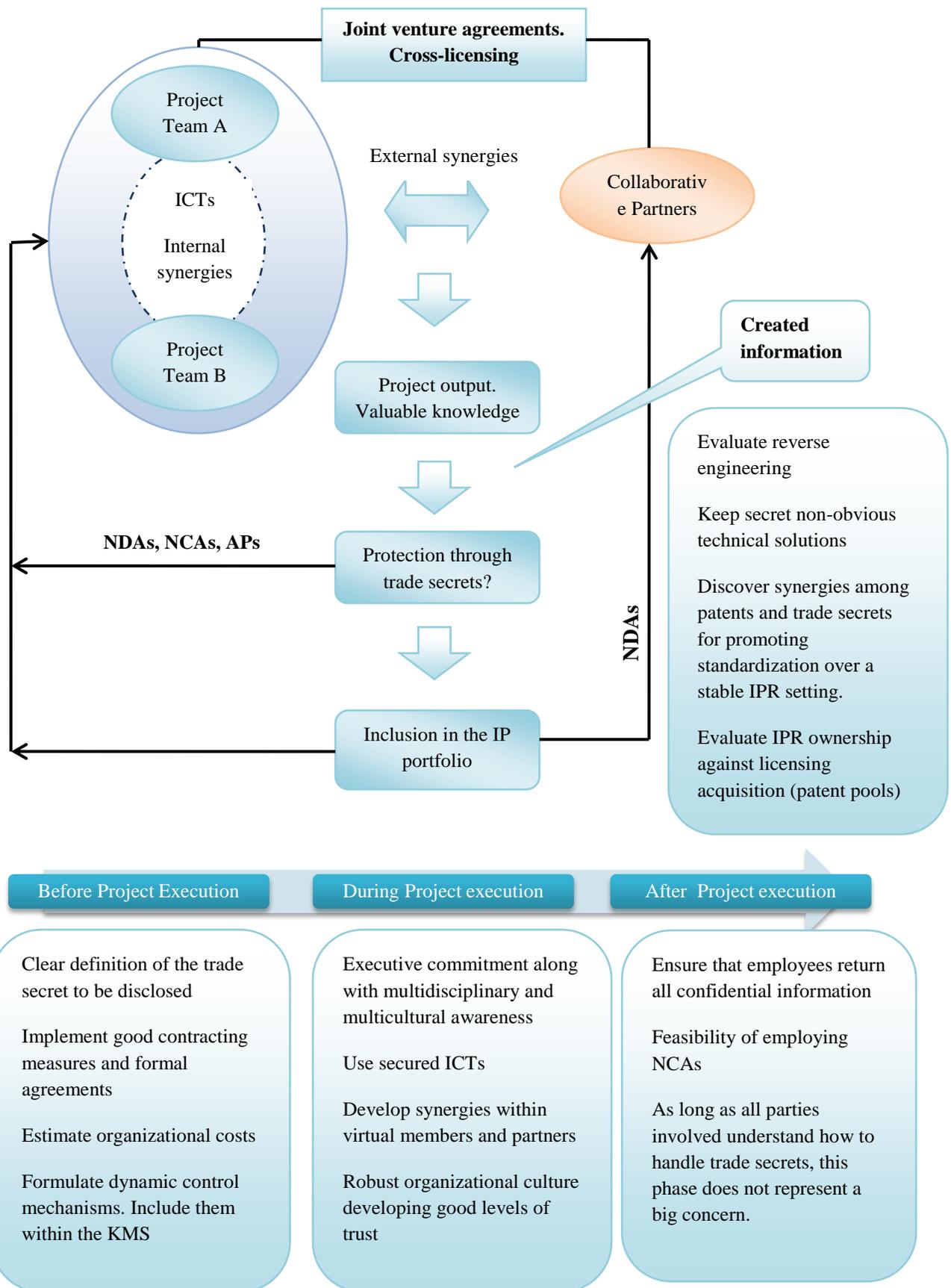


Figure 11. Enhanced model for sharing trade secrets and protecting knowledge developed through projects.



5.6 Limitations of the study

The investigation was carried out during the spring semester of 2012 and, therefore, I experienced problems due to time constraints. Collecting empirical data was also a huge challenge because it became difficult to find people involved in IPRs in telecommunications that could contribute to the study; as a result, 3 interviews were conducted including document analysis as supplementary method. The small size of the sample might be unrepresentative suggesting a low generalization level as mentioned in the methodology chapter. On the other hand, the analysis of three different theories was a demanding activity in this study. Incompatibility between theories and different perspectives constitute the main issues. I started analyzing previous studies in order to have a clear understanding of how the academic circles had been defined and discussed the concepts my research was focused on. Then, the theoretical data were interpreted and interrelated according to my personal reflections.

When it comes to the qualitative research, two interviews were conducted by phone which could have hampered the quality of the data collected. In order to overcome this issue, I sent the interview guide and my thesis presentation to the people to be interviewed so that they became familiar with the concepts to be addressed in the interview. After finishing each interview, I wrote some documents that contained what had been discussed. I then sent those documents via e-mail for possible improvements. Another limitation emanates from the narratives as the responses given by the interviewees rely upon their subjective perceptions.

It became evident that there is a lack of research about intellectual property in project management. Moreover, studies have been directed towards patent development in telecommunications whereas trade secrecy within this industrial sector, according to the information collected, has not been contemplated by the academia. Due to this limitation, the association of the main concepts of the relevant theories in the elaboration my theoretical background became, to some extent, cumbersome. Despite of all the challenges presented, I consider that this investigation provides an excellent starting point for future studies around intellectual property issues in the field of project management, particularly in telecommunications. At the same time, the results of the study entail interesting areas for further research.

5.7 Suggestions for further research

Throughout the course of this thesis I have encountered several issues that might be of special interest for IP researchers. Intellectual property is lately recognized as an essential aspect to promote the business of any organization. Developing integrated security programs aimed at protecting knowledge that represents a competitive advantage, is pivotal to attain success. It is worth noting that much of this knowledge is gained through projects across national and cultural dimensions wherein the implementation of dynamic protection mechanisms becomes paramount. In order to reach a comprehensible level of awareness about IP within the project members, I suggest including such dynamic security practices within the Knowledge Management System (KMS) of the organization. The idea is to observe the implications in regards of organizational culture about IP and the integration level from the technical and corporate areas in the development of IP strategies. Having a protection phase within the KMS might enhance this issue. The model proposed on this thesis is based on literature analysis, improved with the empirical data collected, and focused on the telecommunications sector. Even though the level of generalization is rather low as previously mentioned in the methodology chapter, the model might be tested in standard-based firms embedded in the technology business such as IT.

I believe that the results of this study can be statistically proved by conducting a quantitative research among geographical dispersed organizations in telecommunications. Furthermore, selecting a bigger sample including diverse industrial sectors might also provide higher reliability and generalisability. Studies should also contemplate the feasibility of implementing only patenting or patenting and trade secret in combination as a means to protect technological innovations developed through projects in order to see which of these two alternatives provides a better competitive advantage in the market in terms of exclusivity, positioning, commercialization, and expected revenues.

Since the results of the study do not give information about the likelihood of surrounding patents by trade secrets as mentioned in the literature analysis, another possible area for further research might consider this issue taking into account standardization requirements in the telecommunications field. On the other hand, mechanisms intended to harmonize the relationship between IPRs and standardization in telecommunications become crucial for disseminating technology and reaching a stable IPR environment. Studies, thus, should be



conducted to observe to what extent the implementation of patents and trade secrets in combination can alleviate this relationship.

5.8 Summary

This chapter presents the discussion of the empirical and theoretical findings from this thesis. Factors affecting trade secret disclosure before, during and after project execution constitute the first part of the discussion. Trade secret as an instrument to secure future innovations in telecommunications represents the second part of the discussion. Then, the theoretical model proposed is enhanced by incorporating the key pieces of data discussed in this chapter and is illustrated in figure 11. Limitations of the study and suggestions for further research are addressed in the last sections. The next chapter presents the conclusions of the study, where the problem statement is revisited in order to examine to what extent the research questions have been answered throughout the course of this thesis.

6 Conclusions

This investigation constitutes the final work from my master studies in Project Management at the Norwegian University of Science and Technology (NTNU). I found the subjects discussed during this thesis both fascinating and challenging. I argue that Organizations should recognize the important role that intellectual property plays in project management since a large amount of shared and developed knowledge through projects crossing national and cultural borders, requires proper protection mechanisms. In telecommunications, firms must have a better understanding of intellectual property as a vehicle for not only promoting standardization in the industry but also securing information that confers a competitive advantage.

I reached new and interesting interpretations from the literature by combining the three separated but interconnected theories the theoretical background of this thesis was based on: trade secret protection, virtual project literature and IPRs in telecommunications. A proposed model was constructed, covering the results from the literature study and enriched with the empirical data collected via interviews and document analysis. This model comprises factors influencing the protection of confidential information considered as trade secret across the life cycle of the project, and evaluates the extent to which trade secrets can be used to secure future innovations developed along with collaborative partners within a virtual project setting. I believe that the model is novel in its structure, providing new insight around IP issues in telecommunications projects which, in turn, might be used as a starting point for further studies in the field.

It is important to revisit the problem statement from my study and examine to what extent the research questions have been answered through the course of this thesis. For this purpose, both research questions will be described and connected with the results of the investigation. In the methodology chapter I attempted to provide a clarification of how those questions were created as a result of an exhaustive literature review. In the subsequent chapters, that is, the theoretical background, the data analysis and the discussion; core issues were discussed in order to address the research questions appropriately. The first research question is as follows:

How do telecommunication firms that conduct virtual project activities along with collaborative partners implement intellectual property practices aimed at securing information considered as trade secrets before, during and after project executions?



By developing a substantial literature analysis involving the three relevant theories in the investigation, I proposed a theoretical model (see figure 10) aiming to handle trade secret disclosure when working along with collaborative partners in a virtual project setting, and which revolves around the life cycle of the project. It is worth noting that this model also incorporates suggestions for protecting future innovations developed in the project, but this issue will be discussed when addressing the second research question. I then gathered empirical data in the telecommunications sector through three semi-structured interviews and document analysis. After having analyzed said data, I concluded my thesis with a discussion that relates the literature and the empirical findings illuminating the proposed theoretical model. As it was seen, the discussion chapter is constructed in such a way that factors for regulating trade secret disclosure, before, during and after project execution are explicated, resulting in an enhanced model (see figure 11). I claim that I have answered this research question based on the results of the investigation and the model improved with the empirical data. The second and final research question was also answered relying on the qualitative research to a large extent:

How, and to what extent, does trade secrecy constitute a feasible alternative to substitute or complement patents in the telecommunications sector in order to secure technological innovations developed along with collaborative partners in a virtual project setting?

The literature about IPRs in telecommunications did not show clear evidence regarding the implementation of trade secrets as a means to protect technological innovations. In addition, I could not find any scholar covering this topic in all the theory revised. However, when relating the three theories of the study, I observed that patents and trade secrets can work in combination with the aim of protecting technological knowledge acquired through projects. This issue was also contemplated in the theoretical model including some assumptions derived from the literature analysis. The empirical data gathered suggested that it is possible to utilize patents and trade secrets to secure technical knowledge in telecommunications. Factors such as reverse engineering, jointly IP ownership, standardization requirements, the complexity of the technical solution to be protected and the quality of the patent system might dictate the extent to which patents and trade secrets can be used simultaneously. The key pieces of data from this area were also included in the enhanced model. I argue that the second research question was adequately answered drawing upon the qualitative analysis in particular.



Limitations of the study are associated with time constraints, data gathering and low level of generalization. At the same time, the correlation of the three theories discussed on this thesis represented a demanding undertaking as challenges attributed to incompatibility between theories, different perspectives and conflicts between theory and practice were confronted. Despite of the limitations encountered, I argue that the results from investigation provide a good starting point for future studies around trade secret implementation as a mechanism to secure technical knowledge developed through projects, particularly in geographically dispersed organizations within the telecommunications sector. This study also puts forward interesting areas for further research which were addressed in the previous chapter.

I consider this thesis one of the best academic experiences in my life so far and I am really satisfied with the results obtained. Working on trade secret protection in a virtual project setting was the perfect scenario to associate my technical background in telecommunications with my master studies in project management. I feel rewarded because my investigation was focused on an unexplored area as trade secrecy in telecommunications has not been sufficiently researched by the academic circles. Moreover, I claim that intellectual property is becoming one of the new researchable areas in project management. Organizations cannot be differentiated by how much valuable knowledge acquired through projects they possess but by how well they protect what they know and to what extent they encourage technological developments in the society. Even though the challenges faced, my contribution might be seen as a new theory that adds new value to the field.



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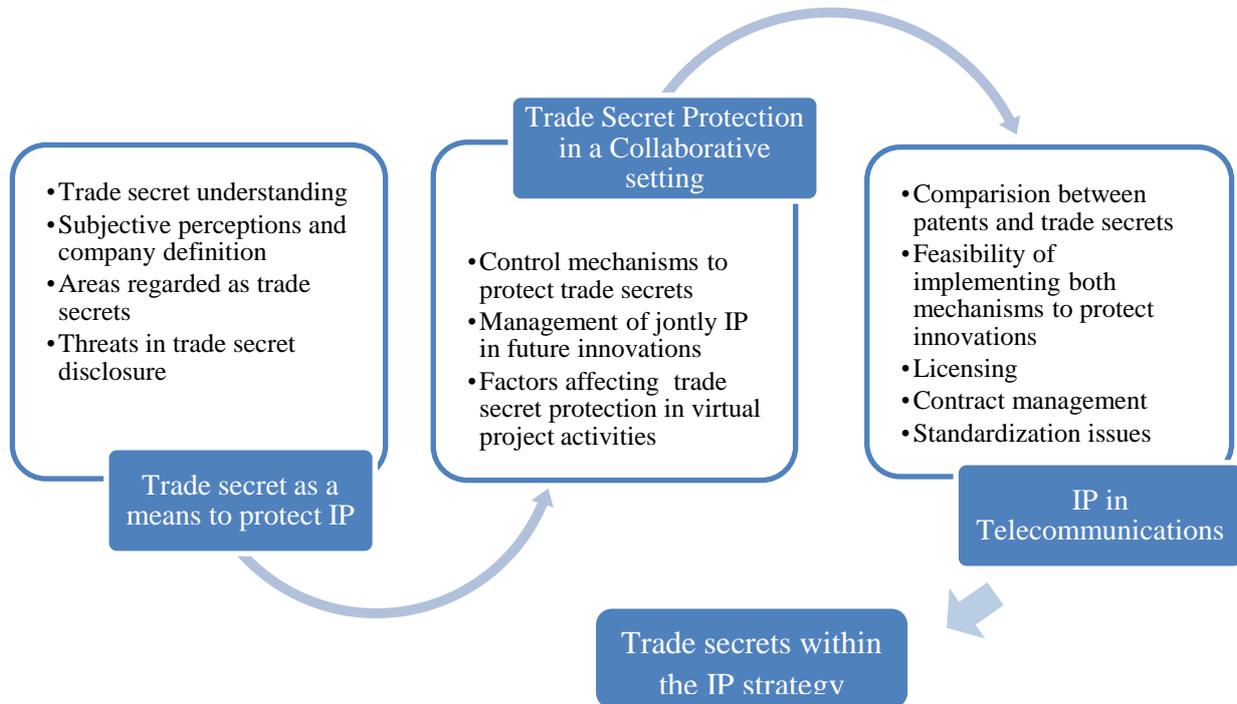




Appendix

A1. Interview guide

Developing and protecting intellectual property in virtual projects: Trade secret protection in Telecommunications.



Firm:

Name:

Current position:

Years of experience:

Trade secret as a means to protect intellectual property

1. What do you understand as trade secrets?
2. Which areas or main topics are regarded as trade secrets?



3. Does your company have a formal definition or description of the concept of trade secret?
4. Does your company employ formal mechanisms and procedures to protect trade secrets? (prevention, containment)
5. Which group do you think represents a bigger threat when it comes to trade secret disclosure? Why do you consider that?

Trade secret protection in a collaborative project setting

6. What are the main mechanisms used to protect trade secrets in a collaborative setting (partners, suppliers, governmental agencies etc)?
7. Based on previous experience, which are the most convenient ones, that is the ones that have least damaging effect on the collaboration?
8. What are the main issues or concerns that make trade secret protection difficult or impractical?
9. Which internal factors or processes have the strongest effect upon how trade secrets are protected in practice?
10. Let us assume that the company conducts a project together with other industrial partners. What are, in your opinion, the most important factors affecting how trade secrets are protected in practice?
11. What if the project is organized as a virtual project crossing national and legal boundaries?



Intellectual property in Telecommunications

12. Let us compare patenting versus trade secrets. Can you say something about their effectiveness and comparative advantages/ disadvantages with regards to establishing, maintaining and enforcing?
13. To what extent does the company use patents and trade secrets in combination to protect intellectual property?
14. To what extent is it feasible to license trade secrets in telecommunications? If so, How? Does the organization implement *hybrid licensing* (patent and trade secret licensing)?
15. What are the most important issues to cover in the contract when trade secrets are licensed?
16. Which mechanisms do you consider can be used to ameliorate the dispute between Intellectual property rights, when using trade secrets, and standardization in telecommunications?

This part will be discussed only with people involved in trade secret strategy

Formulation of IP Strategy

17. Are trade secrets involved in the firm strategy? If so, what are the main concepts to be taken into account when formulating IP strategies?, To what extent are these concepts applicable only in the telecommunications sector?