CHALMERS

Adoption of technical standards by Original Equipment Manufacturers (OEMs)

A Proactive approach to Intellectual Property Strategy

Master of Science Thesis in the Master Degree Programme,

Business Design

JOSÉ LUIS MENDIETA
KARTHIK VENKITESH

Department of Technology Management and Economics
Division of Management of Organizational Renewal and Entrepreneurship – MORE
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden, 2011
Report No. E 2011:067

Report No:1

Adoption of technical standards by Original Equipment Manufacturers (OEMs)

A Proactive approach to Intellectual Property Strategy

José Luis Mendieta & Karthik Venkitesh, 2011

Department of Technology Management and Economics
Chalmers University of Technology
Göteborg, Sweden, 2011

Adoption of technical standards by Original Equipment Manufacturers (OEMs)

A Proactive approach to Intellectual Property Strategy

José Luis Mendieta & Karthik Venkitesh, 2011

Technical Report no: 1

Department of Technology Management and Economics
Chalmers University of Technology
Göteborg, Sweden- 41296
Telephone: +46 (0) 31 – 772 1000

One cannot violate the promptings of one's nature without having that nature recoil upon itself.

- - Jack London

ABSTRACT

Standardization within Information and Communications Technologies (ICT) has played a vital role in shaping technology markets and has occupied a special position within the wider agenda of any technology company's business activity. The process of technical standardization in itself witnesses a congruence of many different actors across geographies, industries and business models. The process of standardization is either market driven or coordinated by independent bodies within governments or industry.

Intellectual property has enabled the development of the hi-tech industry and even more so to the ICT sector. The role of intellectual property in technical standards has been one that has been highly debated and discussed within the community. Our focus in this study is towards the industry-driven voluntary standard setting organizations that facilitate the confluence of the main stakeholders from an intellectual property perspective namely: the holders of intellectual property and the actors who license this intellectual property from the owners in order to gain access to technology. There is tension within this environment where various companies endorse their ideologies and perspectives within intellectual property, the mediation of this process is highly challenging for both technology providers and implementers.

Having this as the background, we set out to delve into the standard compliance process whereby companies license the required intellectual property from the owners in order to build solutions and address the broader consumer market. We set out to investigate the complexity with regard to intellectual property and how companies with low bargaining position on assertion of intellectual property could minimize the challenges arising from the standards ecosystem during adoption of a standard. The research question was hence framed as follows:

"*Can compliant companies overcome Intellectual Property-related challenges and manage complexity through a proactive strategy prior to the adoption of a technical standard?*"

In order to perform the research, the perspective of Original Equipment Manufacturer (OEM) with low ownership of standard related intellectual property was taken. This point of reference was combined with the perspective of a standard that is mature in contrast to one that is under development. Through our literature study, we identified four main issues that potentially influence the position of an OEM namely: IPR policy, Information asymmetry, Actor profiles and Royalties. The methodology adopted for the investigation was through expert interviews from different stakeholder positions with the ecosystem as well as academia. From this investigation, the four main issues were mapped into OEM-specific challenges. After the identification of challenges, a ranking methodology was used to rank high priority challenges. This was followed by giving an introduction to the types of proactive measures an OEM could use to tackle these high priority challenges.

The study was concluded by answering the research question that compliant companies can overcome intellectual property-related challenges and manage complexity through a proactive strategy prior to adoption of the standard, by building up internal capabilities to identify these high priority challenges and address them with strategic action items.

Keywords:

Standard compliance, proactive intellectual property strategy, original equipment manufacturer

ACKNOWLEDGEMENTS

We would like to express our gratitude towards:

Our parents for their immovable support,

Our Professors and supervisors for the invaluable knowledge they have transmitted to us,

The experts who contributed their time and knowledge to provide the fundament for this dissertation,

The "Mexican National Council on Science and Technology (CONACYT)" for their support.

The collaborating company for their continued support

Emil Haldorsson for his valuable guidance

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 BACKGROUND OF STUDY

The industrial revolution marked the beginning of the mass production era and with it the advent of the need for standardization. All of the sudden, the products produced by any given company were no longer isolated but had to interact with other products from the same or from different companies with the purpose of increasing the functionality of each of these. This need was met by agreements between different industrial actors who agreed on shapes and technical specifications that would allow the interaction, and at the same time increase the value of products by the phenomenon known as network effect.

We can illustrate this network effect through the example of the telephone. In this example we the perceived value of the telephone is increased with the number of subscribers to its "network" which can be perceived as a positive externality since the user who buys a phone does not do it with the aim of increasing the value for other subscribers but for his or her own benefit, but at the same time contributes to this communal value nonetheless (Blind 2004). In the decade of the 1980's a change that had been gestating in the world since the invention of the transistor in 1947(Ament 1997-2007) and which surpassed an evolution for over thirty years. The digital revolution(Sandiego 2007), in the same way that the Agricultural and Industrial Revolution, changed the fundamental concepts of goods, products, production and redefined the value structures of the time.

The Digital Revolution marked the beginning of the Information Age, which is characterized by the production of digital electronics, and the technologies derived from them, which includes the computer, mobile phones, communication of people, data transfer and the congruence of these technologies in to a single domain.

The congruence of these technologies brought with it the foreground challenges that hadn't been addressed previously. Prior to the rise of this era, standards had been set and were set by consortia but never had it been so pressing to find solutions which could be used by all the actors in order to capture the benefits of the networking effect. To make the digital revolution possible cooperation between competitors and different actors had to be achieved otherwise the expected functionality could not be met, and thus the creation of standards by consortia became meaningful. This looks to find congruent implementations of diverse technological solutions proposed by various actors which became more common, to match de-facto standards based on proprietary technologies. The rise of the "Information and Communication Technologies (ICT)" industry has more than ever demanded the creation of standards to enable an interaction between complimentary and substitute devices that has resulted in the creation of countless "Standard Setting Organizations" or SSOs. These organizations are consortia of companies that set up the rules and specifications needed to enable this interaction.

Due to these characteristics of the communication technologies industry, the creation and adoption of standards are vital. These two activities represent very different but extremely important problems to asses. In one hand the companies interested in the creation of a standard are united in a consortium to negotiate the creation of the standard and focus on choosing the best technological

solution to be adopted by the interested parties, while at the same time looking to maximize the networking effects that that the collaborative adoption of technology might produce. This task is not an easy one, the collaboration between actors that are competitive in nature who struggle to obtain a bigger share of the market while requiring the sharing of technological solutions. On the other hand we have the adoption of these standards which are created by the consortia or SSOs since not only the actors who participated in the creation of the standard are likely to adopt it, but also actors that even though do not participate in the development efforts are required to comply to these standards. These adoptions of the standards developed by the SSOs are derived from different incentives and are beset by perils of its own.

Both the creation and adoption of the standards set by standard setting organizations are played in different arena such as the commercial, legal and intellectual property, the latter being the subject of this dissertation and possibly the most complex one to address by the actors involved. These interactions between different actors in the industry appear to be a very important factor of the standardization processes especially for companies with low intellectual property interests.

Based on these difficulties a need for further study of the interactions within and around the SSO standardization process and strategies that a medium sized Original Equipment Manufacturer (OEM) could take in order to improve the process and its after effects during adoption of a standard. It is also needed to define how to focus its efforts to ensure that an efficient and risk minimized interaction with SSOs and other actors in the standard setting ecosystem has been identified.

1.2 PURPOSE OF RESEARCH

This thesis aims to study and analyze the interactions between the actors involved in the standardization process within the standard setting framework. This means that the members of the consortia whether they are important IP holders, universities, innovators, service providers or just adopters of technologies encompassed by standards framed by intellectual property will be analyzed in order to shed light upon these interactions. While being able to support the creation of strategies that a company with low Intellectual property interests may follow in order to streamline the adoption of a standard and lower the intellectual property challenges involved as much as possible.

Analyzes made in this thesis will serve as support for the conclusions of the dissertation and will have several objectives such as:

- Identify common intellectual property-related issues and challenges associated to standard compliance
- Strategic insights that will address the issues identified
- A parameterization of:
    - Severity of the issues and challenges
    - Effectiveness of strategies to address such issues.
- Overall strategic solution to streamline standard compliance and examples of operational activities

1.3 RESEARCH QUESTION

The research question has been framed on the hypothesis that standard compliant companies can effectively manage intellectual property related challenges by taking proactive measures to overcome these, prior to the implementation of a standard. Keeping this in mind our over-arching research question is framed as follows:

"*Can compliant companies overcome intellectual property-related challenges and manage complexity through a proactive strategy prior to the adoption of a technical standard?*"

1.4 DELIMITATIONS

In this study, the perspective of an Original Equipment Manufacturer is chosen to gain an understanding of the external environment of a standard setting ecosystem. This would encompass the various types of challenges that ought to be addressed by the OEM prior to considering compliance to a standard, leaving the analysis of other types of actors such as innovators, vertically integrated firms and service providers outside the scope of this study.

The salient features of the position in which the OEM is placed are as follows:

- Small to medium sized player in the communication equipment industry.
- Low assertion power from intellectual property resulting from limited intellectual property ownership
- Competitive advantage from market positioning
- Explorative feasibility study of new standard implementation

As for the OEM, we assume that they are essentially an actor who holds limited research and development capabilities directed towards building platform technologies and subsequently low intellectual property assertion power that is relevant to a particular standard. Henceforth, standard adoption forms a part of the company level strategy in gaining access to the technology and manufacture products to serve downstream markets.

The standards in question have been that of one that is fairly mature in terms of specifications, in contrast to one that is under development, the reason being the nature of the issues and challenges that are posed by a standards development process and its relevance to the context.

The proactive nature of the proposed strategies will be central for the OEMs to carve out effective internal mechanisms that would support and facilitate the strategy, in contrast to reactive strategies that seek to minimize the adverse effects of challenges once they have already presented themselves and have probably evolved into problems.

In the same way the study will be focused on the communications technology industry being the most active in terms of creation of standard setting organizations, the development of standards and the adoption of these standards by companies outside the developing consortia.

Our goal is to lay out a strategic foundation and give an introduction to some proactive steps that an OEM could put in place to mitigate the negative effects that an implementer could face. The implementation mechanisms or operational level recommendations will neither be comprehensive nor exhaustive in a way how a checklist, workflow or guidelines would ideally work. The suggestion of possible actions will be used merely to hint instances of how the strategic outlook can be used at the level of operative action items within the company.

1.5 RELEVANCE OF STUDY

The profiles of the actors involved in the standardization ecosystem are diverse and depend greatly on the incentives of each company and its business model as their position within the value chain. We can find R&D firms, universities, manufacturers, component suppliers, original equipment manufacturers (OEMs) and distributors as well as vertically integrated firms, who besides holding important intellectual property, hold places in almost every step of the value chain. The ecosystem is defined by the interactions between these actors and the negotiations between them. These interactions, their policies and the politics within the development of a standard that shape the issues we analyzed.

In the literature, the problems that are inherit in the standard setting organization models are broadly discussed and analyzed, problems such as the real meaning of licensing under "Fair, Reasonable and Anti Discriminatory" (FRAND) concept, patent hold up, patent thicket, and the fundamental contradictions between anticompetitive law and the basic concept of standardization and try to analyze and propose alternatives to them.

Taking the point of view of an OEM which holds low intellectual property interests and little to no power within the standard setting organizations on one hand, this controversy is far away and there is little that this type of organizations could do to provoke a change to the fundamental policies and concepts within the ecosystem. OEMs have to deal with the policies and interactions within the ecosystem that they cannot change and it is from this inability to change the set structures but the requirement to work with them that creates the need to make the best out of this situation.

This point of view is especially novel since most of the literature available refers directly to the flaws of the standardization system in search of a way it could be modified to be improved but it disregards any strategies that actors may take in order to maximize and the interaction more efficient with the current structure and models in the standardization process, and this is exactly the approach that was taken by our dissertation.

1.6 DISPOSITION

Chapter 1 - Introduction

The Introduction chapter gives a brief overview of the study starting with a background and purpose of the thesis. It also states the research question, delimitations and the relevance of study from an academic context.

Chapter 2 - Problem Discussion

This chapter goes into detail of the context in which the study was performed. An introduction to standardization in the ICT industry and the role of intellectual property within standardization laid the foundation on which the study is performed. Then this chapter goes on to state the main issues that have been identified and will form the basis of discussion in Chapter 5 – Analysis

Chapter 3 - Research methodology

The Research methodology chapter breaks down the main research question further and gives an account of the methodology for data collection and the motivations behind it. The design of this methodology and also its developmental structure will be discussed.

Chapter 4 – Investigation

Moving on from the methodology chapter, this chapter lists the data collected in the form of interviews. Though these interviews are qualitative in nature, this section attempts to follow a standardized reporting procedure that will in turn facilitate key observations in the following chapter.

Chapter 5 – Analysis

This chapter presents the observations that have been developed from the previous section. This includes an in depth analysis into the value network. Furthermore, a mapping of compliance issues and challenges is then done followed by an assessment of the various challenges and a prioritization.

Chapter 6 - Conclusion

This chapter answers the research question that was framed initially and also suggests areas for further research.

2. PROBLEM DISCUSSION

2.1 THE ROLE OF STANDARDIZATION WITHIN INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)

The convergence of computing, mass media and telecommunications is presently a major force behind the creation of new products and services, with different options produced by each one of those industries and adding them to the power of Internet. The global network that is the Internet relies in countless devices made by numerous companies in different parts of the world, components that are replaced constantly and randomly both in time and location, which translates into continuous evolution of the infrastructure that surrounds the technology space. This evolution promotes a big opportunity for technology businesses and at the same time the dynamism poses a challenge to the success factor of these entities. ICT has evolved to provide value in almost all of the areas of communications enabling the transmission of voice, images, video and data between users of new devices and services. An ever-growing number of businesses and homes are profiting from high-speed computer links. This will enable much easier and richer access to new services.

As discussed on Chapter 1, one attribute that is needed for this information age, is the interoperability between devices and technologies. Without interoperability, the use of ICT devices can only occur between devices of the same manufacturers or sharing the same proprietary technologies. In order to bring about interoperability, various companies are required to come together to a consensus on what and how complex technological products can be catered to a consumer with minimal negative economic and social consequences.

In that case, how does one achieve this interoperability? Common consensus on the best technology to be used and the specifications chosen for that technology has to be achieved across the board. This is called a technical standard and as defined by (Hovenkamp, Janis et al. 2003), *"a standard is a set of specifications which seeks to provide a common design to the product or process".*

Considering the size of the industry and the shear amount of actors involved in the research, development, design, production and construction involved in the creation of the immense array of subcomponents and devices that have to interact with each other is with no doubt a titanic endeavour. In the case of ICT it has been the industry that has taken a driver seat in the development of interoperability standards followed by governmental organizations that regulate some aspects of the technology such as the assignment of transmission frequency ranges, but otherwise leave the way free to the industry to regulate itself but keep a vigilant eye to ensure the public benefits such as the selection of the best technologies and the promotion of competition between substitute technologies in the free market.

The creation of new standards is a delicate matter that has to be overseen, analyzed, agreed upon and approved by numerous stakeholders who typically are represented as members of the SSOs. These organizations have the aim of producing interoperability standards that encompass specific technologies and promote the adoption of said standards to the market in general. As pointed out by

(DeLacey, Herman et al. 2006), the highly competitive nature of standardization stems from two aspects:

- *The difficulty in decision making process which arises from choosing early stage technologies from a pool of promising alternative technologies that may be disregarded.*
- *Impact of standards design on profitability where companies with essential intellectual property often enjoy inflow of licensing revenues if their own proprietary technology is included in the standard.*

In recent years there has been a rapid growth of these standard-setting organizations due to the network effect within the ICT sector and the ability of the standard bodies to distribute well-defined superior technologies at a high value for the end-consumer. These organizations are not free of problems, since they can often be heavily biased and represent only the interests of their members or only some of their members and may not have the general public interest in mind.

According to ICT Standards Board (ICTSB 2011), there are more than 400 consortia active globally in ICT. This high number of organizations makes it difficult to keep up with their production of standards and of course do not provide a sole solution for technologies but a broad gamma of solutions to a problem that sheds no light into which technology is superior to the rest and hence leaves that analysis to the adopters in the industry. At the same time a big part of the consortia demands high membership costs which limit the number of actors who may be able to join them, leaving some actor profiles like subcomponent producers, OEMs and small and medium sized enterprises (SMEs) under-represented in the development process.

Even if the creation of standards by consortia is faster than the government standardization processes, the development of the standards in this fashion is still a very lengthy process that takes a few years in the best case. This slow development process does not keep up with the current evolution speed of technical solutions in the industry and requires the development of standards in the need to make several revisions before and after any given standard is set and released to the public.

All the actors in the industry depend highly on the creation and adoption of new technology that will give them a competitive edge; hence one of the key aspects of the ICT industry is its intensive research and development efforts. The race to obtain this edge whether in the creation of new technology or in the adoption and production of products that implements it is imperative for survival of this ecosystem.

A certain tension is created as pointed out by Lemley & Shapiro (2006); there occurs a *"conflict between pro-competitive interoperability and anti-competitive market power"*. This mainly results from the primordial differences in the business models and competences of various stakeholders and at the same time promote a dependency between different levels of the value chain and fierce competition for control of the decision making within the consortia.

It is certainly true that the creation of standards is far from perfect and requires radical changes to confront not only the technological problems that it is trying to solve but also the problems that it creates in turn. None the less the adoption of standards is certainly unavoidable, as is the adoption of these standards by organizations which even though have a big stake in them , have little to no say in their creation, since they may not hold either the necessary intellectual property to contribute or the resources to do so.

The benefits of standardization surpass greatly the problems it creates simply because it makes the creation and adoption of the technologies possible and is high-valued without which the existence of the ICT industry would be questionable. However, the asymmetry in the bargaining position of the various stakeholders comes across as a challenge that the standard setting body needs to consider and this is magnified in the area of intellectual property assertion and resultant effects as will be elaborated in the following section. It is imperative for a standard implementer with negligible bargaining power within the area of intellectual property to understand the various challenges and to act upon them internally. The following section will shed light upon the background of intellectual property within standardization context and aim to set the foundation and form the background in the identification of the issues that lie within the field of interest.

2.2 INTELLECTUAL PROPERTY IN STANDARDIZATION

Property rights in relation to intangibles have been argued to have contributed to being the cornerstone of world of innovation and have provided the impetus for various organizations to make investments in the creation of knowledge. With the growing popularity of intellectual property from the early 1980s, companies have initiated several mechanisms to leverage from their investments made in creation of knowledge and ownership of rights over their proprietary contributions. Hundreds of thousands of transactions have taken place whereby companies either transfer the ownership over their intellectual property or grant permission to use their right through a licensing mechanism. Though these transactions usually take place behind closed doors, there is a legal obligation to report transactions that occur across the border. Thus a mere estimate of cross-border licensing transactions denotes the exponential growth rate of revenue from international licensing from 10 billion USD in 1985 to nearly 110 billion USD in 2004 (Kamiyama, Sheehan et al. 2006). This shows a staggering growth rate over a period of two decades.

On one hand, this strengthens the argument for existence of a functioning market for intellectual property rights. On the other, it also raises deeper questions about how the similarities and differences of the market structure in which intellectual property is contextualized in comparison to traditional market structures. The trade of intellectual property artifacts like patents, copyrights and trademarks surpass the institutional concepts of supply and demand and the process of buying, selling and commodity exchanges that take place from a strictly economic stand-point. According to the classical definition of a well functioning market from an economical perspective, it is one that has transparency, homogeneity of goods and information about prices. This does not necessarily apply to the market of intellectual property rights. Moreover, the flush of patents from the patent systems raises skepticism on the efficiency of the patent system in regulating the supply side of this market.

These issues have raised concerns in the nature of complexities that lie within this paradigm. Today, the intellectual assets within a company are not only considered vital in the wealth creation process, the resultant challenges that arise from these are becoming increasingly difficult to manage. This is especially relevant in the case of standardization where there has been increasing concerns over the role of intellectual property.

With the growing popularity of standardization as an industry-wide mechanism to enable technology access especially within the ICT sector, the complexity within the process of standardization has only

increased to a higher degree. Standardization as a process has enabled companies to address similar issues at a technological level and also serve the market in exchange for a reasonable price. To reduce bargaining costs and promote the adoption of standards, most SSOs offer their members a quid pro quo: in return for the opportunity to promote their proprietary technology, firms must disclose relevant IP, and if it becomes part of the standard, offer a nonexclusive license at "reasonable" rates (Lemley 2002).

Many SSOs strongly discourage standards which implicate IP rights, and some of them actually forbid standards that are based on patented technologies but SSOs that allow standardization on patented technologies require their members to license the use of that technology on a royalty-free "RF" or a reasonable and non-discriminatory basis "FRAND" (Lemley 2002). The underlying aim of a standard setting organization thus is to enable a cost-effective and superior technology to be diffused in the market place especially in scenarios which call for interface mechanisms. Thus the standardized platform allows companies to produce and sell products by adopting a particular standard. However, as pointed out by Miller (Miller 2007), intellectual property adds a control factor on the free access to technology in the standardization process through which the companies would be incentivized to make investments in innovation and rights to exclude others through patent rights.

From the SSO's perspective, the complexity is aggravated when the technologies within a particular standard are proprietary and the IP owners in turn have to grant permission to use them during implementation. Since the overall aim of the SSO in is not in line with managing this nature of complexity within intellectual property, many of the SSO have now installed what is called IPR policies which are a set of rules and procedures various companies that take part in the standardization process are required to abide by. In contrast to the gentleman's agreements that existed during the early years of standardization, companies today attempt to gain undue advantage from the inefficiencies that surround the SSO's IP policies. One classic case that demonstrates such behavior was with the famous federal appeal court case between Rambus and Infineon Technologies which was over the perceived lack of clarity over the SSO's IP policy (Alban 2004). The Rambus case in addition to several other similar instances from various other companies brings about one key observation. Intellectual property rights have gained an increasing importance in the standardization arena and are likely to see continued growth in the future. With the advent of new actor profiles as a result of vertical disintegration and with the increased attention on the strategic exploitation of intellectual property, implementers are required to perform a complete IP due-diligence prior to adoption of a standard.

It is also interesting to get a closer look at the patents that are involved in a standard. As pointed out by Rysman and Simcoe (Rysman and Simcoe 2005), SSO patents have far more citations that other patents and receive these increased citations after the disclosure of the patent. This indirectly tells us that, if patent strength is calculated by the most common ratio - number of citations to the number of years the patent has been in effect, then the SSO patents enjoy higher strength compared to non-SSO patents, thereby increasing its royalty rates from an implementer's (OEM, for instance) perspective. This patent strength argument raises serious questions about the efficiency of the system that is around the intellectual property in the context of technology standardization.

These intellectual property related concerns mark just the beginning of the many others that have surfaced from our study. Most of the previous studies have focused on the issues as mentioned above, of hold-up, royalty-stacking, ambush etc. We attempt to see these issues from a pure implementer's perspective whose position is rather passive in the sense that the implementer holds low IP assertion power and would want to minimize challenges when dealing with the standardization

ecosystem. This study will aim to add a dimension to the previous work done by scholars in the field that bridges intellectual property and standardization.

2.3 COMPLIANCE ISSUES

As we have briefly touched upon in previous sections, the standardization process within an SSO is far from being a perfected affair; it still holds several issues that govern the development and adoption of standards in a consortium environment.

Through an analysis of the available literature we have identified 4 main issues within the intellectual property arena that influence the interaction within the standard adoption landscape.

- SSO IPR policies which are placed within the larger system of SSO governance policies
- Information asymmetry derived from the variation in the information available at different levels of participation.
- Royalties and Transactions
- Profile of actors involved in the consortia

Taking the perspective of an OEM we can then evaluate the aforementioned issues and extrapolate potential challenges that an organization in this position may encounter. These challenges can also be related to the perception that the OEM has on these issues relative to its own position.

2.3.1 INTELLECTUAL PROPERTY RIGHTS POLICIES

As discussed by Lemley(Lemley 2002), most of the standard-setting organizations have written intellectual property Rights Policies (IPR policies) which mainly address the disclosure and licensing requirements of the IPRs that are involved in the standard. Participating organizations are required to make timely disclosure of the IPRs also called "Essential IPRs" which stands for IPR that is absolutely essential for the implantation of the standard. The ETSI definition of essential IPR(ETSI 2010) states that:

> *"Essential IPR" as meaning "that it is not possible on technical (but not commercial) grounds, taking into account normal technical practice and the state of the art generally available at the time of standardization, … [to] comply with a standard without infringing that IPR."*

After the disclosure of the essential IPR the patent holders are required to negotiate licensed based on FRAND (Fair Reasonable and Non-Discriminatory) terms.

Though it looks straightforward at first sight, there have been different issues that have been pointed out by some of the studies done on IPR policies. As Lemley(Lemley 2002) suggests, the policies to

which particular SSOs adhere to, are an important variable for comparing the different SSO proposals available.

In his publication Lemley(Lemley 2002) analyzes the differences between the Policies used by SSOs. From the 29 SSOs analyzed in this study almost one third of the total possessed no written policies to regulate their members, this difference was mainly related to the size of the specific consortium in each case, although it became apparent that the policies governing these organizations are extremely variable but practically all of them require different levels of disclosure of the intellectual property Rights they might hold relevant to the standard in development at least to the best of their knowledge. In some cases there are some penalties in case of failure to disclose this information which might be for example, the commitment to forego any royalties of IPR that hasn't been disclosed, while in other cases the members are asked to license all their IPR under a royalty free scheme.

There are however larger discrepancies between SSOs in the information that they are specifically required to share, while practically all the policies include patents, only a few include copyright and trademarks, or use the term "intellectual property rights" which could be interpreted to include all of the aforementioned. Lemley (2002) also comments on the inclusion of issued patents only and the failure from most organizations to even mention patent applications from the sample of consortia. In the study, only two organizations, the ITU and OSGi, require disclosure of all published pending patent applications while only two other organizations have an intermediate policy, and only one requires information on even the unpublished applications. The issue with unpublished applications is that as these patents are not even publicly viewable for an implementer, they are masked away from obtaining a clear picture of the patent landscape.

This difference in the policies and their requirements for disclosure can be explained by the fact that disclosure of information might affect a company's ability to commercialize and capitalize on their R&D efforts by allowing competitors to have access to information that in any other way would be unavailable and might result in a capered ability to protect their work.

It is interesting as well that a very small number of standard-setting organizations require a search of relevant intellectual property that these companies may possess, not external or even internal; depending on their size some companies face a big problem to determine if any of the intellectual property rights they hold might be relevant for a standard or not. As pointed out by Teece & Sherry(Teece and Sherry 2003), it is impossible for larger firms with huge patent portfolios to perform such a search and a search requirement might even discourage their participation in the first place. Based on the sheer number of patents held by the most active and bigger actors in standardization efforts render this activity problematic and very resource consuming. The consortia have been reticent to demand even reasonable thorough internal searches for patent validity and strength. Hence IPR policies can be seen as an area with impending issues due to:

- Diversity in the nature of policies across various SSOs
- Types of disclosure requirements with patents
- Creation and governance of the IPR policy

2.3.2 ROYALTY MODELS USED BY SSOS

As mentioned above, one of the main aspects of the IPR policies is licensing and this manifests itself in terms of the FRAND commitment. There have been many studies that analyse the FRAND model and its effectiveness. Many scholars have attempted to define the features of FRAND commitment, a collection of which has been studied by Brooks & Geradin (Brooks and Geradin 2010) as follows:

On the basis of a FRAND commitment, a patent holder(s):

- *Must charge no more than the incremental value of his invention over the next best technical alternative;*
- *Must not negotiate for a royalty-free cross-license as part of the consideration for a license;*
- *Must set his royalty rate based on a mathematical proportion of all patents essential to the practice of a standard;*
- *Must set his royalty rate in such a way as to prevent cumulative royalties on the standardized product from exceeding a low percentage of the total sale price of that product;*
- *Must not raise requested royalty rates after the standard has been adopted, or after the relevant market has grown to maturity;*
- *Is not entitled to seek injunctive relief against a standard implementer should they fail to agree on license terms.*

From the above description, it can be seen that though the FRAND commitment may not be a very straightforward mechanism and leaves a lot of room for a recipient to make individual interpretations of these statements. It has definitely been a challenge for various companies especially the licensees to assimilate the implications of the FRAND promise at a level of conception and definition.

In the current literature the subject of different models used to set the royalty payments for licensing of the technologies included in standards is broad. Recent research conjectures that, in an SSO, patent owners can "hold up" patent users in the sense of demanding high royalties for a patented input after the SSO has adopted the patented technology as an industry standard. This is a major problem since by the time a standard is set, some manufacturers may have placed large investments and sunk costs might have been incurred to design end products that incorporate the standard. This tilts the balance to actors that might hold key intellectual property such as essential patents to seek an excessive compensation in exchange for the permission to produce and commercialize the products involved(Lichtman 2006). The assertion of patent holdup addressed here arises because the patent holder does not forbear from charging the highest royalty that it can, once its technology has been knowingly chosen by the SSO for its standard. In order to avoid this “hold up” scenario SSOs commonly require their members to license their intellectual property upon a regime of fair, reasonable, and non-discriminatory (FRAND) licensing.

Patent holdup is not the only concern within the royalty models used by SSOs, each of the actors holding Intellectual property relevant to the standard will negotiate their own licensing agreements with interested licensees. In these negotiations, not only the definition of fair, reasonable, and non-discriminatory will be tested out, but due to the multiple iterations of royalty payments on complementary components for which patents are held by separate firms, “Royalty stack-up” poses a

the issue of increasing the adoption costs of the standard's technology dramatically (Geradin and Layne-Farrar 2007).

2.3.3 INFORMATION ASYMMETRY

As we have discussed previously, the specific policies of the SSOs call for different degrees of information sharing and in some cases are more explicit than in others in what, when and how information is to be shared. In most cases these requirements are very broad and avoid specificity which more times than not, allows various interpretations of what is to be shared.

The information an organization can gain at the cost of participation in the standardization process can have significant implications in its overall strategy and future development. In a standard that is under the development process, information about intellectual property is not often publicly available as it is difficult to do so from even a practical standpoint. The participants of the standard setting organization gain access to this information at the cost of membership in the standard committee and also gain a position to influence standard specifications.

Furthermore, an OEM can also suffer from an asymmetry of information on various levels that is built within the system of the standard setting ecosystem. The "behind closed doors" nature of licensing agreements posts a challenge to the licensees in gaining sufficient insight into how the agreement terms are set and vary according to the licensor profile. This is important even more so as such licensees often in turn act as licensors to actors further downstream in the value chain and would like to comprehend to the royalty payments at both ends. Moreover, the asymmetry is maximized if an OEM interacts with a standard through an intermediary. Though these built-in asymmetries cannot be avoided, this study attempts to pin-point the sources of the asymmetry and assesses the level of challenge posed by them. Hence there is an asymmetry of information that can be seen from such scenarios mainly arising from:

- The extent of membership to the standard-setting organization.
- Disproportionate information depending on the maturity level of the standard
- Built-in lack of information within the standard-setting ecosystem.

2.3.4 PROFILE OF ACTORS

Due to the nature of the standard setting organizations, and the variety of actors within, there is a dichotomy between the collaborations among them and self benefit. The existence of the standard setting organizations and the efforts placed to develop standards themselves respond to the need of the industry to maximize the positive networking effects and allow and extended adoption of a technology that if not by this cooperation would not be possible to produce. At the same time each of these actors may have very different business models, revenue streams and motivations to take part in the standardization process. These inherent differences among the actors involved in the standardization ecosystem permit the alignment of their individual interests in concept but at the same time pull them apart to maximize their individual benefit. Each of these ecosystems which

emanate from consortia is pushed to find a balance between the collective benefit and the individual one. The different profile of actors with the standard setting ecosystem as described by Geradin & Layne-Farrar, 2007 are as follows:

- *Pure innovators or upstream-only firms (i.e., firms that develop technologies and earn their revenues solely by licensing them);*
- *Pure manufacturers or downstream-only firms (i.e., firms that manufacture products based on technologies developed by others but that conduct no basic research of their of their own, limiting their activities to product development, and have no relevant IPRs);*
- *Vertically integrated firms (i.e., firms that develop technologies and manufacture products based on those technologies and the technologies of others); and*
- *Firms that do not create technologies or manufacture products, but buy products that are manufactured on the basis of patented technologies*

From the above categorization, it can be seen that there are companies with differing business models and incentive mechanisms especially with regards to their intellectual property positions. This diversity though argued to provide an aid the process of standardization by offering diverse perspectives; it certainly poses a challenge for an OEM who would potentially interact with any of the above actor profile as appropriate.

2.4 THE STANDARD-SETTING STAKEHOLDER VALUE NETWORK

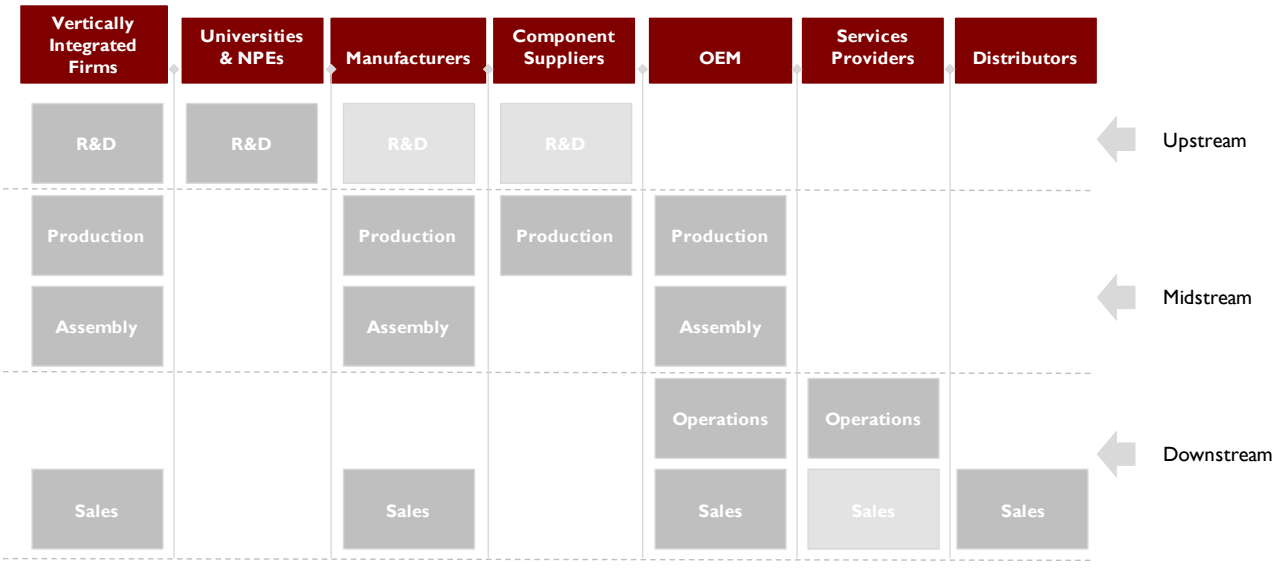

Figure 1 - Stakeholder Value Network

As a continual step after the identification of the various issues, due consideration was given into constructing a value network to understand the flow of value between the various stakeholders. The main intent behind this construction was to understand the roles and relationships both internally

and externally (Allee 2008). As mentioned by Allee (2008), this diagram also goes onto examine the three elements - roles, transactions and deliverables within the network. The end-goal with this was to make analytical observations in Chapter 5 and perform a Value Network Analysis.

Vertically integrated firms are those that have broad capabilities within innovation, production of goods, assembly of components and sale of goods to consumers. These actors actively perform cross-licensing in a standardization setting. Since the chosen area is ICT and telecommunications, it has been assumed that most of the operational functions is taken over by service providers.

Non-practising entities include universities, individual inventors and firms that focus on innovation and license their intellectual property to actors in the downstream.

Manufacturers have been assumed to be significantly different from the vertically integrated firms in the access route to intellectual property. Though they may have an active R&D activities and an intellectual property portfolio, they often in-license the required intellectual property from upstream actors in order to manufacture standard compliant products.

Component suppliers are companies such as Texas Instruments and Qualcomm who perform R&D and whose value propositions are either through licensing of their intellectual property to downstream actors or by selling components such as chipsets to the Manufacturers, Vertically integrated firms and OEMs to name a few.

OEMs are essentially assumed to be more product and market centric. Their capabilities lie on assembly of components, production of units, often infrastructure operations and sale of units. While service providers such as Vodafone focus on operational function and more recently the sale of products, the distributors focus on sale of units in various geographies through retailers.

It is to be noted that the above diagram is drawn out of a rough estimation of the types of actors with due consideration given to their intellectual property position and strategy. It may not however be completely exhaustive in reflecting the myriads of business models adopted by many different companies. This value network essentially represents the various stakeholders who either take an active role through participation in a standard or have a more passive role in implemented a standard that meets a given specification.

By mapping the value network of the various stakeholders within the standard setting ecosystem, we were able to relate to the different issues and resulting challenges that arise from these. Considering the way in which an OEM could potentially realize the issues, the effects can be seen from Upstream, Midstream and Downstream positions of the network. A brief description of the following categories has been given below:

Upstream: In this area, the OEM interacts with companies who make high investments in R&D and thereby hold a high bargaining position through ownership of intellectual property rights within a given standard. These companies are otherwise called "Innovators" and may include research companies, component manufacturers, vertically integrated firms and Universities.

Midstream: These include the actors who perform similar functions as the OEM in the value chain through which the competitive effects of the OEM are likely to be governed. This mainly includes vertically integrated firms and large scale manufacturers.

Downstream: This is an area through which an OEM would get closer to a market and addresses its customers. Actors in this area are adjacent to the broad consumer base and they include vertically integrated firms, manufacturers, service providers and distributors.

3. RESEARCH METHODOLOGY

3.1 RESEARCH PROCESS DESIGN

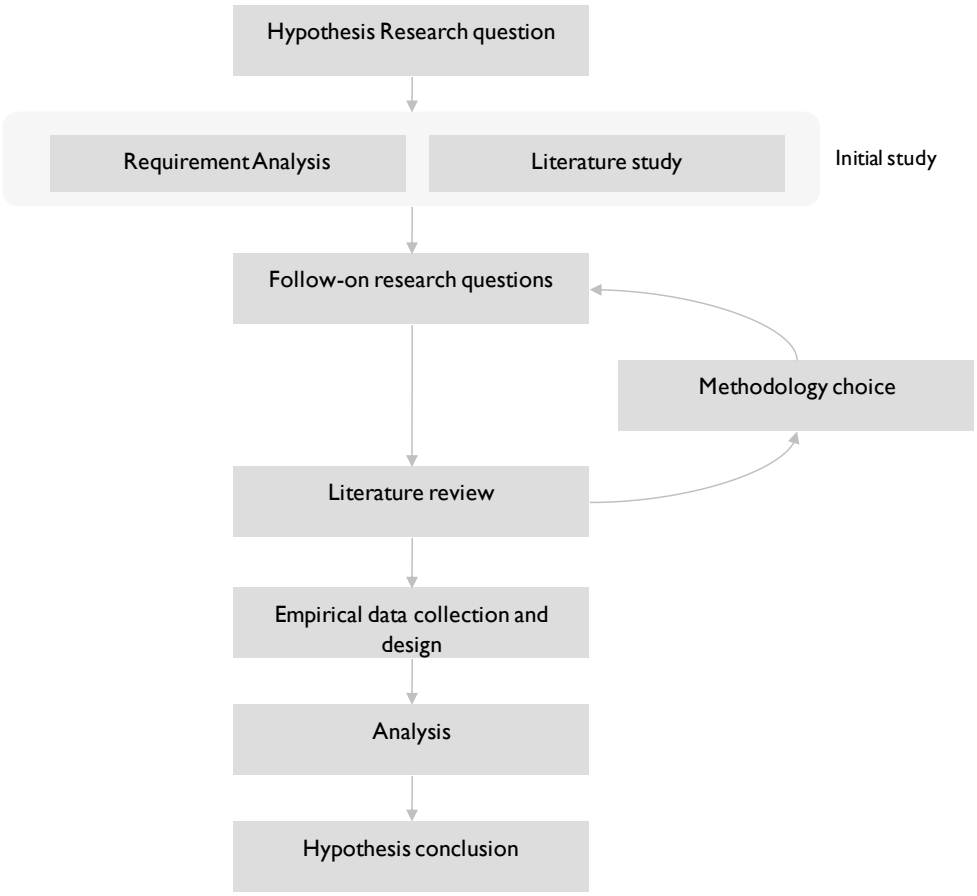

Figure 2 - Research process

Data collection has a central role in the creation of a convincing and well documented dissertation and a previous planning of the sources of that data is essential for a successful proposal (Klein, Dansereau et al. 1994). In this case following the deductive research model we have formulated a research question that better defines a very common inquietude of the small and medium sized OEM that will be the focus of our study.

Taking into consideration with the research question formulated and with previous experience and knowledge as basis, we adventure to formulate a hypothesis that may be the solution to the proposed question.

In order to broaden the base of knowledge, an initial and extensive literature survey was conducted which also served to generate a general picture of the current state of the art within the industry and to familiarize the researchers with common processes and interactions of the actors involved in

standardization. With this broadened knowledge of the industry and actors involved as well as a better comprehension of the most important points relevant to the solutions, a clear identification of the requirements that will have to be met was done.

These conclude the initial study phase and enables the creation of the follow on questions which are a dissection of the research question into different parts to address in an adequate manner the supporting data that will contribute to the conclusions, through an extended literature research and to initiate an iterative process that includes the methodology selection, the follow on questions and the literature review.

After the data collection phase, an analysis took place to process and orders the information in a way that helped us to come to useful conclusions and answered our research question.

3.1.1 RESEARCH QUESTION

The overwhelming discourse of change in the standardization process, responds to the perception of an increment in the activities of patent trolls and non practicing entities within the standardization eco-system. In recent years there has been an increase in the visibility of the intellectual property cases since they have been much publicized(Rothenberg 2005). These cases are raising the awareness that actors within the SSOs, have to change the reactive approach that implementers have had almost as a norm. Among other activities these renewed awareness has served to incentivize several organizations to look for a more proactive approach to manage their intellectual property and to monitor more carefully the implementation processes they might be participating in; with the specific objectives to foresee and minimize the negative effects that the implementation of a standard brings along. Hence the question arises.

"*Can compliant companies overcome intellectual property-related challenges and manage complexity through a proactive strategy prior to the adoption of a technical standard?*"

OEMs currently implement standards based on a market pull model and through a very reactive approach in dealing with challenges resulting from this adoption process. In other words, the standards are adopted because the consumers require the adoption by demanding certain characteristics of a product without the technology being completely developed(Blind 2008); the producers adopt the standards and license intellectual property that is required for the implementation only to the best of their knowledge. This reactive strategy has proven to be ineffective in minimizing possible risks related to the adoption of new standardized technologies, therefore changing the nature of those strategies from a reactive to a proactive model that actively seeks and tries to identify possible challenges in the implementation of such standards and ultimately minimize possible challenges. It is with this same mindset that we will try to identify the strategies that will serve this very purpose, to identify possible challenges and minimize their negative outcomes, thus we state the hypothesis:

Companies can build a proactive strategy which will enable them to identify challenges in the implementation of a standard and take effective measures to address them.

The strategies on which the companies are to depend on, and that will be used to address the challenges that follow implementation of a standard, will necessarily have the characteristic of being

proactive. We can define a strategy to be proactive when it dynamically strives to identify and confront challenges in an offensive rather than in a defensive way. It's important to explain that by offensive we do not imply aggressiveness towards other actors in the standardization eco-system but rather to make early estimates of the possible pitfalls and to take the necessary measures in order to avoid them entirely or reduce their threat as much as possible. This type of strategy can also reduce the total production costs since the possibility of incurring legal costs is decreased as well.

3.1.2 REQUIREMENTS GATHERING AND FOLLOW ON RESEARCH QUESTIONS

As a way to determine the validity of our hypothesis and answer the research question satisfactorily, the research question will be dissected and transformed in to a subset of questions the answers of which will ultimately shed light upon our focus of study.

The research question discussed in previous section can be scanned and divided into different elements. It specifies that the companies in focus are those that comply or will comply with a given standard; it calls for effectiveness in the handling unknown challenges through the creation and deployment of preemptive activities that constitute a strategic approach with the goal of minimizing negative outcomes even before the adoption of the standard. Below you can find the questions that will facilitate the discovery of information that will validate or negate the hypothesis.

1. What are the key IP issues that need to be considered for a medium sized OEM?
    - How does a compliance process take shape and how does it compare to the ideal model of compliance?
    - What complications have been commonly observed?
    - What issues arise from the form both short term and long term perspectives?

2. What challenges can these issues pose from an OEM's perspective?
    - What are the most interesting challenges in compliance as shown by the experts in ICT?
    - How can the challenges be analyzed from the point of reference of a medium sized OEM?
    - How can one prioritize orient themselves to the aimed challenges?

3. What kind of proactive measures can facilitate overcoming these challenges?
    - What are some instances in which the company would face such challenges
    - Based on the expert opinion, what kind measures can lead to minimization of undesirable outcomes from these challenges?

3.1.3 LITERATURE REVIEW

The follow-on questions transform the research question into wider subset of unknowns that have to be understood and answered. A systematic analysis of papers in the subject matter took place to obtain literature references that explained the inner workings of the standardization ecosystem and to identify the possible issues and challenges that might come with the implementation process of a

standard. In this stage of the research we were able to identify the most common issues in the standardization processes described in the previous section "Compliance Issues". In most cases the literature identifies these issues and addresses the system's inadequacy to an effective standardization scene and suggests different forms in which the system should be modified, but falls short on providing strategies that may be used to maximize the benefit of working actively with the current system restricting the possibility of a complete overhaul.

To recap, the literature helps us understand the issues that have to be faced by the companies cooperating in the standardization process but doesn't provide strategies to reduce the negative outcomes of the challenges created by said issues.

3.1.4 METHODOLOGY CHOICE

The choice of methodology was iterative in nature through mapping alongside validation of the method choice to the research questions. After breaking down the over-arching hypothesis based research question further into a sub-set of questions, an appropriate methodology was chosen to collect relevant data that could provide the analysis with support points to answer the questions at hand.

This choice was guided by a deductive approach since the risks and issues identified were in fact specific instances compared in contrast to an established theory. Or as Hyde describes it in his (2000) paper "These specific instances would then go into in search of generalizations about the phenomenon under investigation"(Hyde 2000).

By comparing quantitative versus qualitative data collection approaches as described by Kinnear and Taylor (1996) and Yin in (2002), "the basis for generalization in quantitative approach is statistical in nature"(Kinnear and Taylor 1996) while in "the qualitative study it is analytical in nature"(Yin 2002). Since the analysis points were identified to be qualitative given that these points are based on the organizational experience of the collaboration between actors, the appropriate methodology was chosen. Corresponding to the deductive approach, the two main qualitative data collection methodologies that were evaluated were technology case study approach and in-depth interview approach with experts in the field.

With regard to the technology case study approach, a review of existing literature was done filtering out the most relevant sections that could be suggestive of areas of study. A suitable technical standard was initially considered to perform this study on the basis of availability of information, size of the case study and depth of available data, the outcome being appropriate data collection and extrapolation into an ad-hoc analysis. However, through the recursive iteration of the design analysis method the methodology was linked again to the research question and it revealed non-exhaustiveness of the various compliance issues and risks if a technology case study methodology was to be used. This lack of exhaustiveness occurred because several of these issues were behavioral in nature and varied significantly across various standard setting bodies.

Therefore the choice of qualitative methodology through in-depth interviews was tested against the follow-up research questions for its relevance. Finding to be positive, the alignment of the interview method to the research question and the increased affinity between quality of data and focus to the reported issues, this method was judged to be appropriate. There is an ample gamma of interview

forms design that can be developed to obtain thick, rich data utilizing a qualitative investigational perspective(Creswell 2009). According to Gall et al there are three main models (a) informal conversational interview, (b) interview guided approach, and (c) standardized open-ended interview(Gall, Gall et al. 2003).

In the case of this research paper the decision was taken to design the interviews following the interview guided approach. The quality of the interview depends on the ability of the interviewers "…to ensure that the same general areas of information are collected from each interviewee; this provides more focus than the conversational approach, but still allows a degree of freedom and adaptability in getting information from the interviewee"(McNamara, Scott et al. 2006). Since the objective was to keep a structured order for the interviews while allowing the flexibility of rephrasing the questions or permitting the interviewers to withhold one of the questions if they perceive that the answer had already been offered by the interviewee as described by Gall et al. (Gall, Gall et al. 2003), the trade off with this type of interview according to McNamara, Scott et al.(2006). The lack of consistency in the way research questions are posed because researchers can interchange the way they pose them, this issue will be minimized in selecting the order of the questions but not the form in which the question is posed.

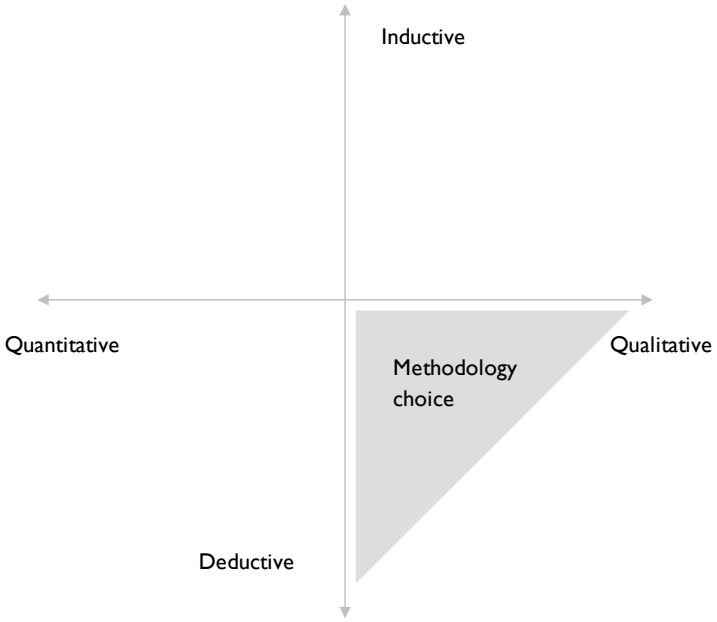

Figure 3 - Methodology choice

3.2 DEVELOPMENT AND VALIDATION

Two phases of the interview process are proposed; a pre-interview process and a post interview process, in Figure 3 the different stages of these processes are shown. The pre-interview process leads to the creation of the materials that will be necessary for the interviews themselves, while the post-interview process refers to the data acquisition and reporting framework.

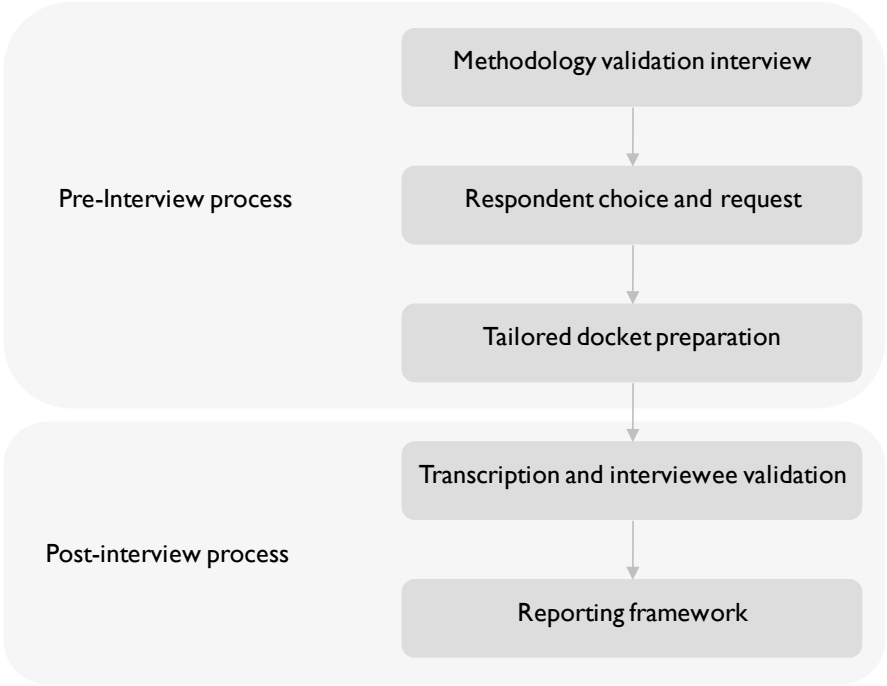

Figure 4 - Development and Validation

(Kvale 1996) suggests the seven different stages that an interview investigation must go through to be reliable and thick on information, stages that were taken into consideration during the evolution of the present dissertation.

> 1. *Thematizing: Formulate the purpose of the investigation and describe the concept of the topic to be investigated before the interviews start.*
>
> *2. Designing: Plan the design of the study, taking into consideration all seven stages, before the interview starts.*
>
> *3. Interviewing: Conduct the interviews based on an interview guide and with a reflective approach to the knowledge sought.*
>
> *4. Transcribing: Prepare the interview material for analysis, which commonly includes a transcription from oral speech to written text.*
>
> *5. Analyzing: Decide, on the basis of the purpose and topic of the investigation, and on the nature of the interview material, which methods of analysis are appropriate.*

6. Verifying: Ascertain the generalizability, reliability, and validity of the interview findings. Reliability refers to how consistent the results are, and validity means whether an interview study investigates what is intended to be investigated.

7. Reporting: Communicate the findings of the study and the methods applied in a form that lives up to scientific criteria, takes the ethical aspects of the investigation into consideration, and that results in an readable product.

3.2.1 INITIAL METHODOLOGY VALIDATION INTERVIEW:

In order to validate the data collection methodology of qualitative inquiry this interview included an academic field expert from the area of standardization in ICT and Open Innovation. The lack of prior art within the literature regarding the development of a strategic approach which could be used by small and medium sized OEMs to face the challenges of standardization in a proactive manner was verified and the data that would be required to the interviewees were discussed in order to facilitate subject-matter interviews that were to follow.

3.2.2 INTERVIEWEE SELECTION

(Polkinghorne 2005) writes "Participants and documents for a qualitative study are not selected because they fulfill the representative requirements of statistical inference but because they can provide substantial contributions to filling out the structure and character of the investigation." The participants were chosen in such a manner that the sample size would be able to offer a large diversity in terms of the stakeholders which take part in the standardization ecosystem as well as domain experts from various fields following the purposive selection model which states that "the purposive selection of data sources involves choosing people or documents from which the researcher can substantially learn about the experience."(Polkinghorne 2005) The selection of appropriate interviewees is essential to obtain rich and thick data and one of the most important steps in the preparation of qualitative research, on this subject Merriam (Merriam 2002) gives some advice to researchers.

> *"To begin with, since you are not interested in 'how much' or 'how often,' random sampling makes little sense. Instead, since qualitative inquiry seeks to understand the meaning of a phenomenon from the perspectives of the participants, it is important to select a sample from which most can be learned. This is called a purposive or purposeful sample."*

As we have discussed previously the selection of the types of participants is also important and serves to the need of triangulation. By triangulation it is possible to move from the point of view of a single person or organization and deepen the understanding of the subject matter.(Polkinghorne 2005) This included - academic scholars, vertically integrated firms, IP holders, component manufacturers and compliant companies. The industry that was chosen was ICT and telecommunications and the companies that were targeted occupied different stronghold positions in

the value chain. As a standard setting body brings together these companies together, the interview recipient classification in terms of the value chain position was key in gaining a real world perspective and incentive position.

After careful consideration of the possible participants the table below shows the spread of participants that were interviewed.

Type of Organization	Position
Academia	Researcher & Professor
Medium size OEM	Patent Engineer
Medium size OEM	CTO
Vertically Integrated Firm	Director
Vertically Integrated Firm	Director IP strategy
Academia	Researcher & Professor
Large OEM	IP Manager
R&D	IP Vice President
Consultancy	Vice President

Table 1 - Interviewee Overview

3.2.3 DOCKET PREPARATION

In order to familiarize the interviewees with the subject matter, a document that contained a short background of the study, the research question and follow-on questions was prepared and shared with the participants prior to each interview. This practice allows the interviewee to familiarize themselves with the goal of the study and to prepare cases and information that they are willing to share to the study. In contrast with everyday participants to qualitative studies, the selection of highly qualified experts as interviewees requires a more open approach to the interview and the participants demand to be aware of the objective, methodology and extent of the study, since their professional opinion will serve as support for the research.

3.2.4 SUBJECT-MATTER INTERVIEWS

As the core of data acquisition, interviews with experts representing diverse actors in the standardization ecosystem were scheduled. The interviews took place in different locations and through telephone and video conferences.

Following the seven stages of an interview investigation(Kvale 1996) the interviews were performed adhering to the interview guide in order to maintain a standardized content of the interview outcomes. In the same manner, the interviews were recorded and transcribed which in turn allowed the analysis of the interviews' contents and satisfies the requirements of a well defined qualitative study according to (Patton 1990).

3.2.5 DATA COLLECTION DESIGN AND REPORTING

Following the steps of the qualitative data analysis guidelines suggested by Côte (Côté, Salmela et al. 1993) the process is started by creating tags which is the identification of concepts that accurately contain the information that has been made available from the interviews, is the first step to organizing the information to be analyzed though dividing the text of each interview into text segments called "meaning units"(Tesch 1990).

The second step in the analysis is the creation of categories where tags with similar meanings are clustered together(Miles and Huberman 1994). It is necessary to create a reasonably exhaustive category system to bring about a standardized reporting format of the interviews as will be seen in the next chapter. The interview transcripts were read through thoroughly and an open coding exercise was performed in order to generate the initial categories as described by Berg(Berg 2007). This initial classification system is built according three typical characteristics of categorization (a) coding experience (b) inductive inference and (c) similarity (Smith 1990).

All the interviews were processed in this way and the categories were revised again to create higher order categories. A reporting framework was then created from this category system which enabled the synchronous reporting of qualitative data(Burnard 1991).

3.2.6 DATA ANALYSIS

An analysis framework was developed for the analysis of the information collected in the previous steps. After categorizing, the data was reported in narrative form in order to give the reader an overview of the content of each of these interviews.

Obtaining Challenges

A list of challenges was compiled by tagging and categorization, as described and expressed by the interviewees. These challenges will be assessed through a quantitative equivalence of a qualitative evaluation through different parameters for each challenge and each interviewee.

The parameterization of the challenges responds to three essential characteristics of the challenges which we are able to judge based on the comments made by the interviewees. These characteristics were intrinsic, effectual and emphasis.

Assessing Challenges

The Intrinsic metrics are those which can be addressed by the OEM while the effectual are those which are external and independent of the company's position. On the other hand, we have the emphasis which is the one that reflects the support from the sources listed in the investigation section.

It is important to keep these three sets of parameters separated from each other since the relationship they hold is not a direct one and has to be treated separately.

The numerical values obtained from this assessment were processed and a resulting list of ranked challenges was produced. The analysis model used for computation will be further elaborated under the analysis section.

The challenges were be positioned within the value network conforming to the perception the OEM has of each and possible strategies to address these challenges concordant with the information also provided by the interviewees, available literature and further analysis.

The procedure on how the challenges are assessed will be described in greater detail in the analysis section of this dissertation

3.2.7 HYPOTHESIS CONCLUSION

Conclusions were drafted from the results of these analyses. The conclusions were at first instance addressed the research question at hand and subsequently affirm the hypothesis that was developed there from.

In this section the answer to the research question and the subset of questions will be discussed to determine the validity of the assessment and proposed strategies.

4. INVESTIGATION

The Investigation phase involved data collection process through interviews and as mentioned in Chapter 3, followed structured approach in gathering the data. Once the data were gathered, tags were created whereby the different concepts and ideas were identified and these tags were then grouped into a category system. The following section presents a brief explanation of the different components of this category system. This category system was intended to act as an aid to the analytical observations that were made in Chapter 5.

4.1 CATEGORY SYSTEM

The category system consists of four components that were identified through the tags that were created. These components are presented below with appropriate sub-components that lie within them.

4.1.1 IPR POLICY

The questions related to IPR policy were categorized into three:

Creation, structure and governance - The typical questions in this section included how standard setting bodies and stakeholders viewed the IPR policy, what motivations went into the development of the policy and what resultant effects were observed and implications the policies had to the ecosystem at large.

Opportunities and threats at company level - The questions in this section discussed the various perspectives companies have on the IPR policy and touched upon its role in the success of the standard at an organizational level.

Non-standardized interaction policies - It is common knowledge that presently, there exists no standardized format for IPR policies as many different standard setting organizations had different strategic interests and some are even ideological driven for example, the Open-source initiatives. Hence the questions in this section dealt with how companies managed their alignment to these different standardization organizational forms and processes especially in their IPR policy requirements.

4.1.2 INFORMATION ASYMMETRY

Benefits and risks of participation - Participation in a standard setting organization have been argued to provide benefits. The questions here dealt with the benefit of participation from a non-IP holder point of view to take an observational role in the process and also the risks of giving away information through participation.

Standard position and Disproportionate information - A standard that is fairly set and less dynamic is rich with IP related information but the one that is highly dynamic and is still under the development process is not. The questions here targeted these differences and how implementers managed these differences from an implementer's point of view.

Built-in lack of information - The aim of the questions in this area was to get a general understanding and reasoning behind of the information asymmetry that is likely to persist within the standards ecosystem for example, the details on bilateral royalty negotiations, the low predictability of the final standard specification, the patent strength of essential IPR and so on.

4.1.3 ROYALTIES AND TRANSACTIONS

The main points of discussion in the section dealt with the FRAND licensing model, essential and non-essential IPR and how companies managed these transactions both externally towards different stakeholders and also internally in arriving at royalty rates, product development and market plans.

4.1.4 ACTOR PROFILE

Divergent incentives - The standardization ecosystem consists of actors with differing business models and incentive mechanisms. Though this diversity is seen to be an asset, it also carries with it many concerns for an OEM as to understand the implications of the diversity and what the different strategic motives are for various participants and non-participants.

Stakeholder relations - Given the diverse actor profile, the questions in this section focused on what it implies for the OEM in terms of the relationships shared with the actors with the standard setting organization or through intermediaries who in turn have relationships with these entities.

4.2 SOURCE A - CONSULTANCY

Organizational profile

Industry	Consulting, Management Services
Type of clients	Private companies, Governmental organizatio
Size	Large Enterprise
Interviewee position	Vice President

Table 2 - Source A - Organizational Profile

Intellectual property position

Licensing activity	Not Applicable
Intellectual property Expertise	Valuation, Mergers & Acquisitions, Antitrust, Compet
Role in technology standardization	Consulting services to various stakeholders

Table 3 - Source B - IP position

Interview data

1. IPR policy

Creation, structure and governance

The interviewee presented us with the misconceptions that lie within the community of standardization about the IPR policy and its governance. We were also able to get a different perspective on how different companies use the IPR policy to safeguard their IP position.

According to the source, there is a general misconception that the more detailed the IPR policy of the SSO is, the better it is for all participants and non-participants, which is not necessarily true. This is due to the fact that often IP holders use this as an instrument to flush out too many details and as a result the policy becomes over-inclusive. Such an over-inclusive policy can mirage the relevant IP landscape particular to the standard.

Opportunities and Threats at company level

We understood from our discussion that though there are many opportunities that the standard adoption provides to the implementer, an OEM should conduct a thorough study of the SSO prior to making any actionable decision.

The interviewee says that from a standard implementer's point of view, there is a presumption of earlier disclosure being better. Though this is valid in most cases, as the standard itself evolves over time, an implementer has to make a due diligence as to when the disclosure was made and to what aspects of the standard does it apply, especially during an instance of early disclosure.

Non-standardized interaction with policies

Since there are very many types of standardization bodies and respective IPR policies, there must be an ad-hoc approach prior to implementing any given standard. A generalized workflow for all standards of interest will then prove to be highly inflexible.

The interviewee expresses agreement to a policy model as that of ETSI where there is a specific declaration of a patent mapped to a specific component and a specific iteration of that component.

2. Information asymmetry

Benefits and risks of participation

When asked about the various benefits and risks for a company if/when participating in standards development process, the interviewee corroborates with the fact that though there are many benefits of joining a standards body, there are IP risks that an implementer should be aware of. An implementer with very little IP assertion power is in many ways insisted on adopting a standard for technology and business interests.

Standard position and Disproportionate information

Through an empirical study made by the source in a study, it was found that the IPR disclosure usually happens after the component specification is released as it is difficult for the IP holder to read well into the standard until the specifications are made. We got an understanding from this that it is often practically not possible to get too much information on a standard that is under fast paced developmental changes.

There is also an issue of technically non-essential patents but commercially essential ones which is more challenging from an ex-ante perspective for an OEM, in the early stages what is going to be commercially essential. If that has been identified then the patents that cover these features have to be identified and this is a case where going through an intermediary provides an easier route as they may have deeper insights into the technical specification and the IP position at component levels.

Built-in lack of information

The interviewee points out that the "less information" support-camp argument that once there is an agreement on FRAND basis and since the licensing transaction includes portfolio of patents, the information on the exactness of essential patent details not very crucial. The “less information”

support camp consists of companies who may not encourage and promote information flow within the ecosystem. The antitrust issues also pose a limitation on attaining more information prior to the standards development unless an implementer also participates in the developmental process.

In other words the interviewee says that through the use of the FRAND model standard setting organizations control the amount of information controlled by the consortium while promoting the flow of information between different actors freeing the consortium interaction of acting as intermediary on information not essential for the collaboration

3. Royalties and Transactions

As pointed out earlier, the interviewee notes the lack of predictability of information and this includes most importantly the information on royalty rates. This is where an implementer faces a challenge and has to make internal decisions in order to minimize concerns. It could be done by looking at the cost structure, competitor analysis, looking at the market place and try to negotiate the best royalty rates. The interviewee also points out that beyond this level of analysis it is difficult to know if the licensing is offered on a FRAND basis. We understood from this comment that standard implementers can take some proactive steps prior to negotiation of licensing terms such as competitor analyzes and benchmarks.

4. Actor profile

Divergent incentives

According to the source, the diversity in the type of players affects - (1) the ability of the implementer to license and (2) the amount at which the licensing will take place. In the early telecommunications standard like the GSM, there were mostly vertically integrated firms who were not specifically interested in licensing their IP to actors outside the standard. Once we entered mobile communications standards, there were upstream actors who based their business model on innovation and this opened a window towards many OEMs enter the market for these products and encouraged downstream actors especially from Asia. We gained a varied perspective from this discussion on how innovators opened up adoption for many OEMs through their upstream specialization in the mobile communication standards.

When asked about the different stakeholder relationships, the interviewee pointed out that when there is no cross licensing, a vertically integrated firm's royalty rates can often exceed that of an NPE if their strategic intent is to close down competition from the OEM. Hence the concerns do not pertain just to the presence of non practicing entities but also spreads across the different stakeholders.

Stakeholder relations

When asked about patent pools, the interviewee states that though pools have been a mechanism to combat many concerns like double marginalization cost, the strategic intent of the pool can also be detrimental in its outcome since sometimes IP holders use this mechanism to exploit weak patents by forming strategic alliance.

There is also an additional concern with intermediaries in a standardization set up, according to the source. As an OEM, the ownership of indemnification duties has to be clarified when dealing with an intermediary who offers a standard specific component. Such indemnities and warranties come with a cost but the OEM should be definitely considered as the additional information asymmetry is passed on to the intermediary.

We understood the importance of the indemnification agreements between the OEM and intermediary even though they could be an expensive feature of the agreement.

4.3 SOURCE B - ACADEMIA

Organizational profile

Industry	Academic University
Type of clients	Not Applicable
Size	Not Applicable
Interviewee position	Assistant Professor, Strategy and Innovation

Table 4 - Source B - Organizational profile

Intellectual property position

Licensing activity	Not Applicable
Intellectual property Expertise	Industrial Organization, Applied Econometrics, Stand
Role in technology standardization	Research

Table 5 - Source B - IP position

Interview data

1. IPR policy

Creation, structure and governance

The interviewee starts off by taking a step back from standard creation and iterating that the market for property rights is not very clear with an increasing flush of patents and also functioning market that is not very well defined. This could provide an understanding as to why a hold up situation has always been a concern during the creation and governance of a standard setting organization. The interviewee pedagogically presented the different responses to standardization namely:

The interviewee also states that there needs to be a more clarity in the IPR policy and there goes a lot of investment in the creation and governance of a standard and others are free to join and play the game.

There are a lot of firms that own intellectual property that we are unaware of, and that the standards may infringe. The game is then played by the other firms who use intellectual property defensively.

Standardization is a way of contributing to technology development but proprietary intellectual property cannot be given away.

Therefore, from the interviewee's comments it can be seen that there can be different viewpoints and perceptions in the creation and governance of the intellectual property related policies that manifests itself into a platform where a joint consensus is reached.

Opportunities and Threats at company level

The interviewee says that one of the obvious threats for an OEM is the issue of hold up. OEMs make significant sunken investments when they commit to a standard and the IP owner are in a position to demand a set price. There can be a lot of pushback on the kind of recommendations of the IP policy especially from the telecommunication companies who want to license IP which means that the politics in the standard setting organizations may influence the results of the standard development.

We were able to gather the thoughts on different political motivations being a factor that goes into the recommendations of the IPR policy and why an OEM should study these policies before making significant investments.

Non-standardized interaction with policies

The convergence of the various industries like Telecom and ICT has given rise to many tensions within the standards ecosystem. Telecom has traditionally been a litigious sector and ICT has witnessed high cross-licensing behavior. The interviewee also points out that vertical disintegration with new business models could be a cause for the ad-hoc approach required when interacting with any standardization body. In other words the evolution of the communications industry and the merging with the computer industry has created the need to sort out differences in the way intellectual property is handled and negotiated with competitors and other actors in the ecosystem.

2. Information asymmetry

Benefits and risks of participation

According to the source, participation in the process can help companies gain an early insight into the latest specifications and also see which firms are pushing which parts of the standard. Since standardization is also fairly political in nature, seats at the table can also an opportunity to be a part of a coalition. Since there is a lot of variation across standard setting bodies, the benefits and risks of participation should be analyzed on a case-to-case basis.

Standard position and Disproportionate information

One of the main aspects that were under discussion was the position of standard being mature or early development was the disclosure rules in a standardization setting. The interviewee then took us through the two main arguments of the disclosure rules:

- IPR should be disclosed and should be very specific information in exchange for the privilege of being in a standard

- Early disclosure allows us to contemplate trade-off between alternate competing technologies and it is very hard to determine essentiality from an IP perspective.

There seems to be an apparent threat of not knowing the relevant IPR details if the actor is not part of the development process.

Built-in lack of information

The interviewee pointed out that since there is a high competition in time to market, it is not in the interest of many companies to perform IP search and ensure patent strength. The built in lack of information also arises from lack of information on licensing transactions. There is a low transparency on the prices of intellectual property transactions.

Here we were able to see why companies dealt with intellectual property concerns at a lower priority compared to key business and market decisions.

3. Royalties and Transactions

When asked about royalty models, the interviewee starts off to with a brief analysis of the basic features of a FRAND license:

- The license cannot be exclusive; negotiations must be made with all.
- No right to seek preliminary injunction.
- Essential patent cannot be put to launder - transfer ownership in order to get around FRAND.
- Non-discriminatory - which is very theoretical since volume discounts are a norm.
- The list price for the intellectual property is often very high.

The source goes on to point out a scenario where the FRAND promise is questioned if/when an intermediary is involved. Though it is may be deemed to be common, it is likely to happen who OEMs who license in standard related components from an intermediary. In this case the IP holder should ideally not have the right to change the price just because the identity of the licensee, say from a component supplier to an OEM.

One key take out from this discussion was the laundering of ownership requirement in FRAND and the practical issues of IP holders in not being able to offer non-discriminatory licensing terms and for the implementers in expecting the same.

4. Actor profile

Divergent incentives

The interviewee says that essential patents form a focal point where companies, more specifically the ones holding IP display rent-seeking behavior. The cross-licensing deals behavior from vertically integrated firms is likely to increase since they are essentially a royalty-free license. Some of the other companies also want to reserve some patents from their portfolio which could be relevant for

the standard but rendered secret to differentiate their implementation from their competitors. As mentioned above, the interviewee also mentions the trend towards vertical disintegration through which new companies have sprung up with more innovative and specialized business models.

We understand that these divergent incentives will only increase with the increase in the vertical disintegration whereby an OEM would have to carefully consider the type of actor it is dealing with.

Stakeholder relations

Patent pools have been a mechanism where the various stakeholders in a standard come together. When asked about its effectiveness, the interviewee goes on to point that it has not been as potent in solving issues as considered. This so because, the one who benefits most form the patent pool is the free rider who holds the essential patent and decides to stay out of the pool. This raises the concern for the IP holder within the patent pool added to the high transaction cost but it also gives rise to the risk for implementers with high royalties.

4.4 SOURCE C - ORIGINAL EQUIPMENT MANUFACTURER

Organizational profile

Industry	Communications equipment
Type of clients	Business to business entities
Size	Small to Medium sized Enterprise
Interviewee position	Chief Technology Officer

Table 6 - Source C - Organizational profile

Intellectual property position

Licensing activity	Negligible
Intellectual property Expertise	Defensive patenting
Role in technology standardization	Implementer

Table 7 - Source C - IP position

Interview data

The interview questions dealt with understanding the various issues faced by an OEM and the challenges faced by the company in the interaction with stakeholders in relation to standardization. Hence, questions and content in relation to IPR policy were omitted for this particular case.

1. Information Asymmetry

Benefits and risks of participation

Though the company presently implements standards that are fairly mature, it does have strategic interests in evaluating the more dynamic ones. The company at the moment does not have as a strategy the active participation in standard development processes. At the moment the strategy

followed by the company calls for adoption of standards and collaborations in the standard setting ecosystem.

Standard position and Disproportionate information

The interviewee says that the company is part of a standard that has been protected by its legacy. Since the standard is highly developed and quite static in its further development, there have been almost no cases of infringement of intellectual property. Being in the position, the company has not felt that the IP related information was not highly crucial. But the interviewee also points out that in future, this information will be crucial if the company would move to a more recent and dynamic standard.

Built-in lack of information

With the company's apt size, the interviewee felt that it was in a "sweet spot" for being a target by companies who actively assert their intellectual property. The interviewee also pointed out that the lack of information of the existence of such players and their behavior can be compensated with thorough analyses based on strong technical competence. Moreover, being an OEM with an exposure the interviewee expresses a need to install mechanisms that would in one hand provide more knowledge regarding IP issues and on the other, compensate for the built-in lack of information.

2. Royalties and Transactions

The interviewee said that the company preferred to take in intellectual property in patent pools as their transaction costs are lower and they are easier to manage. Patent pools have been said to be fool proof and has assured protection. It will also be something that will add value with upfront payment to a packaged solution.

This feedback suggested an OEM's view of preference to a one stop solution for access to technology that reduced the transaction costs.

3. Actor profile

Divergent incentives

The component supplier who serves the OEM, says the interviewee, can be protected since we produce products that almost have forty times the value of the individual components and can hence prove to be more attractive for companies who want to assert their proprietary intellectual property. As mentioned before, the interviewee says that the company has the right size to be approached by companies who want to assert their intellectual property and with no IP due diligence taking place at component level, it poses a challenge.

Stakeholder relations

The interviewee describes the relationship with intermediaries who provide components and how these transactions are usually designed. The strength of IPR position of the supplier also governs the likelihood of risks that is passed on. More than 80% of these transactions are purchase agreements

and the other 20% licensing - especially ones related to software. So far a financial due diligence of the supplier has been key but going forward the IP due diligence will also be a significant factor.

4.5 SOURCE D - ORIGINAL EQUIPMENT MANUFACTURER

Organizational profile

Industry	Communications equipment
Type of clients	Consumers
Size	Large Enterprise
Interviewee position	Senior Manager IPR Acquisitions

Table 8 - Source D - Organizational profile

Intellectual property position

Licensing activity	High
Intellectual property Expertise	Strategic patenting, Acquisition, Licensi
Role in technology standardization	IP holder, Implementer

Table 9 - Source D - IP position

Interview data

1. IPR policy

Creation, structure and governance

As per the interviewee there are significant ideological differences in the creation of a standard setting organization and in many ways an industry initiated standard tends to minimize many concerns. But in instances where there are private entities or individuals/developers that are part of the development, then royalty-free model is the only way out to incentivize its development. This may however pose as a risk of these developments infringing upon the IP of different companies just as in the case of the open source Android platform that has been under investigation now.

Opportunities and Threats at company level

Larger corporations and some medium sized companies are usually the ones who do join a standard setting organization. An OEM can gain early information on some of the specifications of the

standard. An important aspect of the IPR policy is the timing of disclosure. This is an area where the outside actors see a decision-making prospect with regards to implementation.

Non-standardized interaction with policies

There are inherent differences between various standard setting bodies for say standards like OMA (Open Mobile Alliance) - which is FRAND-based and W3C which is essentially royalty free. Though many of the policies are different there can also be similarities for instance in this case, the reciprocity or grant back of intellectual property.

2. Information asymmetry

Benefits and risks of participation

The interviewee points out that as a participant in the standards development process, one has the power to influence decisions as the standard-setting has a political element to it. There are proprietary interests and resulting imbalance seen from different companies or group of companies. It is very important to clarify one's position as an OEM and the intent to join a standards development process.

Standard position and Disproportionate information

The interviewee commented about the position of the standard taking the case of an mp3 player manufacturer. As a manufacturer, joining the standard would have made sense during its development but since the standard is fairly set with very little iteration, it might not be strategic to join the standard setting organization. The decision to join a standard will hence depend highly on the strategic business goals.

Built-in lack of information

The interviewee pointed out that since standardization is a long process, there is a significant lack of visibility of the final outcome of the standard. There is also a fair amount of risk for an OEM whether and what standard will be deployed or not.

3. Royalties and Transactions

When asked about the FRAND model and the royalty streams for essential patents, the interviewee went on to point out a varied perspective on the essential patents. It is to be understood that though essential patents are talked about in the ecosystem, non-essential patents can prove to be more costly as the FRAND terms do not apply to these. Moreover, infringements on essential patents are easier to detect as often are displayed on the websites of the standards body.

Arriving at royalty rates could be a challenge for OEMs. The interviewee says that an OEM could use a discounted cash flow model to get an idea of royalty rates against the volume of sales. There are

several market research reports that are used to aid this process. As per personal opinion, it is very hard to derive a 100% accurate calculation on the royalty rates especially at component levels.

4. Actor profile

Divergent incentives

In the standard ecosystem, the OEM without any IP assertion power can face heavier competition on price from vertically integrated firms who might have price advantage since they engage in many cross-licensing transactions. When it comes to patent pools, they have been economical and from a historical perspective they haven't been very beneficial to OEMs due to the costs for the OEMs. Evaluation of essentiality is about $10,000 for a patent, which is quite high. It has been a challenge to incentivize the free riders. Pools can seem to be an attractive option but carry with it a lot of risks the accessibility of the patents has to be a key factor in deciding whether you should join in or not

Stakeholder relations

If an OEM deals with in intermediary such as a component supplier, indemnifications are usually a mandatory. In a case of infringements especially in a mobile communication equipment, the complete tear-down and IP due diligence can be a highly resource intensive task. There can also be agreements whereby a shared infringement analysis can be done if there are mutual interests.

4.6 SOURCE E - ORIGINAL EQUIPMENT MANUFACTURER

Organizational profile

Industry	Communications equipment
Type of clients	Business to business entities
Size	Small to Medium sized Enterprise
Interviewee position	Patent Engineer

Table 10 - Source E - Organizational profile

Intellectual property position

Licensing activity	Negligible
Intellectual property Expertise	IP protection
Role in technology standardization	Implementer

Table 11 - Source E - IP position

Interview data

As defined by the interviewee the main role of the company in the standardization arena is that of an implementer, since the R&D operations of the company are centered in the production of high tech devices. Although seldom the company diverts resources into the development of new standard related technology, this is the exception rather than the rule; hence there is no strategic interest in participating as a leader of the standard setting process.

1. IPR policy

Opportunities and Threats at company level

The interviewee comments that the membership to SSOs to the company is completely determined by the market. It may also be a difficult task since membership is very resource intensive both financially and in man power, resources which are precious and which have to be very carefully allocated. Hence the role that an OEM would take, whether as information seeker or active

participant in the standardization process, depends directly on the size of the company due to the resource opportunity. In the same way the amount of knowledge controlled by an OEM would also be very influential in the decision on whether to join the standard or not. The policies under which the SSOs are governed are not a decisive factor on the joining decision.

From the company's perspective the biggest threat of joining an SSO is the misuse of resources, the limited power that the company could excerpt on the consortia is very limited and the benefit of joining is not clear. In the other hand the inability to conduct extensive analyzes of the policies governing the SSOs are perceived as a possible threat.

2. Information Asymmetry

Benefits and risks of participation

The interviewee states that in the case of a project of adoption of a new standard, ideally the OEM would like to have access to the actors involved in the development of a standard and detailed information of essential patent owners. Although the information asymmetry problems are numerous it is also important to denote that there are likely a lot of cases in which actors involved in the development of a standard share more information than the required by the SSO.

Hence, it can be seen that the information asymmetry level cannot be generalized and has to be addressed depending upon the case at hand.

Standard position and Disproportionate information

The interviewee comments that there is a great amount of information likely being transmitted by the members of an SSO that is not available to the non-members. The participant also comments that at the same time the benefits of having access to the information related to a standard or being able to influence the course of action of a certain standard being implemented are difficult to point out. Hence, there seems to be a high level of ambiguity in the level and type of information one can get from joining a standards development process.

Built-in lack of information

There is a need to have a sense of which actors possess a good portion of the essential IPRs, this is difficult since most SSO do not demand their members to disclose this information, the costs of compiling a list of the required licenses to be acquired by a company which was not involved in the development of a standard, can be very high in case the SSO does not provide a comprehensive compilation.

3. Royalties and Transactions

In the case of OEMs the collaboration with suppliers is more than a purchasing relationship, usually modifications of the design have to be made that require a tighter collaboration, and these are handled by broad agreements that enclose, the purchasing agreement, IPR and licensing in a single document, hence the licensing agreements are seldom explicit and with exhaustive intellectual property information, in most cases it is difficult to make an assessment of the licensing conditions offered in these deals.

The interviewee suggests that at the very least a due diligence of the IP should be required to the supplier in order to show its current status, in order to minimize the possibility of an infringement and to specify clearly the responsibility in case that's such event would happen. As a minimum a supplier would have to provide the company with support by offering technical support.

4. Actor profile

Divergent incentives

According to the source there are two main issues brought to the table by a divergence in actor incentives. The company recognizes the need to create practices such as an evaluation of the technology and mapping of potential IP owners to take a proactive approach but these measures are not performed intensively because of this, the possibility of not being aware of the presence of a patent troll is low.

In the same way OEMs with a weak IP portfolio have smaller profit margins than vertically integrated firms and have a harder time competing with them downstream not only due to IPRs but the strength of their distribution channels also contribute although the difference in final price might be very small.

Stakeholder relations

The participant commented that it is common that the IP holders require grant back agreements from smaller actors as a condition for granting licenses which drastically limits the collaboration of these small actors in the R&D efforts.

4.7 SOURCE F - VERTICALLY INTEGRATED FIRM

Organizational profile

Industry	ICT
Type of clients	Consumers
Size	Large Enterprise
Interviewee position	Vice President Intellectual Property

Table 12 - Source F - Organizational profile

Intellectual property position

Licensing activity	High
Intellectual property Expertise	Strategic patenting, Licensing, Acquisition
Role in technology standardization	Driver, Implementer

Table 13 - Source F - IP position

Interview data

The interview commented on the motives the company may have for the adoption of standards, and said they were numerous. Nonetheless, the adoption of standards responds to a request from the market in a purely market pull fashion, however there are several procedures that a company has to engage prior to adoption of a standard. The most important aspect of this is a business analysis of the benefits of the adoption, the participant warns that adoption without a careful project and goal definition is risky, although it seems counterintuitive the intellectual property challenges have a secondary priority in the adoption of a standard.

1. IPR policy

Creation, structure and governance

The Interviewee starts the interview by explaining that to his/her professional opinion the bylaws to which a standard setting organization adheres to is one of the most important differentiators between consortia. These policies have to be studied and benchmarked in full detail prior application

for membership, the same consortia can also provide powerful tools in the implementation of their standards like the settlement of licensing disputes.

Opportunities and Threats at company level

A characteristic of the consortia that is extremely important is its exhaustiveness when it comes to disclosing information relative to the ownership of the essential IP of a standard. A high exhaustiveness is certainly a highly desired characteristic in an SSO but very rare.

Non-standardized interaction with policies

The participant conveys that, that the SSO system is flawed since it cannot exert control over their members, since they are not completely legally bound to conform to any of their consortium regulations, and even in the cases where the policies are heeded, companies will comply in most cases with the policies to its minimum requirement in order to maximize their own benefits. Hence the policies may not ensure both absolute cooperation and goodwill from the stakeholders.

2. Information asymmetry

Benefits and risks of participation

In the case of small and medium sized OEMs there is almost no benefit of joining an SSO in the case that the company doesn't possess intellectual property to contribute with this non affiliation to a relevant SSO certainly exacerbates the information asymmetry; nevertheless there are some strategies that can compensate this asymmetry. A good practice these companies should have is to approach companies who are members of the consortia of interest and initiate negotiation to licensing their technologies, through this negotiations it is possible to get good hints of what's going on inside the standard development process.

Standard position and Disproportionate information

The interviewee comments that, companies which are members of the SSO during the development stages of the standard certainly have more information regarding essential patents and may be able to perform intellectual property ownership analysis earlier which would give them an edge over companies who don't have that possibility.

Built-in lack of information

The membership to an SSO in no way ensures a good flow of information, in fact due to its nature, the SSO themselves have incorporated barriers of information between actors, in order not to incur in anticompetitive behaviors.

3. Royalties and Transactions

The interviewee argues that for the costs of licensing, specially from big companies are not high and that these royalty models do in most cases follow a FRAND philosophy, requiring the proportionate share of the R&D costs incurred on and a reasonable mark up, there are few cases in which a company owns more than 20% of the essential patents of a standard, which to that company

represents a 20% discount on licensing costs compared to a company that has to license all the IP requires, normally the total license reaches a fixed percentage of the total value of a product, but this is highly variable in a case by case basis. There are several examples in which the Licensing costs were very high, one of such examples is the initial costs of DVD players which licensing costs were very high and caused the price of the device itself to be incremented

Regarding responsibility for infringements, it would be interesting to develop an insurance system to take away the risk of adoption away from the OEMs or the subcomponent suppliers to which an infringement case could come very costly. Component suppliers for the most part do not possess the resources to take full responsibility in case an infringement case would have to be settled, this responsibility is shared by the OEMs.

4. Actor profile

Divergent incentives

After the standard is completed it is important to conduct a mapping of the technology, in order to understand who is participating in the standardization process and who might hold essential patents. This is done with the objective to identify possible threats, although this type of analyzes do not guarantee a full security there are still some threats that can't be identified such as NPEs that have not participated in the standardization process since there is no way to know which patents they hold and which is their incentive structure.

Stakeholder relations

The participant believes that the collaboration in standard development process does create a rapport between the players and flow of information that expedites negotiations among different actors in the standard setting arena, and has perceived an increasing trend on companies willing to innovate in the collaborations they hold with other actors in the standard setting ecosystem to reach better win-win situations.

We understand from this input that an OEM would potentially face a competition not only on the market side but also in the way the competitors design their contractual relationships with the different stakeholders.

4.8 SOURCE G - VERTICALLY INTEGRATED FIRM

Organizational profile

Industry	Information and Communication Technology
Type of clients	Final consumer, Business to Business
Size	Large Enterprise
Interviewee position	Director of IP strategy

Table 14 - Source G - Organizational profile

Intellectual property position

Licensing activity	High
Intellectual property Expertise	Strategic patenting, Licensing
Role in technology standardization	Standardization driver

Table 15 - Source G - IP position

Interview data

Regarding the reasons for the adoption of standards a company may have, the interviewee point out that, the ownership of essential patents to contribute to a standard is not really a decisive factor in the decision to join or not a consortium that seeks standardization, this decision must be fundamentally a business one, the IP issues and the challenges that accompany standardization efforts are secondary and once the adoption of a standard has been determined to be necessary these challenges have to be addressed and solved as a consequence.

1. IPR policy

Creation, structure and governance

The interviewee also comments that an analysis of the policies that govern a SSO has to be performed prior to initiating collaboration with the consortium, the policies that govern the

consortium have to be respected, this compliance with each SSO's policies at times can be quite resource intensive.

Opportunities and Threats at company level

The interviewee states that, monitoring of policies ruling the SSOs is a constant battle, and sometimes it is difficult to get the necessary information, since the transmission model of most SSO is to make the policies available to be discovered but does not ensure that all the members are completely aware of any modifications to the standing policies. This constitutes a threat since a consortium may make modifications to its bylaws that are not particularly compatible with the company's strategies or processes and the two could clash in some points.

Non-standardized interaction with policies

Due to the lack of standardization between the consortia and require constant updates and an ever present information gathering of all the organizations to which a company belongs to. In the case of large vertically integrated firms the quantity of consortia to which they adhere to can be very large. Most companies in the same industry as one that the interviewee is part of, have developed processes for analysis and verification of the consortia in order to determine the best possible way to maximize the collaboration with any given SSO.

2. Information asymmetry

Benefits and risks of participation

According to the source being member of a standard setting organization, especially during the standard development phases has a lot of benefits, especially in terms of the explicit and implicit information available within the standardization process. During this process the members share a lot of technical information explicitly that enables to direct the research and development efforts that may lead to the development of a larger amount relevant patents to the standard itself. In the same way there is also a flow of implicit information that can be picked up, regarding the interest of the members in certain solutions or by the politics of the process, this can be translated in to a better forecast of what the market will look like and to which standard the market will lean to.

Standard position and Disproportionate information

The participant also states that the amount of information that can be gathered by participation within the standard is variable and depends on the amount of resources that can be allocated to this task, for large companies it is not uncommon to join even competing SSO in order to have a better picture of the dynamics of the industry, which wouldn't be possible for a small or medium company to do. This difference certainly creates a disproportionate access to information that may help bigger companies to formulate more effective strategies.

3. Royalties and Transactions

The interviewee comments that there are several alternatives available regarding to the royalty model requested by an SSO. Some consortia require a royalty free licensing of all the technological solutions proposed by their members to be included in a standard but for the majority of vertically integrated firms are not willing to commit to royalty-free agreements since licensing is one of their major revenue streams and plays a very important part in compensating for R&D expenditure, since this costs can be quite significant.

Most consortia follow a FRAND model, to which vertically integrated firms are very much in favor of, he explains that vertically integrated firms in most cases look for win-win licensing agreements since it serves their best interest to be able to license as many actors as possible to maximize their licensing revenue while enjoy of the positive networking externalities in the downstream; much in contrast with NPEs which do not benefit from this networking externalities and hence try to obtain the largest possible royalties.

But the participants also warns that the use of FRAND is not an easy process, due to the difficulties to determine royalty rates, this is especially important for adopters because FRAND commitment does not mean that all the companies pay the same; the calculation of royalties is normally based in the production volume. Over all the royalties are 5 to 10 percent of the productions cost, but this number is very variable.

From the Licensor perspective it is a best practice to review licensing agreements very often since the conditions for a given price or licensing conditions change very frequently, because of this it is considered better to have a running royalty scheme that can be modified at intervals even though the administrative costs are comparatively larger.

4. Actor profile

Divergent incentives

The participant states that currently, no deep specific or formal analysis of the SSO's members in terms of their type of collaboration and business model is performed prior to join a given consortium, none the less the list of actors involved in a standard setting process is examined given that it does give some information on potential threats. But he warns that most serious threats cannot be determined through this process since NPEs seldom join the SSOs, they prefer to be in the outside and call little attention to themselves.

The interviewee remarks that recently Universities, which in a broad sense are non practicing entities are more active in the standard setting eco-system but are still very small and have diverse incentives, some look for royalties but others only participate from an academic or technical perspective.

Stakeholder Relations

Membership to an SSO brings some interaction possibilities with other members that are interesting, in many cases it is desirable to seek for cross licensing agreements within the SSOs joined, most times this opportunities exceed the perils of membership, for instance, the presence of NPEs in a

standard, and negotiations with them, as well as patent blocks, are an everyday occurrence and have to be handled with care but are unavoidable in the adoption process.

In the same way the interviewee comments that for firms with extensive R&D operations having actors within the standardization process challenge their own patents. It is considered to be a good practice and allows for depuration of the firms portfolio and promotes negotiation of cross licensing agreements.

4.9 SOURCE H - R&D FIRM

Organization profile

Industry	Information and Communication Technologies
Type of clients	OEMs, Service providers
Size	Large Enterprise
Interviewee position	Director, Intellectual Property Rights, Europe

Table 16 - Source H - Organizational profile

Intellectual property position

Licensing activity	High
Intellectual property Expertise	Strategic patenting, Licensing
Role in technology standardization	Driver

Table 17 - Source H - IP position

Interview data

The interviewee talks about the importance of the intellectual property issues in the sight of a standard implementation by any given company, the interviewee explains that intellectual property issues are in no way the main concern regarding the implementation of a novel standard but rather the 3rd or 4th consideration a company has to think about while implementing a standard.

1. IPR policy

Creation, structure and governance

The participant assures that while considering joining an SSO, the clarity of IP policy of the organization in question is a very important factor to analyze to decide whether or not to join any SSO this analysis should take in consideration the specific characteristics of the standard to be adopted and the strategies contemplated for the standard in question. It is a best practice to analyze each policy and map the possible positive and negative aspects that it may bring with it.

Opportunities and Threats at company level

The participant assures that the membership to an SSO has several benefits; it increases the clarity of the ecosystem and allows companies to compete with their own technology or device roadmaps in an environment that otherwise would be not possible to achieve.

In the same way the interviewee comments that due to the slow development of a standard which may extend to several years, this extended timing certainly allows companies who are members of the SSOs to align/tweak their technologies to follow the path set by a possible future standard and hence gain a competitive advantage to companies who are not involved in the standardization efforts. The interviewee emphasizes that from a technological point of view it is important to be part of SSO in view of the fact that membership brings technological benefits.

Non-standardized interaction with policies

Some organization have very evolved policies that address different issues in the case of ETSI the consortium has developed an IPR database that increases the clarity of the ecosystem, this database is created through an analysis of the given standard and the actors involved in it. Although this sort of solution is not adopted by the majority of consortia it is important to point out that the existence of it shows that policies can be very positive and support members in different ways.

2. Information asymmetry

Benefits and risks of participation

The interviewee comments that through the availability of information both explicit and implicit resulting from the membership to an SSO a company can align its products capabilities to be better than others, to the requirements of the market and to take a better advantage of the positive externalities of the networking effect. While on the other hand not being a member of a SSO which might be relevant for the implementation of a standard brings risks as well specifically the lack of influence in the standardization process should not be underestimated it is this influence that allows companies to effectively protect their intellectual property and to promote the use and wide adoption of their respective research and development efforts.

Standard position and Disproportionate information

Being a member of a SSO a company enables the gathering of a lot of information and awards the company the opportunity to align its core competencies and capabilities to the technologies proposed by the consortium or discussed within the SSO the availability of this information might be paramount in the design of a strategic approach to position themselves in such a way that their capabilities might be maximized.

Built-in lack of information

Although the membership to an SSO reports a lot of information of possible strategies of other actors in the organization there are inherit gaps in the available information specially in terms of the ownership and even existence of essential patents within the technology of a standard, brought to the consortia by the inability to force the disclosure of this information to its members, none the less even in its limited capability this option is better to absence of any kind of regulation.

3. Royalties and Transactions

The participant expresses that the levels of royalties set are decided depending on where will the standard be deployed or the market it is aimed for as a first factor to the royalty computation and the projected volumes for its production and sales.

The cooperation between OEMs and their suppliers is a completely different matter although the OEM at some times has little information of the technologies contained in a subcomponent other than the information provided by the supplier itself no component supplier would accept sole responsibility for infringement due to the impossibility of being certain that no infringement is being committed, the suppliers as any other actor in the ecosystem can't be 100% sure that their component is not infringing a third parties IP and hence cannot offer such protections. None the less indemnities depend on the position of the actor asking for them and their overall power in any given industry.

4. Actor profile

Divergent incentives

Related to the actors Involved in a SSO, the interviewee comments that there will always be tension among actors in any consortium this is due to the different profiles they may have or even their unique business models that will shift their interests. However the interviewee explains that it is the balance of the different types of actors which is very important and an analysis of this balance previous to joining an organization must be performed. It is this balance in the amount of each type of actors and not their variety which is of most importance. The interviewee emphasizes that the over abundance of any type of actor is not positive.

Stakeholder relations

The participant comments that In many SSO the power of the downstream actors is larger than the power of the upstream, hence the downstream actors can shape a standard to fit their own

requirements, a clear example of this is the Network operators (carriers) who have an overwhelming buying power since they command the adoption of technologies by the end consumer, although it is often the case that the interest of the final consumers who look for the best and cheapest technology is not aligned to the carriers who look to maximize profit.

5. ANALYSIS

In this section we will analyze the interview transcripts with the aim of gathering the relevant data that will enable us to make a deeper study of the comments given by the interviewees, following the analysis method described in the methodology section.

Remembering the research question which was postulated as:

"*Can compliant companies overcome Intellectual property-related challenges and manage complexity through a proactive strategy prior to adoption of a standard?*"

The analysis followed a deductive approach whereby the postulation of the over-arching research question was followed by a deductive approach leading to a hypothesis and development of the follow-on research questions.

In order to gather required data, we set out to perform an empirical study through expert interviews from disparate entities which have been listed under the Section 4. Due to the qualitative nature of the interviews, category systems were built up in order to synthesize the analysis points that will be discussed in this chapter. The high magnitude of sources and the amount of information necessitated an attempt to compute the main outcome of the study using set characteristics with relevance to the scope and purpose of study.

This chapter will initially present a compiled list of challenges following the steps presented in the methodology chapter that includes the use of tagging and categorization tools. This list contains the challenges that an OEM would face in standard implementation process with corresponding source support, what we call "Emphasis". This will be followed by an analysis of challenges according to some set characteristics and selection of the major challenges that are vital and important for an OEM to address as part of their standard implementation strategy. We also attempt to provide some measures in order to tackle these challenges at company level.

5.1 OVERALL ACCOUNT OF OEM CHALLENGES

Our investigation phase involved data gathering through various expert interviews and subsequently enabled us to report this data in a uniform fashion. Since there is a high number and diversity in the pool of respondents, the number of challenges that were compiled as a result of the investigation was comprehensive in nature.

The table given below lists all the challenges that were identified from the interviews and has been sorted according to decreasing order of frequency of times that interviewees mentioned them. This field has been called "Emphasis" with sources A to E in the same order as mentioned in Section 4. The Emphasis field will be taken into account during the final ranking of the major challenges list that will be elaborated in the following sections.

The overall account of challenges is as follows:

No	List of Challenges	(Emphasis)Source Support							
		A	B	C	D	E	F	G	H
1	FRAND definition and concept	✓	✓		✓			✓	
2	Coordination with Intermediaries	✓			✓		✓		✓
3	Lack of visibility of standard outcome	✓		✓	✓				
4	Price differentiation through VIF cross licensing		✓		✓	✓			
5	Risk of hold-up from in-exhaustiveness of patent pools		✓	✓	✓				
6	Over inclusive IPR and related information	✓	✓						
7	Problems with antitrust issues	✓					✓		
8	High royalties through royalty-stacking	✓					✓		
9	Inability to assess royalty calculations	✓				✓			
10	Actor-influence on recommendations of IPR policy		✓		✓				
11	Lack of information from intermediaries			✓					✓
12	Lack of intellectual property related information	✓			✓	✓	✓		✓
13	Low predictability on the different incentives					✓	✓		
14	Ability to obtain a license to standard-essential patents	✓							
15	Shielding of weak patent in patent pools	✓							
16	Sunk investments for OEM and resulting hold up		✓						
17	Vertical disintegration increasing complexity of interaction		✓						
18	Low focus in IP due to time pressure to reach market		✓						
19	Lack of knowledge in the aftereffects of joining an SSO					✓			
20	Modification of running IPR policies							✓	
21	Flow of implicit information within the SSO							✓	

Table 18 - Overall list of Challenges

5.2 PARAMETERIZATION OF CHALLENGES

In order to perform an assessment of the various challenges that were identified, a set of parameters were developed. These parameters can be broadly divided into Effectual characteristics and Intrinsic Characteristics.

5.2.1 EFFECTUAL CHARACTERISTICS:

These are characteristics which reflect the implication of not addressing a particular challenge as mentioned by the source. In essence, this will assess the level of after effects that would be faced by the OEM during instances where a particular challenge is not met with appropriate steps. Common characteristics were identified in the challenges reported. These characteristics were then categorized in to six different parameters which in turn were used to evaluate each of the challenges and the perception the interviewees have about them.

The parameters used to evaluate the challenges have been weighed equally during the analysis. Due to the qualitative nature of interviews, all the parameters have been assessed low, medium or high (1, 2 or 3) according to the individual source support given to the parameter respectively. The parameter is given a value 0 (not applicable) during instances where a source did not provide any mention on the challenge during the interviews. The six parameters under Effectual Characteristics are as shown below.

1. **Monetary implication:** This denotes one of the most important factors of assessment, the extent of a particular challenge in having monetary implications for an OEM.

2. **Lock-in effect:** When companies decide to implement a standard, they make investments in licenses and infrastructure that locks them in that specific technology or standard, this is known as "Lock-in effect". The lock-in effect is highly undesirable for an OEM during and after standards adoption process and could have more long term implications. Thus a high grading represents a high level of undesirability.

3. **Technological burden:** The challenges that have been graded with high technological burden are ones that question the internal technology development and position of a standard and demand for intensive use of technological competences or use of the research and development resources. The aim of this parameter is to evaluate to which extent these resources are affected.

4. **Influence on competitive position:** OEMs thrive in a highly competitive environment and could face challenges that can have significant effects in their competitive landscape through activities in the technical standards ecosystem. This parameter goes onto assess the level of influence a particular challenge poses in defining the OEM's competitive positioning.

5. **Weight of ad-hoc negotiations:** Though there are many challenges that can be identified, some of them can be potentially met only through ad-hoc bilateral negotiations, this means that although the challenges can be addressed they require a settlement with an outside party and that no unilateral solution might be performed in order to reduce the related challenge. This puts an OEM in a position where proactive measures may not add significant value to overcome these challenges.

6. **Commonality:** The logic behind this parameter follows that, the more common the challenge is in the ecosystem, the more likely that an OEM would come across such a challenge during its activities. Hence the more common challenges have been rated high in order to reflect how the frequency of their occurrence demands a responsive measure.

5.2.2 INTRINSIC CHARACTERISTICS:

Intrinsic Characteristics represents two main parameters that govern the extent to which a challenge can be met with proactive measures from an OEM's perspective. The underlying principle behind including Intrinsic characteristics was to attribute due importance to the position of an OEM and the scope of study. As done with Effectual characteristics, all the parameters have been assessed low, medium or high (1, 2 or 3). These ratings are not essentially based on source support but show our interpretation of the challenges we base this interpretation and therefore the ratings themselves on the knowledge acquired through the literature study and the understanding resulting from the contact with interviewees and the study of the standardization environment in general. Thus, unlike the effectual characteristics, a rating of zero does not apply in this case. The Intrinsic characteristics were parameterized as follows:

1. **Visibility:** This parameter represents the ability of an OEM to identify potential challenges and rate the feasibility of correctly identifying a particular challenge in due time to take action to minimize the negative effects it may convey.

2. **Addressability:** A high grading on addressability would suggest the relative ease with which an OEM could address a particular challenge with the objective to minimize negative effects derived from each challenge this in no way means that the challenge will be easily resolved, but rather denotes the capability of a company to start a process to address that challenge actively.

5.3 ASSESSMENT OF CHALLENGES

5.3.1 EFFECTUAL RATING

Each of the challenges described by the interviewees has been rated according to the scale which was discussed in the previous section for the effectual characteristics. These ratings were assigned with fundament on the comments made by the interviewees and the emphasis they convey on their importance and implications. In this table the addition of the points awarded to each risk is displayed. The column entitled "Total Sum" contains the addition of the rest of the values in the columns of each challenge. This number gives an idea of the severity of the challenge according to the interviewees and gives the first step in the rating process. The source data can be found in the Appendix B

Challenges	Parameters						
	Monetary implication	Lock in effect	Technological burden	Influence on Competitive position	Weight of ad-hoc negotiations	Commonality	**Effectual Rating**
FRAND definition and concept	11	5	5	5	10	10	**46**
Coordination with Intermediaries	11	0	8	3	11	5	**38**
Lack of visibility of standard outcome	9	4	0	7	0	6	**26**
Price differentiation through VIF cross licensing	6	5	3	7	5	5	**31**
Risk of hold-up from in-exhaustiveness of patent pools	8	4	3	6	6	6	**33**
Over inclusive IPR and related information	5	1	1	3	0	6	**16**
Problems with antitrust issues	3	0	0	0	3	5	**11**
High royalties through royalty-stacking	6	0	2	4	3	2	**17**
Inability to assess royalty calculations	6	2	0	2	5	0	**15**
Actor-influence on recommendations of IPR policy	5	1	0	6	5	6	**23**
Lack of information from intermediaries	5	0	4	5	6	5	**25**
Lack of intellectual property related information	9	10	0	1	0	10	**30**
Low predictability on the different incentives	3	1	0	4	3	5	**16**
Ability to obtain a license to standard-essential patents	3	0	3	0	3	2	**11**
Shielding of weak patent in patent pools	2	3	2	0	1	1	**9**
Sunk investments for OEM and resulting hold up	3	3	1	0	3	2	**12**
Vertical disintegration increasing complexity of interaction	2	0	2	3	0	2	**9**
Low focus in IP due to time pressure to reach market	2	1	1	3	0	2	**9**
Lack of knowledge in the aftereffects of joining an SSO	3	2	0	2	0	3	**10**
Modification of running IPR policies	3	3	2	0	0	1	**9**
Flow of implicit information within the SSO	2	0	3	3	0	3	**11**

Table 19 - Effectual Rating

5.3.2 INTRINSIC RATING

This table presents the total number of points awarded in each assessed parameter to the challenges proposed by the interviewees, as described in the section "Parameterization of Challenges". These parameters evaluate the "Visibility Level" and the "Addressability" of each challenge, the "result column contains the mathematical addition of the ratings of the leftmost

Challenges	Parameters		
	Visibility level	Addressability	**Intrinsic Rating**
FRAND definition and concept	3	1	**4**
Coordination with Intermediaries	3	3	**6**
Lack of visibility of standard outcome	1	1	**2**
Price differentiation through VIF cross licensing	1	2	**3**
Risk of hold-up from in-exhaustiveness of patent pools	2	2	**4**
Over inclusive IPR and related information	1	2	**3**
Problems with antitrust issues	1	1	**2**
High royalties through royalty-stacking	2	3	**5**
Inability to assess royalty calculations	2	3	**5**
Actor-influence on recommendations of IPR policy	1	1	**2**
Lack of information from intermediaries	1	3	**4**
Lack of intellectual property related information	2	2	**4**
Low predictability on the different incentives	1	2	**3**
Ability to obtain a license to standard-essential patents	2	1	**3**
Shielding of weak patent in patent pools	1	2	**3**
Sunk investments for OEM and resulting hold up	1	2	**3**
Vertical disintegration increasing complexity of interaction	3	1	**4**
Low focus in IP due to time pressure to reach market	3	3	**6**
Lack of knowledge in the aftereffects of joining an SSO	1	1	**2**
Modification of running IPR policies	1	3	**4**
Flow of implicit information within the SSO	1	1	**2**

Table 20 - Intrinsic rating

As it has been discussed in the methodology section, the effectual and intrinsic and emphasis metrics were kept separately since they hold an inverse co-relation to each other. This characteristic does not allow the direct addition of the points awarded to the challenges in each metric category, in order to be able to relate these metric categories they have to be multiplied to obtain an overall rating.

5.3.3 RANKING OF CHALLENGES

The table below presents a ranked list of the challenges described by the interviewees. The table combines the results of the tables presented previously, including the values obtained for the effectual metrics, causal Metrics and Emphasis. The "factored emphasis" column contains a ratio of the number of instances a challenge was repeated over the total number of Interviewees, which results in the factor

		Parameters				
Rank	Challenges	Effectual metrics	Intrinsic metrics	Emphasis	Factored Emphasis	Final Rating Result
1	Coordination with Intermediaries	38	6	4	0.5	19
2	FRAND definition and concept	46	4	4	0.5	15
3	Lack of intellectual property related information	30	4	4	0.625	12
4	Risk of hold-up from in-exhaustiveness of patent pools	33	4	3	0.375	8
5	Price differentiation through VIF cross licensing	31	3	3	0.375	5
6	Lack of information from intermediaries	25	4	2	0.25	4
7	High royalties through royalty-stacking	17	5	2	0.25	3
8	Lack of visibility of standard outcome	26	2	3	0.375	3
9	Inability to assess royalty calculations	15	5	2	0.25	3
10	Over inclusive IPR and related information	16	3	2	0.25	2
11	Low predictability on the different incentives	16	3	2	0.25	2
12	Actor-influence on recommendations of IPR policy	23	2	2	0.25	1
13	Low focus in IP due to time pressure to reach market	9	6	1	0.125	1
14	Problems with antitrust issues	11	2	2	0.25	0
15	Vertical disintegration increasing complexity of interaction	9	4	1	0.125	0
16	Modification of running IPR policies	9	4	1	0.125	0
17	Sunk investments for OEM and resulting hold up	12	3	1	0.125	0
18	Ability to obtain a license to standard-essential patents	11	3	1	0.125	0
19	Shielding of weak patent in patent pools	9	3	1	0.125	0
20	Flow of implicit information within the SSO	11	2	1	0.125	0
21	Lack of knowledge in the aftereffects of joining an SSO	10	2	1	0.125	0

Table 21- Ranking of Challenges

displayed in the column "factored emphasis" which being a ratio has maximum possible value of 1. The column "Total Rating Result" shows the multiplication of the columns "Effectual Metrics", "Causal Metrics" and "Factored Emphasis" and shows the total rating of each challenge. The table has been sorted in descending order of prominence and the overall ranking of each challenge.

5.4 VALUE NETWORK ANALYSIS

From the final list of challenges, a mapping was done in the value network, which was first introduced and commented upon in the problem discussion chapter, whereby the top ranked challenges were categorized under Upstream, Midstream and Downstream positions in order to facilitate the discussion around proactive measures that will be elaborated in the following section the decision was made in order to be able to relate these measures to the different position within the standard setting environment as we have described in previous sections.

Upstream	Midstream	Downstream
FRAND definition and concept	Coordination with Intermediaries	Price differentiation from VIF Cross licensing
Lack of IP Related information	Lack of information intermediaries	Lack of visibility of standard outcome
Risk of hold-up from in-exhaustiveness of patent pools	Inability to assess FRAND in-license	
High royalties through stacking		
Lack of clarity on IP information - IPR policy		
Lack of visibility of standard outcome		
Over inclusive IPR and related information		

Table 22 - Value Network Analysis

As it has been commented previously in this section the proact6ive pleasures proposed by the experts in the area are applicable to the different divisions of the value network that have been motivated in the methodology chapter.

Upstream – the challenges that are directed towards the interaction with the IP holders through licensing transactions.

Midstream – the interaction with intermediaries such as component suppliers and manufacturing companies who license in the intellectual property from IP holders with a standard and subsequently offer these in the form of products, services or sub-license towards the OEM.

Downstream – the market dynamics of standard related products where the OEM has significant exposure.

5.5 PROACTIVE MEASURES

The following section gives an introductory account to the kinds of internal measures that could be employed by an OEM when dealing with upstream, midstream and downstream challenges. These strategic measures have been suggested by both the interviewees and through an in depth analysis of the measures proposed by them.

5.5.1 UPSTREAM

The following discussion gives an introductory account to the kinds of internal measures that could be employed by an OEM when dealing with upstream related challenges, essentially during direct interaction with the SSO or its members.

Prior to adoption of the standard, an OEM performs a due-diligence on technical aspects and alongside such a process, an IP due-diligence must also be performed whereby an OEM could potentially be in a position to assess the patent landscape within the interest area. In order to perform this, there should be good lines of communication between the various departments relevant to the process with high level of coordination for example, between the teams within intellectual property, Research & Development (R&D) and Product Management.

Some of the most important challenges faced by the OEM as listed above can be attributed to licensing aspects within a standard. Some proactive steps towards this may help an OEM overcome its difficulties within this area.

Firstly, an OEM has to *clearly identify, define and list down the essential and non-essential patents* although it should be remembered the level of complexity of performing this is dependent on the individual case at hand. As a continuous task, OEMs should map this list of essential and non-essential patents to the corresponding product in hand. This could be done by breaking down the product into its components and place the different essential and non-essential patents into the building blocks. This will enable the OEM:

1. Visualize the patent-product mapping and differentiate technically-essential and commercially-essential patents.

   Though there are patents that are technically essential that are licensed by IP holders under FRAND terms, there are also other patents that may not be technically essential per se but may be commercially essential in order to gain a competitive position in the market on a product feature basis. Such patents are non-essential with regard to the SSO, they tend to be more expensive to license to some extent compared to essential patents that is protected the FRAND promise.

2. Assign a royalty cap on a product level

   As a next step to patent-product mapping, an OEM can attempt to assign a royalty cap at a product level whereby a benchmark on the royalty percentages between essential and non-essential patent. The OEM can then perform the DCF model to get an idea of the royalty rates against the volume of sales (through market research reports). Based on this the OEM can potentially opt for a licensing reduction strategy by scouting for alternate technologies.

The OEM also has to make a *clear study of the FRAND promise by licensors* and be aware of the fact that companies that hold essential patents may not transfer the ownership of patents in order to override the FRAND promise. Thus the ownership change with essential and non-essential patents has to be studied in order to see if the OEM is entitled to obtain a FRAND based license if not offered.

A careful analysis of the IPR policy is also a mandatory requirement prior to a standard adoption process. Most of the SSOs behind mature standards publish their IPR policy on the SSO webpage. It should also be seen where there have been any major changes in the IPR policy over time and if so, what those changes have been. This will enable an OEM to understand the governance and extrapolate the observation into the future with potential changes and its resulting implications.

When considering licensing from patent pools, an OEM has *to perform a due diligence of the companies involved and evaluate the strength of the patents through its own technical competence.* The challenge with free-riders should be given a high priority before considering joining a patent pool as a licensee.

Another important challenge for the OEM prior to a standards adoption process is the lack of predictability to the standard outcome. In order to tackle this challenge, tools such *as real options valuation* which is an important tool for valuation and strategy creation of corporate investment (Borison 2005), should be made in order to guide the decision making process. This is highly relevant for the OEM as the company's option to invest can be a significant factor in deciding its value in the market.

There can be instances where an OEM decides upon adopting a risky standard in terms of intellectual property, purely based on a market-driven decision. In these instances, *an OEM should make an estimate of the cost of licensing including the possible cost of litigation with a supposition that it takes place.* It is important to perform this prior to the adoption process. Furthermore, if the risk level of litigation is significantly high, the OEM can choose to diversify its portfolio so that the company can survive if it suffers from an injunction. Although this level of internal litigation analysis can be resource-intensive, they can significantly improve the predictability in the standards adoption process and minimize the complexity.

Another factor that is closely related to litigious considerations is an external analysis of litigation activity within the standard. *By looking into the history of litigations of the companies involved in the standardization ecosystem, an OEM can assess the riskiness level of adopting a standard.* An incentive management study should also be performed by tracing standard members' activities in the past and their behavioral aspects in the context of standardization and at an overall level of business conduct.

In this section the measures that an OEM can follow in order to minimize the adverse effects of the upstream challenges have been discussed, we can summarize these measures as follows:

- *Clearly identify, define and list down the essential and non-essential patents*
- *In deep study of the FRAND promise made by licensors*
- *A careful analysis of the IPR*
- *Due diligence of the companies involved in the standardization process and any patent pools that might be relevant.*
- *Use tools such as real options valuation*
- *Estimate of the cost of licensing including the possible cost of litigation with a supposition that it will take place.*
- *By looking into the history of litigations of the companies involved in the standardization ecosystem, the risk level of adopting a standard can be estimated.*

5.5.2 MIDSTREAM

As we can see from the challenges detected by the experts the collaboration and coordination with intermediaries represent the most significant set that OEMs have to address and the regulation of this collaboration has to be clearly defined and regulated by agreement of the parties involved.

It is extremely important to know and understand the companies that will collaborate with the OEM in the development of compliant and non compliant devices. Experts indicate that *analyzing the litigation history of suppliers*, provides a very good snapshot of the way in which the suppliers' conduct their business, this information is vital to determine possible issues that the supplier has faced before and that may represent a problem once again.

The inclusion of indemnity and warranty clauses in the collaboration agreements is one of the main concerns that have to be tackled. During the collaboration negotiations both parties the OEM and the component supplier will try to minimize the responsibility of third party intellectual property infringements. In these situations it is typical by the supplier to accept responsibility of infringement involving its own designs, while the OEM takes responsibility of infringements derived from the instructions given to the supplier to be included in the subcomponents commissioned. A bigger problem arises on infringements that are derived from the inclusion of specifications or designs required for the product to be compliant to a given standard.

In the case that infringement to a third party's intellectual property arises from the compliance to a standard, a license has to be sought from the third party. In most cases licensors prefer to deal with the OEMs themselves, this preference responds most likely to the possibility of charging royalties based on the cost of the higher cost of the final product rather than the comparatively lower cost of the subcomponents. Suppliers in this case normally refuse to give indemnities or warranties to third party intellectual property infringement. Nonetheless, it should be kept in mind that the *supplier is in a better position to determine if the intellectual property rights infringed are truly essential* to the device or subcomponent and to give a judgment on whether or not the device or subcomponent are in fact infringing. In this case the OEM is in a position to require the inclusion of a clause that calls for support of the supplier, in which ever way it would be possible for them to contest the infringement allegations.

In a proactive mindset an OEM can also *ask its suppliers for an intellectual property due diligence*, in order to prove that an analysis of the intellectual property related to the subcomponent, has been analyzed and that the required licenses, to the best of the suppliers knowledge, have been sought and sorted out.

Some experts have commented on the possibility of acquiring of a "Potential infringement-litigation Insurance" although this type of insurance is expensive.

In general it is very difficult to determine if the royalty paid has been calculated using a FRAND model, nevertheless checking the history of a patent in order to verify if it has been included in a standard that requires a FRAND commitment in the past, since the same FRAND commitment does not allow a patent to change its royalty model. This means that if a *patent has been licensed using a FRAND model in the past it should not lose this characteristic*, even if it is sold or transferred.

We can summarize these measures as follows:

- *Analyze the litigation history of suppliers*
- *Include of indemnity and warranty clauses in the collaboration agreements*
- *Request from suppliers to determine if the intellectual property rights infringed are truly essential*
- *Request from suppliers an intellectual property due diligence*
- *Verify if a license has been promised under FRAND promise since it should conserve this characteristic*

5.5.3 DOWNSTREAM

In the case of the downstream the experts recognize that although the price differentiation created by the dissimilitude in quantity of intellectual property available is indeed common*, the final effects on the OEMs are not extreme, and can be compensated by reduction of costs in other areas*, for example increasing the efficiency of the value chain or by negotiation with suppliers. If at all the OEM comes across standards where a direct vertically integrated competitor is involved, a study of the competitor's patent portfolio can enable the OEM to make a call on that particular standard in terms of the final prices and addressable market.

On the other hand, the effects of the lack of visibility of the standard's outcome can be minimized by obtaining information from potential licensors and delaying the adoption of the standard until the pull of the market almost demands such an adoption.

The experts also commented on the need to decrease the possibility of infringement when targeting new markets by performing a *comprehensible freedom to operate study* before any major target market expansion, which will minimize the possibility of incurring in litigation costs overseas.

We can summarize as follows:

- Compensate differences in costs of licensing by making other areas more efficient
- Obtain information from potential licensors
- Perform freedom to operate studies in case of expanding to new markets

6. CONCLUSIONS

The conclusions that are directed towards the OEM are derived from the analytical study made in Chapter 5 whereby the most important challenges were mapped with equal weight given to the context of the OEM business activity and standard implementation strategy.

The study conducted makes an attempt at answering the question:

"*Can compliant companies overcome intellectual property-related challenges and manage complexity through a proactive strategy prior to adoption of a standard?*"

The conclusion derived from the analysis is that companies can significantly overcome intellectual property-related challenges and manage complexity through a proactive strategy prior to adoption of a standard. The first step is therefore identifying the nature of complexity and its implications before installing mechanisms at an organizational level to mitigate negative outcomes.

The study identifies three zones from which these challenges originate as shown in the diagram above. As an OEM, it is therefore not sufficient to look upon at one aspect of the value network but analyze and understand the interaction between and amongst the various stakeholders within the standard setting ecosystem. From an OEM's perspective, these interactions have been identified as

Upstream: The direct interaction with IP holders and the standard setting organization

Midstream: The indirect interaction with the SSO through intermediaries such as manufacturers and component suppliers.

Downstream: The interaction with the market drivers namely – competitors, customers and market structures.

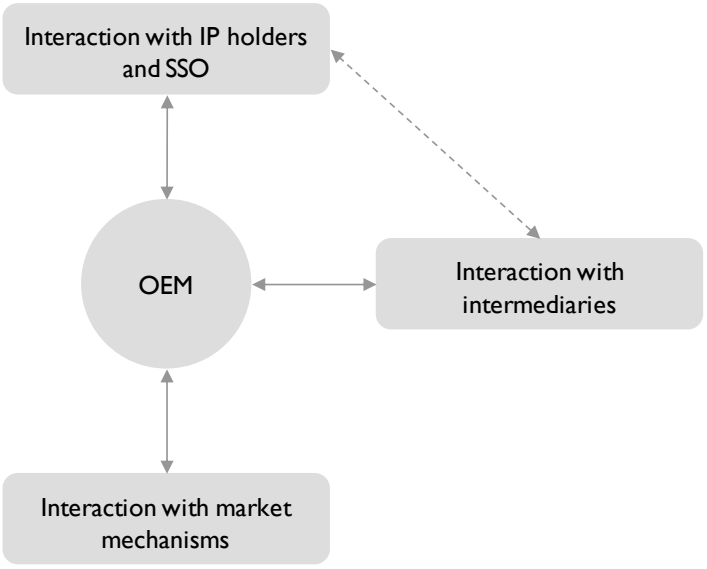

Figure 5 - OEM Interaction

6.1 SUGGESTIONS FOR FURTHER RESEARCH

Although the purpose of this dissertation has been met, the available time to conduct the research has been limited and further exploration of the interactions between actors in the standard setting ecosystem are yet to be explored and described in more detail. It is within these interactions that dynamics of the standard setting development and adoption take place, and are also these dynamics the ones that limit and shape the paths taken by companies during the task of adoption of a given standard within their products. For instance it would be extremely interesting to analyze the behavior of non practicing entities within the standard setting ecosystem.

In this dissertation, proactive strategies of how to address the most important challenges particular to the standard implementation process have been proposed, but this proposition could be complemented through the development of an information management system that would increase the visibility of the challenges described presently. In the same way companies who are interested in participating within the standard setting environment could very well use a way to manage the best practices such as the ones described in the present dissertation but a framework of how to adopt the strategic outcomes touched upon needs to be developed.

After the development of the dissertation we are convinced that the consequences of litigation due to infringement of intellectual property could be severe especially for small companies, and although some studies and attempts to build a "Patent Litigation Insurance" have been performed before, further development is possible and in the long run a working model that would reduce the cost of these consequences, could be generated.

The present dissertation has been framed to address proactive strategies that can be adopted by OEMs to minimize the negative outcomes of challenges within the standardization ecosystem but further analysis on reactive strategies is also necessary.

BIBLIOGRAPHY

Alban, D. (2004). "Note, Rambus v. Infineon: Patent Disclosures in Standard-Setting Organizations." 19 BERKELEY TECH. L.J.(309).

Allee, V. (2008). "Value Network Analysis and value conversion of tangible and intangible assets." Journal of Intellectual Capital **9**(1): 5-24.

Ament, P. (1997-2007). "Transistor." The Great Idea Finder Retrieved 17-04-2011, 2011, from http://www.ideafinder.com.

Berg, B. L. (2007). Qualitative research methods for the social sciences, Pearson/Allyn & Bacon.

Blind, K. (2004). The economics of standards: theory, evidence, policy, Edward Elgar.

Blind, K. (2008). "A welfare analysis of standards competition: The example of the ECMA OpenXML standard and the ISO ODF standard." (Workshop on Standardisation <13, 2008, Skoevde, Sweden>).

Borison, A. (2005). "Real Options Analysis: Where Are the Emperor's Clothes?" Journal of Applied Corporate Finance **17**(2): 17-31.

Brooks, R. G. and D. Geradin (2010). "Taking Contracts Seriously: The Meaning of the Voluntary Commitment to Licence Essential Patents on "Fair and Reasonable" Terms."

Burnard, P. (1991). "A method of analysing interview transcripts in qualitative research." Nurse Education Today **11**(6): 461-466.

Côté, J., J. H. Salmela, et al. (1993). "Organizing and interpreting unstructured qualitative data." The Sport Psychologist **7**(2): 127-137.

Creswell, J. W. (2009). Research design: qualitative, quantitative, and mixed methods approaches, Sage Publications.

DeLacey, B. J., K. Herman, et al. (2006). "Strategic Behavior in Standard-Setting Organizations."

ETSI. (2010). "European Telecommunications Standards Institute." Retrieved 04-15-20011, 2011, from http://www.etsi.org.

Gall, M. D., J. P. Gall, et al. (2003). Educational research: an introduction, Allyn and Bacon.

Geradin, D. and A. Layne-Farrar (2007). "The logic and limits of ex ante competition in a standard-setting environments."

Hovenkamp, H., M. D. Janis, et al. (2003). "Balancing Ease and Accuracy in Assessing Pharmaceutical Exclusion Payments."

Hyde, K. F. (2000). "Recognising deductive processes in qualitative research." Qualitative Market Research: An International Journal **3**(2): 82-90.

ICTSB. (2011). "ICT Standards Board." Retrieved 04-15-2011, 2011, from http://www.ictsb.org/.

Kamiyama, S., J. Sheehan, et al. (2006). Valuation and Exploitation of Intellectual Property. STI Working Paper 2006/5. Paris: OECD).

Kinnear, T. C. and J. R. Taylor (1996). Marketing research: an applied approach, McGraw-Hill.

Klein, K. J., F. Dansereau, et al. (1994). "Levels Issues in Theory Development, Data Collection, and Analysis." The Academy of Management Review **19**(2).

Kvale, S. (1996). Interviews: an introduction to qualitative research interviewing, Sage Publications.

Lemley, M. (2002). "Intellectual Property Rights and Standard Setting Organizations." California Law Review 90: 1889-1981."

Lichtman, D. G. (2006). "Patent Holdouts and the Standard-Setting Process." SSRN eLibrary.

McNamara, C., E. Scott, et al. (2006). Field Guide to Consulting and Organizational Development: A Collaborative and Systems Approach to Performance, Change and Learning, Authenticity Consulting, LLC.

Merriam, S. B. (2002). Qualitative research in practice: examples for discussion and analysis, Jossey-Bass.

Miles, M. B. and A. M. Huberman (1994). Qualitative data analysis: an expanded sourcebook, Sage Publications.

Miller, J. S. (2007). "Standard Setting, Patents, and Access Lock-In: RAND Licensing and the Theory of the Firm."

Patton, M. Q. (1990). Qualitative evaluation and research methods, Sage Publications.

Polkinghorne, D. E. (2005). "Language and Meaning: Data Collection in Qualitative Research." Journal of Counseling Psychology **52**(2): 137-145.

Rothenberg, J. (2005). "Intellectual property lawsuits increase in Tech Valley, nationally." The Business Review.

Rysman, M. and T. Simcoe (2005). "Patents and the Performance of Voluntary Standard Setting Organizations." NET Institute Working Paper No. 05-22.

Sandiego, U. o. (2007). "History of the digital age." Retrieved 03-14-2011, 2011, from http://history.sandiego.edu/gen/recording/digital.html.

Smith, E. E. (1990). "Categorization." An invitation to cognitive science: Thinking: 33-53.

Teece, D. J. and E. F. Sherry (2003). The Interface between Intellectual property law and Antitrust Law: Standards Setting and Antitrust.

Tesch, R. (1990). Qualitative research: analysis types and software tools, Falmer Press.

Yin, R. (2002). Case Study Research: Design and Methods, Third Edition, Applied Social Research Methods Series, Vol 5, Sage Publications, Inc.

APPENDIX

APPENDIX A – INTERVIEW DOCKET TEMPLATE

SSO and standard specific questions

1. What is the importance of the IPR policy being a mainstream component within the SSO from the compliant company's perspective?
2. Does IPR issues comprise a significant portion of the business decision to adopt a standard or not? If yes, what are they?
3. During an external scan of the standard, what do the compliant companies see as their challenges in terms of the actor profile within the standard, lack of visibility etc..?
4. What kind of information will aid the compliant company make a go-no-go decision for compliance to a particular standard?
5. Referring to question 4, how do you think companies acquire information about future prospects of a particular standard ahead of time (without a membership), as part of initial evaluation from a technology and market perspective?
6. Assuming the standard is developed and set, how and why does a company make a decision to join an SSO as a member? What are the potential benefits and risks in doing so?
7. Are there any special considerations to be made by a compliant company when it comes to patent pools within SSOs especially if/when essential patents are held by a free-rider outside the pool
8. As a compliant company be it a component supplier or OEM, how do you map your upfront licensing fee and set royalty rate based on forecasted sales? How is the risk managed here? How are royalties with essential patents negotiated?
9. How do you evaluate or scan non-essential patent holders and other sources to acquire technologies outside essential claims? Is there a licensing fee reduction strategy followed

OEM-Component supplier relationship

10. What kind of agreements exists between component suppliers and OEMs? Are they mostly purchase agreements or are there a good number of license agreements as well?
11. As an OEM, how often do you directly deal with royalty agreements with IP holders of the SSO and how does that work?
12. Standards give out various configuration options at technology levels say T1 and T2. You have component supplier C1 specializing in T1 and C2 for T2 correspondingly. The standard allows you to choose between either of the technologies T1 or T2 as part of adoption and thus a relationship with either C1 or C2. What factors do you consider before you get into such a relationship from an IP and business perspective?

13. As an OEM, how does a company get information on the strength of the license agreements between a component supplier and IP holder be it infringement, freedom to operate
14. Is it a norm within an OEM setting to look up at Essential patents and perform IP due diligence at a component level?
15. What kind of control structures for indemnities and warranties exist between the OEM and component supplier especially during infringement of IP?
16. Other than the ones mentioned above, are there any other IP issues that an OEM should think about in dealing with the component supplier?

17. How do OEMs look upon Open source software or royalty free licenses that are embedded within the licensed component technology that is set on FRAND basis?

Downstream markets

18. How do you deal with standard compliant products in your distribution channel, especially when addressing to a global market?
19. How do you deal with product pricing in relation to the licensing fee, in case where a vertically integrated competitor offers a favorable price through cross licensing.
20. Do you have a license to product mapping to decide a cap on the licensing fee paid per product in order to decide on pricing?
21. Are there any threats from other IP than patents - copyrights and trademarks etc.., essentially owned and operated by the SSO when addressing the market?
22. In general, you have any other IP considerations with compliance before considering choice of business model on the market side?

APPENDIX B – INDIVIDUAL EFFECTUAL RATINGS

FRAND definition and concept									
Effectual Rating	A	B	C	D	E	F	G	H	
Monetary implication	2	3	0	3	0	0	3	0	11
Lock in effect	3	1	0	1	0	0	0	0	5
Tecnological burden	3	2	0	0	0	0	0	0	5
Influence on Competitive positon	1	0	0	2	0	0	2	0	5
Weight of ad-hoc negotiations	3	1	0	3	0	0	3	0	10
Commonality	3	3	0	2	0	0	2	0	10

	15	10	0	11	0	0	10	0	46
Coordination with Intermediaries									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	0	0	3	0	3	0	2	11
Lock in effect	0	0	0	0	0	0	0	0	0
Tecnological burden	0	0	0	2	0	3	0	3	8
Influence on Competitive positon	0	0	0	3	0	0	0	0	3
Weight of ad-hoc negotiations	3	0	0	3	0	2	0	3	11
Commonality	0	0	0	3	0	0	0	2	5
	6	0	0	14	0	8	0	#	38
Lack of visibility of standard outcome									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	0	3	3	0	0	0	0	9
Lock in effect	2	0	1	1	0	0	0	0	4
Tecnological burden	0	0	0	0	0	0	0	0	0
Influence on Competitive positon	2	0	3	2	0	0	0	0	7
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	2	0	2	2	0	0	0	0	6
	9	0	9	8	0	0	0	0	26
Cross licensing of vertically integrated firms - price differentiation									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	0	3	0	1	2	0	0	0	6
Lock in effect	0	3	0	2	0	0	0	0	5
Tecnological burden	0	1	0	2	0	0	0	0	3
Influence on Competitive positon	0	3	0	3	1	0	0	0	7
Weight of ad-hoc negotiations	0	2	0	3	0	0	0	0	5
Commonality	0	3	0	2	0	0	0	0	5
	0	15	0	13	3	0	0	0	31

Risk of hold-up from in-exhaustiveness of patent pools									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	0	3	3	2	0	0	0	0	8
Lock in effect	0	1	2	1	0	0	0	0	4
Tecnological burden	0	0	1	2	0	0	0	0	3
Influence on Competitive positon	0	2	3	1	0	0	0	0	6
Weight of ad-hoc negotiations	0	3	3	0	0	0	0	0	6
Commonality	0	3	1	2	0	0	0	0	6
	0	12	#	8	0	0	0	0	33
Over inclusive IPR and related information									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	2	0	0	0	0	0	0	5
Lock in effect	0	1	0	0	0	0	0	0	1
Tecnological burden	0	1	0	0	0	0	0	0	1
Influence on Competitive positon	0	3	0	0	0	0	0	0	3
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	3	3	0	0	0	0	0	0	6
	6	10	0	0	0	0	0	0	16
Problems of Antitrust									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	0	0	0	0	0	0	0	3
Lock in effect	0	0	0	0	0	0	0	0	0
Tecnological burden	0	0	0	0	0	0	0	0	0
Influence on Competitive positon	0	0	0	0	0	0	0	0	0
Weight of ad-hoc negotiations	3	0	0	0	0	0	0	0	3
Commonality	2	0	0	0	0	3	0	0	5
	8	0	0	0	0	3	0	0	11
High royalties through stacking									

Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	0	0	0	0	3	0	0	6
Lock in effect	0	0	0	0	0	0	0	0	0
Tecnological burden	0	0	0	0	0	2	0	0	2
Influence on Competitive positon	2	0	0	0	0	2	0	0	4
Weight of ad-hoc negotiations	3	0	0	0	0	0	0	0	3
Commonality	0	0	0	0	0	2	0	0	2
	8	0	0	0	0	9	0	0	17
Inability to assess FRAND in-license									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	0	0	0	3	0	0	0	6
Lock in effect	0	0	0	0	2	0	0	0	2
Tecnological burden	0	0	0	0	0	0	0	0	0
Influence on Competitive positon	2	0	0	0	0	0	0	0	2
Weight of ad-hoc negotiations	3	0	0	0	2	0	0	0	5
Commonality	0	0	0	0	0	0	0	0	0
	8	0	0	0	7	0	0	0	15
Pushback on recommendations of IPR policy									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	0	2	0	3	0	0	0	0	5
Lock in effect	0	1	0	0	0	0	0	0	1
Tecnological burden	0	0	0	0	0	0	0	0	0
Influence on Competitive positon	0	3	0	3	0	0	0	0	6
Weight of ad-hoc negotiations	0	3	0	2	0	0	0	0	5
Commonality	0	3	0	3	0	0	0	0	6
	0	12	0	11	0	0	0	0	23
Lack of information from intermediaries									
Effectual Rating	A	B	C	D	E	F	G	H	0

Monetary implication	0	0	3	0	0	0	0	2	5
Lock in effect	0	0	0	0	0	0	0	0	0
Tecnological burden	0	0	1	0	0	0	0	3	4
Influence on Competitive positon	0	0	3	0	0	0	0	2	5
Weight of ad-hoc negotiations	0	0	3	0	0	0	0	3	6
Commonality	0	0	2	0	0	0	0	3	5
	0	0	#	0	0	0	0	#	25
Lack IP related information									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	0	0	2	2	2	0	0	9
Lock in effect	2	0	0	3	3	2	0	0	10
Tecnological burden	0	0	0	0	0	0	0	0	0
Influence on Competitive positon	0	0	0	1	0	0	0	0	1
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	3	0	0	2	3	2	0	0	10
	8	0	0	8	8	6	0	0	30
Low predictability on the different incentives									0
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	0	0	0	0	3	0	0	0	3
Lock in effect	0	0	0	0	0	1	0	0	1
Tecnological burden	0	0	0	0	0	0	0	0	0
Influence on Competitive positon	0	0	0	0	3	1	0	0	4
Weight of ad-hoc negotiations	0	0	0	0	3	0	0	0	3
Commonality	0	0	0	0	3	2	0	0	5
	0	0	0	0	#	4	0	0	16
Ability to obtain a license									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	3	0	0	0	0	0	0	0	3

Lock in effect	0	0	0	0	0	0	0	0	0
Tecnological burden	3	0	0	0	0	0	0	0	3
Influence on Competitive positon	0	0	0	0	0	0	0	0	0
Weight of ad-hoc negotiations	3	0	0	0	0	0	0	0	3
Commonality	2	0	0	0	0	0	0	0	2
	11	0	0	0	0	0	0	0	11
Likelihood of licensing weak patent from patent pools									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	2	0	0	0	0	0	0	0	2
Lock in effect	3	0	0	0	0	0	0	0	3
Tecnological burden	2	0	0	0	0	0	0	0	2
Influence on Competitive positon	0	0	0	0	0	0	0	0	0
Weight of ad-hoc negotiations	1	0	0	0	0	0	0	0	1
Commonality	1	0	0	0	0	0	0	0	1
	9	0	0	0	0	0	0	0	9
Sunk investments and hold up									
Effectual Rating	A	B	C	D	E	F	G	H	0
Monetary implication	0	3	0	0	0	0	0	0	3
Lock in effect	0	3	0	0	0	0	0	0	3
Tecnological burden	0	1	0	0	0	0	0	0	1
Influence on Competitive positon	0	0	0	0	0	0	0	0	0
Weight of ad-hoc negotiations	0	3	0	0	0	0	0	0	3
Commonality	0	2	0	0	0	0	0	0	2
	0	12	0	0	0	0	0	0	12
Vertical disintegration increasing complexity of interaction									
Effectual Rating	A	B	C	D	E	F	G	H	
Monetary implication	0	2	0	0	0	0	0	0	2
Lock in effect	0	0	0	0	0	0	0	0	0

Tecnological burden	0	2	0	0	0	0	0	0	2
Influence on Competitive positon	0	3	0	0	0	0	0	0	3
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	0	2	0	0	0	0	0	0	2
	0	9	0	0	0	0	0	0	9
Low resources in IP due to time pressure to reach marke									
Effectual Rating	A	B	C	D	E	F	G	H	
Monetary implication	0	2	0	0	0	0	0	0	2
Lock in effect	0	1	0	0	0	0	0	0	1
Tecnological burden	0	1	0	0	0	0	0	0	1
Influence on Competitive positon	0	3	0	0	0	0	0	0	3
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	0	2	0	0	0	0	0	0	2
	0	9	0	0	0	0	0	0	9
Benefits and risks of joining an SSO									
Effectual Rating	A	B	C	D	E	F	G	H	
Monetary implication	0	0	0	0	3	0	0	0	3
Lock in effect	0	0	0	0	2	0	0	0	2
Tecnological burden	0	0	0	0	0	0	0	0	0
Influence on Competitive positon	0	0	0	0	2	0	0	0	2
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	0	0	0	0	3	0	0	0	3
	0	0	0	0	#	0	0	0	10
Changes in standing IPR policies									
Effectual Rating	A	B	C	D	E	F	G	H	
Monetary implication	0	0	0	0	0	0	3	0	3
Lock in effect	0	0	0	0	0	0	3	0	3
Tecnological burden	0	0	0	0	0	0	2	0	2

Influence on Competitive positon	0	0	0	0	0	0	0	0	0
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	0	0	0	0	0	0	1	0	1
	0	0	0	0	0	0	9	0	9
Flow of implicit information within the SSO									
Effectual Rating	A	B	C	D	E	F	G	H	
Monetary implication	0	0	0	0	0	0	2	0	2
Lock in effect	0	0	0	0	0	0	0	0	0
Tecnological burden	0	0	0	0	0	0	3	0	3
Influence on Competitive positon	0	0	0	0	0	0	3	0	3
Weight of ad-hoc negotiations	0	0	0	0	0	0	0	0	0
Commonality	0	0	0	0	0	0	3	0	3
	0	0	0	0	0	0	11	0	11