Intellectual Property Management and Commercialization: Open and Closed Innovation Settings

Thesis presented by:
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In the subject of Innovation Management

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Co-supervisor: Prof. Andrea Piccaluga

Scuola Superiore Sant’Anna
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To Parsa and Dorsa
<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACKNOWLEDGEMENT</strong></td>
</tr>
<tr>
<td><strong>INTRODUCTION</strong></td>
</tr>
<tr>
<td>Background and aims of the research</td>
</tr>
<tr>
<td>Structure of the Dissertation</td>
</tr>
<tr>
<td>a) IP management literature and emerging trends</td>
</tr>
<tr>
<td>b) Innovation and IP in Iran</td>
</tr>
<tr>
<td>The main publication profile</td>
</tr>
<tr>
<td>Other contributions during the PhD</td>
</tr>
<tr>
<td>a) The role of orchestration in a publicly funded research network</td>
</tr>
<tr>
<td>b) The changing competitive landscape of the global petroleum industry</td>
</tr>
<tr>
<td>c) IP paradoxes in developing countries: the case of software IP protection in Iran</td>
</tr>
<tr>
<td>d) Facilitated access to Iranian patent information</td>
</tr>
<tr>
<td>e) Regional Innovative Behavior: Evidence from Iran</td>
</tr>
<tr>
<td>References</td>
</tr>
<tr>
<td><strong>CHAPTER 1: Emerging Intellectual Property Management Practices</strong></td>
</tr>
<tr>
<td>1.1. Introduction</td>
</tr>
<tr>
<td>1.2. Emerging IP management practices</td>
</tr>
<tr>
<td>1.2.1. Increasing use of patents to protect service innovations</td>
</tr>
<tr>
<td>1.2.2. Strategic disclosure by smaller firms</td>
</tr>
<tr>
<td>1.2.3. Leveraging trademark to survive the waves of technological disruptions</td>
</tr>
<tr>
<td>1.2.4. Loosening the appropriability regime and/or taking advantage of it</td>
</tr>
<tr>
<td>1.2.5. Using formal IPRs to protect business models</td>
</tr>
<tr>
<td>1.2.6. Using patent aggregation services</td>
</tr>
<tr>
<td>1.2.7. Providing patent shelter to business partners</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>1.3. A broader concept of being IP visionary</td>
</tr>
<tr>
<td>1.4. Conclusion</td>
</tr>
<tr>
<td>References</td>
</tr>
</tbody>
</table>

**CHAPTER 2: Platform leaders to provide Patent Shelter**  

<table>
<thead>
<tr>
<th>2.1. Introduction</th>
<th>43</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2. Platforms-centric competition, litigation threat and complementors’ reaction</td>
<td>44</td>
</tr>
<tr>
<td>2.2.1. Lobbying on the legislative front</td>
<td>46</td>
</tr>
<tr>
<td>2.2.2. Increased monitoring</td>
<td>46</td>
</tr>
<tr>
<td>2.2.3. Preemptive patent acquisition</td>
<td>47</td>
</tr>
<tr>
<td>2.2.4. Litigation insurance</td>
<td>47</td>
</tr>
<tr>
<td>2.2.5. Joining patent aggregators</td>
<td>47</td>
</tr>
<tr>
<td>2.2.6. Creating low-cost defense solutions</td>
<td>48</td>
</tr>
<tr>
<td>2.2.7. Access to the platform leaders' patent portfolio</td>
<td>48</td>
</tr>
<tr>
<td>2.2.8. Relying on IP defense and indemnification obligations of licensors</td>
<td>49</td>
</tr>
<tr>
<td>2.3. Analysis and results</td>
<td>49</td>
</tr>
<tr>
<td>2.3.1. Patent Shelter: serving a defensive function</td>
<td>49</td>
</tr>
<tr>
<td>a) Umbrella protection</td>
<td>50</td>
</tr>
<tr>
<td>b) Case-specific protection</td>
<td>51</td>
</tr>
<tr>
<td>2.3.2. Patent Shelter: serving a signaling function</td>
<td>55</td>
</tr>
<tr>
<td>2.4. Conclusions</td>
<td>56</td>
</tr>
<tr>
<td>References</td>
<td>57</td>
</tr>
</tbody>
</table>

**CHAPTER 3: Innovative activities in an artificial closed innovation setting**  

| 3.1. Introduction                                 | 62 |
### 3.2. Stimulating scientific and technological endeavor in Iran

### 3.3. Previous studies: not really representative

### 3.4. Sources and data

### 3.5. Results

### 3.6. Discussion and conclusion

Reference

---

### CHAPTER 4: Commercialization of patented technologies in Iran: a policy-effectiveness perspective

#### 4.1. Introduction

#### 4.2. Commercialization of patented technologies

#### 4.3. Research methodology

- **4.3.1. Research design**
- **4.3.2. Data collection**
- **4.3.3. Data analysis**

#### 4.4. Results of Cross-Case Analysis

#### 4.5. Conclusion

Reference
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This dissertation is about innovation but it also helped me to become more innovative as a person. My innovative experience at Scuola Superiore Sant’Anna in Pisa has been nothing short of amazing. I have deep gratitude for all who helped me gain this invaluable experience.

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INTRODUCTION
Background and aims of the research

Increasing recognition of the commercial value of Intellectual Property (IP) has made its management an important business challenge. IP management has long been a major research theme for innovation scholars as well. Teece (1986) was the first who brought IP into the mainstream management theory in his seminal paper, Profiting from Technological Innovation, usually referred to as PFI framework.

Teece suggested that companies cannot make profit simply by coming up with new ideas. Instead, they need to find a way not just to deliver value to customers, but also to capture sufficient returns. This would enable them to take the risks associated with investing in innovation. He indicates several elements, namely appropriation regimes, complementary assets, and timing that determine the innovators’ ability to appropriate value from new technology (Teece, 1986).

An important element of Teece’s “appropriability regime” is IP and IP-related decisions by firms. Therefore, IP needs to be managed and as Di Minin and Faems (2013) indicated, the success and failure of an innovative endeavor might be determined by firms’ choices related to IP management. In other words, IP management cannot be considered as the logical consequence of a go-to-market strategy. Instead, it can enable a company to differentiate itself in the marketplace (Di Minin and Faems, 2013).

Despite, this background, IP management is a recent phenomenon. As Al-Aali and Teece (2013) put it: “The systematic integrated management of IP is a recent phenomenon. This is despite the fact that intellectual property has been around for several centuries.”

IP Management is a complex, multifaceted and rapidly evolving managerial activity and research topic. There are many factors that contribute to its increasing level of complexity, including: (1) there are a variety of different IP rights, like patents, trademarks, copyrights, industrial designs, and trade secrets; (2) IP law differs from country to country and it is continuously changing and evolving; (3) IP rights are subject to micro and macro-level analysis from economical, legal, managerial and even technical perspectives; (4) IP management is affected by and must leverage the new, fast changing technologies; (5) IP management needs to cope with the fast moving pace of the business world.

To elaborate the latter point, one should consider that the business world has gone through constant change since the PFI framework first laid out in the 1986. Among
the most significant developments over the last three decades, one can refer to: (1) The growing adoption of open-innovation practices in many sectors of the economy; (2) The increasing cumulative nature of innovation in a variety of industries; (3) The rise of Servitization; (4) the explosion of IP-intensive and IP-enabled business models; (5) the more global context of innovation; (6) the emergence of platform industries; (7) the expansion of the market for IP; (8) the expansion of the realm of patentability (e.g. Al-Aali and Teece, 2013; Chesbrough, 2003; Hanel, 2006; Chesbrough et al, 2006). Changes like these, separately and collectively, have led to the increased complexity of IP management beyond what already studied and reported in the literature.

In the face of this complex and rapidly evolving landscape, some companies have managed to reinvent their approach to IP management to come up with better ways to create and capture value from IP. These efforts, however, has not properly reflected in the IP literature. The vast majority of literature surrounding IP comes from the law and economics spheres, rather than IP management. Even among those prior managerial studies, only few had focused on IP business management. The first part of this research was a quest to address this gap.

Although the business world has gone through tremendous change over the last three decades, countries have not been affected the same way or even to a comparable degree by all the change drivers. Iran is a case in point. For instance, the growing wave of globalization and adoption of open innovation practices has not had profound effects on many sectors of the Iranian economy, as this country has been under economic sanctions for over 30 years. In recent years, the dispute with Iran over its nuclear program has led to even tougher economic sanctions that was described by U.S. Treasury Secretary as “the most severe sanctions in world history.” Then an important question arises: How is the innovation and IP management in Iran different from other countries?

Interestingly, Iran has responded to foreign imposed trade sanctions by increased investment in its own scientific and economic infrastructure. The expansion of higher education and increased expenditure on research and development are just two of the policy mechanisms that have fueled the country's more active approach toward science and technology (UNESCO Science Report, 2010). The government R&D expenditure as a percentage of the Gross Domestic Product (GDP) increased from 0.49 in 2001 to 0.62 in 2009 (Soofi and Ghazinoory, 2013). The results, in terms of knowledge creation, have been impressive. As reported by Thomson Reuters’ Science Citation Index (SCI) the number of Iranian articles published in the...
international journals rose from only 1296 in 2000 to 10894 by 2008 (UNESCO Science Report, 2010).

The above-mentioned particularities about Iran make it an interesting case for innovation and IP management research. Considering the remarkable growth rate of Iran's international scientific output, one might expect a similar pattern to be true also for innovative output of the country. There have been, however, very few attempts to examine innovation and IP management in Iran. Prior studies have mostly used general policy analyses (e.g. Soofi and Ghazinoory, 2013), small-scale surveys (e.g. Mohammadi, et al, 2013) and national level economic data (e.g. Mani, 2004). This is mainly due to a limited access to reliable data on innovation indicators of the country. **The second part of this research addressed this gap.**

**Structure of the Dissertation**

The results of this research can be summarized in two main areas that are presented in the following four chapters. What follows, provides a brief overview of each of these major areas.

a) **IP management literature and emerging trends**

**Emerging IP management practices**

First, a thorough literature review was conducted to identify the emerging IP management practices. In the course of this research, the most interesting and future-oriented cases were shortlisted. In studying and introducing these practices, the main focused was on their features, drivers, and the context in which they have evolved. More specifically, a distinction has been made between established and emerging IP management practices. Established practices mean those which are well-known, widely adopted by practitioners and commonly reported in the literature. By contrast, emerging practices are those which are new, future-oriented, and rarely studied and/or practiced.

This research introduces seven emerging IP management practices and in order to better represent them, grounds the findings in the IP literature and puts them in contrast to the related established practices. Table1 shows that each one of the
introduced practices is based on a shift in companies’ approach toward IP management.

<table>
<thead>
<tr>
<th>Practices</th>
<th>Previous approach</th>
<th>New approach</th>
<th>cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Increasing use of patents to protect service innovations</td>
<td>Product-focused</td>
<td>Product/Service oriented</td>
<td>Swiss Re</td>
</tr>
<tr>
<td>2 Strategic disclosure by smaller firms</td>
<td>Defensive disclosure</td>
<td>Strategic disclosure</td>
<td>Natural Dental Implants</td>
</tr>
<tr>
<td>3 Leveraging trademark to survive the waves of technological disruptions</td>
<td>Transferring value from patents to trademarks</td>
<td>Transferring value from patents to trademarks and vice versa</td>
<td>Dolby Laboratories</td>
</tr>
<tr>
<td>4 Loosening the appropriability regime</td>
<td>Taking appropriability regime for granted</td>
<td>Stratigically loosening the appropriability regime</td>
<td>Merck Gene Index</td>
</tr>
<tr>
<td>5 Using formal IPRs to protect business model innovations</td>
<td>Protecting product-innovations</td>
<td>Protecting product/business model innovations</td>
<td>Progressive PAYD auto insurance</td>
</tr>
<tr>
<td>6 Using defensive patent aggregation services</td>
<td>Closed approach to lowering IP-related risks</td>
<td>Open approach to lowering IP-related risks</td>
<td>RPX Corporation</td>
</tr>
<tr>
<td>7 Providing protection to business partners against patent litigation threats</td>
<td>IP management at firm level</td>
<td>IP management at platform level</td>
<td>Lodsys</td>
</tr>
</tbody>
</table>

This research, then, located the above-introduced seven emerging practices on the IP Value Hierarchy, as one of the most frequently cited models in the IP management literature (Davis and Harrison, 2001). Davis and Harrison (2001) proposed the IP management hierarchy, as shown in Figure 1 that consists of five levels. Each level corresponds to a level of sophistication in the way that companies approach IP management and relies on the foundation of the lower levels. In this hierarchy, IP Visionary companies, located at the top, not only fully integrate their IP strategy with their business strategies, but also look outside and into the future. The definition of IP visionary firms, as provided Davis and Harrison (2001), is focused on identifying customers' unmet needs and working with R&D to develop technologies and products to fill that gap. In their view, Visionary companies use IP to stake a claim on the future products and technologies.

Although all seven identified practices can be located in the top level of the Hierarchy, the results of this research shows that the definition of being IP Visionary, for those located at the top, falls short in, at least, two aspects: (1) it limits the
changes that future may hold to only new products, technologies and markets, and (2) it extend the low-level defensive approach to IP to the future.

The findings stressed the need for new IP management frameworks that could guide and accommodate a wide variety of emerging IP management practices.

Platform leaders to provide Patent Shelter

Among the emerging IP management practices identified and reported during the first phase of this research, one was particularly interesting, as it had never been reported in the literature. The move of the so-called platform leaders to provide protection to their business partners against patent litigation threats had only been reported in the news. This move could be a major shift in large companies’ approach to IP management as it uses IP to serve business interest of the firm at platform level. This could have significant potential implications.

To investigate this emerging practice, this research looked at the rapid evolution of industry platforms and how their business model is increasingly threatened by the recent surge of patent litigation. The rise of platform-based business models is a perfect example of how the major drivers of change in the business world have paved the way for new and disruptive ways of doing business. This, in turn, calls for a new set of competencies for IP management, since problems and challenges faced when managing IP at platform level are different from those needed for IP management within a firm’s borders.

In this phase of the research, three specific research questions were addressed: (1) How might a platform leader react to the increasing patent litigation threats? (2) What are the encompassing factors that affect a platform leader's decision to react (or not to react) to litigation threats against its platform and partners operating on it? (3) What is the broader significance of a platform leader's response in the context of platform-based business models?

Although some scholars (e.g. Leten, 2013; Chesbrough, 2006; Alexy et al, 2009) have indicated the problematic nature of IP management within collaborative arrangements and suggested some guidelines on how to mitigate its negative consequences, there has been no attempt in the literature to address these three questions.
This phase of the research started by exploring the growing evidence on platform leaders' reaction to patent litigation threats. To gather the related insights and construct a typology, the publicly available information on cases, in which the reaction of a platform leader to an actual or potential patent assertion threat against its platform was reported, were collected and screened. Different scenarios under which platform leaders’ reaction is anticipated were characterized. Finally, the reported cases were allocated to the identified scenarios and the bigger picture was analyzed.

The results show that platform leaders need to, and have already started to, respond to this kind of litigation threats in order to keep their platforms healthy and growing and to make them as attractive as possible to complementors. Moreover, providing Patent Shelter, apart from its defensive function, also serves a signalling function which helps distinguishing low-risk ecosystems in an inter-platform competition context.

The results show that platform leaders' defensive response can happen at two different levels: the level of the overall platform and the level of each specific patent litigation attack. We also proposed a conceptual framework to help explain under what circumstances a platform leader might decide to step in and engage in case-specific defensive actions. Based on our framework (Figure1), the results indicate that over time, platform leaders have changed their approach toward case-specific patent litigation defence. While in the past, they would engage in patent litigation only when their own business was the direct target, in a number of emerging cases, they did it when a few blockbuster complementors or many platforms' partners were under attack. One should expect Patent Shelter coverage to expand further in the future to include cases in which developers of niche products are under attack.
This research shows that managing IP at platform level differs from and could be much more complicated than the traditional firm-level approach. IP management at platform level presents a largely unexplored territory for many big companies. Therefore, large technology-based companies, especially those already involved in platform initiation and leadership, need to equip themselves with the knowledge and tools needed to effectively manage IP at platform level.

b) Innovation and IP in Iran

Innovative activities in an artificial closed innovation setting

Over the past several decades, we have witnessed a greatly increased interest in using patent statistics as a proxy for innovative activities at national, sectoral, technology, and firm levels (e.g. Archibugi and Planta, 1996; Pavitt, 1985). Patents are known not to be perfect indicators of innovative activities and this imperfection becomes more
apparent when domestic patents of developing countries are discussed (Da Motta e Albuquerque, 2000). However, there is almost no perfect substitute measure of technological innovation. In absence of patent statistics, many arguments are reduced to pure speculation or to the use of only distantly related measures and proxies.

Despite the increasing interest in using patent information for innovation studies, there have been no attempts to undertake an in-depth investigation into patents registered in Iran. Accordingly, the nature and extent of patenting activities in Iran have long been something of a mystery. This has been mostly due to the fact that until recently, the publicly available information on Iranian patents was very limited. The Iranian Patent Office had no open-to-public database and did not publish special gazettes for Iranian patents. The only official statistics on Iranian patents were the yearly number of filed applications and granted patents, as provided by the national Patent Office.

The only reliable way to get access to the country’s patent data used to be and still is the “Iranian Official Journal,” since the Patent Office asks each applicant to publish an advertisement in the Official Journal before issuing the grant certificate. For this research a dataset of patents granted in Iran was constructed, for the first time, by daily record of the granted patent information as it appeared on the “Iranian Official Journal” over the 2008 to 2010 period. For each granted patent, the following items were obtained and recorded: application date, grant date, names and addresses of inventors and applicants, title of inventions, and terms of protection. This dataset comprises 31997 observations.

Using this unique dataset, this research explored, for the first time, the patenting activity in Iran. The descriptive statistics of patent data were mainly used to quantitatively describe the most notable features of patenting activity in Iran over the 2008–2012 period. It showed that, contrary to Iran's fast scientific progress, the number of patents registered in the country experienced a sharp decline over the studied period. It also demonstrates that an exceptionally large share of patents is owned by individual inventors.
The research addresses the question of the geographic concentration of innovative activities at provincial level within the country. The results indicate that innovative activities are strongly concentrated around Tehran, the capital (see Figure 2). Finally, various pieces of evidence were referred to, which implies that Iran's decreased patenting activity could be mostly due to other factors (e.g. patent system reform) rather than the country's slowing pace of technological innovation.

**IP Commercialization in Iran**

Commercialization of technologies has attracted increasing attention over the past years due to its role in improving national competitiveness. Iran has not been an exception as the country's policy-makers have been actively engaged in crafting national policies in order to facilitate and promote commercialization of technologies. The effectiveness of the existing policies in this field, however, has never been properly researched. This research, based on the careful study of 10 cases of successfully commercialized patented technologies in Iran, aimed for the first time to address this gap.

To this end, exploratory multi-case study approach was chosen. This research relies on theoretical sampling. In other words, the selected cases were chosen for theoretical, not statistical, reasons. Accordingly, the cases were chosen in a way to cover as diverse sectors/technological fields as possible. Sector/technology
diversification enabled the research to consider differences in a number of commercialization contexts.

The main data collection method used by our research team was semi-structured interviews using an open-ended interview protocol. The interviews were conducted individually on a face-to-face basis using a voice-recorder. Interviewees were asked to describe the history of their patented technology and its commercialization. In particular, they were asked to name those supportive government policies which they felt to be helpful for them and explain how and at what point in time they enjoyed those supports. Then they were asked to evaluate the effectiveness of those supportive measures from their own point of view.

We started our analysis by deep-diving in each case as a stand-alone entity. To better display the effects of different policies and interplay of various factors in each case, we graphically displayed the chronological flow of events and their connections throughout the commercialization process. Based on the collected data on each case, the milestones and major drivers and obstacles in force at each phase were highlighted (see for instance Figure 3). Then, the policies that positively affected the process at each stage were added.

Figure 3. Sample chronological trail of a Commercialization process
After graphically displaying the chronological flow of the commercialization process, an explanatory effects matrix for each case was made to highlight a summary of the case. This matrix allows threads of causality to emerge. As a result, two matrixes were built: (1) Company profile; and (2) Policy profile. In order to do the cross-case comparison, we mixed each of the aforementioned case-level matrixes to construct two meta-matrixes:

From the results of the cross-case analysis of the ten case studies, it was concluded that the extent of the perceived effectiveness of the policies varied from case to case. Moreover, due to the unique circumstances of each case, a golden list of generalized supportive policy measures cannot be identified as always causing technology commercialization success or, always preventing failure. The findings placed significant emphasis on the need to consider the inevitable differences between cases and company/technology-specific characteristics of each case.

The results showed that some of the implemented policies have been indeed of vital importance in successful commercialization of patented technologies, as far as the studied cases are concerned. The two policies with the highest perceived effectiveness were the financial supports and the services offered by incubation centers.

The results also revealed, for the first time, that some of the existing supportive policy measures have not served their intended purpose in positively affecting the commercialization process of patented technologies in Iran. For instance, the results show that- against general expectation- frequently held invention and innovation exhibitions as well as the government-supported media coverage have not been beneficial for the commercialization process of the studies cases.

The interview data across all ten cases revealed that there are a number of supportive measures that need to be fine-tuned for greater effectiveness. We also showed the effective role of two governmental policies, which were not originally intended to boost technology commercialization.
The main publication profile

Four different research papers were written based on the findings of this research. What comes next is a brief profile of their presentation/publication status.

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<th>Paper title</th>
<th>Authors</th>
<th>Conference/Journal</th>
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</tr>
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<tbody>
<tr>
<td>1</td>
<td>Emerging Intellectual Property Management Practices</td>
<td>Seyed Kamran Bagheri, Alberto Di Minin, Andrea Piccaluga</td>
<td>The R&amp;D Management Conference-23-26 June 2015- Pisa</td>
<td>Accepted for presentation</td>
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<td></td>
<td>Intellectual Property Visionaries of the new business era</td>
<td>Seyed Kamran Bagheri, Alberto Di Minin, Andrea Piccaluga</td>
<td>The R&amp;D Management Conference-23-26 June 2015- Pisa</td>
<td>Accepted for presentation</td>
</tr>
<tr>
<td>2</td>
<td>Platform leaders to provide Patent Shelter</td>
<td>Seyed Kamran Bagheri, Alberto Di Minin, Andrea Paraboschi, Andrea Piccaluga</td>
<td>The R&amp;D Management Conference- 3-6 June 2014- Stuttgart</td>
<td>Presented</td>
</tr>
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<td>The R&amp;D Management Conference- 3-6 June 2014- Stuttgart</td>
<td>Presented</td>
</tr>
<tr>
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<td>It is not about being generous: Platform leaders and patent shelter provision</td>
<td>Seyed Kamran Bagheri, Alberto Di Minin, Andrea Paraboschi, Andrea Piccaluga</td>
<td>Research-Technology Management Journal</td>
<td>Under review</td>
</tr>
<tr>
<td>3</td>
<td>Innovative activities in an artificial closed innovation setting</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>---------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Innovative activities in Iran: a first glance | Seyed Kamran Bagheri  
Mojgan Samandar Ali  
Mehdi Goodarzi | World Patent Information Journal  
| 4 | Commercialization of patented technologies in Iran: a policy-effectiveness perspective |
| Effectiveness of Iranian policies on commercialization of patented technologies | Seyed Kamran Bagheri  
Mehdi Goodarzi  
Maral Mahdad | 4th International Conference of Management of Technology- 1-2 December 2014 -Kish Island- Iran  
Presented/won the Best Paper Award |
| Commercialization of patented technologies in Iran: a policy-effectiveness perspective | Seyed Kamran Bagheri  
Alberto Di Minin  
Mehdi Goodarzi  
Maral Mahdad  
Meysam Jahani | Technological Forecasting and Social Change Journal (Special issue on Iran)  
Under review |
**Other contributions during the PhD**

I have published several other papers over the course of my PhD - some related to the main research themes, some not. What comes next is a brief profile of their presentation/publication status. The abstracts of these papers are presented as well.

<table>
<thead>
<tr>
<th></th>
<th>Paper title</th>
<th>Conference/Journal</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Who orchestrates publicly funded research networks</td>
<td>Seyed Kamran Bagheri Kinsuk Mani Sinha Alberto Di Minin</td>
<td>Presented</td>
</tr>
<tr>
<td></td>
<td>The role of orchestration in a publicly funded research network</td>
<td>Seyed Kamran Bagheri Kinsuk Mani Sinha Alberto Di Minin</td>
<td>Under review</td>
</tr>
<tr>
<td>2</td>
<td>The changing competitive landscape of the global petroleum industry</td>
<td>Seyed Kamran Bagheri Alberto Di Minin</td>
<td>Published</td>
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<td></td>
<td></td>
<td>Journal of World Energy Law &amp; Business Vol. 8 (1), 2015, pp. 1-19</td>
<td>Published</td>
</tr>
<tr>
<td>3</td>
<td>IP paradoxes in developing countries: the case of software IP protection in Iran</td>
<td>Seyed Kamran Bagheri Elena Casprini</td>
<td>Published</td>
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<td></td>
<td></td>
<td>Int. Journal of IP rights Vol. 19, January 2014, pp. 33-42</td>
<td>Published</td>
</tr>
<tr>
<td>4</td>
<td>Facilitated access to Iranian patent information</td>
<td>Seyed Kamran Bagheri</td>
<td>Published</td>
</tr>
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<td></td>
<td></td>
<td>World Patent Information Journal Vol. 37, June 2014, pp. 43-47</td>
<td>Published</td>
</tr>
<tr>
<td>5</td>
<td>Regional Innovative Behavior: Evidences from Iran</td>
<td>Mojgan Samandar Ali Seyed Kamran Bagheri Alberto Di Minin</td>
<td>Under review</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technological Forecasting &amp; Social Change Journal (Special issue on Iran)</td>
<td>Under review</td>
</tr>
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</table>
a) The role of orchestration in a publicly funded research network

Cooperative arrangements for innovations constitute a notable and vibrant domain of research. The position occupied by an organization in a cooperative arrangement has started receiving scholarly attention. In this paper, we examine cooperative research arrangements which are funded by public bodies. The decision of public bodies to appoint different kinds of entities in the focal position of Publicly-Funded Research Networks (PFRNs) and to hand over the network orchestration role to them- at least partially- could have many implications.

We empirically examined the innovative outcome of the systems providers in PFRNs with different kinds of players as their orchestrators. The empirical setting of our paper is the Danish wind power market in the period 1979-2011. The analysis is done from a network orchestration perspective and a systems provider’s perspective. Our research shows that if the funding public bodies aim at "new-to-the-market" innovations, it is better to position organizations closer to the market (i.e. systems providers, suppliers, and users) as orchestrators. From a systems provider perspective, we found that the probability of introducing new-to-the-firm innovations is higher when the systems provider is only acting as a network cooperator and not as an orchestrator. These findings contribute to a better design of public funding schemes and corporate strategies.

b) The changing competitive landscape of the global upstream petroleum industry

From the 1920s to the 1960s, seven major International Oil Companies (IOCs) were almost the only market players of the global petroleum industry. Their share of oil and gas reserves, however, fell dramatically from about 85% in 1970 to less than 10 percent today. Changes in the competitive dynamics of the upstream petroleum industry are, however, less studied areas in the literature. We conduct a review of previous studies to answer the question: Is the traditional business model of IOCs still valid? We propose a theoretical framework and give a historical account of IOCs erosion and Global National Oil Companies'(GNOCs) ascent to the top. Finally, we
explore an array of possible future scenarios. We argue that IOCs are not in a position to regain the lost ground if they remain wedded to their traditional business model.

c) Intellectual Property Paradoxes in Developing Countries: The Case of Software IP Protection in Iran

In the context of developing countries, scholars have started to report at least two paradoxical phenomena related to intellectual property (IP) protection: (1) weak appropriability regime despite having fairly good IP laws and regulations, and (2) increased demand for intellectual property rights (IPRs) despite low level of IP protection. Beyond these paradoxes, prior research suffers in varying degree from two common flaws: (a) they either considered de jure or de facto IP laws, but not both, and (b) they did not represent all developing countries, being mostly focused on China with no empirical support.

This paper aims at addressing these gaps by exploring both de jure and de facto software IP protection in Iran as a less-researched developing country. The authors look at the de jure software IP protection and, then, empirically investigate the de facto software IP protection in the country. The results show that despite having multiple legal mechanisms for protecting software innovations, Iranian software developers consider the overall level of software IP protection offered as low. Paradoxically, a vast majority of the surveyed software innovators had applied for various available IP rights.

d) Facilitated Access to Iranian Patent Information

Commercialization of technologies has attracted increasing attention over the past years due to its role in improving national competitiveness. Iran has not been an exception as the country's policy-makers have been actively engaged in crafting national policies in order to facilitate and promote commercialization of technologies. The effectiveness of the existing policies in this field, however, has never been properly researched. Our research, based on the careful study of 10 cases of successfully commercialized patented technologies in Iran, aims for the first time to address this gap. Our results indicate that the commercialization process of the studied patented technologies was very much affected by some company/technology-
specific characteristics. We show that the two policy measures with the highest perceived effectiveness were the financial supports and the services offered by incubation centers. Our results also show that some of the existing supportive policy measures did not serve the intended purposes and some other measures need to be fine-tuned, as far as the studied cases are concerned.

e) Regional Innovative Behavior: Evidence from Iran

The present paper studied regional innovative behavior in Iran through a spatial knowledge production function approach by employing Principal Components Analysis (PCA). To this end, the determinants of regional innovative behavior as measured by the number of granted Iranian patents to resident applicants were analyzed. In addition to the total number of patents, the effects of the innovative factors were examined on Company patents, University patents, and Personal patent, separately. 14 explanatory variables were converted by PCA into three components: Contextual Index, Industrial Index and Welfare Index. The results showed that Welfare Index was relatively more important in explaining innovative behaviors at regional level, while Company patents were more sensitive to Contextual Index. Moreover, the results indicated that there is no knowledge spillover across Iranian regions.

References


CHAPTER 1

Emerging Intellectual Property Management Practices

The business world has changed dramatically. Increasing adoption of open-innovation practices, the rise of servitization and the explosion of IP-intensive and IP-enabled business models are among the most recognized changes of the modern global economy. These, inter alia, have led to the increased complexity of IP management beyond what already studied and reported in the literature.

In this paper, we: (1) introduce some of the emerging business practices in IP management; (2) refer at least to one business case for each emerging practice and place each into context; (3) try to locate the identified practices within a widely adopted IP management framework, the Value Hierarchy Pyramid. We argue that many companies have already understood the strategic implications of IP for their businesses. However, the concept of being at the top of the IP management hierarchy needs to be broadened as the existing concept falls short in, at least, two aspects: (1) it limits the changes that future may hold to only new products, technologies and markets, and (2) it extend the low-level defensive approach to IP into the future. Our study shows that the Value Hierarchy Pyramid could be improved to accommodate for the new realities of Open Innovation era.
1.1. Introduction

IP management is a complex, multifaceted and rapidly evolving managerial activity and research topic. There are many factors that contribute to its increasing level of complexity, including: (1) there are a variety of different IP rights, like patents, trademarks, copyrights, industrial designs, and trade secrets; (2) IP law differs from country to country and it is continuously changing and evolving; (3) IP rights are subject to micro and macro-level analysis from economical, legal, managerial and even technical perspectives; (4) IP management is affected by and must leverage the new, fast changing technologies; (5) IP management needs to cope with the fast moving pace of the business world.

In the face of this complex and rapidly evolving landscape, some companies constantly reinvent their approach to IP management to come up with better ways to create and capture value from IP. These efforts, however, has not properly reflected in the IP literature. The vast majority of literature surrounding IP comes from the law and economics spheres, rather than IP management. Even among those prior studies, which have considered IP from a managerial perspective, only a few focused on IP business management. Davis and Harrison's (2001) IP management hierarchy for evaluating and upgrading firms' IP management practices is certainly among the most significant works in this field. Therefore, it is not surprising that their proposed hierarchy has become one of the most widely used typologies amongst businesses.

The global economy, however, has changed dramatically since 2001 when IP management hierarchy was introduced for the first time. Increasing adoption of open-innovation practices in many sectors of the economy is one of the most recognized changes of modern business management in the last decade. The rise of servitization and the explosion of IP-intensive and IP-enabled business models are among the other most significant developments in the business world. These, inter alia, have led to the increased complexity of IP management beyond what already studied and reported in the literature.

The first phase of this research, identifies some emerging IP practices and tried to position them in the IP management hierarchy. More specifically, we introduced seven emerging IP management practices and distinguished them from established ones. By established practices we mean those which are well-known, widely adopted by practitioners and commonly reported in the literature. By contrast, emerging practices are those which are new, future-oriented, yet rarely studied and/or practiced and very few well-documented cases about them can be found in the literature.
This study was a quest to identify these emerging practices. After dropping the rather established practices, the most interesting and future-oriented cases were shortlisted. In studying the emerging practices, the focus was on their features and drivers, looked at the context in which they have evolved and searched for examples of their adoption.

Then, a widely adopted IP management framework, the Value Hierarchy Pyramid, was used to picture how IP-related business practices have evolved over time. Although the framework is a significant contribution to IP Management, the results of this study show that it could be improved in the light of the recent fast-paced developments in technology and business environments. The emerging practices that were identified in this research all fall within the fifth level of the Pyramid, the IP Visionary Level, although not exactly in the way Davis and Harrison had anticipated in their framework back in 2001. Their definition of IP Visionary companies at the top of the pyramid falls short in, at least, two aspects: (1) it limits the changes that future may hold to only new products and technologies and markets, and (2) it extend the low-level defensive approach to IP to the future. In other words, there are many more dynamics going on inside the "IP visionary" box not adequately reflected in the Value Hierarchy Pyramid.

This chapter opens up the "IP visionary box" and provides examples of other possible change drivers at work and how IP visionary companies leveraged those to create business opportunities for themselves in a new business era. On the other hand, it shows that IP visionary companies do not necessarily rely on acquiring more IP rights to secure their interest in the future. Instead, they may decide not only to decline to acquire IP rights, but also to purposefully loosen the appropriability regime in selected technological domains based on strategic grounds.

1.2. Emerging IP management practices

In what follows, some of the identified emerging IP management practices are introduced. In introducing each visionary practice, we explain the underlying drivers of change. We indicate how the new generation of IP visionary firms managed to change their approach to IP in order to create strategic options for their business. In order to better represent these practices, we grounded our findings in the IP literature by referring to the related established practices.
1.2.1. Increasing use of patents to protect service innovation

Today, the services represent by far the largest economic sector in many economies. In the US, for instance, they comprise about 80% percent of all economic activity. Service-intensive firms have become the drivers of growth and the locus for innovative activity within the emerging “knowledge economy” (Hipp & Herstatt, 2006). “Servitization” - the process of creating value by adding services to products - is happening in almost all industries on a global scale (Vandermerwe & Rada, 1989; Baines et al., 2009). However, the focus has overwhelmingly been on IP protection in manufacturing firms and, thus, IP management in services is a far less researched area (Miles et al., 2000; Blind et al., 2003; Amara et al., 2008; Berg & Einspruch, 2009).

As of 2000, a few scholars have started to address the need of service providers to protect their innovation. Special attention has been given to the need of knowledge-intensive business services (KIBS) (Miles et al., 2000; Blind et al., 2003; Hipp & Herstatt, 2006; Amara et al., 2008; Bader, 2008). Although the rationale for protecting innovation in the manufacturing and service organizations is similar, there are some critical differences in the ways in which innovation is protected in these two contexts (Nambisan 2001; Hurmelinna-Laukkanen & Ritala, 2010). It has been widely believed that services are characterized by a much weaker appropriability regime, mostly due to the intangibility and interactivity of many service innovations (Miles et al., 2000; Dolfsma, 2005; Hipp, 2006; Amara et al., 2008; Miles, 2008; Hurmelinna-Laukkanen & Ritala, 2010).

It has been found that service companies, quite like their manufacturing counterparts, simultaneously consider many alternative formal and informal IP protection methods (Amara et al., 2008). The frequently used informal protection means included secrecy, customer relationship management, gaining lead-time advantages, complex design approach, long-term labour contracts, exclusive contracts with suppliers, and establishing a reputation (Andersen & Howells, 2000; Blind et al., 2003; Dolfsma, 2005; Hipp & Herstatt, 2006).

It was believed that the role of formal IP protection is only of minor importance to service companies (Blind et al., 2003; Dolfsma, 2005; Hipp & Herstatt, 2006) and that they do not rate the lack of effective IP protection as a major obstacle in innovation (Hipp, 2006; Miles et al., 2000; Howells & Tether, 2004). There were many evidences that the propensity to patent and the number of patent applications were much lower in the service sector compared to the manufacturing sector. Blind et
al. (2003) highlighted that "patents are the least important IPR for the interviewed service companies". The increasingly short life cycles of new service-based products was considered as another reason of low usage of patents by service firms (Blind et al., 2003; Hurmelinna-Laukkanen & Ritala, 2010). It also had been argued that service businesses do not patent since they generally use items developed and patented by their suppliers rather than by themselves (Berg & Einspruch, 2009).

Expansion of the realm of patentability to cover software and business methods, however, has helped change the traditional approach of service companies to patent protection. In order to provide new services and remain competitive in the market, many firms have no choice but to device innovative business models and rely increasingly on software solutions. These, in turn, have caused some service firms to increase their use of patent protection.

The reinsurance company Swiss Re

The reinsurance business is a business-to-business activity, which could cover the whole spectrum of underwriting risk in the life and non-life areas. Reinsurance products by their very nature are susceptible to copying. As Tufano (1989) estimated, replicating a financial product would cost less than half of the innovator’s original investment. Therefore, there is tendency to use formal instruments, e.g. IPRs, to protect innovative solution.

The Swiss Reinsurance Company (Swiss Re), founded in 1863, is a leading company in reinsurance business with more than 70 offices in 30 countries. Although using copyrights and trademarks has a long history in Swiss Re, patenting is a new practice for the company. Copyrights and trademarks used to be handled by the legal department and external lawyers respectively. However, in 2001, after the introduction of e-business-based reinsurance products, the company established a central IP department at its corporate headquarters in Zurich to focus on building a strong patent portfolio. Now Swiss Re’s patent portfolio has grown significantly as it has more than 100 inventions mostly related to business models that run off computer systems and the geographical coverage of the patents is focused on Europe, the USA, India, and China. The company has a clear patent strategy and is becoming very experienced and successful in out-licensing patented technologies (Bader, 2008).
1.2.2. Strategic disclosure by smaller firms

"Strategic disclosure" and "defensive disclosure" are two different practices, although they share a common feature and that is: publication of information in order to create novelty-destroying prior art. Defensive publishing is widely-known and traditionally-used defensive practice for raising the inventive step threshold, making it impossible or at least more difficult for rivals to obtain patent related to the disclosed information, and secure their “freedom to operate” (FTO). It is a particularly effective strategy when companies, usually motivated by cost-saving concerns, see limited value in the patent that they could obtain or consider their FTO as crucial (Henkel & Pangerl, 2008; Baker and Mezzetti, 2005; Hall et al., 2012).

Strategic disclosure, on the other hand, is when companies reveal their internally developed knowledge in a systematic and large-scale manner to boost their competitive position in the market with no intention of abandoning that field of technology (Alexy et al., 2012; Baker & Mezzetti, 2005). As Peters et al. (2013) noted strategic disclosure can be used to reveal both patented and not patented prior art and find application either alone or in relation to particular patents. Companies can also use strategic disclosure in relation to particular patents to: (1) extend the scope of a patent by stating alternative potential markets or uses for a technology; (2) early reveal a patent application (i.e. prior to official publication) to signal technological advances and discourage competitive development; (3) pave the way by establishing common prior art for future collaborative innovation.

A few scholars have addressed different aspects of strategic disclosure and provided examples of its adoption by bigger companies (e.g. Eisenberg, 2000; Baker & Mezzetti, 2005). However, the practice has not yet been adopted by smaller companies. In the light of the aforementioned arguments, one may reasonably expect that the practice will continue to grow in popularity and use under resource constraints inherent to smaller firms.

*Natural Dental Implants*

Natural Dental Implants, a Berlin-based technology start-up founded in 2006, had developed an innovative solution for tooth replacement, which is particularly less-invasive, time-efficient, and safer if compared with existing technologies. Ruedger Rubbert, the company’s founder and CEO, is a serial entrepreneur with extensive IP experience. He aimed at establishing technological leadership in the US, the largest
cosmetic dentistry market in the world, and to make the company an attractive acquisition candidate within three to seven years (Peters et al., 2013).

His patent strategy was to create a solid protective space around its main concept in the biggest markets, that is the US and Europe. The company, however, acts in a very competitive industry and hundreds of competitors were trying to establish prior art around the core technology. Natural Dental Implants decided to search the field, make all kind of variants out of its core concept and publish them. This approach enabled the company to enhance the benefits of their core patents by adding claims to them and stating alternative potential markets or uses for their technology. In order to enjoy a time advantage and avoid wasting time and resources in defending the company’s patents and challenging the validity of the competitor’s similar filings, the company decided to publish its patent specification just a couple days after their filing. This approach also enabled the company to signal early technological advances and discourage competitive development (Peters et al., 2013).

Natural Dental Implants, by combining a well-protected proprietary base with strategic disclosure, has managed to facilitate rapid diffusion of its concepts and tip its emerging market in their direction. It has established an advantage in time and space relative to its competition (Peters et al., 2013).

1.2.3. Leveraging trademark to survive the waves of technological disruptions

The literature on IP management in technology-based enterprises has been overwhelmingly focused on patents. However, IP rights are not only a matter of technical advantage and all other forms of IP, in particular trademarks, are often crucial for value creation and capture through innovation. However, the combined use of different types of IP rights has received little attention in literature.

Teece (1986) indicated that innovators may be able to develop and maintain a "tight appropriability regime" by using valuable trademarks as co-specialized assets strategically. Since trademarks can be renewed indefinitely, this strategy uses the patent period to transfer the value of the patent into the trademark and prolong its value beyond expiration (Statman & Tyebjee, 1981). Schwiebacher and Müller (2009) point to yet another complementary use of patents and trademarks, where trademarks are interpreted as carriers of technological information.
Conley et al. (2013), however, have recently reported on an emerging practice in combining patent and trademark rights. This practice could be characterized as using trademarks to manage technology transitions. Companies transfer the value of their patented inventions to a trademark and then leverage the value of their trademark to enter a new market in which totally new technologies are needed.

Dolby Laboratories

Dolby Laboratories' first patent was on Dolby A-type noise reduction system, a new form of audio signal compression and expansion to reduce the background noise in magnetic tape recording. Dolby patented the B-type noise reduction (NR) system in 1968, which enabled it to move the functional benefit of its technology to the consumer market. It decided to license out its proprietary B-type technology to device manufacturers, surprisingly, royalty free. This strategy established Dolby B as the standard consumer tape noise reduction technology and promoted sales of Dolby B-equipped cassette recorders. Licensees put “Dolby NR” name on the devices and, therefore, the front of his customer’s products became a Dolby advertising platform. By doing so, Dolby tied the Dolby trademark to its patented inventions and transferred its initial value proposition, which was based on patented benefits of its analogue technology, to its trademark without relying on expensive marketing (Conley et al., 2013).

In 1990, noise free digital sound technology entered the market and suddenly rendered Dolby’s patented A-, B- and C-Type NR methods (all about analogue sound signal processing) obsolete. Dolby leveraged the enhanced value of its trademark to sustain its market share in the face of a disruptive technological shift and facilitate its entry to the new market. Dolby responded two years later with the first major Dolby SR-D (called Dolby Digital) release. The company, then, expanded its new technology to almost all domains of digital sound and in 1997 Dolby Digital became the standard for professional DVD recording (Conley et al., 2013). Therefore, Dolby successfully leveraged the value of its trademark to survive a major technological disruption.

1.2.4. Loosening the appropriability regime
The appropriability regime is weak when it is easy to imitate an innovation and legal protection (such as patent) cannot be acquired (Teece, 1986). In the past, it was widely believed that appropriability is exogenous and given. Therefore, firms' ability to capture the profits generated by an innovation was dependent upon their strategy to develop complementary assets and capabilities given the appropriability regime (Pisano, 2006).

The conventional wisdom is that the stronger the appropriability regime, the better for the innovators. However, some innovative companies have realized that a strong appropriability regime is not always appealing (Pisano, 2006; Hurmelinna-Laukkanen et al., 2007; Pisano & Teece, 2007). In fact, there may be situations in which companies are strategically motivated to loosen the appropriability regime in a selected technological area in an effort to profit from their innovations more efficiently by other means. Recent business developments suggest that some leading companies have actually traveled down this path by taking their complementary asset positions as given and try to endogenously weaken the appropriability regime in order to optimize the value of those assets (Pisano & Teece, 2007).

Merck Gene Index Case

The genomics science and technology rapidly expanded in the late 1980s and 1990s as the Human Genome Project began producing sequence data on a mass production scale. Researchers started to identify the genetic bases for many complex diseases. Pharmaceutical companies, who are known to be among the main advocates of strong IP regimes, started to worry about getting held hostage by those companies who claimed ownership of a key gene or genes related to a disease where they had substantial commercial interest. Merck, with a very advanced research base in cardiovascular disease, was among the first pharmaceutical companies who felt this threat. If other companies were able to claim proprietary rights over the genes related to cardiovascular disease, this could potentially threat its business and, in the worst scenario, lead to a hold-up situation. Instead of aggressively pursuing IP rights in genes, which was the strategy followed by some large pharmaceutical firms, Merck attempted to alter the appropriability regime. In 1994, Merck, in collaboration with Washington University, started a project to create a database (the Merck Gene Index) of expressed human gene sequence and to put the resulting data and information public. By making these data publicly available, Merck has been trying to prevent privatization of genes that could potentially block its future research plans.
Technically speaking, Merck, for strategic reasons, has been "loosening" its upstream appropriability regime (Pisano, 2006).

1.2.5. Using formal IPRs to protect business models

A business model describes a company's design of the value creation, delivery and capture mechanisms (Teece, 2010; Zott et al., 2011). The business model literature, however, has so far mainly dealt with value creation and deliver and the value capture challenge is under-researched.

Some scholars suggested that business model innovation by itself can become part of IP (Zott et al., 2011) and the concept of appropriability regimes can be applied to it (Desyllas & Sako, 2013). This has coincided with the expansion of patentable subject matters to fields like computer software and business methods. The availability of business method patents has obviously opened new perspectives for the protection of business models. It is believed that, in general, a business model is distinguishable from a business method, which is a specific way of doing business (Ovans, 2000; Teece, 2010). However, there are cases in which an entire business model can be embedded in digital code and protected by a business method patent (Ovans, 2000). Teece (2010) indicated that although business logics behind a new model are unlikely to be protectable, certain business methods underpinning it could fall within the scope of patentable subject matters.

Trademarks could also be constituent components of business models, especially when they have compounding effects together with business method patents. These effects occur when patents layout the basic idea and the business logic of a new model and trademarks convey what the business model is in a very short phrase or single word so that people understand what the company does when they hear it over time (Desyllas & Sako, 2013).

Tight appropriability by itself cannot guarantee sustainable competitive advantage for business model innovators. Instead, they need to build the necessary specialized complementary assets to sustain their longer-term competitiveness. Therefore, protecting business model innovation by a portfolio of IPRs is primarily for preventing imitation and “buying time” to fine-tune the model and build specialized complementary assets (Desyllas & Sako, 2013).
**Pay-As-You-Drive auto insurance**

Progressive, as one of the top five US auto insurers, introduced the Pay-As-You-Drive (PAYD) auto insurance in the late 1990s. PAYD is an innovative way of calculating insurance premiums, which uses Global Positioning System (GPS) to record policyholder’s actual driving behavior and offers several advantages both for the company and its customers. The company designed a new business model around its PAYD auto insurance service. Before introducing PAYD's market test, Progressive decided to protect the key components of its business model by acquiring formal IPRs. In 1996, it applied for its first PAYD-related patent in the US. It was followed by the filing of three other patents to build a strong patent portfolio around PAYD. Progressive also registered 13 trademarks in the US to protect the names of the different marketed versions of PAYD, including Pay-As-You-Drive and Pay-How-You-Drive. These trademarks convey its new business model in a short phrase or single word. Combination of trademark and patent rights not only provided Progressive with some degree of exclusivity, but also prevented others from easily inventing around PAYD and offering similar variations of it. Progressive has used its IP rights to prevent competitors from imitating its business model. In 2011, it filed a patent infringement lawsuit against Allstate and Liberty Mutual. The company reached an out-of-court deal with Allstate and granted it a license to PAYD's patent portfolio (Desyllas & Sako, 2013).

Although some of the top insurance companies in the US began offering their own usage-based insurance, the Progressive's IP protection has been effective to prevent direct imitation and force them to develop their own model of usage-based insurance. This defensive IP strategy has given Progressive more time to fine-tune its innovative business model (Desyllas & Sako, 2013).

1.2.6. Using patent aggregation services

Nowadays, companies developing and commercializing new technological products and services in many industries face a dense web of overlapping patents owned by many individual players. In such multi-invention settings, it has become increasingly difficult for companies to obtain all the necessary rights needed for legitimately selling the final products (Shapiro, 2001; Somaya et al., 2011). As argued by Heller and Eisenberg (1998), the need to acquire too many licenses from IP owners may force operating firms to underinvest in the commercialization of innovative technologies.
Aggressive patenting, cross licensing, patent pooling, using patent litigation insurance, and increasing monitoring efforts, used to be considered as possible ways to cut through the patent thicket (Merges, 1999; Shapiro, 2010). This turn out, however, not to be enough.

Recently, a number of companies have started to provide patent aggregation or acquisition services. Patent aggregators provide a defensive shield for their member organizations against IP litigation as they took control of patents which are potentially dangerous for their clients. This protection not only gives the members more freedom to operate and shares the risks and costs of patent acquisition and litigation, but also lowers their patent search and license negotiation costs (Wang, 2010). In general, patent aggregation service has been considered as an efficient market based solution for navigating through the patent thicket. That is the reason why an increasing number of operating companies have joined the subscribers' list of defensive patent aggregators.

**RPX Corporation**

RPX is a company founded in 2008 that provides "defensive patent acquisition services". Its subscribers not only get licenses to potentially dangerous patents acquired by RPX, but can also use those patents in counter-lawsuits against non-members who initiate litigation against members. RPX's knowledge as a frequent participant in the patent market allows it to serve as an extension of a client's in-house patent department to better develop their IP strategy. RPX announced that by December 31, 2012, it had acquired more than 1,800 patents representing more than 1,000 avoided litigations for its members. It also had managed to negotiate more than 300 releases and dismissals from 40 litigations (RPX website, 2013). IBM and Cisco Systems were its first subscribers and by 2012 its fast-growing client network grew to 120 companies representing a diverse array of technology sectors. Google, Ericsson, Sony, Sharp, eBay, HTC, Intel, Samsung, Microsoft, NEC, Nokia, and many other big technology-based companies have already joined the RPX's clients (Hagiu & Yoffie, 2013).

1.2.7. Providing patent shelter to business partners
Patent litigation is a complex phenomenon by nature. Engagement in patent litigation is also too costly, too time-consuming, and too unpredictable. Companies have been very reluctant to get involved in the process unless they come directly under litigation threat. It has been, however, very unlikely for companies to intervene in patent litigation processes to defend their business partners.

But the business landscape has changed dramatically over the recent years. For instance, the so called industry platforms have increasingly played a dominant role in many sectors. A platform is led by a company- platform leader- who sets it up and drives coalitions of complementary firms to innovate around it and provide products and services on top of it (Parker & Van Alstyne, 2007). Platform leaders, who are typically big companies, have been and still are the main targets in patent litigations due to the possibility of patent owners getting awarded big money for damages. Recently, however, smaller complementors operating as partners on the platforms have increasingly been the target of patent infringement lawsuits.

As far as small platform partners are concerned, patent fights are massively unbalanced against them, since they don't usually have the resources and expertise needed to fight back (Chien, 2012). When platform partners are under patent litigation threat, platform leaders can still choose to follow the aforementioned traditional approach and stay out of the conflict. However, patent attacks against platform partners could have serious and far-reaching consequences, as it could dramatically undermine the entire platform and their flourishing business model. As Bagheri et al. (2014) showed, some platform leaders have recently decided to step in and provide "Patent Shelter" and protect some of the partners acting on their platform against patent assertion threats.

**Lodsys**

What has been happening with Lodsys is a good example of this emerging practice. Lodsys Group, A Texas-based company, has being suing many independent developers working on Apple and Google’s ecosystems since 2011. As in July, 2011 Lodsys was suing 37 defendants, including Rovio (the company behind the blockbuster “Angry Birds” saga) and Dan Castelnuovo (the creator of “Pocket God”), accusing them of infringing its four patents on in-app purchasing feature. Google and Apple which were safe as they had already had licences for the claimed patents, decided to intervene and defend their developers, though they opted for different approaches to the problem. Apple inserted itself into the dispute on behalf of its
developers, claiming that it has a licence for the related patents, and that the licence extends to the many partners who use Apple’s technology to create contents as well. Google, on the other hand, requested a re-examination of Lodsys patents, aiming at amending the patents so that Lodsys would not be able to assert them against its complementors (Bagheri et al., 2014).

In this case, platform leaders- Apple and Google- chose to defend their business partners solely based on strategic grounds. They came to realize that the growing litigation threats against their mostly small platform partners discourages innovation on the part of complementors and poses a serious risk to their platform design. On the other hand, a platform leader's decision to provide Patent Shelter goes well beyond its apparent defensive intent and serves as a distinctive feature in the context of platform-based competitions (Bagheri et al., 2014).

1.3. A broader concept of being IP visionary

In their book, Edison in the boardroom: how leading companies realize value from their intellectual assets, Davis and Harrison (2001) proposed an IP management hierarchy, as shown in Figure 1.1, that consists of five levels. Each level corresponds to a level of sophistication in the way that companies approach IP management and relies on the foundation of the lower levels. In vertical order, beginning with the lowest, these levels are: defensive, cost control, profit center, integrated and visionary. The proposed IP management hierarchy is one of the most widely used typologies amongst businesses. Many companies have utilized it to evaluate and upgrade their current IP management approaches. In this research, we used the same framework to picture how the IP-related business practices have evolved over time.
In Davis and Harrison's (2001) hierarchy, IP Visionary companies are at the top. They described IP Visionary companies as those who not only fully integrate their IP strategy with their business strategies, but also look outside themselves and into the future. Their definition of IP visionary firms is focused on identifying customers' unmet needs and working with R&D to develop technologies and products to fill that gap. In their view, Visionary companies use IP to stake a claim on the future products and technologies.

However, trying to locate the above-introduced seven emerging practices (as summarized in Table.1) on the IP Value Hierarchy, we came to realize that this definition falls short in, at least, two aspects: (1) it limits the changes that future may hold to only new products, technologies and markets, and (2) it extend the low-level defensive approach to IP to the future. Considering the studied cases, we can argue that there are other change drivers at work at IP visionary level which visionary companies leverage to better create business opportunities for themselves. Examples of these change drivers include: (1) The widespread adoption of open innovation practices; (2) The expansion of patentability realm to cover software and business methods; (3) The rapid growth of Internet and prior art databases; (4) The increased complexity and dynamics of technological development; (5) The growing share of the service sector in the economy; (6) Increasing threat of patent infringement.
lawsuits, especially by NPEs or Trolls; (7) The booming platform-based economy. In reality, there are many circumstances in which some of the above-mentioned change drivers work in concert. In other words, there are many more dynamics going on inside the "IP visionary" box.

IP visionary companies not only identify and monitor these rule-changing trends, but also alter and fine-tune their approach toward IP in a way that enables them to leverage the changes and create business opportunities. Table 1.1 shows that each one of the introduced practices is based on a shift in approach toward IP management. These would not, however, be possible if those companies had restricted their monitoring efforts only to potential future product, technology and market disruptions. Therefore, despite what Davis and Harrison (2001) envisaged, IP visionary companies do not necessary rely on acquiring more IP rights to secure their interest in the future. Instead, they may decide not only to decline to acquire IP rights, but also to purposefully loosen the appropriability regime in selected technological domains based on strategic grounds.

The studied emerging IP visionary practices by no means constitute an exhaustive list. We are also reluctant to claim that the identified emerging actions represent best practices that will necessarily grow in diffusion and popularity. Some of these emerging practices will flourish; others will go bust. Some will be put into mainstream usage by IP managers; others may be replaced by more proactive and innovative ones. Every mainstream, however, starts from pioneering experiments.

Table 1.1. The studied emerging IP Visionary practices

<table>
<thead>
<tr>
<th>Practices</th>
<th>Previous approach</th>
<th>New approach</th>
<th>cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Increasing use of patents to protect service innovations</td>
<td>Product-focused</td>
<td>Product/Service oriented</td>
<td>Swiss Re</td>
</tr>
<tr>
<td>2 Strategic disclosure by smaller firms</td>
<td>Defensive disclosure</td>
<td>Strategic disclosure</td>
<td>Natural Dental Implants</td>
</tr>
<tr>
<td>3 Leveraging trademark to survive the waves of technological disruptions</td>
<td>Transferring value from patents to trademarks</td>
<td>Transferring value from patents to trademarks and vice versa</td>
<td>Dolby Laboratories</td>
</tr>
<tr>
<td>4 Loosening the appropriability regime</td>
<td>Taking appropriability regime for granted</td>
<td>Strategically loosening the appropriability regime</td>
<td>Merck Gene Index</td>
</tr>
</tbody>
</table>


5 Using formal IPRs to protect business model innovations

<table>
<thead>
<tr>
<th>Protecting product/innovations</th>
<th>Protecting product/business model innovations</th>
<th>Progressive PAYD auto insurance</th>
</tr>
</thead>
</table>

6 Using defensive patent aggregation services

| Closed approach to lowering IP-related risks | Open approach to lowering IP-related risks | RPX Corporation |

7 Providing protection to business partners against patent litigation threats

| IP management at firm level | IP management at platform level | Lodsys |

### 1.4. Conclusion

IP management is a rapidly evolving business domain and research topic and its implications for business performance have increased rather dramatically over the past decade. Davis and Harrison's (2001) proposed IP management hierarchy, is among the works that provided a significant contribution to the literature in the IP management field. The model has frequently been used by companies as an introduction to IP management and as a useful insight into the best practices of visionary companies.

Our study shows that in the new business era, the Visionary level of the Value Hierarchy Pyramid has enlarged considerably so that it could accommodate a wide variety of visionary IP management practices. The practices presented in this chapter were just examples of how IP-conscious companies succeeded in unlocking the potential of IP at the Visionary level of the pyramid. They were helpful in opening up the "IP visionary box" and provide examples of other possible change drivers at work and how IP visionary companies leveraged those to create business opportunities for themselves.

IP management hierarchy was a very useful tool for picturing the evolution of IP management in the late 1990s and early 2000s. However, ever since, many firms have adopted more complex approaches to IP. Some have even gone further to build their entire business model around IP. Therefore, it seems that Edison is already in the boardroom. What is needed now is a framework that accommodates a wide variety of change drivers at IP visionary level and provides innovative companies with more insights, options and support in order to further upgrade their IP management function.
References


CHAPTER 2

Platform leaders to provide Patent Shelter

On August 12, 2011, Google filed a request with the U.S. Patent and Trademark Office (USPTO) for the re-examination of two patents asserted by a patent firm, Lodsys, against several Android coders. It was most probably the first public move of the Internet giant to defend Android application developers from a patent lawsuit. This is just one of a growing number of similar initiatives undertaken by "platform leaders" to protect independent complementors active on their platforms against patent assertion threats.

In this chapter, we examine the emerging evidence on platform leaders' initiatives to provide “patent shelter” for their partners. We argue that this reaction could serve two important functions: (1) maintaining and reinforcing a platform ecosystem, and (2) differentiating a platform relative to its rivals. We show that platform leaders' defensive response could happen at two different levels: (1) providing umbrella protection, and (2) defensive intervention in specific patent litigation cases. Finally, we propose a conceptual framework that helps understand platform leaders' possible case-specific reactions under six different scenarios. We analyzed the evolution of their decision-making over time and its practical implications.
2.1. Introduction

Over the last few years there has been a shift in many sectors as the so called industry platforms have increasingly played a dominant role. Industry platforms have been defined as technological building blocks that act as a foundation on top of which an array of firms and individuals develop a set of inter-related products, technologies and services (Gawer 2009). A platform is led by a company who sets it up and drives coalitions of complementary firms to innovate around it and provide products and services on top of it (Parker and Van Alstyne 2007). Personal computers, cell phones, gaming systems, streaming media, and telecommunications infrastructure are among those industries that have fully embraced the platform-based business models.

The strategic importance of industry platforms is steadily growing and this has also brought new challenges, as, inter alia, industry platforms have become the target of an increasing number of patent infringement claims. These claims are usually very painful especially on the complementors' side of platforms. In fact, many complementors who contribute to industry platforms are small and entrepreneurial businesses that cannot afford fighting back in costly legal battles. As these small companies usually cannot afford good legal counsel the chance of them losing lawsuits is quite high. Accordingly, the consequences of patent litigation threats are particularly severe and have become a growing concern for them.

But what has been the reaction of platform leaders to these increasing threats? On August 12, 2011, Google filed a request with the U.S. Patent and Trademark Office (USPTO) for the re-examination of two patents asserted by a patent firm, Lodsys, against several Android coders (Isaac 2011). Other platform leaders (also called platform owners or platform sponsors) have recently decided to step in and provide "Patent Shelter" and protect complementors active on their platform against patent assertion threats.

This is an important change in platform leaders' strategic approach to Intellectual Property (IP), with significant potential implications. Therefore, a number of new questions have recently emerged that need to be adequately addressed, including: (1) How might a platform leader react to the increasing number of patent litigation threats? (2) What are the encompassing factors that affect a platform leader's decision to react (or not to react) to litigation threats against its platform partners? (3) What is the broader significance of a platform leader's response in the context of platform-based business models? Our work seeks to address these questions.
To gather the related insights and construct a typology, we collected and screened the publicly available information on cases in which the reaction of a platform leader to an actual or potential patent assertion threat against its platform were reported. We relied on prior literature and our prior research to characterize different scenarios under which platform leaders’ reaction is anticipated. Then we set up a series of interviews with executives and industry analysts to understand the possible case-specific reactions under different scenarios.

We show that platform leaders need to, and have already started to, respond to this kind of litigation threats in order to keep their platforms healthy and growing. Providing Patent Shelter, apart from its defensive function, also serves a signalling function which helps distinguishing low-risk ecosystems in an inter-platform competition context. We show that platform leaders' defensive response can happen at two different levels: the overall platform and each specific patent litigation attack. We also proposed a conceptual framework to help explain under what circumstances a platform leader might decide to step in and engage in case-specific defensive actions. We argue that over time, platform leaders have changed their approach toward case-specific patent litigation defence. We expect them to expand further the coverage of their Patent Shelter in the future to even include cases in which developers of niche products are under attack.

2.2. Platforms-centric competition, litigation threat and complementors’ reaction

Nowadays many industries are characterized by competition among platforms. The products and services offered on an industry platform are usually a combination of core components provided by one company-platform leader- with complements made by a variety of independent firms (Gawer and Cusumano 2008). Apple's App Store and Google's Play Store are shining cases of platforms wherein hundreds or thousands of partners create and appropriate value (Zahra and Nambisan 2011).

In this chapter, by platform we always refer to "industry platform," which differs from a product platform, and is not fully under the control of the platform leader, although the latter may have some proprietary elements (Gawer and Cusumano 2008). Platform leaders open their technology to complementors and motivate them to join the same "ecosystem." This has caused industry platforms to have more than one market "side." In other words, a platform leader competes not only to attract end users but also to win the cooperation of firms that build complementary applications
and devices. For instance, since the launch of the Apple’s App Store in 2008, the platform attracted millions of users. It is believed that there are more than one million apps available on App Store with more than 300,000 registered app developers only in the US market.

The trend towards industry platforms becoming commonplace and increasingly software-intensive has coincided with the emergence of so-called pro-patent era. Despite some national differences, this era is characterized by stronger enforcement of IP rights and the expansion of the realm of patentability to cover software and business methods (Hanel 2006). Broader IP and stronger enforcement have led to an increase in patent activity of companies and a big surge in patent litigation. As Figure 2.1 shows, the total number of patent assertions in the US has recorded a significant rise in recent years (Executive Office of the US President 2013).

Platform leaders, who are typically large brands/companies, have been and still are the main targets in patent litigations (Bessen et al. 2011) mostly due to the possibility of patent owners getting awarded big money for damages. More recently, however, smaller complementors operating on the platforms have increasingly been the target of patent infringement lawsuits.

![Figure 2.1](image)

Figure 2.1. Number of patent litigation cases commenced, 2006-2012
(Source: Executive Office of the US President, 2013)

Figure 2.1 points to yet another noteworthy effect: an increasing share of patent litigations in the US are brought by the so-called Non-Practicing Entities (NPEs) who own patents but do not develop or commercialize new technologies (Chien 2012).
Rather, they engage in aggressive litigation against companies that do produce goods and services to collect fees from them. In recent years, NPEs have started to issue warning letters to a number of app developers that contribute to industry platforms and ask them for a fee that is far less than what litigation would cost. As far as app developers are concerned, patent fights are massively unbalanced in favor of attackers. As NPEs not only have experienced in-house patent teams, but also enjoy economies of scale in legal expenses. Once the initial legal preparation work has been done, they can send out a large number of letters to companies, threatening lawsuits if they do not receive payment.

Independent complementors may put their business at risk by fighting back the NPEs. In order to avoid litigation, they may decide to cease selling their products on platforms or to pay annoying settlement fees regardless of the merits of the underlying claims. These could have significant operational impacts on the business of these small companies. The smaller the company, the more severe the impact (Chien 2012). It is, therefore, worth asking: what other actions can small complementors undertake to better address the increasing threat of patent litigation.

In what follows, we briefly review some of their alternative options.

2.2.1. Lobbying on the legislative front

To start with, many businesses want to see changes in the patent law to make it harder for patent owners, especially NPEs, to threaten a business without consequence. Groups representing small and innovative businesses have built several campaigns on this ground and have already generated positive results on the legislative front. Although these achievements on the legislative front will most likely bring positive changes to the patent system, they are not expected to fully deter the problem of aggressive patent litigation. Moreover, litigation reforms may deter some suits from being brought in the first place, but cannot directly or necessarily help small developers against whom litigation is threatened, but not brought (Chien 2012).

2.2.2. Increased monitoring

Conducting freedom-to-operate searches and asking for relevant licenses before launching new products have long been used as strategies to navigate through patent thickets and avoid costly litigations. Over time, however, the patent landscape has
become extremely complex (Somaya et al. 2011). Thus, it is not surprising that patent monitoring as an increasingly complex and costly function has become an almost impossible task for many small complementors (Reitzig et al. 2007).

2.2.3. Preemptive patent acquisition

Preemptive patent acquisition is a well-known strategy to reduce patent risk by removing the threat posed by dangerous patents. *Ex ante* licensing as a defensive strategy, however, is generally based on extensive monitoring and evaluation of the patent landscape, the tasks that many small businesses simply cannot afford. Even if small complementors manage to identify potentially dangerous patents, agreeing on mutually acceptable royalties is often a highly challenging task for them (Somaya et al. 2011).

2.2.4. Litigation insurance

In the atmosphere of increased risk, insurance, as one of the most obvious risk management devices for individuals and businesses, could have been a relevant option for the complementors. Patent litigation insurance in principle means transferring the risk of loss in a patent suit to an insurer in exchange for an agreed premium. Such insurance could cover third-party liability, defense, and indemnity costs incurred by the business in patent infringement suits. In reality, however, attempts to provide patent litigation insurance have largely been unsuccessful as it is too expensive for businesses and too risky for insurers (CJA Consultants, 2003; Fuentes 2009).

2.2.5. Joining patent aggregators

Given the emerging concerns about the complexity of multi-invention settings and the increasing prominence of NPEs in the patent system, a number of companies have introduced defensive patent aggregation or acquisition services. These companies provide a defensive shield for their member organizations by acquiring the patents which are potentially dangerous for them (Wang 2010). Patent aggregators' subscription fees, however, are affordable only to high-income companies. Many
complementors cannot afford the tens of thousands of dollars it takes annually to join the club of protected members.

2.2.6. Creating low-cost defence solutions

Given small firms' difficulties to afford the high costs of patent defense, overcoming financial disadvantage of small firms could provide a more even playing field. This, in turn, will encourage small complementors to engage in patent defense and not to settle quickly. Since attorney's fees constitute a large portion of costs associated with patent fights, undertaking any measure to lower these fees could be helpful. That is why App Developers Alliance (ADA), for instance, has recently teamed up with a number of law schools in the US to launch the Law School Patent Troll Defense Network. The network is aimed at bringing together a variety of existing law school clinics in the US to help app developers better fight off NPEs by providing them with free legal services (App Developers Alliance 2013). There are, however, genuine concerns over the amount and quality of the free legal services offered by university law clinics and law students. Not many companies are willing to risk their business fighting a patent infringement suit relying on free or low cost legal services, while attackers are often represented by very experienced and highly paid patent litigation attorneys.

2.2.7. Access to the platform leaders' patent portfolio

A common defense against potential or actual patent litigations is a counterattack on the claim of infringement. The defendant investigates whether the other company is infringing on any of its own patents. If it discovers that there is a likely infringement, it will use them as a base for its counterattack. This defense strategy, however, is only feasible for companies with a strong patent portfolio. In the context of industry platforms, complementors may negotiate for the right to use platform leader's huge patent portfolio in counterattack litigations to compensate their weakness. While there may be cases where a platform leader is willing to do so, there are at least two factors that make this scenario non-practical for small companies. First, even in the case of access to a big patent portfolio, it is still up to the platform members to spend a lot of money and defend themselves in a patent litigation. Second, this defensive shield is not effective against all kinds of patent asserting entities. NPEs, for instance, are very much invulnerable to counterclaims for infringement.
2.2.8. Relying on IP defence and indemnification obligations of licensors

 Providing infringement defense or indemnity clauses have long been a \textit{de facto} standard in patent licensing agreements. Defense and indemnification obligations require licensors to step in and partially or fully reimburse and recompense licensee's losses and expenses due to IP infringement.

 Although referring to indemnification obligations of licensors could be a plausible options for some complementors, it is only applicable to cases in which (1) a complementor acts under a technology license agreement; (2) IP defense and indemnification provisions have been explicitly set forth in the agreement; and (3) the disputed technology clearly falls in the scope of the licensed IP. This, however, is a very narrow and specific circumstance.

 Considering the above, independent complementors acting on industry platforms appear to be tied-handed in the face of the growing threat of patent litigation. As it is very likely to expect patent assertion threats against industry platforms to continue, and quite possibly amplify, in the future, platform leaders cannot remain indifferent to these growing threats. Their indifference discourages innovation on the part of complementors and poses a serious risk to the platform design and its underlying business model. Thus, they need to step in and provide some sort of "Patent Shelter" for the partners active on their platform. However, a number of questions have emerged that need to be addressed: (1) How might a platform leader react to the increasing number of patent litigation threats? (2) What are the encompassing factors that affect a platform leader's decision to react (or not to react)? (3) What is the broader significance of a platform leader's response in the context of platform-based business models?

 2.3. Analysis and results

 Our findings show that platform leaders' reaction could serve two different yet important functions: defensive and signalling. In what follows, we explore these two functions respectively.

 2.3.1. Patent Shelter: serving a defensive function
Platform leaders have defensively responded to this challenge at least at two different levels: (a) protecting the whole platform by discouraging potential attackers and (b) intervention in specific patent litigation attacks. In what follows, we briefly explain these two responses.

\section*{a) Umbrella protection}

Platform leaders may decide to build or reinforce a common defensive umbrella covering the whole platform against patent litigation. The most common way of doing so is to generate a bigger pile of related patents that, in turn, reduces the platform leader as well as it partners' risk of facing patent litigation. Besides the option of applying for more patents in the selected areas, platform leaders may try to acquire other's IP rights related to a broad or specific type of technology. Google's main motive in acquiring Motorola in 2011 was considered by many industry observers to be leveraging the 17,000 patents owned by Motorola to secure the future of Android (Hsu 2014). Nortel's 6000 patents ending up in the hands of a consortium headed by Apple and Microsoft also follows the same pattern (Mullin 2013).

In the above-mentioned cases, a platform leader acquires a big pile of patents which corresponds to a rather broad technological field. However, it is more common to see platform leaders acquiring small companies to get access to their collection of patents related to a specific technology that they see as potentially critical for their platform. In February 2012, for instance, Apple acquired San Francisco-based Chomp Inc. reportedly for $50 million. Chomp’s core technology was a search engine algorithm which was considered as important for platforms like App Store (Satariano and MacMillan 2012).

The third way of providing umbrella protection is for platform leaders to enter in cross-licensing deals with other players with relevant big patent arsenals. Google's recent cross-licensing deal with Samsung Electronics, for instance, is a clear move to reinforced Android's community defensive posture (Hsu 2014). Finally, the fourth possible mechanism is for the platform leaders to use the so-called patent aggregators' services. Following this path, a growing number of big technology-based companies-like Google, Ericsson, Sony, eBay, HTC, Intel, Samsung, and Microsoft- have already joined RPX, a San Francisco-based patent aggregator (Hagiu and Yoffie 2013).
b) Case-specific protection

Besides providing an overall protection shield, platform leaders may decide to get involved in specific patent litigation attacks to defend their partners. However, they have to act very selectively in providing a case-specific Patent Shelter. Therefore, it is quite reasonable to see the focal firm's reaction fine-tuned according to the type and extent of the external threat as well as to the role and relative position of the defendant inside its innovation ecosystem.

We developed a conceptual framework to classify platform leaders' reactions based on the source of technology and the targeted player(s). By technology source we mean who provided the technical solution, which is underlying the infringement claim, to the alleged infringer(s). The second variable identifies the target of the patent litigation. Six possible scenarios are considered within this framework. The following is a brief outline of each scenario.

First scenario: platform leader as the source and the target

Under the first scenario, a platform leader is the source of the technology at issue and is directly threatened or attacked. This has been, and most probably will be, a very common scenario in patent assertion. Patent attacks against a platform leader could have serious and far-reaching consequences, since it threatens the whole ecosystem's stability. Obviously, the leader has no option but to take part in litigation and defend its technology and the platform. In this scenario, the attacker may simultaneously file infringement lawsuit against a number of complementors which act on the same platform and use the same technology. While this makes the dispute more complex, it does not substantially change the situation since the leader has to take the action anyway.

SimpleAir patent lawsuit against Google is just a recent example of this very common scenario. SimpleAir claimed that Google's Android infringed its patent covering push notification over wireless networks and a Texas federal court ruled in its favor (Chirgwin 2014). Smartflash's patent infringement lawsuit against Apple and a number of gaming developers which use Apple's iTunes Store to sell their wares, is another relevant example (Patently apple 2013).

It is noteworthy that the risks involved in attacking the leaders are also far higher as it may backfire and lead to severe consequences. IA Lab is a particularly apt case in
point. In April 2010, IA Lab filed suit against Nintendo claiming that its Wii console and related products infringed two of its patents. Nintendo was successful in defending the lawsuit. The court ordered IA Labs to pay Nintendo's cost, which IA Lab simply couldn't afford. As a result, Nintendo simply obtained IA Labs' assets, including its entire patent portfolio (Brightman 2014).

Second scenario: platform leader as the user and the target

In scenario 2 a platform complementor or an external independent company assigns or licences out a given technology to the platform leader. Therefore, the focal company is just a user of the technology that is allegedly infringing on attacker's patent(s). But as the lawsuit is brought against the focal company, it has to defend itself. It may happen that a company who licensed out the technology to the platform leader files an infringement case claiming that the licensee has violated the terms and conditions of the license agreement. Besides acting quickly to defend the lawsuit, a platform leader may begin a quest to identify and acquire relevant patents which support its position in the lawsuit. These could be patents that cover some aspects of the technology in question or those helpful in launching a counter-attack.

Although platform leaders do not hesitate in defending themselves under the two first scenarios, they may or may not choose to defend their complementors, if they happen to be under attack on similar infringement grounds. Google, for instance, decided to not only protect itself, but also to defend its Android developers against Rockstar Consortium. Rockstar filed infringement suit against Google, and reached out to many Android developers to license its patents. Google, in turn, filed a counter-attack seeking to invalidate Rockstar's patents. Google went further to claim that Rockstar has unfairly targeted its partners and has "placed a cloud on Google’s Android platform" (Meyers 2013).

Third scenario: strategic or a large number of partners under attack while leader is the source

In this scenario, the technology is provided for use by the platform leader and it is adopted in the ecosystem. However, instead of the platform leader, it is either a few blockbusters or a large number of platform’s complementors that are threatened or sued for patent infringement. These kinds of attacks could be motivated by inter-
platform competition or aim at collecting as much settlement fees and/or infringement damages as possible.

If the technology in question is licensed by the platform leader and the license agreement clearly provides that the licensor will defend and/or indemnify the licensee in case of a patent infringement claim, then the platform leader, subject to the provisions of the license agreement, shall defend, partially or fully indemnify and hold the licensee harmless. Very recently, for instance, Google announced that, due to its contractual obligations, it will take over defense of some of the claims in Apple’s current patent lawsuit against Samsung. Google also promised to indemnify Samsung should it lose on those claims. Some of the disputed software features are created by Google and Samsung is distributing them under “Mobile Application Distribution Agreement” with Google (Fried 2014).

When IP defence and indemnification provisions are not explicitly set forth in the license agreement, the platform leader can choose to stay out of the conflict and not to react. However, platform leader’s inaction could dramatically undermine the entire platform. In that case, a platform leader, most probably, makes an effort to protect or save what they can.

**Fourth scenario: strategic or many partners under attack while leader is not the source**

Under the scenario 4 patent litigation threats are, again, brought against either a few blockbuster or a large number of a platform’s partners. The fact that the platform leader is not the source of the disputed technology makes this case different from that of Scenario 3. In this case, a platform leader could also be among the users of the technology but it is not the target of the litigation. Therefore, opting for non-intervention is a viable option for the leader. However, it may choose to defend its partners solely based on strategic grounds.

What has been happening with Lodsys case is a good example. Lodsys Group, an American company based in Texas, has been suing many independent developers working on Apple and Google’s ecosystems since 2011. As in July, 2011 Lodsys was suing 37 defendants, including Rovio (the company behind the blockbuster “Angry Birds” saga) and Dan Castelnuovo (the creator of “Pocket God”), accusing them of infringing its four patents on in-app purchasing feature (Issac 2011). Google and Apple which were safe as they had already had licences for the claimed patents,
decided to intervene and defend their developers, though they opted for different approaches to the problem. Apple inserted itself into the dispute on behalf of its developers, claiming that it has a licence for the related patents, and that the licence extends to the many coders using Apple’s technology to build contents as well. Google, on the other hand, requested a re-examination of Lodsys patents, aiming at amending the patents so that Lodsys would not be able to assert them against Google’s complementors (Samuels 2013).

The Google’s move to defend HTC also falls under this scenario. In September 2013, Google gave nine of its patents to HTC - a Taiwanese manufacturer of smartphone and tablet devices based on the Android. The nine patents in question gave HTC enough ammunition to hit Apple with a counter-attack. This came after Eric Schmidt, Google Chairman, promised back in July 2013 that his company would aid HTC’s patent fight against Apple. He stated: “We will make sure they don’t lose” (Srivastava 2013).

Fifth and sixth scenarios: a few non-blockbuster partners under attack

Under the last two scenarios, it is neither the platform leader nor its strategic partners who are under attack. Instead, patent infringement is or could be brought against one or a small number of non-blockbuster complementors. In the fifth scenario it is the platform leader who provided the technology at issue, while in the last scenario the focal company is not the source. Apart from the cases in which a platform leader is the licensor of the disputed technology (Scenario 5) and clear defence and/or indemnification provisions are included in the license agreement, platform leaders have so far preferred not to react. This non-reaction is quite reasonable considering the fact that patent litigation is too costly, too time-consuming, and too unpredictable. Furthermore, the number of complementors who fall into this category could be too large that, even in the case of platform leaders' willingness, they cannot guarantee such a support to all of them.

However, we believe that the future may bring changes in certain approaches to these scenarios. Historically, many markets have been dominated by a small number of blockbuster products. Over the recent years, however, the Internet has increased the share of niche products and created a longer tail in the distribution of sales. Given this trend, it is quite correct to conclude that niche products can grow to become a large share of total sales on platform markets (Brynjolfsson et al. 2011). As a result, the relative importance of non-blockbuster partners will increase, at least in the
context of the Internet platform-based business models. Thus, it is expected to see platform leaders gradually become more attentive to and aware of evolving patent infringement threats against every single complementor acting on their platforms. This by no measure means that platform leaders will in some point in the future offer full patent litigation insurance to all of their platform partners. However, it is likely for them to come up with new ways to strengthen the sense of security against patent assertion threats.

Figure 2.2 illustrates an overview of the possible scenarios of patent assertion threats against an industry platform and the platform leader's reaction in case of each described scenario.

<table>
<thead>
<tr>
<th>Source of disputed technology</th>
<th>Platform leader</th>
<th>Complementor/Others</th>
<th>Platform Leader's reaction</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who is under attack?</td>
<td>Platform leader (with or without its complementors)</td>
<td>Scenario 1</td>
<td>Always react</td>
<td>Most common in the past and present and most probably in the future</td>
</tr>
<tr>
<td></td>
<td>Blockbusters and/or a large number of complementors</td>
<td>Scenario 3</td>
<td>React Selectively</td>
<td>Emerging</td>
</tr>
<tr>
<td></td>
<td>Few non-blockbuster complementors</td>
<td>Scenario 5</td>
<td>React very selectively strategically</td>
<td>Maybe in the future</td>
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<td></td>
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<td>Scenario 2</td>
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<td>Scenario 4</td>
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<td>Scenario 6</td>
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Figure 2.2. Platform leaders' likely reactions to patent litigation threats against their platform partners

2.3.2. Patent Shelter: serving a signalling function
Platform complementors who join a platform, are betting on which platform leaders to follow (Cusumano and Gawer 2002). They continuously assess platform leaders' performance in lining up potential partners and in creating value for the entire innovation ecosystem around their platforms. Accordingly, a platform leader's decision to provide Patent Shelter goes well beyond its apparent defensive intent and serves as a distinctive feature in the context of platform-based competitions. A platform leader, by defending its complementors, signals to its current and potential platform partners that they can rely on its strong IP management muscles in the face of future IP challenges. This signaling and the sense of security that comes with it, in turn, could make a platform more appealing to developers as compared with other competing platforms. As a result, if a small app developer, who considers itself a reasonably likely target of patent litigation, sees a platform leader truly committed to support its developers' community, it may give preference to join/stay in that specific platform. This somehow resembles the so-called "rabbit" strategy of Intel by which it assists a promising platform member in a visible way to draw the attention of investors and potential partners (Cusumano and Gawer 2002).

We argue that platform markets represent a new competitive landscape wherein the nature of IP strategy is more complex than usual. The dynamics of competition in the complementors' side of the market is complicated and less known. The signaling function of providing Patent Shelter could potentially affect the evolution of platform-based business models and the role of IP management therein over time as complementors, especially smaller ones, will be more inclined to contribute to the most popular as well as the safest platforms. Patent Sheltering creates room for leaders to differentiate their platforms and might also help them secure more favorable terms from platform members.

2.4. Conclusions

Patent litigation is a complex phenomenon by nature. In this phase of the research, we looked into a specific context in which this complexity is particularly evident: technology-based multi-sided industry platforms. Some practical implications of our research are:

- Managing IP at a platform level differs from and could be much more complicated than the traditional firm-level approach. IP management at a platform level presents a largely unexplored territory for many big companies. Therefore, large technology-based companies, especially those already involved
in platform initiation and leadership, need to equip themselves with the knowledge and tools needed to effectively manage IP at a platform level.

- We outlined four ways for platform leaders to provide a robust umbrella protection for the whole platform against patent litigation threats.

- The proposed scenario framework presented here could serve as a guideline for platform leaders to fine-tune their reactions to case-specific patent litigation attacks aimed at them and their platform partners. Our framework is designed to take into consideration the type and extent of the external litigation threat as well as the role and relative position of the defendant inside the platform’s innovation ecosystem.

- Although defending platform complementors against patent litigation is considered as being too risky, time consuming and costly by many large companies, our results suggest that they may need to revisit these concerns in the context of a growing platform-based competition. They can, instead, follow the strategy of intelligent and selective patent sheltering to convey a sense of security to the whole platform ecosystem and simultaneously make their platform more appealing to independent complementors. Patent sheltering could create room for leaders to differentiate their platforms and might also help them secure more favorable terms from platform members. This selective sheltering coverage might even include future developers of niche products.

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CHAPTER 3

Innovative activities in an artificial closed innovation setting

This chapter proposes a descriptive account of basic features of innovative activities in Iran during the period 2008-2012 measured by patents registered before the Iranian Patent Office. The results of this research show a pronounced downward decline in the number of Iranian patents during the studied period. It also demonstrates an exceptionally large share of individuals as patent holders. It indicates that innovative activities are strongly concentrated around Tehran, the capital. Finally, the results refer to evidence which implies that Iran's decreased patenting activity in recent years could be mostly due to other factors rather than the country's slowing pace of technological innovation.
3.1. Introduction

Over the past several decades, we have witnessed a greatly increased interest in using patent statistics as a proxy for innovative activities at national, sectoral, technology, and firm levels (Pavitt, 1985; Archibugi and Planta, 1996). Patents are known not to be perfect indicators of innovative activities and this imperfection becomes more apparent when domestic patents of developing countries are discussed (Da Motta e Albuquerque, 2000). However, there is almost no perfect substitute measure of technological innovation. In absence of patent statistics, many arguments are reduced to pure speculation or to the use of only distantly related measures and proxies. As Griliches put it: "In this desert of data, patent statistics loom up as a mirage of wonderful plentitude and objectivity. They are available; they are by definition related to inventiveness, and they are based on what appears to be an objective and only slowly changing standard. No wonder that the idea that something interesting might be learned from such data tends to be rediscovered in each generation."(Griliches, 1998).

Despite the increasing interest in using patent statistics as an indicator of technological activity, there have been no attempts to undertake an in-depth investigation into patents registered in Iran. Accordingly, the nature and extent of patenting activities in Iran have long been something of a mystery. This is mostly due to the fact that until recently, the publicly available information on Iranian patents was very limited. The Iranian Patent Office had no open-to-public database and did not publish special gazettes for Iranian patents. The only official statistics on Iranian patents were the yearly number of filed applications and granted patents, as provided by the national Patent Office.

A few attempts to analyze the patenting activity in Iran, due to the aforementioned limitations, have been focused only on Iranians patenting abroad - mostly in the US (Noruzi and Abdekhoda, 2012; Sarkissian, 2013). However, the number of Iranian patents in the US, due to many differences between Iran and the US in terms of the economic costs and benefits of patenting, is not a good proxy of innovative activities inside Iran.

This phase of the research explores, for the first time, the patenting activity in Iran. The descriptive statistics of patent data are mainly used to quantitatively describe the most notable features of patenting activity in Iran over the 2008–2012 period. It shows that, contrary to Iran's fast scientific progress, the number of patents registered in the country experienced a sharp decline over the studied period. We also
demonstrate that an exceptionally large share of patents is owned by individual inventors.

This research addresses the question of the geographic concentration of innovative activities at provincial level within the country. The results indicate that innovative activities are strongly concentrated around Tehran, the capital. Finally, this chapter refers to evidence which implies that Iran's decreased patenting activity could be mostly due to other factors (e.g. patent system reform) rather than the country's slowing pace of technological innovation.

3.2. Stimulating scientific and technological endeavor in Iran

Over the last decade or so, Iran has responded to foreign imposed trade sanctions by increased investment in its own scientific and economic infrastructure. The expansion of higher education and increased expenditure on research and development are just two of the policy mechanisms that have fuelled the country's more active approach toward science and technology (UNESCO Science Report, 2010). The government R&D expenditure as a percentage of the Gross Domestic Product (GDP) increased from 0.49 in 2001 to 0.62 in 2009 (Soofi & Ghazinoory, 2013).

The increased investment in education resulted in almost 26 percent growth in the adult literacy rate from 1990 to 2008. Moreover, the number of researchers per million inhabitants has risen from 500 in 2000 to 850 in 2007. The results, in terms of knowledge creation, have been impressive. As reported by Thomson Reuters’ Science Citation Index (SCI) the number of Iranian articles published in the international journals rose from only 1296 in 2000 to 10894 by 2008 (UNESCO Science Report, 2010). Another report based on publication data from a 30-year period (1980 to 2009), indicates that Iran's scientific output has grown 11 times faster than the world average, faster than any other country (Archambault, 2011). Although these numbers are quantitative indicators, quality indicators too refer to a similar trend. The bimonthly newsletter of Thomson ScienceWatch.com, for instance, shows that Iran was among the countries that achieved the highest percentage increase in total citations in the period from December 2007 to February 2008 (UNESCO Science Report, 2010).
As the above numbers show, the imposed economic sanctions against Iran, with the primary aim of cutting off technology sale and transfer to the country, have initiated new efforts in the country to foster indigenous science and technology capabilities. Considering the remarkable growth rate of Iran's international scientific output, one would expect a similar pattern to be true for patented inventions of the country. This research, however, reveals a different pattern. This chapter offers summary information on the results and provides descriptive statistical analyses of the number of patents to quantitatively describe the most notable features of patenting activity in Iran over the 2008 to 2012 period.

3.3. Previous studies: not really representative

As mentioned earlier, the Iranian Patent Office had no open-to-public database and did not publish special gazettes for Iranian patents. The office has never provided official details beyond the annual numbers of filed applications and granted patents. In July 2012 the Iranian Patent Office launched a trial version of an online searchable patent database. This online database, however, still suffers from many deficiencies (Bagheri, 2014). Therefore it is not suitable for a thorough/systematic patent analysis.

Considering the difficulties in accessing the country's patent data, it has been a very difficult task for researchers to conduct any detailed study on patenting activities and
trends in Iran. In recent years, a few attempts have touched upon the patenting activities of Iranians. However, due to the aforementioned difficulties, the focus of these studies has been on Iranians patenting abroad - mostly in the US. For instance, Noruzi and Abdekhoda explored the patenting activity of Iranians by looking into the United States Patent and Trademark Office (USPTO), World Intellectual Property Organization (WIPO), and European Patent Office (EPO) patent databases (Noruzi and Abdekhoda, 2012). They limited their search to patents with at least one Iranian inventor filed in those offices over the period 1976–2011. They showed an increasing trend in the number of filed patent applications by Iranians over the time period. Moreover, they noted that the highest number of patents studied (27 %) were related to "chemistry/ metallurgy" technology area. However, since their research does not include patents registered in Iran and due to the very low number of the observations (only 212 patents), the results cannot adequately portray the patenting activity of the country.

Sarkissian investigated the patents granted to Iranians by the USPTO (Sarkissian, 2013). The search yielded 72 patents granted to Iranian inventors in the US over the period 2002-2012. The results of this study also revealed a surge in the number of Iranian patents registered in the US and that the capital city Tehran is the most cited inventor city in Iran. Again, due to the very low number of patents studied in his research, the results do not paint a representative picture of the innovative activities in Iran.

As Pavitt indicated there are many differences amongst countries when it comes to the economic costs and benefits of patenting (Pavitt, 1985). This is in part due to the differences in costs, time and standards of the patent examination and enforcement, together with the expected market size. Accordingly, exploring domestic patents of developing countries provides a much broader picture than USPTO patents (Da Motta e Albuquerque, 2000). Even if the number of Iranian patents in the US has been statistically sufficient, which is not the case, it could not be referred to as a good proxy of innovative activities inside Iran.

The data introduced in this chapter can open a new path to further study on innovative behavior of Iran as a developing country which has been under economic sanction.

3.4. Sources and data
The only reliable way to get access to the country’s patent data used to be and still is the “Iranian Official Journal,” since the Patent Office asks each applicant to publish an advertisement in the Official Journal before issuing the grant certificate. The Official Journal's advertisements, however, only reflect partial bibliographic information of granted patents. The word “partial” is used since it lacks some of the basic elements of patent bibliographic data. For example, the International Patent Classification (IPC) codes have never been assigned to the granted patents and, thus, never been appeared in the patent advertisements of the Official Journal (Bagheri, 2014).

For this research a dataset of patents granted in Iran was constructed, for the first time, by daily record of the granted patent information as it appeared on the “Iranian Official Journal” over the 2008 to 2010 period. For each granted patent, the following items were obtained and recorded: application date, grant date, names and addresses of inventors and applicants, title of inventions, and terms of protection. This dataset comprises 31997 observations.

Then, in order to have a rough picture of the different areas of technology to which the studied patents pertain, first characters of IPC codes were allocated to each patent in the dataset by our research team. The first character of IPC is the "section symbol" consisting of a letter from A ("Human Necessities") to H ("Electricity"). The data also do not cover details regarding the number of patent applications filed each year, as only successful applications appear in the Iranian Official Journal.

3.5. Results

While Iran's stance in some aspects of scientific advancement appears encouraging, our results showed that the number of registered patents in Iran declined sharply during the period between 2008 and 2012. Figure shows that the number of patents granted, broken down by residents and non-residents. The number of issued Iranian patents dropped dramatically from 7954 in 2008 to 4717 in 2012. In other words, around 40% fewer patents granted in 2012 than in 2008 (it can be noticed that the number of registered patents in 2012 slightly increased compared to the previous year).
Given the tough and increasing economic sanctions against Iran that have prohibited any kind of trade or business transactions with Iran, it is not surprising to see the very low and declining share of non-resident patents in the country. Figure 3.3 shows that the non-resident share of total granted patents in Iran decreased from its peak of 8.7% in 2010 to around 2% in 2011 and 2012, while the average share of non-resident patent applicants of 130 patent offices was between 40.1 and 35.5 percent over the same period (WIPO, 2013).
Figure 3.3. The non-resident share of total granted patents in Iran

The most active foreign patent applicants in Iran over the study period are largely European companies from Germany, Switzerland, France and Italy (Figure 3.4). It is noteworthy that these countries were among the 10 top countries with highest exporting value to Iran over the same period (TCCIM, 2014).

Figure 3.4. Countries with the most active foreign applicants in Iran, 2008-2012.

Perhaps the most distinctive feature of patenting in Iran is the extremely low share of legal entities as owners of granted patents. Only 12.5% of total patents were granted to legal entities in the 2008-2012 period, while the rest were granted to natural persons (Figure 3.5). This is in contrast with the observations in developed and emerging economies, where the trend is the opposite and most new patents are registered by the business sector. For instance, only 7 to 8 percent of all granted patents in the US were individual-owned in the same period (USPTO, 2013). Even in a developing country like China, around 50 percent of patent applications are made by legal entities (Motohashi, 2006).
Figure 3.5. The share of individuals vs. legal entities in Iranian patents, 2008-2012.

Figure 3.6 shows not only that the share of individual-owned patents is high, but also the proportion of solo-inventor patents is high. Solo-inventor patents account for more than 50 percent of all patents granted between 2008 and 2012. Having said this, we need to add that the number of inventors per patent has been slowly and steadily increasing.
The use of patent data to explore technological specialization of countries, regions and companies has predominantly relied on the use of the IPC codes. However, the IPC codes of Iranian patents have never been allocated. Although Iranian patent law requires the Patent Office to allocate IPC codes to the registered inventions and include those codes in the patent advertisements of the Official Journal, the Office has failed to do so (Bagheri, 2014).

In this study, first characters of the IPC codes were allocated to each patent in the dataset by our research team. Our results show that differences between technical subject matters of patents are quite clear. It can be seen in Figure that "Mechanical engineering, lighting and heating" (F) and "Chemistry and Metallurgy" (C), with 28 and 22 percent of all patents, respectively, are the technology domains most commonly targeted by Iranian inventors. While only 2 and 1 percent of all registered patents, respectively, fall in the "Fixed construction" (E) and "Textile and paper" (D) categories.

![Figure 3.6. Number of inventors per each Iranian patent, 2008-2012](image)

![Figure 3.7. Distribution of IPC sections for Iranian patents in Iran](image)
Figure 3.8 illustrates the distribution of non-resident patents across different IPC sections. Interestingly, non-resident applicants targeted more or less the similar technological fields as their Iranian counterparts.

Figure 3.8. Distribution of non-Iranian patents in Iran across IPC sections

Over the recent decades, a growing number of innovation economists have used patent data to carefully study the geographical dimension of innovative activities and its implications (Breschi and Malerba, 2001). They found out that innovative activities commonly have a highly unbalanced geographical distribution (Acs et al, 2002) partly due to difficulties associated with the transfer of complex and non-codified technological knowledge, which necessitates large amounts of personal interactions (Dosi, 1988). In other words, innovative actors of an innovation system tend to be geographically concentrated as this concentration could potentially facilitate knowledge transfer among them (Acs et al, 2002). Studying the distribution pattern of Iranian patents across Iranian provinces we showed that Iran is not an exception in this regard.

The provincial distribution of Iranian patenting activity shows a high degree of concentration. For instance, 39.31 percent of all patents are registered in Tehran, the capital and the top five provinces (out of 31) account for almost 60.46 percent of all Iranian patents over the study period.

Given the big population disparity among the thirty one provinces, we used the number of registered patents per 1000 inhabitants of each province to better capture and demonstrate the geographical distribution of Iranian patents. The map below
(Figure) shows how this distribution varies across the provinces. The darker the color, the higher the concentration of patenting activities in a given province.

Figure 3.9. Geographical distribution of Iranian patents at province level, 2008-2012

3.6. Discussion and conclusion

The objective of this study was to provide a first overview of patenting activity in Iran, as a proxy for the country's innovative activities. Iran has been under economic sanctions for the last 30 years. Over the past few years as the sanctions have been intensified, the country's rate of scientific growth has become one of the highest in the world. The country, therefore, represents a very interesting research area for innovation studies. Yet very little is known when it comes to the nature and extent of innovative activities in Iran.

The results of our research show that the number of Iranian patents sharply declined over the 2008-2012 period. Despite the decreasing trend, however, one should be careful in interpreting the results of this study, as this does not necessarily mean the extent and scope of innovative activities in Iran have been reduced. For instance, it is important to note that before 2008, Iranian patent system was declaration-based, and applications were registered without substantive examination. In 2008, a new patent law came into force that required the Patent Office to examine applications with
respect to their compliance with the patentability requirements (Bagheri et al, 2000). The Patent Office, in an attempt to comply with this legal requirement started to send patent applications to universities, research centers, and science and technology parks, asking them to evaluate the novelty, inventive step and industrial applicability of those applications. Although this examination structure more resembles that of traditional scientific peer review rather than the internationally accepted process of patent examination (Sarkissian, 2008), patent registration in Iran has become more difficult ever since. This could be clearly seen in

![Figure 3.10](image)

**Figure 3.10** Average examination time of successful patent applications increased dramatically between 2008 and 2012.

Moreover, as the new law came into force, the patenting cost increased significantly—especially for legal persons. The increase in the cost of patenting and the introduction of the above noted examination process appear to be important contributing factors...
that led to a significant decreasing trend in the number of patents filed and granted per year beginning from the patent system reform. It is also noteworthy that according to WIPO’s country-specific statistical profile, patenting activity in Iran had experienced a period of strong growth before the patent system reform.

In Iran, the share of patents granted to individuals is quite high (around 78%) and individuals are by far the dominant innovative players of the country. Therefore, it is reasonable to say that, the inventive activities in Iran are to a great extent individual-based, as opposed to enterprise-based like those in the context of developed countries. This is also a clear indicator that Iranian companies and universities are less conscious of the patent system. Considering the lower chance of realizing the commercial value of individual-owned patents, one could reasonably expect the majority of technologies described in the Iranian patents to have never been reduced to practice.

The results of this research also showed that innovative activities are strongly concentrated in Tehran, the capital, and a couple of other big cities. This was not surprising given the huge provincial development disparities in Iran with historical rooting of many universities and research centers, manufacturing activities, modern services, financial institutions, headquarters of big national companies and good infrastructure in a few numbers of provinces. For instance, only Tehran and Isfahan provinces are responsible for 19.03% and 7.28%, respectively, of the total number of university students in Iran (IRPHE, 2013).

The results further indicate that the distribution of Iranian patents among technological classes is also concentrated. The country's inventors are highly specialized in "Mechanical engineering, lighting and heating" (F) and "Chemistry and Metallurgy" (C) technologies as the most number of patents have been granted in these categories.

As there had been no prior research on patents registered in Iran, our study is the first step towards a better understanding of innovative activities in Iran based on the number of patents granted in the country over the 2008–2012 period. Although this initial description helps to characterize some of the basic features of innovative activities in Iran, due to the rather short time span of the data, the results should be taken with caution. Future research on the data over a longer period of time may very well serve to reduce or alleviate some of the limitations of our study.
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CHAPTER 4
Commercialization of patented technologies in Iran

Commercialization of technologies has attracted increasing attention over the past years due to its role in improving national competitiveness. Iran has not been an exception as the country's policy-makers have been actively engaged in crafting national policies in order to facilitate and promote commercialization of technologies. The effectiveness of the existing policies in this field, however, has never been properly researched. This research, based on the careful study of 10 cases of successfully commercialized patented technologies in Iran, aims for the first time to address this gap. The results indicate that the commercialization process of the studied patented technologies was very much affected by some company/technology-specific characteristics. We show that the two policy measures with the highest
perceived effectiveness were the financial supports and the services offered by incubation centers. The results also show that some of the existing supportive policy measures did not serve the intended purposes and some other measures need to be fine-tuned, as far as the studied cases are concerned.

4.1. Introduction

The significant role of patented inventions in economic development of advanced countries has caused national policy makers correspondingly endeavor to plan and implement appropriate policies in order to increase the likelihood of patented technology commercialization. In absence of such policies, it is reasonable to expect innovation-boosting initiatives at national level to yield less than expected outcomes.

On the other hand, having a thorough understanding of the patented technology commercialization process in the related context could significantly improve the policy-making process. Moreover, constant monitoring of the implemented policies enables policy-makers to adjust/adapt the policies in a timely manner.

Looking at the Iranian context, one could easily observe a set of policies aimed at facilitating technology commercialization process, the outcome of which, however, has never been researched before. This research aimed at addressing this gap with two major objectives: (1) Careful documentation and analysis of a set of selected patented technology commercialization cases in Iranian context; and (2) Investigating the effectiveness of the related national policies retrospectively. Accordingly, our research question is: Which governmental policies have been effective in promoting patented technology commercialization in Iran? Trying to answer this question, we followed the multi-case study methodology and conducted exploratory analyses of ten successful commercialized cases.
The results of this research indicate that commercialization process follows a different pattern in each case and case-specific characteristics have a significant impact on the process. The financial supports and the services offered by incubation centers turn out to be the two policies with the greatest number of perceived effectiveness. Moreover, the research shows that some current supportive policies in the field of technology commercialization lack the expected effectiveness, as far as the studied cases are concerned. Invention and innovation exhibitions as well as the government-supported media coverage fall in this category. It also shows the effective role of two governmental policies, which were not originally intended to boost technology commercialization. We conclude that in order to craft new policies or fine tune the current ones, Iranian government should avoid one-size-fits-all approach and carefully consider company/technology-specific characteristics in the field of commercialization.

4.2. Commercialization of patented technologies

Technology commercialization, as a complex and multi-faceted phenomenon, has been subject of many research studies over the recent years. In the past, commercialization was considered as the last stage of new product development (e.g. Kotler, 1994) or transfer of technology from a research organization to a firm (e.g. Chiesa & Piccaluga, 1998). Over the years, it became clear that commercialization resembles a process of turning technology into commercially successful products rather than a happening that unfolds at a certain point in time.

Although some may consider commercialization as a linear process, in reality commercialization follows a series of overlapping phases that integrates different business activities (Biemans, 1992; Jolly, 1997; Nevens et al., 1990). Some scholars went further to consider technology commercialization as a phenomenon taking place within a network of different actors within an innovation ecosystem. From this perspective, companies can rarely succeed alone in technology commercialization and they need to work hand in hand with other organizations and stakeholders (Aarikka-Stenroos et al., 2014; Chesbrough, 2003; Gawer et al., 2002)

Prior research, however, have mostly taken technology in its broadest meaning. Due to the same generalization in prior research, their outcomes fall short in guiding specific policies aimed at promoting commercialization of patented technologies.
Patents have a much narrower definition zone than that of technology. While a high rate of patents never reach the markets due to organizational or strategic reasons (Pasquini et al., 2012), increasing the commercialization chance of patented technologies have long been a major policy concern.

There have been few exceptions in research where patented technologies and commercialization thereof have been the main research focus. PatVal-EU project is an opt case in point, which concentrated on technologies that have been patented in European Patent Office. The primary goal of this European Commission-funded project was to derive implications for increasing the number of inventions that yield economic returns (Gambardella et al., 2007; Guiri et al. 2007; Gambardella, 2013). Svensson’s research (2007) is also among exceptional cases where patented technology commercialization and effectiveness of related policies are investigated in Swedish context. Grimm and Jaenicke (2012) focused on the commercialization of patented technology generated by university researchers. Their objective was to help understand the proper institutional environment for patenting and exploitation of patents in Germany.

The aforementioned studies, however, mostly relied on quantitative analyses of big survey data that only shows part of the picture. Although big data is of great value for answering “how many”, “how often”, or providing factual data on patented technology commercialization, qualitative research is needed for understanding why the phenomenon is happening and what affects the process.

Although the aforementioned researches conducted in other countries are useful, technology in general, and technology commercialization in particular, are highly context dependent and research within Iran is essential to better inform policy making.

Over the last two decades, Iran has responded to foreign imposed trade sanctions by increasing its investment in scientific and economic infrastructure. This, inter alia, led to the significant expansion of higher education, increased expenditure on research and development, significant growth in the adult literacy rate, and increased number of researchers per million inhabitants (Sarkissian, 2008; Soofi & Ghazinoory, 2013). As reported by Thomson Reuters’ Science Citation Index (SCI), the number of Iranian scientific papers published in the international journals rose from only 1296 in 2000 to 10894 by 2008 (UNESCO, 2010). Thus, the imposed sanctions against Iran, a primary aim of which was to cut off technology transfer to the country, have caused Iranians to initiate new efforts to foster indigenous science and technology
capabilities. The country’s government has launched major initiatives and implemented several policies to foster domestic technology development and commercialization. The effectiveness of the implemented policies aimed at boosting commercialization of indigenously developed technologies, however, has never been evaluated. This research aims at addressing this gap by evaluating those government policies which, directly or indirectly, affected patented technology commercialization in Iran.

4.3. Research methodology

As explained before, the following exploratory research question is derived from the research gap and issues identified in the literature review:

RQ. Which governmental policies have been effective in promoting commercialization of patented technologies in Iran?

4.3.1. Research design

Trying to answer the above question, exploratory multi-case study approach was chosen. This approach was selected considering the need to gather in-depth, rich data on the phenomenon (Yin, 2003). As Eisenhardt (1989) indicated, the qualitative approach is useful for understanding the rationale or theory underlying relationships. Exploratory research is also appropriate here since effectiveness of policies aimed at patented technology commercialization is a poorly researched subject and little is known about it in the academic literature.

The multi-case study approach allows us to compare the similarities and differences of the commercialization process as affected by supportive policies in different contexts (Silverman, 2013). Our research relies on theoretical sampling. In other words, the selected cases are chosen for theoretical, not statistical, reasons. As Pettigrew (1988) suggested, considering the limited number of cases which can usually be studied, it makes sense to choose cases such as extreme situations and polar types. Accordingly, we chose our cases in a way to cover as diverse sectors/technological fields as possible. Sector/technology diversification enabled the research to consider differences in a number of commercialization contexts.
Our research was carried out in 2014 in Iran. We compared and contrasted findings based on ten in-depth case studies. As Eisenhardt (1989) stressed, there is no ideal number of cases in a multi-case study. However, a number between 4 and 10 cases usually works well. In practice, the number of cases is determined based on pragmatic considerations such as time and money, since with more than ten cases, the complexity and volume of the data increase significantly.

As mentioned earlier, this research was focused on patented technologies. This approach enabled us to better identify and track the technology in question throughout the commercialization process. On the other hand, due to the legal nature of patents, there is much more clarity as to the persons and companies who were involved in developing and protecting a particular technology. More specifically, we looked for commercialized technologies registered before Iranian patent office over the period 2003-2013. Two other criteria were used in filtering the initial list of candidate technologies: (1) commercialization carried out through a legal person; and (2) scientific base and successful commercialization of the technology were certified by a related authority (like a science and technology park or an incubation center).

4.3.2. Data collection

The main data collection method used in this research team was semi-structured interviews using an open-ended interview protocol. The semi-structured interviews allowed the interviewees to express their comments freely; therefore, in-depth data and insights were collected. In designing the interview questions, we focused on a selected set of dimensions extracted from the literature. However, as it is common in case study research, new dimensions started to reveal in the course of interviews. For instance, the effects of taking a research sabbatical overseas on the commercialization process was not in our “start list” and were added later on.

The interviews were conducted individually on a face-to-face basis using a voice-recorder. To increase the richness of the data as well as the confidence in the findings, the interviews were done by three different investigators.

In the interviews, we asked the inventors/entrepreneurs to describe the history of their patented technology and its commercialization. In particular, we asked them to name those supportive government policies which they felt to be helpful for them and explain how and at what point in time they enjoyed those supports. Then we asked
them to evaluate the effectiveness of those supportive measures from their own point of view.

Before interviews, we asked each inventor/entrepreneur to fill a form with specific quantitative questions regarding their technology and company (e.g. the number of employees, patent filing date, revenue generated by selling related products or licensing). In accordance with our agreement with some of the interviewees, we cannot disclose all the names of the studied technologies and their owners.

Interview data were transcribed and combined with questionnaire and archival data, including published and unpublished reports and media coverage, to reconstruct the commercialization story of each case. The data triangulation made possible by multiple data collection methods provided stronger substantiation of constructs and enhanced the validity of our analysis.

4.3.3. Data analysis

The analysis started by deep-diving in each case as a stand-alone entity. The aim was to identify the unique patterns of each case before investigating the similar patterns across cases. An extended case report was, then, written for each case. Descriptive codes were used to identify, label and cluster data related to each construct. This data reduction approach led to the identification of core data categories.

To better display the effects of different policies and interplay of various factors in each case, the chronological flow of events and their connections throughout the commercialization process were graphically displayed. Based on the collected data on each case, the milestones and major drivers and obstacles in force at each phase were highlighted. Then, the policies that positively affected the process at each stage were added.

Figure 5.1 is a one of these chronological illustrations, which displays the chronological flow of the commercialization process of a catalyst for steam reforming of hydrocarbons. This patented technology belongs to Sarv Oil & Gas Industry Development Company. Each chronological display accompanies a brief descriptive narrative. One can easily note in Figure 4.1 that the process initiated by a research project funded by an Iranian governmental organization. A group of young and fresh post graduates led by an experienced engineer were in charge of the whole process. Although the team had a successful prior experience in technology
commercialization, its average level of business and IP-related knowledge and skills was not sufficient. They founded the company and filed the related patent after building a working prototype of the technology. The international economic sanctions against Iran helped the team to more easily market their technology-based product in the Iranian oil and gas market. Their stories of substituting a sanctioned imported product with a domestically developed one have enjoyed good media coverage. In this case, the whole process, from idea to market, took them around seven years.

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting the Research Project</td>
<td>2000</td>
</tr>
<tr>
<td>Founding the Firm</td>
<td>2004</td>
</tr>
<tr>
<td>Pilot Production</td>
<td>2004</td>
</tr>
<tr>
<td>Patent Filing</td>
<td>2006</td>
</tr>
<tr>
<td>Market Entry</td>
<td>2007</td>
</tr>
</tbody>
</table>

![Sample chronological trail of a Commercialization process](image)

**Figure 4.1.** Sample chronological trail of a Commercialization process

After graphically displaying the chronological flow of the commercialization process, we made an explanatory effects matrix for each case to highlight a summary of the case. This matrix allows threads of causality to emerge. As a result, two matrixes were built: (1) Company profile; and (2) Policy profile.

The company profile section, portraits some the most relevant features of the company in question. For instance, in analyzing each case, it is important to consider and assess their level of success in commercialization. Issues of company size and experience may also affect the commercialization process and effectiveness of the related policy measures.
The policy profile section, instead, focuses on the supportive policies and their effectiveness, based on interviewees’ perception of these measures.

In order to do the cross-case comparison, each of the aforementioned case-level matrixes were mixed to construct two meta-matrixes: Company profile (Table 5.1) and Policy profile (Table 4.2). By doing so, a combination of case-oriented and variable oriented approaches were followed. This cross-case analysis not only enabled the researchers to develop more powerful explanations, also enhanced the generalizability of the results, although generalization is not a proper goal of a case study research.
### Table 4.1. Company profile matrix

<table>
<thead>
<tr>
<th>Related Sector</th>
<th>Size (No. of employees)</th>
<th>Operating period (years)</th>
<th>Prior experience in commercialization (Failure/Success)</th>
<th>Size of the domestic market</th>
<th>Size of the export market</th>
<th>Research Continuity</th>
<th>University/Research Center Collaborations</th>
<th>Business skills of inventor/Entrepreneur</th>
<th>Collaboration with other companies</th>
<th>Collaboration with other inventors</th>
<th>Commercialization Channel (Product/Licensing)</th>
<th>Size of the domestic market</th>
<th>Size of the export market</th>
<th>Research Continuity</th>
<th>University/Research Center Collaborations</th>
<th>Business skills of inventor/Entrepreneur</th>
<th>Collaboration with other companies</th>
<th>Collaboration with other inventors</th>
<th>Commercialization Channel (Product/Licensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Food and Beverage</td>
<td>200</td>
<td>46</td>
<td>Yes</td>
<td>Average</td>
<td>Big</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Good</td>
<td>Low</td>
<td>Non-related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing/Product</td>
</tr>
<tr>
<td>2 Electronic/Medical Device</td>
<td>180</td>
<td>15</td>
<td>Yes</td>
<td>Big</td>
<td>Big</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Good</td>
<td>Average</td>
<td>Related</td>
<td>Related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing/Related</td>
</tr>
<tr>
<td>3 Advanced Polymer Material</td>
<td>60</td>
<td>6</td>
<td>Yes</td>
<td>Average</td>
<td>Small</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Low</td>
<td>Low</td>
<td>Good</td>
<td>Low</td>
<td>Related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing/Related</td>
<td></td>
</tr>
<tr>
<td>4 Oil and Gas</td>
<td>50</td>
<td>13</td>
<td>Yes</td>
<td>Big</td>
<td>-</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Good</td>
<td>Low</td>
<td>Related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing/Related</td>
<td></td>
</tr>
<tr>
<td>5 Software/Artificial Intelligence</td>
<td>44</td>
<td>10</td>
<td>No</td>
<td>Average</td>
<td>-</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td>Low</td>
<td>Good</td>
<td>Low</td>
<td>Related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing/Related</td>
<td></td>
</tr>
<tr>
<td>6 Nanotech, Agriculture</td>
<td>40</td>
<td>4</td>
<td>Yes</td>
<td>Average</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Good</td>
<td>No</td>
<td>Averagel</td>
<td>Non-related</td>
<td>Licensing/</td>
<td>Related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing</td>
</tr>
<tr>
<td>7 Oil and Gas/Medical</td>
<td>12</td>
<td>3</td>
<td>No</td>
<td>Smal</td>
<td>-</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td>Low</td>
<td>Related</td>
<td>Related</td>
<td>Product</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing</td>
<td>Related</td>
</tr>
<tr>
<td>8 Electronic and Micro-electronic</td>
<td>10</td>
<td>2</td>
<td>No</td>
<td>Smal</td>
<td>-</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td>Low</td>
<td>Related</td>
<td>Product</td>
<td>Related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing</td>
<td>Related</td>
</tr>
<tr>
<td>9 Medical and Pharmaceutical</td>
<td>3</td>
<td>3</td>
<td>No</td>
<td>Smal</td>
<td>-</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Low</td>
<td>No</td>
<td>Low</td>
<td>Related</td>
<td>Related</td>
<td>Product</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing</td>
</tr>
<tr>
<td>10 Civil/Construction</td>
<td>3</td>
<td>4</td>
<td>No</td>
<td>Smal</td>
<td>-</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Low</td>
<td>No</td>
<td>Low</td>
<td>Related</td>
<td>Product</td>
<td>Related</td>
<td>Product</td>
<td>Good</td>
<td>Yes</td>
<td>Related</td>
<td>Licensing</td>
</tr>
</tbody>
</table>
### Table 4.2. Policy profile matrix

<table>
<thead>
<tr>
<th></th>
<th>Financing</th>
<th>Media Coverage</th>
<th>International Patenting</th>
<th>Invention exhibitions</th>
<th>Network initiation and orchestration</th>
<th>Access to University Research Facilities</th>
<th>Incubation Services</th>
<th>Research sabbatical overseas</th>
<th>Amrith (Doing research instead of military service)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>++</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>++</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>++</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>++</td>
<td>+</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>++</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>++</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>++</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
4.4. Results of Cross-Case Analysis

Looking at the chronological sequence of commercialization process and the factors affecting it across all ten cases one could easily see that, despite some similarities between cases, the process of technology commercialization in each case is markedly different. This indicates that the success of commercialization efforts is influenced by a complex interaction of case-specific factors.

Although all the studied cases were successful in commercialization of their patented technologies, their performance in the market differ considerably. As it could be seen in Table 4.1, the larger the size and the operation period of a company, the better its market performance. Some bigger companies even managed to sell the products based on their patented technology abroad. This confirms previous findings in the literature (e.g. Gambardella et al., 2007) that firm size is an important determinant of the commercialization chance of patented technologies.

One of our major findings in the current research is the very low level of business training and education of Iranian inventor-entrepreneurs. The interviewed inventors/entrepreneurs were all graduates of science and engineering schools in which no business courses has been offered to students. Therefore, many Iranian science and engineering graduates lack the basic skills and knowledge necessary to introduce a patented technology into the market. As one interviewee simply put it: “I wish I had the chance to learn the basics of marketing and business management back in high-school or university. Now I’ve learnt some good things through the daily running of my own business, but I’ve paid a high price for it.”

The low level of business training and education of Iranian science and engineering graduates could be a reason behind the better commercialization record of the larger and more experienced companies. In other words, learning by doing seems to be the main source of business training for many Iranian technopreneurs.

Furthermore, the case studies also show that many Iranian companies consider producing and selling of products as the only commercialization channel of their patented technologies. Only in one case, the company decided to license out its technology. Although receiving licensing fee generated a good amount of revenue for this company, it altered its commercialization strategy as soon as it came up with enough capital to set up its own manufacturing facility. This could be explained by what Teece (1986) referred to as “weak appropriability regime”.

88
A regime of appropriability points to factors that affect an innovator’s ability to capture the value generated by its innovation. One of the main dimensions of such a regime is the efficacy of legal mechanisms of protection. In countries where the legal shield of patents is weak, the small innovative firms cannot rely on contractual arrangements in acquiring the complementary assets needed for commercialization of their technology. Therefore, they usually incur the high costs of building those assets within their boundaries and follow the integration strategy: manufacturing and selling the products based on their patented technology. In such a context, innovators often lose out to asset holder competitors (Teece, 1986).

The results of this research indicated that considering the perceived weak enforceability of patent rights in Iran, a great deal of innovative companies commercialized their patented technology through manufacturing and selling the products based on that technology. This may explain why only one of the studied cases had decided to license out its technology while many of them do not have the essential complementary assets needed.

It is evident from the case study data that the interviewed inventors/entrepreneurs had a relatively poor knowledge of intellectual property (IP). As Table 4.1 shows, there is not much variation among the studied cases in this respect. Although technopreneurs need to rely on professionals for help with their IP issues, they should have strategic thinking as regard to acquiring and enforcing IP rights. For instance, except in one case, all of the inventors/entrepreneurs considered the Iranian patent rights as unenforceable. Interestingly, their perception of ineffectiveness of the country’s patent system was entirely based on stories they had heard. However, in our exceptional case the company filed an infringement suit in court and managed to successfully enforce its patent. This indicates that the enforceability of patent rights in Iran is most probably not as weak as many inventors/entrepreneurs believe.

The above discussion clearly indicates that commercialization of patented technologies has followed a different pattern and affected by different set of factors in each case. Therefore, one could reasonably expect the supported policies to create varied effects from case to case. If so, this could also be an indicator that in designing policy measures, company/technology-specific characteristics should be given particular emphasis.

Table 4.2 summarizes our findings on the effectiveness of government’s policies aimed at boosting commercialization of patented technologies in Iran, as perceived by the interviewees. As mentioned earlier, if a certain policy was not mentioned by
an interviewee or not perceived as supportive, the related cell is left white and
marked with a dash for that case in the matrix. Based on interviewees’ perception of
these measures, we marked each supportive policy for each case as ineffective
(yellow), moderately effective (green) and very effective (dark green).

As expected, financing the commercialization process has been a major challenge for
all the studies cases. Therefore, most of the cases made use of the financial
supporting measures provided by the government. In six and two of the cases, the
government’s financial support was perceived as very effective and moderately
effective respectively. In other words, it seems that securing enough financial support
has been instrumental in their success.

Despite the utmost importance of financial supports in this context, a number of the
participants in this multi-case study expressed frustration with the lengthy and
bureaucratic process involved. The studied firms had to go through very lengthy and
complex qualification processes that in most cases took them several years.

From observations made by interviewees, it is evident that the related governmental
financial support measures are extremely risk-averse in nature and the personal
character of the managers in charge of implementing those measures compensates
that systematic risk-aversion. In other words, if the related manager believes in the
commercial potential of the technology in question and is personally ready to take the
risk of financing that technology, going through the whole process would be much
easier. However, in the opposite case or when that supportive manager leaves its
position, the whole process may be stopped or even brought to an end.

The results show that, at least in these cases, “government procurement guarantee”
was by far the most effective financial support mechanism in fostering
commercialization of patented technologies in Iran. Moreover, none of our cases had
used conventional bank loans throughout the commercialization process as they
consider them too risky.

Over the recent years, the policy of promoting the culture of science, technology and
innovation through mass media has been actively pursued by the Iranian government.
The state TV and other governmental media often widely cover success stories of the
Iranian inventors and technology based companies. There is no wonder, thus, to see
nine out of ten of the cases enjoyed intensive media coverage. It was evident from
our interviewees’ statements that this media coverage, despite being free of charge
and interesting, was not perceived as beneficial or effective as far as their
commercialization process was concerned. One reason could be the fact that the
primary goal of this free coverage has been to provide content for mass media in line with their public awareness-building campaign while overlooking the specific needs of the companies and their commercialization efforts.

The next policy was government support for patenting the Iranian inventions abroad. The goal has been to help those inventors who pursue commercialization of their technologies in other countries by providing them with subsidized services of professional patent attorneys. Our results, however, show that in most cases the inventors/entrepreneurs were not even aware of such a supportive mechanism. The only two cases who actually made use of this support, did not find it much helpful for their commercialization efforts. It seems that, at least in our cases, the selected firms lacked the skills and assets needed for commercializing their technologies abroad while the companies that already commercialized their technology in other countries could have been better candidates for receiving such supports.

Each year, many innovation and invention exhibitions and festivals are arranged in Iran. These exhibitions or festivals, which vary in size and are held in varying parts of the country, mainly aim at introducing high-tech inventions of Iran and promoting national pride and self-confidence. Although most of the cases studied had participated at least once in those exhibitions or festivals, they found them not to be beneficial for their commercialization process. The interviewees believed that the current design of innovation and invention exhibitions in Iran does not give them the opportunity to meet those who could be potentially interested in their technologies. For instance, these exhibitions are general-purpose and not sector-specific, while the chance of their technology getting spotted is much higher in sector-specific exhibitions. However, the interviewed inventors/entrepreneurs asserted that there is no supportive measure from the government to help them take part in industry-specific fairs and exhibitions.

As mentioned earlier, companies can rarely succeed alone in technology commercialization. Government supports, then, in initiating and orchestrating innovation networks has been regarded as a key measure to enhance commercialization. Our research findings, that networking supports could be effective in Iranian context as well. However, Iranian innovative companies, at least in these particular cases, had rarely received such a support.

Although the involvement of the studied firms in research collaboration with universities was very limited (see Table 5.1), almost all the cases had to refer to universities to get different kinds of certificates or lab services. Innovative firms
often need access to dedicated and typically expensive lab space and associated equipment. Purchasing such equipment can be out of reach of many small or medium-sized firms, especially if that equipment won’t be used often. To overcome this challenge, governments can provide these firms with subsidized and flexible access to university laboratory space. This allows a company to pay much less for what it needs, as it uses it. This turned out to be an effective commercialization boosting policy in our cases. Despite their promising outcome, these kinds of commercialization support were only reported in three cases (see Table 5.2).

The case study evidence also revealed that services provided by governmental incubation centers were particularly important in commercialization of their patented technologies. Most of interviewees stated that, at the beginning, they entered an incubation center primarily to make use of the low-rent office space. Later on, however, they came to know that the hands-on business training and skill development programs offered there were of vital importance in success of their technology commercialization efforts. From observations made in this research, it is evident that the policy of development and expansion of business incubation centers, rigorously followed by Iranian government over the last two decades, has been a very effective measure in promoting technology commercialization in the country.

One of the unexpected findings of this research is that, the commercialization process in some of the cases were initiated or greatly influenced by those scholars who took research sabbatical overseas and came back with innovative ideas and determination to reduce those ideas to practice.

The positive effect of "Amrieh\textsuperscript{1}" on commercialization of patented technologies, at least in these particular cases, was another unanticipated outcome of our research. This so-called Amrieh gives Iran's elite national talents the chance not to be distracted and to keep their focus on their technology development and commercialization process.

4.5. Conclusion

\footnote{Military service is compulsory for all Iranian men over 18. There are, however, some exemptions. University graduates with exceptionally high intellectual capacity and academic aptitude have been given the option to involve in research projects instead of the compulsory military service obligations.}
This research looked at governmental policies aimed at supporting commercialization of patented technologies in Iran. By following multi-case study methodology, we tried to see which governmental policies have been perceived as effective in promoting patented technology commercialization in Iran. While we do not generalize our case study findings, we believe that our observations offer deep understanding of the phenomena in its natural contextual setting.

From the results of the cross-case analysis of the ten case studies, it was concluded that the extent of the perceived effectiveness of the policies varied from case to case. Moreover, due to the unique circumstances of each case, a golden list of generalized supportive policy measures cannot be identified as always causing technology commercialization success or, always preventing failure. Our case study findings placed significant emphasis on the need to consider the inevitable differences between cases and company/technology-specific characteristics of each case.

The results showed that some of the implemented policies have been indeed of vital importance in successful commercialization of patented technologies, as far as the studied cases are concerned. The two policies with the highest perceived effectiveness were the financial supports and the services offered by incubation centers.

The results also revealed, for the first time, that some of the existing supportive policy measures have not served their intended purpose in positively affecting the commercialization process of patented technologies in Iran. This research showed that- against general expectation- frequently held invention and innovation exhibitions as well as the government-supported media coverage have not been beneficial for the commercialization process of the studies cases.

The interview data across all ten cases revealed that there are a number of supportive measures that need to be fine-tuned for greater effectiveness. This research also showed the effective role of two governmental policies, which were not originally intended to boost technology commercialization.

While this in-depth case study research has provided important indications on how to develop new policy measures in order to effectively promote the commercialization of patented technologies, their applicability beyond this small group of cases needs to be examined. These findings should be further tested through additional cases or qualitative research in this setting. Moreover, future research should also take into consideration unsuccessful cases of technology commercialization in order to give a better and more profound understanding of the phenomenon in Iranian context.


References


