

FACTORS AFFECTING PATENT AND UTILITY MODEL ACQUISITION TENDENCY

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—Abstract —

In this paper we present an empirical analysis based on motivations of firms to acquire IP protection and on their perceptions of factors hampering their participation in granting processes and aim to find which factors might increase the patent and utility model acquisition tendencies of technopark firms. Our results from multivariate analysis confirm that acquisition tendency is positively affected by perception about patent/utility model benefits and contributions to firms and submitted incentives/supports. In other words, before acquiring patent/UM, firms are required to have positive perception that this tool will be beneficial for them and improve their performance. Besides, there is a positive relationship between the knowledge level of firms and perception of benefits of patent/utility model. But the costs and difficulties negatively affect that perception. So, the most important barrier for the acquisition tendency is seen as the costs and the difficulties of procedures.

Key Words: *IP, Patent/Utility Model, Acquisition Tendency, Technopark, Developing Country.*

JEL Classification: O3

1. INTRODUCTION

Knowledge is a prerequisite for innovation processes and an important value especially for technology focused firms. Therefore, in recent years these firms began to give high importance to intangible assets for ensuring sustainable growth and enhancing competitive advantage (Chang, 2005; Namvar et al., 2010). Firms are trying to protect their ideas and innovations derived from new technologies, by the intellectual property rights (IPRs). This protection has become a priority in the competitive strategy of powerful industries and countries (Sarkissian, 2008), in order to gain more value from knowledge (Namvar et al., 2010).

The IPRs, which can be regarded as the more tangible part of a firm's knowledge source, include a variety of different rights such as patents, utility models (UMs), trademarks, industrial designs, trade secrets, geographical indications, copyrights etc. IPRs are important on both micro and macro-level, and are subject to analysis on regional, industrial or firm level (Palmqvist et al., 2012). From innovation policy perspective, patents aim to foster innovation in private sector by allowing inventors getting profit from their inventions (OECD, 2004). It was argued in many studies that the technical information contained in patents is the source of R&D activities and innovative ideas, and also the protection provided by patent contributes to the dissemination of information and nurturing of an innovation culture (Crosby, 2000; Shukla, 2005).

UMs are similar to a patent and sometimes referred to as "petty patents" or "innovation patents". They are considered particularly suited for SMEs that make "minor" improvements to, and adaptations of, existing products (The World Intellectual Property Organization (WIPO), 2015). Since not only patents but also UMs are both the input and output of innovation process. Previous empirical work on the relationship between IPRs and economic growth of national level has almost exclusively used a measure of patent and UM protection (Lederman and Saenz; 2005; Kim et al., 2012). Since UMs are IPRs means that are used as much as patents in developing countries, UMs should be handled together with patents.

In a related line of studies it was found that IP protection have a significant influence on economic growth and technological development of a country (Sen, 2003; Shukla, 2005; Lehman and Garduno, 2004) and countries which have an

effective protection of IP are better in innovation (Kanwar and Evenson, 2003). Some researchers suggested that a country's IP protection depends on its level of development (i.e. technological ability) and R&D expenditure. Developed countries have much more patent and R&D activities than developing countries (Lederman and Saenz, 2005; Chen and Puttitanun, 2005). The most important reason behind this aspect is that technological innovations under patent protection simultaneously foster the level of competition and catalyze the innovative enterprise furnished from the information of the patent documents. Other empirical studies, however, couldn't find a direct effect of IP protection on growth but the effect is likely to be indirect (Park and Ginarte, 1997).

The protection of IP in developing countries has also come to the fore in recent years and has been studied by several researchers (Namvar et al., 2012; Shukla, 2005; Sarkissian, 2008). These studies generally stated that developing countries fail to generate innovations due to limited resources in terms of R&D funds and human capital and have not yet gained available industrialization tradition like developed countries.

According to 2014 figures, patent applications to offices of high-income economies are at 58.4 percent that is the largest proportions of patent filing activity (WIPO, 2015). However, offices of upper-middle-income economies received the majority of UM (92.7%) applications. Lower-middle-income economies accounted for 2.7% for patent filing activity. This data suggests that patent applications in developing countries are far behind the developed ones. Some of the reasons for under-utilization of IP protection in developing countries can be attributed to the lack of R&D culture, unrealized university-industry cooperation, partial awareness of the role, importance and the economic value of IPRs, high cost of getting a patent/UM according to the level of income and insufficiency of funding and incentives (Dericioglu, 2010; Shukla, 2005).

While most studies analyzed IP protection in the U.S. and as well as in Europe, very few analyzed the attitudes and behaviors of firms about protection of IP at developing countries. In this study we present an empirical analysis based on the motivations of firms to acquire patents/UMs and perceptions of factors hampering their participation in granting processes. To date, there have been scarce formal and comprehensive empirical analyses of patents/UMs from these perspectives. First we proposed that decisions on acquisition of patents/UMs are driven by the perceived value and provided incentives. We aimed to extract relations between these factors. Second, we proposed to analyze the effects of dimensions (first, knowledge level about legal and technical aspects of patents/UMs and their

processes, second, perceptions about existing barriers to IP use) on the firms' perceptions about benefits/contributions of implementing patents/UMs.

The remainder of this article is organized as follows. Section 2 provides the background literature on the concept, benefits, importance, cost and difficulties of gaining patents/UMs, motives to file IP protection, incentives/supports for applications and differences between developing and developed countries. This section also presents the theory development, conceptual model and hypothesis. Section 3 outlines research methodology, scope, data, scale development, research design and the results of the research. Section 4 provides results from descriptive statistics and regression analysis. Section 5 concludes the article with a discussion of the results, recommendations for successfully increase IP protection activities within technopark firms, limitations and an agenda for further research.

2. PATENTS AND UMs

2.1. Importance of patents/UMs and knowledge about protection

A patent is a set of exclusive rights granted by law to applicants for inventions that are new, non-obvious, and commercially applicable. It is valid for a limited period of time (generally 20 years), during which patent holders can commercially exploit their inventions on an exclusive basis (WIPO, 2015). Patent documents show that creative inventor has the right to use his/her ideas in a certain period of time, disclosure, marketing, and authorize others to use the document by law (Griliches, 1998; Sen, 2003), but only in the country or territory which grants the patent (Shukla, 2005). Patents cover products and processes, undergo substantive examination, and are costly to obtain (Kim et al., 2012).

UM protection is given for minor innovations which comprise improvements to, and adaptations of, existing products like devices and tools. UMs are issued for a shorter duration (7 to 10 years) (WIPO, 2015). UMs protect those of relatively low inventiveness and technologies that are 'new-to-the-country'. For these reasons, UMs can be taken in a shorter time and cheaper to obtain. Not all countries provide UMs protection, such as the U.S. and U.K. The few developed countries that protect UMs include Germany, Japan, and some European countries (Kim et al., 2012). Developing countries such as China, Belarus, Malaysia, Thailand, and Turkey prefer UMs more frequently than patents.

UM can be a learning device and thus a stepping stone for developing more patentable inventions later on (Kim et al., 2012). Easily obtained UMs facilitate incremental innovation by SMEs/research organizations and the absorption and diffusion of technology. Maskus and McDaniel (1999) studied the use of UMs in Japan and found that this type of protection had positive impacts on the growth of Japan. This situation leads to an increasing need for IPR research which includes not only the patents but also UMs.

Owen-Smith and Powell (2001) emphasized two key benefits of IP, protection and leverage. In addition to being a legal document that protects the output and production methods, IP protection is a kind of business strategy whose function ranges from the investments into R&D to the protection of the technological advancements, to the enlargement of the market share, and to outwitting the rivals in the market. With regard to studies, the most important reasons or objectives of IP protection are:

- Providing a motivation for innovation activities, disclosure of new knowledge and stimulating creativity (Siebeck et al., 1990; Shukla, 2005; Mazzoleni and Nelson, 1998),
- Serving technological and economical parameters of a firm and a nation as a whole (Shukla, 2005), thus it provides prestige and competitive power to a firm,
- Preventing piracy and counterfeiting both at national and global level (Shukla, 2005),
- Helping technology transfer and global technological dynamism (Siebeck et al., 1990),
- Permitting orderly exploration of a broad prospect of inventions (Mazzoleni and Nelson; 1998) and then helping orient future research and development projects by “patenting around” existing technology (Shukla, 2005; Siebeck et al., 1990).

Patents/UMs can be found in patent databases which are often used by companies and investors in their screening process for technological trends and opportunities (Veer and Jell, 2012). They provide information about the history and state-of-the-art in one’s own technological area, give direction to researchers and thus they could determine R&D priorities (Shukla, 2005; Blind et al., 2006).

It is essential for technology firms to be aware and understand IP related issues and processes for its effective use (Pitkethly, 2010). When an individual possesses knowledge, awareness is a natural accompaniment. Awareness occurs when an individual is conscious of and informed about a subject. Knowledge, on the other hand, requires a theoretical or practical understanding of the subject matter (Govindaraju, 2009). In this regard, in order to use the IP system effectively one should possess essential knowledge before filing. This knowledge can be subdivided firstly into, the mere knowledge of an IP system's existence that comprises basic understanding of the requirements for obtaining IPRs and differences between various types of IPRs and secondly more detailed knowledge and understanding of how to use the IP system effectively of the benefits of IP (Pitkethly, 2012). At a more advanced level, knowledge and understanding expected of professional advisers who can be consulted by potential users of the system, awareness of and access to sources of IP related information including access to IP databases (Pitkethly, 2010). Firms should also know the legal processes for IP protection.

According to a survey of the IP awareness of UK industry, it was reported that larger companies are more IP aware and have greater resources to both find out about IP and do something about it, but on the other side, SMEs and the mass of micro-enterprises which form the cradle of IP and future large companies are effectively unaware of the IP system and consequently do not make informed decisions (Pitkethly, 2010). For a developing country India, Shukla (2005) stated that researchers, innovators and scientists are not conscious of early filing of patents and also not aware of the importance and the economic values that can be accrued from patents. Knowledge and understanding of the IP system users is essential for patent/UM awareness. This awareness is considered to have a positive impact on the firms' perception about the benefits and contributions derived from the patent/UM. Therefore our first hypothesis is:

H1: There is a significant relationship between IP knowledge level and firms' perceptions about contributions and benefits of IP protection.

2.2. Costs and difficulties of gaining patents/UMs

The surveys indicate that the most important difficulty regarding IP systems which firms emphasize is the cost, complexity and length of procedures.

Important consideration in the process of acquiring patent/UM is the need to know the different costs and difficulties that will be encountered. Identifying these costs is no easy task (Maredia, 2001). A variety of costs may be perceived by firms including application or acquisition, maintenance and defense (Malewicki and Sivakumar, 2004; Moir, 2008). Patent application and maintenance costs are fixed during a given time, but defense costs vary over time. Details of filing and its maintenance costs given by Shukla (2005) include (i) patentability search, (ii) preparation of patent application, (iii) filing fees, (iv) search/examination fees, (v) fees at the grant stage, (vi) fees paid to attorney (if any), etc. It involves external expertise (patent agents) and language translation costs (Christensen, 2008).

Applying and obtaining a patent right is comparatively easier than maintaining (or renewing) and defending the patents. When the cost of patents in Turkey is compared and contrasted with its equivalents, it appears that the price of 20-year long patent maintenance equals to €5,891 in Turkey whereas the charge in the same category is €1,627 in the U.S., €13,170 in Germany and €2,583 in Israel (Patentvista, 2016). If firms want to protect their patent globally, this can be quite expensive depending on the legal and technical complexity involved.

Empirical evidence suggests that direct costs could be particularly large in a developing country (Maredia, 2001; Kim et al., 2012) and especially for SMEs it is hard to undergo based on their (restricted) financial means (Sichelman and Graham, 2011). Given the GDP per capita for the U.S. as \$54,629 and Turkey as \$10,515 in 2014 (The World Bank, [web], 2016), it is plausible to assume that the cost of patent is in favor of developed countries. Even if the costs of obtaining patent seem to be lower in Turkey, the level of national income and firm size are the cases at hand due to high charges on the maintenance of the patents for the firms.

It has been acknowledged by previously conducted studies that the major impediment to obtaining patent is the costs, especially for SMEs. Both the timely process and the costs involved in the patenting process pose a problem for SMEs and may decrease the incentives for patenting inventions (Christensen, 2008). Cohen et al. (2000) asserted that the costs associated with patents, particularly their defense, disproportionately discourages small firms from availing themselves of patent protection. Just as five reasons for not applying for a patent considered by Cohen et al. (2000): 1. Difficulty in demonstrating the novelty of an invention; 2. The amount of information disclosed in a patent application; 3. The cost of application; 4. The cost of defending a patent in court; 5. The ease of

legally inventing around a patent. According to their results, two of the five reasons are about cost.

The standard system of IP management would be inaccessible for many small entrepreneurs and grassroots innovators due to limited resources and their risk-averse nature (Maredia, 2001; Gredel et al. 2012). Sichelman and Graham (2010) found in their study which was held by approximately 15,000 startup and early-stage companies, that young technology companies are especially sensitive to the costs of acquiring and enforcing patents. Hanel (2006) stated that small firms often lack or cannot afford to build up specific competencies and they also lack the financial capability to defend the infringed IPRs. They use IPRs less frequently than the large ones. But if the cost of an innovation is high, it is most likely to be patented by firms. However, some countries establish low cost systems like UMs. Masurel (2002) discussed the patenting behavior of Dutch SMEs and found that many SMEs are uncertain about the patentability of their innovations due to high patenting costs, having too little time, and unclear patenting procedures.

Based on the findings of the previous studies, it has been noted that the difficulties of costs and procedures encountered during the IP protection process have an important effect on the firms' points of view regarding the benefits and contributions as opposed to proclivity for direct acquisition. This paper's second hypothesis over the impact of the difficulties and cost is the following:

H2: There is a significant relationship between the difficulty and cost of acquiring IP protection by firms and firms' perceptions about contributions and benefits of IP protection.

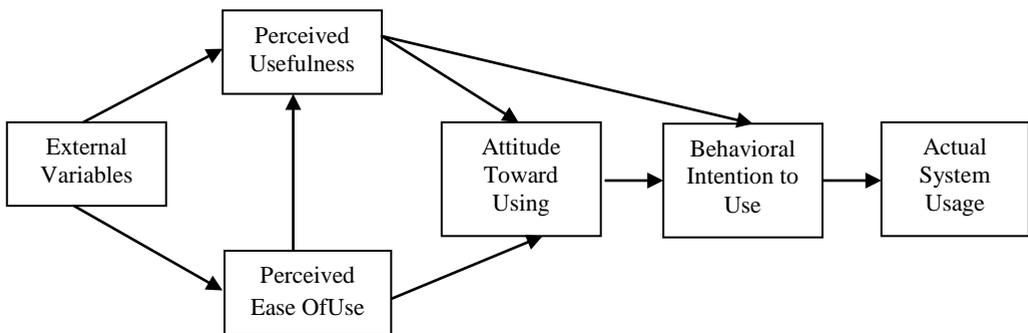
2.3. Perceptions of patent/UM benefits and contributions

The rationale behind the decisions of firms to acquire patent/UM is those corporations' perceptions about benefits and contributions of legal protections. The case is similar to the Technology Acceptance Model (TAM). Based on the theory of reasoned action, Davis (1986) developed the TAM which proposes that by the impact of external variables, perceived ease of use and usefulness predict applications usage. Perceived ease of use refers to the degree to which a person believes that the use of a system will be effortless. Perceived usefulness is defined as being the degree to which a person believes that the use of a system will

improve his/her performance. Notwithstanding the costs being incurred, the buyers' motive for possessing personal computers is about their expectations of utility maximization emanated from certain benefits and contributions such as the practicality for course materials, instrumentality to increase course grades and increasing opportunity of communication with friends. It is the perceived levels of benefits and contributions that bring about the relevant action of buying.

TAM has been widely used in literature by several researchers and expanded in order to adapt it to the various contexts like technology selection and decision-making (Figure 1):

Figure-1: Technology Acceptance Model (Davis et al., 1989)



Source: Davis et al., 1989

In the same vein with that rationality at micro-level, the reason for firms to obtain IP protection for their respective products and designs turns out to be the perception of benefits and contributions at macro-level. The effectiveness of the system thus depends not just on what it provides but on what innovators perceive that it provides (Pitkethly, 2012). Once the firm has an idea about the perceived value of the patent, it must decide on patent development strategies (Malewicki and Sivakumar, 2004).

In the IP related literature, researchers have identified various motives to file patent/UM applications which include prevention of imitation, blocking, signaling, securing the freedom to operate, fostering licensing opportunities,

improvement of negotiation basis, motivation of staff and technical image (Blind et al., 2006; Cohen et al., 2000; Sichelman and Graham, 2010; Veer and Jell, 2012).

According to various studies (Blind et al., 2006; Sichelman and Graham, 2010), protection from imitation is the most important motive or the main motivation in patenting for all sectors. Duguet and Kabla (1997) revealed by the investigation of 299 French firms that the main reason why French firms patent was prevention of copying and the second most important reason was to prevent rivals from patenting a related invention.

Cohen et al. (2000) found that the most prominent motives for patenting include prevention of copying, prevention of rivals from patenting related inventions (i.e., "patent blocking"), use of patents in negotiations and prevention of suits. They also stated that patenting is driven by strategic reasons and a large majority of patents are taken out for defensive reasons. Blind et al. (2006) named this motive, "strategic motive" which is to block competitors.

Patents can play an important role in "signaling" the value of a firm's technology and inventiveness (Sichelman and Graham, 2010). Firms use patent to enhance market prestige of the product and the firm's reputation (Shukla, 2005; Mazzoleni and Nelson, 1998) or technological image, in other words, an instrument for marketing activities which is especially important for small firms (Blind et al., 2006). In this way, firms achieve and secure competitive advantage in an industry (Blind et al., 2006; Cohen et al., 2000) and attract cooperation with other companies, customers, and research institutes. Signaling role of patents is important for especially early-stage small firms which want to attract financing and to improve their chances of surviving (Sichelman and Graham, 2010).

Patents are increasingly being used by small firms as earning of licensing revenue (Duguet and Kabla, 1997), improving their position in negotiations with other companies (Blind et al., 2006), avoiding trials and protection of investors' capital invested in the venture (Siebeck et al., 1990; Shukla, 2005). Patenting increases a young firm's visibility to potential investors, cooperation partners or customers (Arundel, 2001; Christensen, 2008). Moir (2008) stated that firms take out very large numbers of patents for strategic reasons which include misleading competitors about the key directions of research, making significant patents harder to find, challenging other firms in cross-licensing negotiations, and preventing entry to a market. Veer and Jell (2012) compared the patenting motives of individual inventors, universities, and small firms to large firms, and

found that the generation of licensing opportunities, using patents as signals to indicate their technological capabilities and innovativeness to potential investors or customers were the most important functions of patents perceived to be important for SMEs.

For internal purposes, patents are used not only for motivation, but also a performance indicator of R&D departments to assess and reward R&D personnel and to measure the internal performance of the firm's technologists (Duguet and Kabla, 1997; Blind et al., 2006). Blind et al. (2006) found that especially important motives behind the use of patents are to improve a company's own position in negotiations with partners, licensees and the financial sector, or to use patents as incentives for R&D personnel or performance indicators. Cohen et al. (2000) found that smaller firms (1-249 employees) were more likely than medium-sized and larger firms to use patents for reputational purposes, such as improving their company and technological image. Sichelman and Graham (2010) reported that startup firms hold patents for strategic use to help defend against patent infringement suits and to increase negotiating power with other firms.

Despite these valuable findings about the motives for IP protection, studies failed to investigate and explain awareness and background knowledge why firms in developing countries patent in less numbers. Given the results of these studies, it has been assumed that there is a positive correlation between recognition of the benefits and contributions of the patents and the tendency of firms for gaining patent/UM. In line with the above mentioned considerations, our third hypothesis is:

H3: There is a significant relationship between firms' perceptions about contributions and benefits of IP protection and their acquisition tendency.

2.4. Incentives and supports given for patents/UMs

At country level, IP supports can be evaluated within the national innovation system at the macro (country) and in terms of institutions/organizations at the micro level (technopark, firm, etc.). At the macro level, first it is essential for a country to build an efficient innovation infrastructure. This involves supporting basic research and applied R&D capabilities, facilitation of its commercialization, easy access to various information infrastructures. An effective IPRs law may be a necessary feature in this system that promotes economic growth, but it is not sufficient. A well-functioning patent office is necessary for any IP system to be

effective (Pitkethly, 2012; Erstling and Strom, 2010). A patent office can be a crucial factor in helping to achieve those objectives by embracing high-speed information technology to analyze and support patent acquisition (Sherwood et al., 1998).

There are also centers in other countries for providing assistance and promoting awareness by giving financial support and organizing seminars (Pitkethly, 2012). Financial and other incentives to increase patent/UM grants submitted by patent offices or institutions in the system of national innovation system varies from country to country. For example, The Scientific and Technological Research Council of Turkey (TUBITAK) is the main body responsible for organizing R&D activities on the national level in Turkey. TUBITAK started a program called “Patent Application Promotion and Funding Program” in 2006. The purpose of the program is to increase the number of national and international patent applications of Turkey, to encourage people to make patent applications, and to increase awareness about registering intellectual and industrial property rights (TUBITAK, 2016). All patent applications (except UM) can be supported by this program. Since the beginning of that incentive program in August 2006, there has been an incremental increase in the number of patent applications in the Turkish Patent Institute. The figures become greater such that they rise from 935 in 2005 to 1,090 in 2006, and to 1,838 in 2007 (TPE, 2016). However, increase in the first years was not as in subsequent years numerically, the average growth rate remained at the level of 20%. Yalciner and Akin (2009) put forth, in their study which analyzed the patent supports of 52 countries, that most of the patent mechanism was provided to SMEs and real persons, the range of financial supports vary depending upon their processes and submitted with different ways (loan, refundable, non repayable and donation). Besides, they also pointed out that IPR incentives were given some specific subject and sector over specific institutions for recycling sector in UK and biotechnology in Ireland.

Larger companies tend to be more IP aware and have greater resources to both find out about IP and do something about it (Pitkethly, 2010). They have their own and separate IP departments with patent attorneys and engineers responsible for managing IPRs (Blind et al., 2006; Pitkethly, 2012). Advice regarding IP protection mainly comes from external patent or trademark attorneys or external solicitors to large companies. For SMEs advice mainly comes from patent offices rather than in-house sources (Pitkethly, 2010).

Besides the costs of obtaining and maintaining the patent, firms should carefully examine the technology and legal provision. This assessment is most often very

difficult to make and may require external competencies for small firms (Christensen, 2008). SMEs often partner with intermediaries including IP brokers, venture capitalists, and technology trading platforms to commercialize their technologies externally (Elton et al., 2002). Gredel et al. (2012) pointed to the functionality of patent-based investment funds as new agents in the field of technology commercialization and patent intermediation. Funds provide resources and competencies and complement SMEs' deficits and commercialization barriers.

Many countries have taken action to promote awareness, especially amongst SMEs. Support programs have been created by various centers and organizations even providing assistance with IP costs for making more use of IP system around the world. One of these, The Technology and Innovation Support Center (TISC) program, run by WIPO. This program is designed to give innovators easy access to local patent databases and other science and technology resources, on-site training and distance learning courses, supporting awareness-raising activities, sharing experience and related services (WIPO, 2014).

Another example, PATent LIBrary (PATLIB) is a network of patent information centers located throughout Europe. The PATLIB centers provide valuable patent information services to SMEs, private inventors and academics, to a large extent, free of charge (European Patent Office, 2013). These centers provide services to enterprises include:

- Advice and information regarding patent applications,
- Technological information; searches in patent databases including technology watch, novelty search and examination of the freedom to operate,
- Raising patent awareness by organizing workshops and seminars related to the technological aspects of IP (e.g. infringement, data mining in patent-databases) (Dooren, 2007).

Within the perimeters of technoparks, SMEs can take the benefit of consultation (about patent, brand, venture capital, etc.), technical and financial assistance through patent sponsorship programs within the context of education/seminar/briefing, marketing, law and advertisement. Pekol and Erbaş (2011), in that regard, found that the sponsorship provided inside Turkish technoparks has been positively influencing the firms' decision to acquire patents. Considering the above mentioned points our fourth hypothesis is:

H4: There is a significant relationship between the utilization level of available incentives/supports and acquisition tendency of firms.

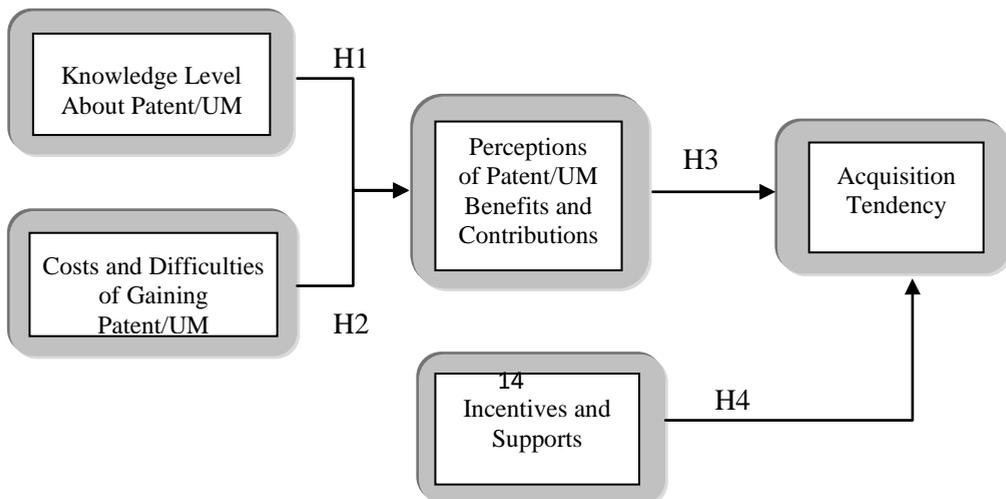
In summary, the literature and expert opinions suggest that the probable factors which may affect firms' perceptions of patent/UM filing behaviors are;

- IPRs knowledge levels of firm executives or employees that may affect the decision,
- Cost and the difficulty level of the acquisition process,
- Perceptions of benefits and contributions (commercial, reputational, monetary value etc.),
- Incentives/supports given to firms for obtaining.

We propose a Patent/UM Acquisition Tendency Model in this study. It is similar in spirit to TAM (Davis et al., 1989) in that it adapts external factors (knowledge level and perception of cost) affecting intentions of firms to accept and acquire IP protection in a developing country.

Our model consists of two independent variables that are antecedents to the perceived value of patent/UM benefits. We assumed that acquisition tendency arises from and are influenced by perceptions of patent/UM benefits and support given to firms for acquisition. We include some control variables which characterize the length of stay in technopark and in which technopark they operate. Our model that aims to find possible relations among these factors is given in Figure 2 below:

Figure-2: Patent/UM Acquisition Tendency Model



3. RESEARCH METHODOLOGY

3.1. Scope of the study and the sample

SMEs are essential for economic development of countries. But policies fall short of encouraging them to protect their innovations. In literature researches suggest that SMEs under utilize the IP protection system which can raise their competitiveness especially in most of the developing countries. Within the developing countries whose prime mode of production depends upon basic technologies, here, Turkey is the case at hand, the small scale firms that are on the pursuit of attaining innovative product development choose to be inside the technoparks due to logistical and administrative concerns. Considering the technopark firms' role over acquisition of advanced technology, innovative capacity, positive attitudes and trends on new product and process development, this study focused on technopark firms, covering both patenting and non-patenting. These firms are supposed to be more aware of IP system and good choices (with potentially significant end-results) for a detailed study to find out the factors affecting acquisition tendency.

Studies that aim to measure and evaluate the performance of patents/UMs in developing countries should be implemented in those technoparks in terms of the above-mentioned potential. We based our contribution of a survey among Turkish technopark firms. In Turkey, by the end of December 2015, 3,744 firms continue to operate in 49 technoparks. Field study in which survey method was used to collect data, conducted with firms operating in Ankara (The capital of Turkey) technoparks. Since Ankara has the technoparks that are both one of the first established and one of the most mature entities in this category in Turkey, this city is selected as sample of the research. Among the existing 6 technoparks, selection is determined according to the presence of highest rankings in the criteria of IPRs within "Comprehensive Results of Regions of Technology Advancement Performance Index, 2011" (MSIT, 2012).

Our objective was to collect data from selected 226 firms (except for software) in Bilkent Cyberpark, METU and Hacettepe Teknokent which have a total number of 582 firms. It is important to note that the questionnaires refer to all firms whether they file patent applications or not. In total, 102 questionnaires were returned, resulting in a response rate of 45 percent. It is determined that the supposed sample is good enough to represent the technopark firms as a whole.

3.2. Scale development

The instruments have been adapted from the existing literature as stated in the Table 1.

Table-1: Scale Construct

Scale Subjects	Sources
Knowledge About Patent/UM	Smith (1999), Sen (2003), Sampat (2009), Pitkethly (2012)
Costs and Difficulties of Gaining Patent/UM	Cohen et al. (2000), Arundel (2001), Shukla (2005), Dericioglu (2010)
Perceptions of Patent/UM Benefits/Contributions	Smith (1999), Blind et al. (2006),Sampat (2009)
Incentives and Supports	Jackson (2003), Yalciner ve Akin (2009)
Acquisition Tendency	Cohen et al. (2000), Lotti ve Schivardi (2006), Lee ve Kim (2010)

Following the construction of the questions in congruence with the purpose of the study, 6 specialists in the area of IPRs were consulted about the viability and sufficiency of the scale subjects on the way towards collecting data. Accordingly, after the conduct of content validity, the number of items that the questionnaire comprises decreased to 39 from 44. First part of the questionnaire consists of three questions that address the demographic features such as the activity area of the firm in the technopark, duration of the firm’s presence in the technopark and range of competence of firm to innovate. Second part, on the other hand, deals with knowledge level of firms about patent/UM, difficulties encountered in gaining processes, supports received, and their perceptions and tendencies about acquisition. Five-point Likert scale was used for all dimensions.

In the final stage of the scale development process, a pilot study was conducted in order to investigate the reliability and validity of the supposed scales. 39 items were included to the survey in the pilot study. Data was handled and analyzed by using SPSS 17.0 software package. Based on the results, validity and reliability of the scales were interpreted as being at high levels and then the process of collecting data continued.

Exploratory factor analyses were performed to validate the constructs and measure the factor loadings. The adequacy of the sample in factor analysis and the sample's conformity to factor analysis were evaluated by reference to Kaiser-Meyer-Olkin (KMO) coefficient and Bartlett's test of sphericity (Tabachnick and Fidell, 2001). In that respect, the test results indicate that collected data based on the scale subjects appears to be receptive to the application of principal components factor analysis.

Factor loadings after a varimax rotation are considered satisfactory as cutting point of 0.45 and above. Factor analyses were repeated by eliminating the items with the loadings below 0.45. Cronbach's alpha coefficient was used to test reliability. Alpha coefficient is supposed to be 0.70 or more to consider the scale is reliable (Nunnally, 1978). In the analysis, items that decrease the alpha value were eliminated and elimination was stopped when the desired value was reached. 5 items were excluded from scales considering their negative effects on factor construct. As a result, the scales which were consist of 39 items decreased to 34 and analyses were made on these 34 items. As a summary table, the scale items, range of factor loadings, factor correlations (α) and total variance explained for each variable is tabulated in Table 2 which also indicates the reliability and validity of the scales.

Table-2: Validity and Reliability Statistics of Factor Analyses

Variables	# of Items	Range of Factor Loadings	Cronbach Alpha (α)	Total Variance Explained (%)
Knowledge About Patent/UM	11	0.692-0.821	0.928	58.772
Costs and Difficulties of Gaining Patent/UM	6	0.632-0.831	0.826	54.331
Perceptions of Patent/UM Benefits and Contributions	6	0.773-0.861	0.900	66.928

Incentives and Supports	6	0.618-0.853	0.856	58.208
Acquisition Tendency	5	0.682-0.773	0.753	50.645

Finally, a data analysis including descriptive statistics and regression analysis was designed.

4. FINDINGS

4.1. Findings related to demographic features

67.1% of the firms participated in the study have been operating in the technoparks for 1-5 years and the remaining 32.9% for 6-10 years. Since the number of employees is less than 250, firms are in SMEs category. The firms stated that they have high level technological competence to invent and later to develop new products. Competencies of the firms are taken to be satisfactory for the acquisition of patent/UM whose precondition is the capacity to innovate. That aspect of the research results is assumed to deliver significant inferences for the developing countries like Turkey. It is also assumed that an awareness about patent/UM could not bring forth the same implication to the countries that are out of the group of developing countries whose prime mode of production is based on basic technologies.

4.2. Findings related to variables

Average scores related to variables are presented in Table 3.

Table-3: Average Scores of Variables

Variables	Mean(1-5)	S.D.
Knowledge Level About Patent/UM	3.76	0.721
Perception Level of Costs and Difficulties of Gaining Patent/UM	3.31	0.727
Perception Level of Patent/UM Benefits and Contributions	3.91	0.723
Level of Submitted Incentives and Supports	2.86	0.669
Acquisition Tendency Level	3.55	0.491

Our first variable concentrates on firms' understanding and knowledge about patent/UM. It can be seen from the results that firms know much about patent/UM concepts and procedures. This is one of the most significant finding to measure the tendency of obtaining patent/UM. It is because, in order for corporations to be enthusiastic to acquire patent/UM, they should be in need of being aware of and of knowledgeable about these legal protections' benefits at high levels.

Moreover, a *t* test was conducted to check whether the firms located or the duration of their stay in those technoparks have any effect on the level of patent/UM awareness, there was no statistically significant difference. This finding can be interpreted as informative/awareness raising seminars and training programs on the issues of innovation, R&D and IPRs are held specifically or at the same level by the technopark administrations at diverse technoparks. However, relatively low levels of the incentives and supports variable validates the fact that those above-mentioned activities are carried out at lower levels. Furthermore, among the firms operating under the technoparks, the ratio of the R&D employees is about 81.5 % (MSIT, 2012). Very significant proportion of R&D staff has undergraduate and graduate (M.A., Ph.D., Postdoc) degrees. Then it becomes apparent that the reason behind the technopark firms' high level of knowledge and awareness about IPRs is the qualified workforce with higher education backgrounds.

Furthermore, in the 5-point scale, the position of the firms on the issue of utilizing incentives and supports is 2.86. It has been noted that supports such as financial inducements, consultation, educational assistance and services provided by technopark administrations are at unsatisfactory levels. Thus, it becomes obvious that the incentives should be advanced.

Given the level of all the firms participated in the study as SMEs, perception of difficulties and costs for the whole sample are judged to be high such that it equals to 3.31. Dericioglu (2010) stated that one of the reasons behind the low numbers of Turkish national patents is attributed to the reasoning of "high costs incurred while acquiring patents in Turkey". Having been one of the most influential impediments to the individuals' and the firms' act of obtaining patents, costs influence the tendency of acquiring patent/UM in a negative manner due to pessimistic points of view about it. Given the fact that the technopark firms have limited number of employees, it is seen that almost all of them are at the SMEs level and have annual turnover around \$ 2 million (MSIT, 2012). It is the realistic

result that the procedures are considered as complex and difficult because of the fact that a firm, that conducts its activities through this turnovers, perceives the patent/UM costs as high and lacks of qualified personnel to handle those complex procedures,

As assumed by Pitkethly (2010), IP awareness and firm perceptions of IP importance are critical factors of running an efficient IP system. The firms that participated in the study display high values of perception about the benefits/contributions and tendency to acquire patent/UM. Due to the technological capabilities and innovativeness of firms hosted by the technoparks, patent/UM acquisition-related trends are expected to be high. That finding illustrates the willingness of the firms to gain patent/UM.

The study conducted by Lotti and Schivardi (2010) explicates the patent acquisition tendency in 15 EU member states and reached to the conclusion that innovative activities are the most important factors for that tendency. It has been also discovered that there is a correlation between R&D activities and innovative product developments of the firms and their acquisition tendency. The survey carried out by Lee and Kim (2010) among 1,255 firms in Korea delineates the pattern that there is a positive correlation between the acquisition of patents and R&D activities of firms.

According to the current law pertaining to the administration of the technoparks, for a firm to be located and later continue to stay in there, firms have to engage in R&D projects, develop new and advanced technologies and cooperate with universities, high technology institutes or public R&D centers. Hence, those firms have been supervised by the administration of the technoparks whether the existing R&D and industry potential in the zone is adequate or not by evaluating both their R&D activities and adequacy of personnel (expertise with at least a graduate degree etc.) working for R&D activities.

However, it should be emphasized beforehand that owing to the national innovation system in the country has not yet reached a certain level of maturity, it would be unrealistic to expect great success for bringing new and innovative products. The gap between the level of awareness and the number of realized patent/UM is attributed to the country's maturity level in technology development skills.

4.3. Findings of hypothesis testing

Every dependent and independent variable is tested for normality. All the variables were normally distributed and for the following analyses parametric tests were used. In the first step, the relationships between the independent variables (knowledge level and perceived high cost and difficulties) and the dependent variable (perception of patent/UM benefits and contributions) were tested, using a series of multivariate regression. Findings of the analysis are presented in Table 4:

Table 4: Effects of Independent Variables on Perception of Patent/UM Benefits and Contributions

Independent Variables	Beta (β)	S.D.	<i>t</i>	Sig.	Multi-Collinearity Statistics		
					Tolerance	VIF	
(Constant)	4.176	0.399	10.473	.000			
Knowledge About Patent/UM	0.371	0.077	4.819	.000	.997	1.003	
Costs and Difficulties of Gaining Patent/UM	-0.504	0.076	-6.600	.000	.997	1.003	
R²= 0.416		F= 35.324		p= .000		Durbin Watson= 2.277	
Dependent Variable: Perceptions of Patent/UM Benefits and Contributions							

Multivariate regression model is statistically significant (F: 35.324; p: .000). Within the model, Durbin Watson statistic did not detect any autocorrelation with a value equaling to 2.277. Tolerance and VIF values also show that there isn't a multicollinearity problem. The coefficient of determination (R²) indicates the goodness of fit of the model. Independent variables explain 41.6 % of the variation in the dependent variable.

When *t* value was analyzed with regard to the point estimates of the coefficients, two variables that are added into the model give statistically significant results. We found a positive coefficient(β : 0.371) for level of knowledge variable and a significant negative coefficient(β :-0.504) for perceived costs and difficulties of gaining patent/UM variable.

Based on the results, following conclusions with respect to the hypotheses can be drawn. First of all, H1 and H2 hypothesis were supported by the results of the

regression analysis. It has been found that there is a high level of relationship between the levels of firms' knowledge, perceptions of difficulties/costs and perceptions of benefits/contributions about patent/UM. The relation can be interpreted in a way that when the firms' level of knowledge increases, their perceptions of benefits and contributions will also follow the same trend along with declining perceptions of difficulties and costs.

In general, during the process of purchasing any product, it is normal to encounter a negative correlation between difficulties arising from the high price and perceptions of benefits and contributions about the product. This situation is explained in the TAM model (Davis, 1986) through the same point of view. Limited financial means of technopark firms and the negative perception deriving from the patent/UM acquisition costs and procedures also affect the expected benefit and contribution perception in a negative way. Sichelman and Graham (2010) mentioned this in their findings that even though startup firms are well aware of the strategic uses of patents, resource constraints may cause fewer engagements in these strategies.

Finally, the perception of benefits/contributions and incentives/supports variables were taken as independent variables and acquisition tendency variable as dependent. The relationship between these variables was evaluated using multivariate regression. Findings of the analysis are presented in Table5:

Table-5: Effects of Independent Variables on Acquisition Tendency

Independent Variables	Beta (β)	S.D.	<i>t</i>	Sig.	Multi-Collinearity Statistics	
					Tolerance	VIF
(Constant)	1.193	0.214	5.585	.000		
Perceptions of Patent/UM Benefits and Contributions	0.451	0.045	9.962	.000	.984	1.016
Incentives and Supports	0.208	0.049	4.248	.000	.984	1.016
	R²= 0.568	F= 65.017	p= .000		Durbin	Watsor
	1.791					

Dependent Variable: Acquisition Tendency

Regression model was statistically significant (F: 65.017; p: .000). Value of R² was founded as 0.568. According to this result, perceptions of patent/UM related benefits/contributions and incentives/supports explain the 56.8% of the change of the firm's acquisition tendency.

Perceptions of patent/UM benefits and contributions level have a positive and statistically significant effect on patent/UM related acquisition tendency (β : 0.451). If the patent/UM related perceptions of firms' increases one point, acquisition tendencies will increase with the coefficient of (β : 0.451). Based on this result, H3 is accepted. It is also found that there is a statistically significant relationship between the supports/incentives and acquisition tendency levels of firms (β : 0.208). Thus H4 is supported by the results of the regression analysis.

Both giving financial incentives and advice for informing firms supplied by different government institutions will positively affect acquisition tendency. Additionally, it can be stated that supports will play a role especially for diminishing the perceived negative effect of the cost and difficult procedures perception indirectly and will have positive effect on the perception of acquisition. One important issue pointed out in the findings that the positive effect of benefits/contributions perception on the propensity to acquisition tendency is higher than incentives/supports effect.

5. DISCUSSION, CONCLUSIONS AND LIMITATIONS

It is seen at a glance that the patent numbers of developing countries like Turkey, are a lot lower than developed countries like Germany, US, and Japan. The studies which analyze the reasons of this phenomenon mainly concentrate on the criteria of these countries' innovation indicators (The Innovation Union Scoreboard, 2015). Although the main reason of low patent numbers is the presence of concrete indicators that are input for inventions, another important reason, which is the firms' perceptions about patent/UM, is evaluated in this study.

The firms we surveyed are located in innovative technoparks that have positive attitudes and trends on new product and process development. It is considered that, the factors that affect patent/UM acquisition tendencies of firms will be their perception of benefits/contributions and incentives/supports. In this respect, we

tried to investigate the effects of factors on the patent/UM acquisition tendency with a sample of small technopark firms of Turkey which has far lower patent/UM numbers than developed countries. It is the first of its kind to research the issue that has been rarely studied in current management and innovation literature.

5.1. Implications of empirical results

From our theoretical discussion and empirical findings, we can draw several implications. The perception behind firms' IP protection behavior is explained by the results of our model. In line with the hypotheses, our main finding is that, if firms believe that gaining patent/UM protection provides some benefits (prevention of imitation, signaling, fostering licensing opportunities, improvement of negotiation basis, motivation of staff, technical image etc.) they will decide on patent/UM development strategies despite the costs and difficulties. In other words, before acquiring patent/UM, firms are required to have positive perception that these tools will be beneficial to them and improve their performance. This perception largely affects the acquisition tendency.

Our study also points to the importance of factors affecting the level of firms' perception of patent/UM benefits and contributions. First, we found that knowledge level on means of protection positively affects that perception. Additionally, in the current situation, knowledge level of the firms hosted in technoparks is quite high. The importance of knowledge and awareness is stressed and seen as a prerequisite for IP protection in literature (Pitkethly, 2010; 2012; Shukla, 2005). In this study, it is asserted that higher level of knowledge and awareness provides higher perceived benefits.

Second, consistent with the literature, costs and difficulties negatively affect the benefit and contribution perception and accordingly the acquisition tendency. With regard to firms' perceived difficulty of patent/UM acquisition and cost levels, perceptions are negative. So, currently, the most important barrier for the acquisition tendency is seen as the costs and the difficulties of procedures. In developing countries like Turkey, SMEs with low financial capacities find the costs high. Although these SMEs conduct many R&D projects, high cost of application discourages these firms from IP protection. This finding is seen as the most important one which can be presented to decision makers for solution.

Dericioglu (2010) explains the reasons of low patent numbers in Turkey as follows:

- i. Lack of R&D culture,
- ii. Lack of enough resources for R&D,
- iii. Lack of university-industry cooperation,
- iv. Underestimation of getting a patent action,
- v. High costs of patent acquisition despite low income rates.

Taking into account that the study is conducted in technoparks, it is obvious that, the firms in technoparks have overcome the problems related to R&D resources and culture. It can be also argued that, in Turkey's most advanced technoparks, the problem of university-industry cooperation has been overcome too (MSIT, 2012; Kilic, 2009).

As of December 2015, in the technoparks, which were founded to develop and design new products, the number of ongoing R&D projects is 8,525 and whereas finished ones is 18,318. Applied/approved patent numbers of the innovative firms in these technoparks is only 301. The results show that, the first three outcomes of previous studies are not applicable to current study. Our evidences approve that, costs of IP protection is the most important barrier for acquisition. Underestimation of patent acquisition is also founded as a reason for low acquisition levels.

We conclude that there are two main reasons lead to under-utilization of IP protection by SMEs. One of them is the belief that the benefits to be brought by IP protection to the firms are lesser when compared to the costs and challenges to be endured. Thereupon the firms don't provide protection and rely more on secrecy, granting patent/UM is the second best option for protection. The contributing factor for the firms' preference of secrecy for their developments is because of the risk of losing market opportunity. Moreover, it is argued by Arundel (2001) that despite the benefits of patents, firms do not obtain them and declare information about their new discoveries to avoid revealing their innovative investment areas. According to Arundel, contrary to large scale firms, small scale firms choose keeping their discoveries within their firms. It is not expected that all innovation will result in patent. Previous literature also shows that as the firms get larger, their patent and R&D tendency also increases. Christensen (2008) argued that large firms produce, in absolute terms, more products and processes that may be

patented. This may in turn justify establishing an internal patent expertise, or even-department, and will generally enhance the buildup of internal competences in managing the patenting process.

Other important reason is the high costs (including application and defense costs in case of infringement) and fairly long and slow registration procedures in the Patent Office. The costs negatively affect the willingness of firms about the patent acquisition. Sichelman and Graham (2010) found that startup firms are more price-sensitive than large firms to the costs of acquiring and enforcing patents. The dominant factors deterring the patenting of entrepreneurial innovation are costs. In Turkey, a study from Pekol and Erbaş (2011) indicated that the main reason for not acquiring patent was the complex patent procedures which require expertise. Patent owned firms have also stated that long procedures as the first and high costs as the second reason.

5.2. Practical implications

We believe that our evidences have useful implications for practitioners of SMEs, technopark administrations and institutions. The research results show that acquisition tendency can be increased by patent/UM related incentives with the coefficient of (β : 0.208) and existing incentives for IP protection in Turkey are inadequate. Although SMEs make innovations, policies fall short of encouraging SMEs to patent their innovations. There are duties for technopark administrations, TTOs and other guidance institutions to direct firms act in a patent/UM focused manner. In this regard, to diminish the cost and difficulty perception and to increase the patent/UM acquisition tendencies, firms should be assisted financially and the use of existing incentives should be provided easier. While doing this, due to the cost disadvantages of SMEs in developing countries, incentive rates should be determined inversely proportional with the size of the firms and in varying proportions. The incentives should include tax cuts. By determining annual patent/UM goal (e.g. 30,000), direct cash incentives may be distributed until reaching this goal. Part of these incentives may be given to the owner of invention to encourage further studies. Supporting mechanisms should be formed to help creation of a more favorable environment for the SMEs to innovate and to establish better coordination between related institutions. It is considered that, by that way, patent/UM granting for every invention will contribute to both technological and economical development and creation of an IP culture of the firms hence the countries.

Furthermore, lack of fast and effective mechanisms against imitating also affects the firms in this process. It can be asserted that, the difficulty perceptions of firms can be diminished and inclinations towards patent/UM acquisition can be increased through building a unit within technoparks to help the firms which do not have patent/UM units. In addition to this, IP Institute has to simplify the procedures.

Knowledge and awareness about IP related issues and processes are essential for the perception of benefits/contributions about patent/UM of firms. High awareness level of firms derives from the sample members being in the post-graduate level. With regard to the evidence about knowledge over perception of benefits/contributions, it is required to give advice and information regarding patent applications for firms, and provide training for youth generation about IP starting from high schools. It is also essential to increase the guidance activities by periodically organizing various patent awareness workshops to create consciousness among employees and managers about IP protection's benefits and contributions for themselves and their firms.

5.3. Limitations and future research

Two limitations of the research persist. First of all, this study is directed towards the Turkish technopark firms and may not claim universality. If the researchers want to test the validity of our findings for other sectors or developing countries, they may study with additional factors. Second, despite the sufficient size of samples for the reliability of statistical tests applied, to acquire more reliable results and a higher response rate, similar studies may be conducted in different industrial firms outside the technoparks. Studying the relationship between patent/UM acquisition tendencies and awareness levels for different sectors will contribute to the technological progress of developing countries and increase the tendencies related to the IPRs.

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