

CHALLENGES IN OPEN INNOVATION FOR ICT COMPANIES IN TECHNOLOGY DEVELOPMENT ZONES

NİHAN YILDIRIM

Istanbul Technical University / Management Engineering Department, Turkey
yildirimni@itu.edu.tr

KÜBRA ŞİMŞEK

Istanbul Technical University / Management Engineering Department, Turkey
kubrasimsek90@gmail.com

Copyright © 2015 by İstanbul Technical University. Permission granted to IAMOT to publish and use.

ABSTRACT

Open innovation that is known as the use of purposive inflows and outflows of knowledge with a view for accelerating firms' own internal innovation, and expanding the markets through external use of innovation, respectively is a very important window of opportunity for companies that are obliged to improve their innovativeness continuously due to intense competition environment. On the other hand, technology development zones are the platforms that act as an intermediary between the technology developer and technology diffuser to create value through transferring inventions and know-how from the university and research institution labs to the markets. These zones enable technology start-ups innovate and survive. Referring to their collaborative and networking nature, technology development zones have the potential to be connectors for open innovation across the universities, research Labs, start-ups, SMEs and large companies. However, to create and protect their technological know-how against larger and more competitive firms, start-up companies and SMEs in university based technology development zones may have the intention to keep their innovation systems closed and prefer to stay within the clusters of their collaboration network. This orientation to closed approaches prevents them from using technology development zones' eco-system and knowledge-sharing with similar companies as a leverage for growth. In this context, to address the obstacles and resources of open innovation for start-up companies and SMEs in technology development zones, this study aims to explore the perceptions of companies in technology development zones on open innovation. By conducting a survey among 98 information communication technology developer companies in major university technology development zones in Turkey, current open innovation practices and factors that act as obstacles for open innovation for these companies are searched. Types, scales, structures, shareholder types and experience of companies are also explored for their impacts on the orientation towards open innovation. Findings reveal that the IT companies in university based technology development zones do not utilize open innovation sufficiently, but they have intended to. Main constraints of companies in adapting open innovation practices are concluded as the lack of resources, while idea management and customer demand do not constitute critical constraints. However, they view import of technologies by inbound open innovation as a barrier. Customer immersion, lead users, collaboration and partly innovation intermediaries, innovation networks and platforming are among commonly practiced tools. However, because some of them strictly reject idea competitions, IP in-licensing and tech-out licensing, it is concluded that the IT companies in technology development zones are in need of improving their a practical understanding about open innovation.

Key words: Information technology, open innovation, SME, start-up, technology development zone.

INTRODUCTION

In today's rapidly increasing competitive environment, innovativeness is a must for achieving the required differentiation and cost advantage. However, providing the financial, human resources and knowledge inputs to technology development is a challenging task for all organizations that have limited resources no matter how efficiently they work. Therefore, expanding this resource base by inter-organizational exchange and collaboration all along the value chain and competitive forces had been on the agenda of innovators. The framework of open innovation had been theorized by Chesbrough (2006) and opened an opportunity window for improving innovativeness competencies especially for SMEs and start-ups. Especially companies that focus on technology development like technology start-up and spin-off companies in technology development zones are the potential users and practitioners of open innovation as they are in constant need of patenting and licensing new technologies as a part of their business model. From this point of view, there is a need for research on exploring the levels of practicing and utilization of open innovation in these types of companies to provide a strategic framework for technology development zones that can enable them benefiting from open innovation for achieving their objectives and realizing their mission. Especially in developing countries, in the last decade there is a significant shift to establishing technology development zones within university eco-systems to construct the institutional infrastructures that are required for triple helix of academic entrepreneurship and catch up with the developed countries in terms of university-industry collaboration and linkages.

In this context, based on the surveys and in-depth interviews with selected companies from major technology development zones especially in western regions of Turkey, this study aims to explore the ICT companies that are located in these technology development zones in terms of their open innovation practices, intentions and barriers. As a part of a larger research agenda on all university technology development zones in the country, this study aims to provide the basic motives of companies that operate in technology development zones from this sampling. In the first sections, theoretical background on open innovation and its approaches, methods are introduced. Current situation of technology development zones in Turkey is also presented in short. Survey method, data collection is explained in the methodology section. Findings and conclusion are presented in the final section.

OPEN INNOVATION

The advantages of having external linkages for product development have been realized a long time ago. Trott and Hartmann (2009) argue that open innovation is old wine in new bottles. Carter and Williams (1959) discovered that the key characteristic of the firms, which made inroads in technology, was quality information from outside the firm. Also, Allen and Cohen (1969) proved the prominence of external linkages in information acquisition from outside the firm due to working through gatekeepers. However, Henry Chesbrough originated and popularized the term of open innovation for the first time.

Although firms, which use closed innovation particularly bases on internal R&D, consider R&D labs as a strategic asset and create entry barriers for their potential rivals, open innovation paradigm assumes that any firm cannot longer afford to make innovation by performing R&D and marketing activities single-handedly. Figure 1 and Table 1 illustrate the differences between closed innovation and open innovation.

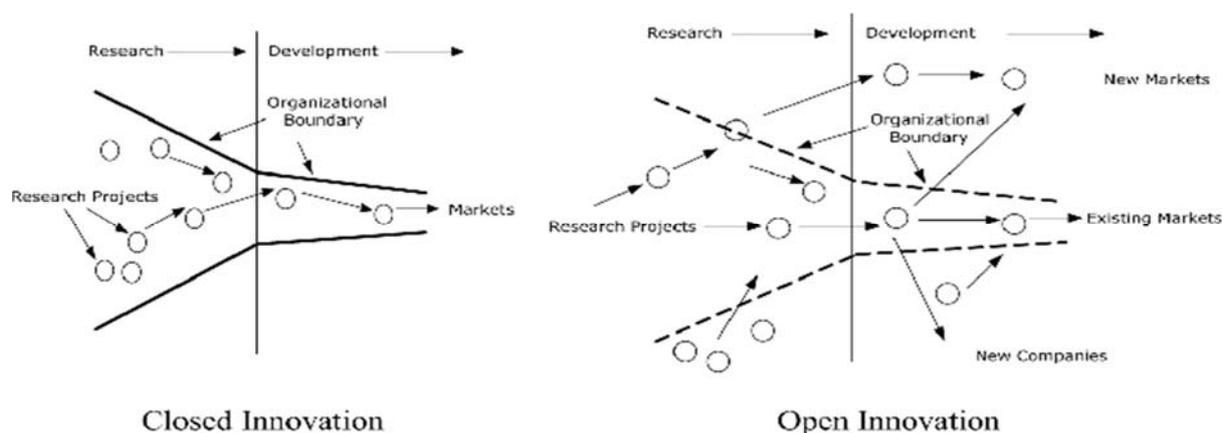


Figure 1: Closed vs. Open Innovation (Chesbrough, 2003)

Open innovation can be considered as the antithesis of the closed innovation that R&D activities and product development are conducted internally and also the products are distributed by the firm. This approach handles R&D as an open system (Chesbrough, 2006). By virtue of open innovation, precious ideas can come from inside or outside the firm and can go to market from both sides as well (Chesbrough, 2003a).

Table 1: Contrasting principles of closed and open innovation (Chesbrough, 2003b)

Closed Innovation Principles	Open Innovation Principles
The smart people in our field work for us.	Not all of the smart people work for us so we must find and tap into the knowledge and expertise of bright individuals outside our company.
To profit from R&D, we must discover, develop and ship it ourselves.	External R&D can create significant value; internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to market first.	We do not have to originate the research in order to profit from it.
If we are the first to commercialize an innovation, we will win.	Building a better business model is better than getting to market first.
If we create the most and best ideas in the industry, we will win	If we make the best use of internal and external ideas, we will win.
We should control our intellectual property so that our competitors do not profit from our ideas.	We should profit from others' use of our intellectual property whenever it advances our own business model.

Open innovation is defined as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough, 2006). In this respect, open innovation comprises two facets both as outside-in and as inside-out, stated in other words technology exploration and technology exploitation. While inbound open innovation, or technology exploration stands for innovation activities to capture and benefit from external sources of knowledge to leverage current technological developments, outbound open innovation, or technology exploitation suggests that firms can look for external organizations, whose business models are suitable for commercialization of a given technology. In a completely

open system, firms would combine and capitalize both technology exploitation and technology exploration to get maximum value due to their technological capabilities and complementary competencies of others (Chesbrough and Crowther, 2006; Lichtenthaler, 2008; van de Vrande and others, 2009). The most frequently used technology exploitation and technology exploration practices are shown in Figure 2.

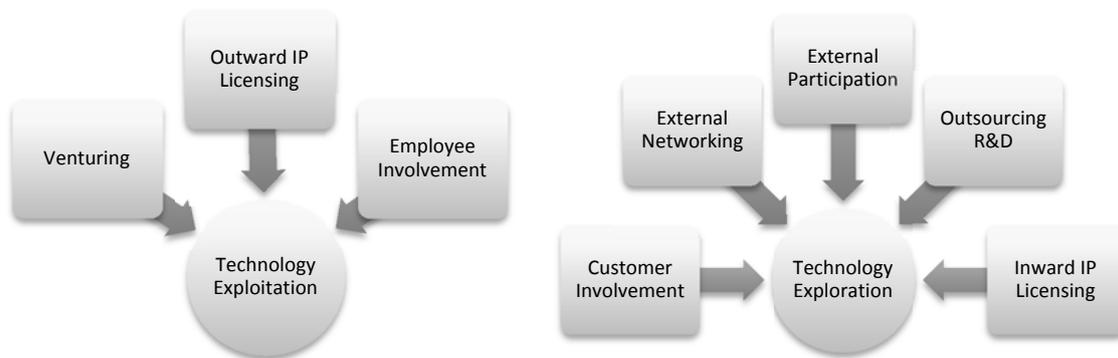


Figure 2: The most frequently used technology exploitation and technology exploration practices (van de Vrande and others, 2009)

Technology Exploitation

Firms can transfer their technologies to outside the firm through technology exploitation on the purpose of gaining benefit from internal knowledge. Technology exploitation is separated into three practices as venturing, outward licensing of intellectual property, and the involvement of non-R&D workers in innovation initiatives (van de Vrande and others, 2009).

Venturing is defined as starting up a new organization by practicing of spinning-off or spinning-out internally generated ideas. Apart from internal knowledge, support from the parent company may also include finance, human resources, legal advice, administrative affairs, etc. (van de Vrande and others, 2009). Chesbrough demonstrated the grand potential of venturing by indicating how the market value of 10 spin-off companies collectively goes beyond the value of the parent company, Xerox, by a factor of two at the end of 2001, although they fell sharply in 2000 and 2001 because of the collapse in technology stock prices (Chesbrough, 2003a).

IP has a place in open innovation in consequence of using inflows and outflows of knowledge, and means “subset of ideas that (a) are novel, (b) are useful, (c) have been reduces to practice in a tangible form, and (d) have been managed according to the law. IP includes patents, trademarks, copyrights, and trade secrets (Chesbrough, 2003a). Outward-IP licensing stands for commercialization of internal ideas to external companies whose business models fit the innovation better for putting on market (Chesbrough, 2006). In other words, outward IP licensing means offering or selling licenses to external organizations to generate better profit from firm’s own intellectual property (van de Vrande and others, 2009). A company manages its intellectual property both developing its business and profiting from other companies’ use of the company’s knowledge (Chesbrough, 2003a). According to Gassmann (2006), having an intellectual property is more important than having a factory and IP have turned to a strategic asset. Companies can have more opportunities through licensing of their internally generated patents and trademarks to outside of the company (Gassmann, 2006). Lichtenthaler and Ernst (2007) have showed the importance of

being a valuable knowledge provider in the market on the purpose of increasing benefits of technology out-licensing. Thus, companies can overcome the imperfections in the knowledge market.

Finally, employee involvement means capitalizing on the knowledge of company's own employees even if they are not the employees of internal R&D departments (van de Vrande and others, 2009). Every employee in the organization, with different professions, background information, competencies, and experiences may provide value unexpectedly to innovation process of the company. Employees can be incorporated in innovation process of the company in several ways, such as by getting their opinions and suggestions, encouraging them to take initiatives or implement ideas, creating self-directed teams, organizing an internal competition, etc. (Van Dijk & Van den Ende, 2002).

Technology Exploration

Technology exploration stands for activities that enable the firm to acquire new knowledge and technology from outside the firm. The most commonly used technology exploration practices are separated into five groups as customer involvement, external networking, external participation, outsourcing R&D and inward licensing of IP (van de Vrande and others, 2009).

Customer involvement is one of the ways of technology exploration through counting customers in innovation process directly. To illustrate, the firm can conduct an active market research to understand needs of customers, or develop products on the basis of customers' modifications or specifications regarding similar products of the firm (van de Vrande and others, 2009). According to Gassmann, customer involvement is the major constituent of open innovation (Gassmann, 2006). Besides, von Hippel (1988) argues that customers are one of the external sources of useful knowledge and they are essential to marketing research thanks to having real life experiences with products. It was also specified that enabling users to make modification on machines, equipment and software helps company with better interface to the innovation process. (von Hippel, 2005).

External networking is yet another important component of open innovation (Chesbrough, 2006). It refers to draw on or cooperate with external network partners in order to support innovation process and comprises all activities to acquire and preserve connections with these external sources of social capital, inclusive of individuals and organizations. In other words, external networking includes formal collaborative projects, as well as informal networking activities. Owing to networks, knowledge gaps can be filled swiftly without the need for spending a lot of time and money (van de Vrande and others, 2009). R&D alliances can also be considered as networks and they have become famous between non-competing companies for acquisition of technology (Gomes-Casseres, 1997). In addition, Nooteboom argues that in his work, in which was examined the use of alliances in technology based industries, when firms focus on their core competencies and do not wish to develop adequate absorptive capacity themselves; they may utilize strategic alliances with the intent of gaining knowledge and obtaining the complementary competencies from other firms (Nooteboom, 1999). Other scholars have studied the use of alliances and keiretsu, or enterprise groups, particularly that comprise multifarious families of firms located around commercial companies, main banks, vertically integrated suppliers and distributors associated with outstanding manufacturers in several industries, such as electronics, automotive, etc. (Gerlach, 1992; Dyer, 1996).

External participation provides the company with improvement of innovations, which were originally deserted or looking unpromising. Enterprises may make equity investments in start-ups or existing businesses on the purpose of getting access to their knowledge or watching for potential opportunities (Chesbrough, 2006). When the watched technologies come to enterprises' attention, mentioned equity investments bring more opportunities for further external collaborations (van de Vrande and others, 2006).

Outsourcing R&D is another way of technology exploration and refers to buying R&D services from other organizations: public research organizations, universities, suppliers and so forth (van de Vrande and others, 2009). The assumption underlies open innovation concept is that handling all R&D activities on your own internally is not possible and external R&D creates significant value for enterprises. Gassmann (2006) enunciated that technical service providers such as engineering firms and high-tech institutions have become more valuable in the innovation process and many companies have reduced cost of R&D by means of R&D outsourcing.

The open innovation concept considers that the company should be an active buyer and seller of intellectual property. Inward licensing of IP stands for buying or only using intellectual property of external organizations, such as copyright, patent, or trademark to gain benefit from innovation opportunities (Chesbrough, 2006). Firms put emphasis on selling their own IP to other firms than buying from outsiders but this is a dangerous oversight. They should consider the value that can be created by accessing external technologies, instead of recreating it unnecessarily (Chesbrough, 2003a). Inward licensing of IP may be vital for accelerating R&D and feeding business model of the company.

OPEN INNOVATION IN SMES

Chesbrough (2003a) defined open innovation using the case studies of large and experienced firms. Up to the present, open innovation has been studied mostly in high-tech multinational companies, which have large internal R&D departments. There has been limited number of research regarding open innovation in SMEs. *"SMEs are the largest number of companies in an economy, but they are under-researched in the open innovation literature"* (Gassmann and others, 2010). One of the most comprehensive researches regarding open innovation in SMEs belongs to van de Vrande and others (2009). Drawing on a survey database of 605 innovative SMEs in Netherlands, it was concluded that SMEs are increasingly implementing open innovation practices in their innovation process. Another finding was that SMEs primarily benefit from technology exploitation activities through initiatives and knowledge of their non-R&D workers. For technology exploration, mostly customers were involved in innovation process. Moreover, it was concluded that external networking is an important open innovation practice for SMEs to acquire missing knowledge. On the other hand, it was seen that a minority of SMEs practices outward and inward IP licensing, external participation, and venturing activities. The reason of these outcomes was explained with formality, structure and investment. The most popular practices for SMEs such as customer involvement and external networking do not require substantial investment because of being informal and unstructured practices. In contrast, outward and inward IP licensing, external participation, and venturing activities require substantial investment, formalized contracts, and structured innovation process for risk management. Another major finding was that SMEs are increasingly practicing open innovation and becoming more open.

MOTIVES AND CONSTRAINTS OF OPEN INNOVATION IN SMES

Firstly, firms apply open innovation practices in their innovation process because of adapting to changing environment and tracking trends. It is clear that the knowledge landscape is totally different today in comparison with past. In our day, there is a plentitude of knowledge in almost every area around us. Compared to 1970s, knowledge is more widely dispersed today. This change in knowledge landscape brings along necessity of change for organizational adaptation (Chesbrough, 2003a). Due to the fact that some other reasons such as mobile workers, wealth of venture capital and reduced product life cycles force enterprises to change, they cannot afford to innovate on their own (van de Vrande and others, 2009). In the interview-based study of Chesbrough and Crowther (2006), they concluded that enterprises do not make innovation in a different way for innovation's sake; conversely, expectation of growth in revenues and new products is primary motive to adoption of open innovation concepts. In another research, it is found that the motives to engage in open innovation practices in SMEs are mainly market-related motives. A broad set of open innovation practices are used by SMEs to serve customers effectively or to get into the new markets with major objectives to generate revenue and to provide continuity of growth (van de Vrande and others, 2009). Also, as shown in Table 2, the potential motives of open innovation in SMEs are classified comprehensively by van de Vrande and others (2009).

Table 2: Classification of Open Innovation Motives in SMEs (van de Vrande and others, 2009)

Category	Description
Control	Increased control over activities, better organization of complex processes
Focus	Fit with core competencies, clear focus of firm activities
Renewal	Improved product development, process innovation, market innovation, integration of new technologies
Knowledge	Gain knowledge bring expertise to the firm
Costs	Cost management, profitability, efficiency
Capacity	Cannot do it alone, counterbalance lack of capacity
Market	Keep up with current market developments, customers, increase growth and/or market share
Utilization	Optimal use of talents, qualities, and ideas of current employees
Policy	Organization principles, management conviction that involvement of employees is desirable
Motivation	Involvement of employees in the innovation process increases their motivation and commitment

On the other hand, SMEs face a lot of constraints when they engage in open innovation practices in their innovation process. In the open innovation literature, there are limited numbers of studies regarding constraints of open innovation.

In the paper, of which aim is to advance understanding of the process of knowledge transfer in strategic alliances, it is found that partner specific variables, such as cultural distances and

organizational distances, are related to knowledge ambiguity that in turn negatively affects knowledge transfer (Simonin, 1999). Similarly, van de Vrande and others (2009) argue that the most important constraints to open innovation result from similar causes, including both cultural and organization problems. Besides, effective adoption to open innovation practices necessitates defeating two crucial challenges that are not invented here syndrome (NIH) and lack of internal commitment (Chesbrough & Crowther, 2006). Katz and Allen (1982) describe NIH syndrome as “tendency of a project group of stable composition to believe it possesses a monopoly of knowledge of its field, which leads it to reject new ideas from outsiders to the likely detriment of its performance.” and they also argues that NIH is a critical barrier for external knowledge acquisition. While NIH syndrome relates to negative manners towards technology exploration, companies may also have negative manners towards technology exploitation, leading to only used here (OUH) syndrome (Herzog and Leker, 2010). It is clear that managing open innovation practices is more complex and difficult than managing closed innovation and it requires critical organizational, financial, and human resources Narula (2004) argues that SMEs are constrained by their limited resources because of their small size. As shown in Table 3, Gruber and Henkel (2006) also claim that small firms have difficulties related to their smallness and newness.

Table 3: Key challenges for new venture management (Gruber & Henkel, 2006)

Newness of the Firm	Smallness of the Firm
Unknown organizational entity	Very limited financial resources
Lack of trust in the abilities and offerings	Few human resources
Reliance on social interactions among strangers	Lack of critical skills
Lack of exchange relationships	Limited market presence
Lack of internal structures, processes/routines	Limited market power, disadvantage in negotiations
Lack of experience	
Lack of historical data for planning purposes	

Liability to smallness is stated as having few personnel and financial resources. Although smallness allows new ventures freedom in their business, limited availability of resources restricts them. Due to lack of financial resources, small firms cannot resist unfavorable business conditions and they can suffer from even minor inefficiencies (Gruber & Henkel, 2006). In the study of van de Vrande and others (2009), the finding, which is in line with the previous argument, is that medium-sized enterprises adopt and implement open innovation practices more often than small enterprises. Medium-sized enterprises put required scale and resources in order on the purpose of organizing innovation activities and they can be considered as mine of knowledge that can be outsourced purposively in comparison with small enterprises.

On the other side, liability to newness occurs if the firm is lacking in organizational structure and has deficiencies regarding firm-specific roles, task and capabilities. Under these circumstances, new firms are in disadvantageous position compared to mature firms (Gruber & Henkel, 2006).

Chesbrough (2010) makes a mention of structural deficiencies of SMEs regarding open innovation and touches on difficulties related to absorptive capacity, absorbing external ideas and technologies, partnerships and intellectual property rights.

Having adequate absorptive capacity is crucial especially for technology exploration. Cohen and Levinthal (1990) define absorptive capacity as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends”. According to Chesbrough (2010), SMEs frequently do not have the ability to support dedicated personnel and resources to identify useful external knowledge. Even external ideas and technologies are identified and transferred in the beginning; SMEs typically do not have the ability to absorb external ideas and technologies as well. Most of the SMEs do not have personnel with sufficient scientific background to understand, absorb and exploit the scientific discoveries and technologies, which are developed at research laboratories, universities or inside large companies. Nevertheless, Spithoven and others (2010) argue that SMEs can get over this problem through benefiting from third party technology intermediaries, which can help SMEs out with supporting their ability to investigate the market for emerging technologies and develop their ability to absorb technologies. Additively, third party technology intermediaries help SMEs out with performing complementary R&D activities such as business intelligence, technology road mapping, enabling networking by identifying potential partners, or facilitating collaboration with external partners (Spithoven and others, 2010). Moreover, SMEs run into difficulties when they make partnerships with others. SMEs are frequently seen as unattractive partners by universities, and research organizations and most of the universities and research organizations prefer to collaborate with larger and well-known enterprises (Chesbrough, 2010). Besides, SMEs frequently do not have the market power for capturing the value of externally sourced knowledge if not protected by IPRs (Chesbrough, 2010). In the study regarding challenges in adopting open innovation strategies in SMEs, Rahman and Ramos (2013) classify constraints to open innovation with variables comprehensively as shown in Table 4.

Table 4: Classification of Open Innovation Constraints in SMEs (Rahman & Ramos, 2013)

Human Aspects	General Constraints	Policy Constraints	Competition
Scarcity of skilled manpower	Lack of market demand (Low purchasing power of customer)	High cost of open innovation	Increase quality of product/ service
Scarcity of non-skilled manpower	Lack of skilled manpower	Lack of financing	Increase product differentiation
Low image of the profession	Too expensive manpower	High economic risk	Look for market niches (demand)
Low image of the sector	Lack of quality management personnel	Organizational rigidities	Increase marketing activity
Low image of the type of enterprise	Problems with administrative regulations	Government regulations	Reduce costs of production
Wage levels too expensive	Problems with infrastructure (e.g., electricity, gas, communication, etc.)	Lack of customers' responsiveness	Forming strategic partnerships

Human Aspects	General Constraints	Policy Constraints	Competition
Unpleasant work	Problems with access to finance (other than interest rates)	Lack of knowledge to use new technology	Reduce prices (prices of products/ services)
Unpleasant working conditions	High interest rates	Lack of information on market	Increase working hours
	Lack of knowledge in implementing new form of technology		Look for other foreign markets
	Lack of knowledge in implementing new form of organization		Reduce production
	Difficult to protect intellectual property		

The research of Rahman and Ramos (2013) observes that there are four aspects within the constraints that a firm faces during its business process. These aspects are human aspects, general constraints, policy constraints and constraints, which could be generated because of global competition.

TECHNOLOGY DEVELOPMENT ZONES IN TURKEY

For the first time, technology policy in Turkey took place in the Fourth Five-Year Development Plan in time period of 1979-1983. In 1989, State Planning Organization (SPO) has been appointed to establish technology development zones (Research and Investigation Report, 2009). In Turkey, 59 technology development zones were established up to September 2014 which 41 of them continue to operate. The number of technology development zones by year and the number of firms which operate in technology development zones in Turkey are shown in Figure 2 and Figure 3).

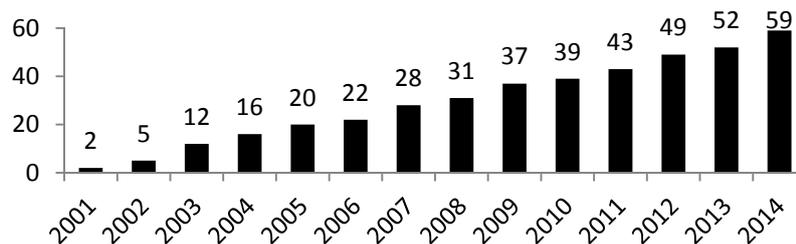


Figure 2: The number of technology development zones in Turkey by year (sagm.sanayi.gov.tr, 2014)

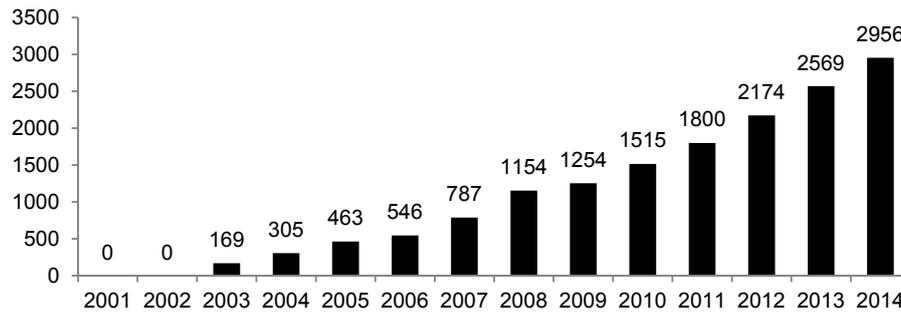


Figure 3: The number of firms in technology development zones in Turkey by year
(*sagm.sanayi.gov.tr, 2014*)

METHODOLOGY

The main aim of the study is to get status of open innovation in high-tech SMEs, which operate in science parks in Turkey across. The other aims are to identify constraints and obstacles faced by high-tech SMEs.

For designing the survey, information concerning innovation and types of innovation was collected from the literature. Then, how we convert an invention into value and related new paradigms were discussed by taking the literature into consideration. The information regarding open innovation and its practices, SMEs in Turkey, status of open innovation in SMEs and technology development zones in Turkey was also researched and collected from the literature. Thereafter, a survey was developed in an attempt to evaluate the high tech SMEs, which operate in science parks in Turkey, in the light of information gathered from literature. After developing the survey, we consulted from ITUNOVA – ITU Technology Transfer Office to take an expert opinion into account. In line with the recommendations of the experts, we updated the questionnaire for being more convenient for technology development zone companies;

- i. Scales were edited.
- ii. A new question regarding intellectual property rights was added to survey.
- iii. Some typos and ambiguities were corrected.

Besides demographic and corporate characteristic questions, 5-likert scale and yes/no options were used for some questions. The survey questions are regarding innovation, open innovation and its practices, and motives and challenges for open innovation.

This study includes the first findings of a larger-scale research on the technology development zones that operate within university eco-systems. Hence the survey is limited with the main technology development zones in the western regions of Turkey. In further research, the survey will be distributed to remaining 30 technology development zones as well. Survey is e-mailed to 98 people in 5 selected main high-tech companies in technology development zones (ITU ARI Technology Development Zone, ULUTEK Technology Development Zone, Trakya University Edirne Technology Development Zone, West Mediterranean Technology Development Zone, Ankara (CYBERPARK) Technology Development Zone, METU Technology Development Zone, Çukurova Technology Development Zone and Sakarya University Technology Development Zone). 20 firms responded to our survey. Therefore, survey response rate is approximately %20. 10 of the respondent firms are

also visited by the researchers for in-depth interviews. To analyze the collected data SPSS20 computer software was used.

Respondent firms' establishment dates vary between 1995 and 2013, while majority of them (10) was established between 2001 and 2010. Most of the respondent companies are from software segment in IT industry as shown in Figure 4.

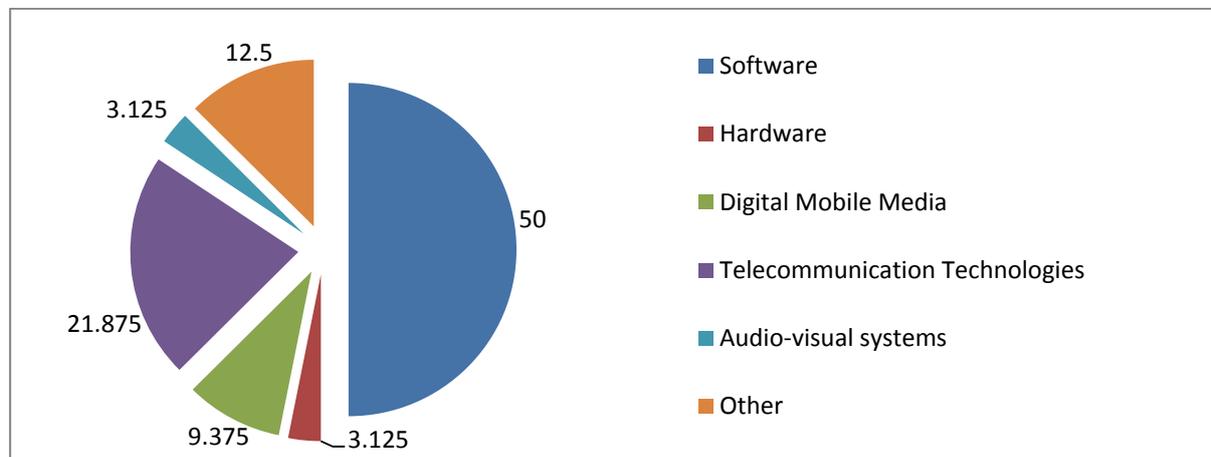


Figure 4: Respondent Firms' Activity Areas

Half of the respondents are small scaled technology start-ups with less than 10 employees and with an income of 1 million TL by year 2013. Scales of companies are given in the Table 5.

Table 5: Scale of Respondent Firms

Number of Employee	Frequency	%	Net income	Frequency	%
1-9	9	45	< 1 million TL	10	50
10-49	5	25	1 million TL- 8 million TL	5	25
50-99	2	10	8 million TL-25 million TL	1	5
100-249	2	10	25 million TL-40 million TL	3	15
More than 250	2	10	> 40 million TL	1	5
Total	20	100	Total	20	100

Respondents from these companies are from executive level (see Table 6).

Table 6: Respondents' role in the organization

Role in the organization	Frequency	Percent
Owner	9	45
Manager	10	50
Specialist/Engineer	1	5
Administrative/Support personnel	0	0
Total	20	100

FINDINGS

Open Innovation Practices of the Respondent Firms

At first, when the innovativeness level of the respondents are questioned by the number of innovations during the three years 2012 to 2014, it can be seen that most of the respondent firms (65%) introduced good innovations and half of them introduced new services (see Table 7).

Table 7: Innovations of respondent firms during 2012 to 2014

New or significantly improved goods (excluded the simple resale of new goods and changes of a solely aesthetic nature)	Yes	No	Total
Frequency	13	7	20
Percent	65	35	100
New or significantly improved services	Yes	No	Total
Frequency	10	10	20
Percent	50	50	100

When we look into the enablers of these innovations, these participating companies developed most of their new products or services in-house with 75%. On the other hand, only 4% of the participating firms prefer other enterprises and institutions during development of new goods or services (Figure 5).

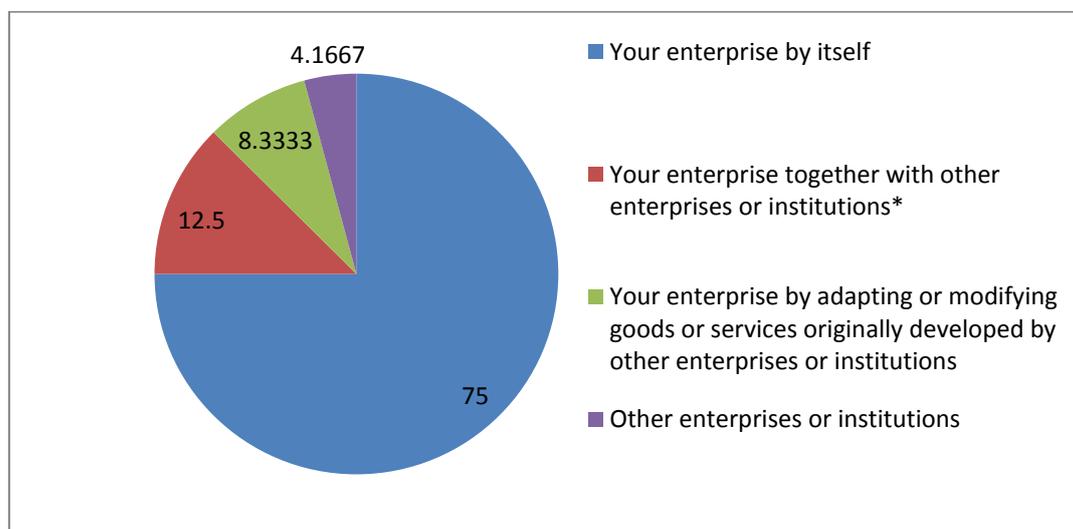


Figure 5: Developers of new goods and new services in respondent companies

Besides, the open innovation practices of the respondent companies are explored. The options of related question were taken from the study of Krause and others (2012) that they extracted the practices for small and medium sized companies. Table 8 shows the open innovation practices that were used in the survey and their descriptions.

Table 8: Classification of practices of open innovation (Krause and others, 2012)

Open Innovation Practice	Description
Platforming	Providing a base product to which customers can extend the capabilities of the product and add value to all involved (such as iPad and Apple store applications).
Idea Competitions / Challenges	Rewarding individuals, groups or companies for providing ideas to solve specific stated problems in the form of a competition or challenge.
Customer Immersion	Observation of the customer-product interaction process to further enhance products or services.
Collaboration	Developing new products, services or other capabilities through collaborating with customers, suppliers, or other 3 rd parties.
Innovation Networks	Incorporating the input from a network of contributors such as innovation hubs, advisory boards, Science and technology Centres.
Innovation Intermediaries	A company which focuses its business on helping other companies implements various facets of open innovation.
IP or Tech In-Licensing or Acquisition	Licensing or buying patents and technology and incorporating it into your organization.
IP or Tech Out-Licensing or Selling	Licensing or selling your own patents and technology to other organizations or spinning out a new company.
Lead Users	Identifying innovations added to your product by users for their own use and then incorporating the ideas back into your product.

Table 9 shows the most common and rare open innovation practices. 30% of companies had idea competition experience, but %40 believes that the implementation would be good, though they do not have any attempts about these.

- i. The most common open innovation practices are customer immersion and lead users, which enable leveraging the contribution of stakeholders from the upstream side of value chain.
- ii. Collaboration is also among the almost mostly adapted practices, together with innovation intermediaries.
- iii. These are followed by innovation networks and platforming. Also almost half of the remaining firms believed that implementing networking and platforming for innovation would be good.
- iv. On the other side, 6 firms reject to take place in competitions and challenges, as they also do not think to apply IP in-licensing or acquisition. Same firms are also against to IP tech-out licensing. So among these respondent firms, same 6 firms stated that they do not have intentions to apply licensing or idea sharing.

Table 9: Open Innovation practices of respondent firms during 2012 to 2014

Open Innovation Practices	We use or about/plan to use	Implementation would be good	We do not think to or never apply
Idea Competition/Challenges	20%	40%	40%
IP or tech-out Licensing or Selling	35%	35%	30%
IP or Tech-in Licensing or Acquisition	30%	35%	35%
Innovation Network	50%	35%	15%
Innovation Intermediaries	30%	40%	30%
Collaboration	65%	25%	10%
Customer Immersion	80%	20%	0%
Lead Users	60%	25%	15%
Platforming	40%	40%	20%

Constraints and Barriers to Open Innovation

To analyze the perceptions of the respondents from technology companies established in technology development zones on the constraints and obstacles for practicing open innovation, we also provided a list of possible constraints and obstacles that hinder open innovation and asked respondents how often do they face these challenges. These constraints were taken from the study entitled as "Open Innovation in South African SMEs" of Krause and others (2012). Table 10 shows the constraints and description of them. By interviews we explained the content of these constraint statements.

Table 10: Barriers to using open innovation in the organization for SMEs (Krause and others, 2012)

Barriers to Open Innovation	Explanation
Finance	Obtaining financial resources
Resources	Cost of innovation, time needed and human resources needed
Commitment	Lack of employee commitment, resistance to change
Knowledge	Lack of technological knowledge, lack of competent personnel, lack of legal/administrative knowledge
Marketing	Insufficient market intelligence, market affinity, marketing problems with new products
Administration	Bureaucracy, administrative burdens, conflicting rules
Quality of Partners	Partners does not meet expectations, deadlines are not met
Idea Management	Employees have too many ideas, no management support, no formal process for innovation
Customer demand	Customer demand too specific, innovation appears not to fit the market

Barriers to Open Innovation	Explanation
Organization/ culture	Balancing innovation and daily tasks, communication problems, aligning partners, organization of innovation
Intellectual Property Rights	Ownership of developed innovations, user rights when different parties corporate
User acceptance	Adoption problems, customer requirements misjudged
Competent employees	Employees lack knowledge/competences, not enough labor flexibility

As can be seen from the Table 11, finance, administrative clauses, and resources together with knowledge are among the highly agreed constraints. From the resource based approach of Grant (1995), respondents believe that the lack of resources (including the intangible assets like knowledge) is standing as the barriers to implementing open innovation

On the other hand, idea management is perceived as one of the strengths of technology companies in technology development zones, as this constraint is commonly rejected by the respondents. Also the customer demand is not seen as an obstacle by the significant number of respondents.

Table 11: Constraints to Open Innovation

Constraint to Open Innovation	Total Disagree	Neither agree nor disagree	Total Agree
Commitment	40%	35%	25%
Knowledge	30%	25%	45%
Idea management	60%	20%	20%
Intellectual property rights	35%	35%	30%
Finance	30%	15%	55%
Administrative	30%	25%	45%
Resources	25%	20%	55%
User acceptance	35%	40%	25%
Customer demand	45%	25%	30%
Organization/culture	35%	30%	35%
Partners	40%	40%	20%
Marketing	30%	35%	35%
Competent employees	30%	30%	40%

Barriers to inbound and outbound open innovation is also questioned in the survey questionnaire and in-depth interviews. Options of related questions were taken from the study of Savitskaya and

others (2010) that they explore constraints to open innovation for two facets of open innovation in China.

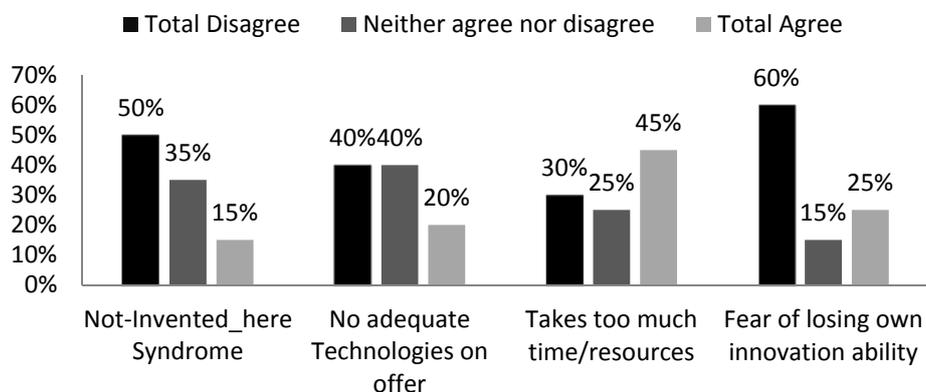


Figure 6: Barriers to Inbound open innovation

As shown in Figure 6, “Fear of losing own innovation ability” is not viewed as a barrier to In-bound Open Innovation. As well, half of the respondents believes that “Not-invented here syndrome” is not a barrier for this kind of open innovation method. However, importing a technology by inbound open innovation practice is perceived as a process that consumes and resources by a significant number of respondents.

As well, barriers to outbound open innovation are explored and the findings are shown in Figure 7. “Not-Sold-here Syndrome” and “Lack of marketplaces for Technologies” are not viewed as barriers to outbound Open Innovation by half of the respondents. Difficulty of finding buyers and Impact of the complexity of IPRs is a barrier that a significant finding could not be reached on.

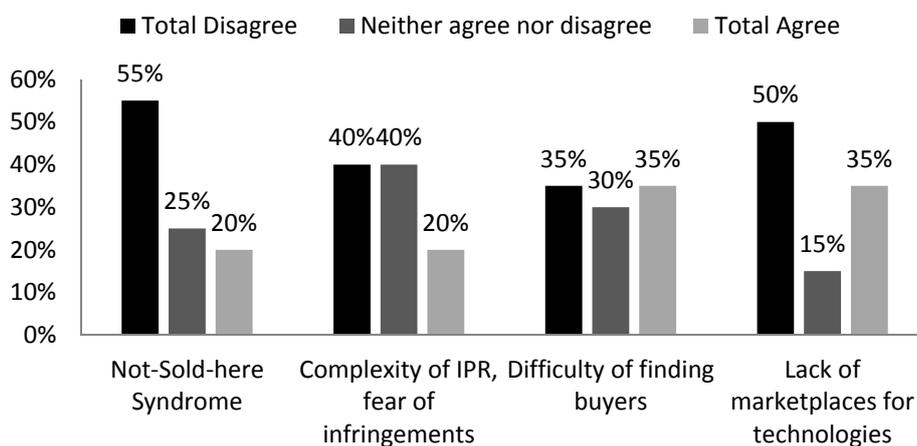


Figure 7: Barriers to Outbound open innovation

As stated in the literature (Rahman & Ramos, 2013), human resource aspects are important factors in implementing open innovation in SMEs. Hence the human resource problems in the company are explored and the findings are presented in Figure 8.

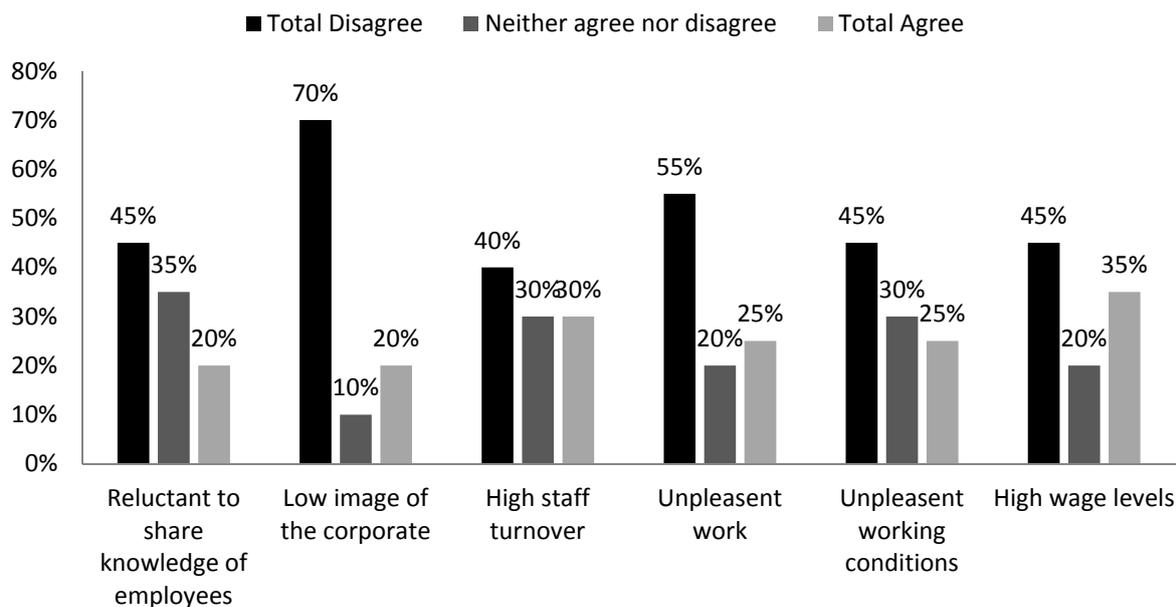


Figure 8: Human resource problems in the company

Among respondent companies, human resource problems like low corporate image or unpleasant work are not perceived as critical barriers to open innovation. Almost half of the respondents do not think that other human resource related problems are important, either.

CONCLUSION

Although most of the explored companies that have introduced mostly product and somehow service innovations in-house, they had been practitioners of some open innovation methods like Customer immersion and Lead Users, Collaboration and partly Innovation Intermediaries and Innovation Networks and Platforming. However, some of the companies strictly reject idea competitions and challenges, IP in-licensing or acquisition, and IP tech-out licensing.

Finance, Administrative clauses, and resources together with knowledge are among the highly agreed constraints for open innovation, while the Idea management and customer demand did not indicate a potential as a barrier. “Fear of losing own innovation ability” or “Not-invented here syndrome” is not a barrier for inbound open innovation method, while any barriers to “Outbound Open Innovation” are not perceived significantly.

Human resource problems like low corporate image or unpleasant work are not perceived as critical barriers to open innovation.

The major limitation to this study is comes from the collection of data, as only main technology development zones in the western regions of Turkey were studied and a limited sample could be covered. Hence, the study includes the first findings of a larger-scale study in technology development zone of whole country. In further research, we aim to increase the number of firms (min 100 firms) that participate in the survey and also the survey will be distributed to remaining technology development zones. In this paper, we explored the current open innovation factors and practices that act as constraints to open innovation especially for start-ups and small and medium-

sized enterprises in technology development zones. In further research trends, motives and strategic objectives of open innovation can also be considered.

REFERENCES

- Allen, T.J., Cohen, S.I., (1969), Information Flow in Research and Development Laboratories. *Administrative Science Quarterly*, 14(1), 12–19.
- Bessant, J.R., Tidd, J., (2007), *Innovation and Entrepreneurship*. Chichester: John Wiley and Sons.
- Carter, C.F., Williams, B.R., (1959), The Characteristics of Technically Progressive Firms. *Journal of Industrial Economics*, 7(2), 87–104.
- Chesbrough, H.W., (2003a), *Open Innovation: The new imperative for creating and profiting from technology*. Boston, Mass.: Harvard Business School Press.
- Chesbrough, H.W., (2003b). The Era of Open Innovation. *MIT Sloan Management Review*, 44(3), 35-41
- Chesbrough, H.W., (2010), Open Innovation: A Key to Achieving Socioeconomic Evolution How Smaller Companies can benefit from Open Innovation. *Economy, Culture & History Japan Spotlight Bimonthly*, JAPECO, Japan Economic Foundation (JEF).
- Chesbrough, H.W., Rosenbloom, R.S., (2002), The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spin-off Companies. *Industrial and Corporate Change*, 11(3), 529-555.
- Chesbrough, H.W., Crowther, A.K., (2006), Beyond High Tech: Early adopters of open innovation in other industries. *R&D Management*, 36(3), 229–236.
- Chesbrough, H.W., Vanhaverbeke, W., West, J., (eds.) (2006), *Open Innovation: Researching a New Paradigm*. Oxford: Oxford University Press.
- Cohen, W.M., Levinthal, D.A., (1990), Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152.
- Dyer, J.H., (1996), Does Governance Matter? Keiretsu Alliances and Asset Specificity as Sources of Japanese Competitive Advantage. *Organization Science*, 7(6), 649-666.
- Gassmann, O., (2006), Opening up the innovation process: towards an agenda. *R&D Management*, 36(3), 223–228.
- Gassmann, O., Enkel, E., Chesbrough, H.W., (2010), The Future of Open Innovation. *R&D Management*, 40(3), 213-221.
- Gerlach, M., (1992), *Alliance Capitalism: The Social Organization of Japanese Business*. Berkeley CA: University of California Press.
- Gomes-Casseres, B., (1997). Alliance Strategies of Small Firms. *Small Business Economics*, 9(1), 33-44
- Grant, R., (1991), The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, 33(3), 114- 135.
- Grant, R., (1995), A Knowledge-Based Theory of Inter-Firm Collaboration. *Academy of Management - Best Paper Proceedings*, 17-21.
- Grant, R. M., (1996), Toward a Knowledge-Based Theory of the Firm. *Strategic Management Journal*, 17, 109-122

- Gruber, M., Henkel, J., (2006), New ventures based on open innovation – An empirical analysis of start-up firms in embedded Linux. *International Journal of Technology Management*, 33, 356-357.
- Herzog, P., Leker, J., (2010), Open and Closed Innovation: Different Innovation Cultures for Different Strategies. *International Journal of Technology Management*, 52(3-4), 322-343.
- Katz, R., Allen, T.J. (1982), Investigating the not-invented-here (NIH) syndrome: a look at performance, tenure and communication patterns of 50 R&D project groups. *R&D Management*, 12(1), 7–20.
- Krause, W., Schutte, C., du Preez, N., (2012), Open Innovation in South African Small and Medium-Sized Enterprises, *Proceedings of the International Conference on Computers & Industrial Engineering (CIE42)*, Cape Town, South Africa, CIE & SAIIE 2012: 201-210
- Lichtenthaler, U., (2008), Open innovation in practice: an analysis of strategic approaches to technology transactions. *IEEE Transactions on Engineering Management*, 55(1), 148–157.
- Lichtenthaler, U., Ernst, H., (2007), Developing Reputation to Overcome the Imperfections in the Markets for Knowledge. *Research Policy*, 36(1), 37–55.
- Narula, R., (2004), R&D collaboration by SMEs: New opportunities and limitations in the face of globalization. *Technovation*, 24(2), 153–161.
- Nooteboom, B., (1999) *Inter-Firm Alliances: Analysis and Design*. Routledge, London.
- Rahman, H., Ramos, I., (2013), Challenges in Adopting Strategies in SMEs: An Exploratory Study in Portugal. *Issues in Informing Science and Information Technology*, 10, 431-448.
- Savitskaya, I., Salmi, P., Torkkeli, M., (2010), Barriers to Open Innovation: Case China. *Journal of Technology Management & Innovation*, 5(4), 10-21.
- Simonin, B.L., (1999), Ambiguity and the process of knowledge transfer in strategic alliances. *Strategic Management Journal*, 20(7), 595-623.
- Spithoven, A., Clarysse, B., Knockaert, M., (2010), Building absorptive capacity to organize inbound open innovation in traditional industries. *Technovation*, 30(2), 130–141
- Trott, P., Hartmann, D., (2009), Why Open Innovation is Old Wine in New Bottles. *International Journal of Innovation Management*, 13(4), 715-736.
- Van de Vrande, V., Lemmens, C., Vanhaverbeke, W., (2006), Choosing governance modes for external technology sourcing. *R&D Management*, 36(3), 347–363.
- Van de Vrande, V., deJong, J.P.J., Vanhaverbeke, W., de Rochemont, M., (2009), Open innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29(6-7), 423–437.
- Van Dijk, C. and Van den Ende, J., (2002), Suggestion systems: transferring employee creativity into practicable ideas. *R&D Management*, 32(5), 387–395.
- Von Hippel, E., (1988), *The Sources of Innovation*. New York: Oxford University Press
- Von Hippel, E., (2005), *Democratizing Innovation*. Cambridge, MA, MIT Press.
- Törel, M. (1991), *Dünyada ve Türkiye’de Teknoparklar*. Sanayi Kongresi Bildiriler Kitabı, 148, Ankara.
- Research and Investigation Report, (2009). 4691 sayılı Teknoloji Geliştirme Bölgeleri Kanunu Uygulamalarının Değerlendirilmesi ile Uygulamada Ortaya Çıkan Sorunların Çözümüne İlişkin Öneri Geliştirilmesi, 2009, 1, pp. 33 <https://www.tccb.gov.tr/ddk/ddk26.pdf>

SAGM.GOV.TR , 2014. TGB Report,

http://sagm.sanayi.gov.tr/userfiles/file/TGB%20g%C3%BCncel%20d%C3%B6k%C3%BCmanlar/TGB%20GENEL%2017_10_2014.pdf