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Constraints to Open Innovation in Science and Technology Parks

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Abstract

Open innovation that is known as the use of purposive inflows and outflows of knowledge with a view to accelerate firms' own internal innovation, and expand the markets through external use of innovation is a very important window of opportunity for all firms to keep up with technology and survive. However, firms, which face lots of constraints to engage in open innovation, may be in tendency to closed approaches and reluctant to use open innovation. In terms of open innovation, however, our understanding of the factors, which are disincentives to apply open innovation, is still incomplete. On the other hand, science and technology parks are the platforms that enable firms to innovate in an open system thanks to their networking nature across universities, research labs, start-ups, SMEs, and large firms. In this context, this study aims to explore the factors that obstruct the use of open innovation based on the data gathered from 102 ICT firms that operate in science and technology parks in Turkey. Constraints to open innovation that are compiled from relevant literature are subjected to exploratory factor analysis to reduce the number of variables, and uncover some new structures. Constraints concerning "confidentiality and conservativeness of the firm", "human resources, brand and image", "resources and costs", "management and organization", "market, partnership, and technology sources" and "administration" are found as the constraints to open innovation faced by firms operating in science and technology parks.

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Keywords: Open Innovation, Innovation Management, Science and Technology Parks, ICT industry

1. Introduction

At the present time, international competition has been growing lastingly and moving with the times is the only way out to survive in the competitive environment, which forces its actors to introduce innovations in every part of life unceasingly. For this reason, firms, all over the world, strive mightily at developing innovations. In other

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respects, no matter how efficient a firm works, developing innovations using its own internal resources beclouds surviving. It is a fact that even the largest and most reputable companies with most extensive in-house capabilities have difficulties in developing innovations by themselves. Under these circumstances, even the companies, which compete with each other, use complementary knowledge and technology in cooperation to reduce costs and share risks. Additionally, companies include their suppliers, customers and employees in developing innovation. All these emerging developments indicate that this new paradigm, which is called open innovation, has become a significant part of innovation management and will shape the future (Huizingh, 2011).

Open innovation that is originated by Chesbrough (2003) is known 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). On the other hand, science and technology parks (STPs) give companies an opportunity to innovate in an open system because of the fact that they act as an intermediary between technology developer and technology diffuser and transfer innovations from universities and research labs to the markets. Considering their networking nature, STPs are the mediators and providers of open innovation for universities, research labs, start-ups, SMEs, and large companies. However, companies operating in STPs may be inclined to keep their innovation systems closed and stay their own networks due to constraints to engage in open innovation, and this orientation to closed approaches prohibits companies from the use of ecosystems of STPs. Unfortunately, there are limited number of studies regarding problems and obstacles of open innovation faced by STP companies. To contribute to the theory in this context, current study aims to explore the factors that encumber the use of open innovation based on the data collected from ICT companies that operate in STPs in Turkey. The major contributions of the study to enhance the knowledge on open innovation practices are as follows: (1) it provides theoretical use of open innovation in STP companies; (2) it fills the gap regarding constraints to open innovation in order to augment the use of open innovation as a theoretical basis, and (3) it compiles these constraints as a summary by means of exploratory factor analysis. Despite the data is limited to ICT companies that operate in STPs, this study may provide insights on constraints to open innovation to all practitioners and researchers from different contexts.

The outline of the paper is as follows. Second section provides background of the study and touches on open innovation and constraints to open innovation, and STPs. Third section presents research method and the characteristics of the sample. In the fourth section, data analysis and findings of the study are presented. Finally, the last section comprises conclusions and limitations of the study and suggestions for further research.

2. Literature Review And Hypotheses

2.1. Open Innovation

Open innovation, which is originated by Chesbrough (2003) in order to reduce the gap between industry and academia, is known 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). Despite the fact that companies, which use closed innovation particularly based on internal R&D, consider their R&D laboratories as a strategic asset and hence they create entry barriers for their potential competitors, open innovation paradigm argues that companies can no longer afford to make innovation by performing R&D activities single-handedly. In that case, open innovation is considered as the antithesis of the closed innovation and it handles R&D as an open system (Chesbrough, 2006). The differences between open innovation and closed innovation are depicted in Figure 1 and listed in Table 1. In the open innovation model, which is based on the principal of abundant knowledge that must be used quite easily if it provides value for the company, the boundary between a firm and its environment is more permeable compared to closed innovation model.

Considering the definition of open innovation provided by Chesbrough (2006), open innovation comprises two facets: technology exploration (outside-in) and technology exploitation (inside-out). While technology exploitation suggests that firms should look for external organizations, whose business models are more suitable for commercialization of a given technology, technology exploration refers to innovation activities to capture and benefit from external sources of knowledge and technology (van de Vrande et al., 2009).

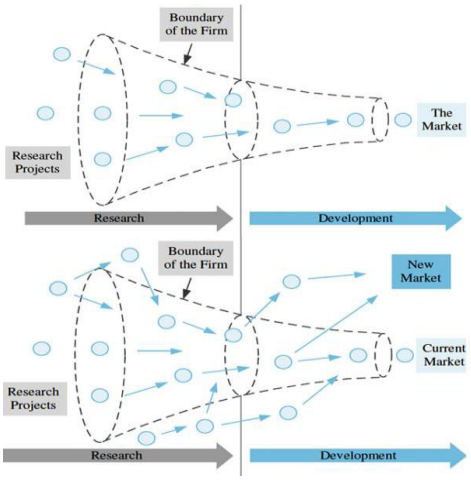

Fig 1. The closed innovation model versus open innovation model (Simic, 2013)

In a completely open system, firms would combine and capitalize both practices of technology exploitation and technology exploration in order to get maximum value thanks to their technological capabilities and complementary competencies of other organizations (Chesbrough & Crowther, 2006; Lichtenthaler, 2008; van de Vrande et al., 2009).

Table 1. Contrasting principles of closed innovation 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.

Dahlander & Gann (2010) provide another classification of open innovation that has the potential to be considered as a main framework for open innovation as presented in Table 2. They identify four main modes of open innovation –revealing, selling, acquiring, and sourcing- as an extension of the study of Enkel et al. (2009). They differentiate between technology exploitation where knowledge flows outside the firm, and technology exploration where external knowledge flows inside the firm and break them down further by adding the dimension of pecuniary versus non-pecuniary. This implies that openness is not necessarily a binary classification of open versus closed (Chesbrough, 2003a) and the idea behind open innovation can be seen on a continuum, ranging from closed to open (Dahlander & Gann, 2010).

Table 2. Classification of Modes of Open Innovation (Dahlander & Gann, 2010, Aas & Pedersen, 2016)

	Pecuniary	Non-pecuniary
Technology Exploration (Inbound Open Innovation)	Acquiring (Cultural and strategic alignment)	Sourcing (Incentives and preconditions for individual's involvement)
Technology Exploitation (Outbound Open Innovation)	Selling (Management of tangible innovation outputs)	Revealing (Incentives and preconditions for sharing)

Chesbrough & Brunswicker (2013) classify the modes of open innovation and present the most frequently used practices of these modes as shown in the Figure 2.

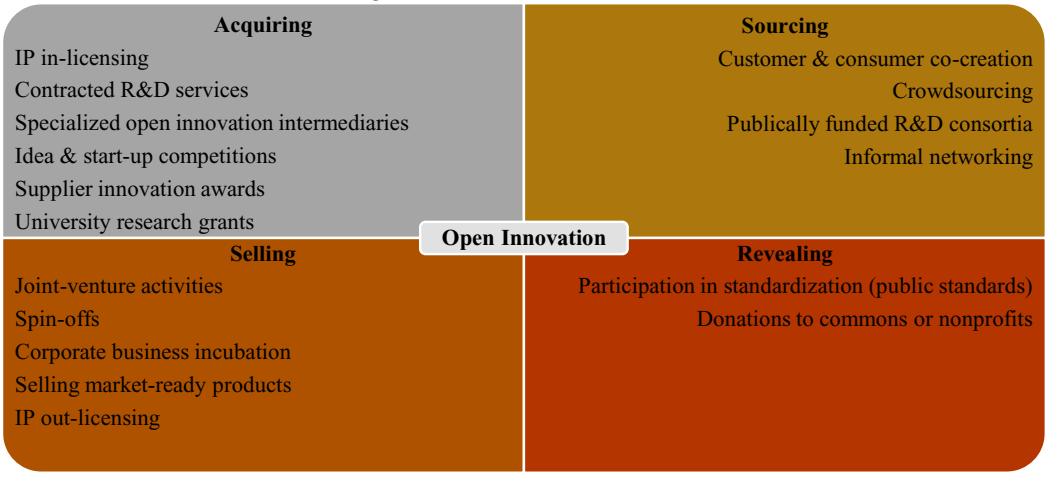

Fig 2. Classification of Open Innovation Practices (Chesbrough & Brunswicker, 2013)

2.2. Science and Technology Parks(STPs)

Fostering university-industry cooperation in an effort to promote innovation and increase innovation performance is one of the most important strategies of developed and developing countries (Gulbas, 2011) and STPs are emerged from the relationships between the universities, industries, and governments (Yalcintas, 2014). According to Storey and Tether (1998), role of the STPs is to enable academics at the local universities to commercialize research ideas, to provide accommodation for current large companies wishing to locate near a university on the purpose of facilitating research links with people or department within the university, and to provide high quality accommodation for current SMEs that are using and developing advanced technologies. According to the International Association of Science Parks (IASP, 2016), "a STP is an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a science park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities."

STPs are one the most appropriate candidates as a multifaceted connecter for open innovation across large companies, SMEs, start-ups, universities and research laboratories as illustrated in Figure 3. Several networking sessions that are organized by STPs provide mentioned actors with opportunities such as in-licensing and out-licensing of IP, flow of human capital etc. (Narasimhalu, 2013).

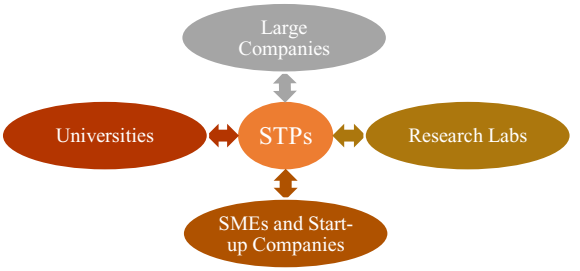

Fig 3. Role of Science and Technology Parks in Open Innovation (Narasimhalu, 2013)

2.2.1. Science and Technology Parks in Turkey

For the first time, initiatives regarding establishment of STPs in Turkey have been arisen in 1980s. As a result of these efforts, technology centers have been established thanks to the cooperation between universities and KOSGEB and STPs have obtained legal status with The Law of Technology Development Zones adopted in 2001. The first STP of Turkey is Marmara Technopark that was founded in 1999 within TUBITAK Marmara Research Center (Kaplan, 2011). In Turkey 63 STPs have been founded up to December 2015 and 50 of them are operating (tgbd.org.tr, 2016). The number of STPs and the number of companies that operate in these STPs in Turkey by year are depicted in Figure 4 and Figure 5.

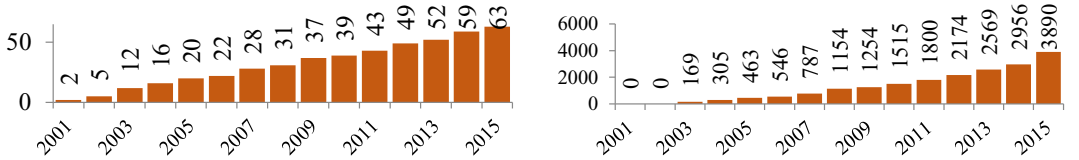

Fig 4: The number of technology development zones and the number of firms in technology development zones in Turkey (BTGM, 2016)

2.3. Constraints to Open Innovation

Although firms face a lot of constraints when they engage in open innovation, limited number of previous research are found in open innovation literature. In this section, the most frequently repeated constraints to open innovation are presented. Especially, constraints faced by start-ups and SMEs are investigated owing to the fact that this study focuses on STP firms, which are mostly micro, small and medium-sized companies.

Simonin (1999) argues that partner specific variables such as cultural and organizational distances are related to knowledge ambiguity that in turn affects knowledge transfer negatively. In a similar manner, Van de Vrande et al. (2009) allege that the most crucial constraints to open innovation results from similar causes including cultural and organizational problems. Especially, not invented here syndrome (NIH) and lack of internal commitment are two important challenges that should be circumvented to adopt to open innovation effectively (Chesbrough and Crowther, 2006). Not invented here syndrome refers to negative reactions to knowledge that comes from outside of the organization (Katz & Allen, 1982; Lichtenthaler & Ernst, 2006; Kathoefer & Leker, 2010) and as it can be understood from the definition, NIH syndrome is a critical barrier to technology exploration. While NIH syndrome relates to negative attitudes towards technology exploration, not sold here (NSH) syndrome relates to negative attitudes towards technology exploitation (Herzog & Leker, 2010). Savitskaya et al. (2010) explore the barriers to each facets of open innovation as shown in the Table 3.

Table 3. Barriers to Inbound and Outbound Open Innovation (Savitskaya et al., 2010)

Barriers to Inbound Open Innovation	Barriers to Outbound Open Innovation
Not-invented-here (NIH) syndrome	Not-sold-here (NSH) syndrome
No adequate technologies on offer	Complexity of IPR, fear of infringements
Takes too much time/resources	The difficulty of finding buyers
Fear of losing own innovation ability	Lack of marketplaces for technologies

In particular, small and/or new companies are constrained by their smallness and newness when they engage in open innovation (Narula, 2004; Gruber & Henkel, 2006). Liability to smallness means having few personnel and financial resources. In spite of the fact that smallness allows firms freedom in the business processes, they cannot resist unfavorable business conditions and suffer from even minor inefficiencies because of limited resources (Gruber & Henkel, 2006). Van de Vrande et al. (2009) argues that medium-sized enterprises adopt and implement open innovation practices more effective in comparison to small-sized enterprises. On the other side, liability to newness arises from lack of organizational structure and deficiencies in firm-specific roles, tasks and capabilities (Gruber & Henkel, 2006). Additionally, Chesbrough (2010) makes a mention of structural deficiencies of SMEs concerning open innovation and difficulties related to absorptive capacity, partnerships and intellectual property rights. SMEs frequently do not have adequate absorptive capacity, which means the ability of an organization to notice the value of new and useful external information, understand and apply it to commercial ends (Cohen &

Levinthal, 1990; Chesbrough, 2010). Moreover, inexperienced SMEs and start-ups run into difficulties when they make partnerships with larger companies that are long-established and complex organizations (Minshall et al., 2010). Besides, ability to protect intellectual property may be limited for SMEs due to their economic dependence on large companies (Chesbrough, 2010). Because of experienced difficulties with large companies, smaller companies may be in tendency to stay within the clusters of their own organization and this orientation to closed approaches prevents them from making use of open innovation. In addition to barriers mentioned above, Krause et al. (2012) make a comprehensive list of barriers that are faced by SMEs as shown in the Table 4.

Table 4. Barriers to Open Innovation (Krause et al., 2012)

Barriers to OI	Explanation
Finance	Obtaining financial resources
Resources	Cost of innovation, time needed and human resources needed
Organization/culture	Balancing innovation and daily tasks, communication problems, aligning partners, organization of innovation
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
Commitment	Lack of employee commitment, resistance to change
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

3. Methodology

3.1. Research Goal

The main concern of this study is to determine constraints and obstacles to open innovation faced by ICT firms that operate in STPs in Turkey.

3.2. Sample and Data Collection

A cross-sectional survey is developed in order to collect data from STP companies in Turkey. The draft survey that is developed in the light of the information gathered from the related literature is translated into Turkish and expert opinion is taken to make the survey more convenient for firms. After taking recommendations from the expert from ITUNOVA-ITU Technology Transfer Office, the survey is updated and published on ITU Data Collection and Statistical System. Then a pilot study is conducted in ITU ARI Technology Development Zone. After completing the pilot study and considering feedbacks of the firms, survey is updated one more time. In the sequel, survey link is e-mailed to 515 firms that are selected randomly from 41 STPs in Turkey. 102 firms from 38 STPs respond to our survey and response rate is approximately 20%. A follow-up survey is e-mailed to companies that do not participate in the survey and the responses received from some of these firms are mostly related to lack of time.

Because the constraints and barriers to open innovation are multidimensional and intangible, comprehensive measures that are collected from the related literature are adapted to this research and they are operationalized by means of 5-point Likert scale ranging from “never” to “a great deal”. Items concerning constrains to open innovation are adapted from the studies of Savitskaya et al. (2010), Krause et al. (2012), and Rahman & Ramos (2013). Data processing is performed using the SPSS Software, version 20.0.

3.2.1. Characteristics of the Respondent Firms

All respondents are from executive level. Most of the firms are founded within the last 5 years and it means that participants of this study are mostly new companies, which may face constraints because of their newness. In addition, majority of the participants are micro, small and medium-sized enterprises as it is expected (see Table 5). More than half the respondent companies have less than 10 employees and annual net income of 64 percent of these

companies are less than 1 million TL. It means that STP companies may face constraints to engage in open innovation because of their size, as well.

Table 5. Number of Employee and Net Income of the Respondent Firm

Number of Employee	Frequency	Percent	Net income (Turkish Lira)	Frequency	Percent
1-9	55	53,9	Less than 1 million TL	64	62,7
10-49	26	25,5	1 million TL- 8 million TL	18	17,6
50-99	6	5,9	8 million TL-25 million TL	11	10,8
100-249	8	7,8	25 million TL-40 million TL	6	5,9
More than 250	7	6,9	More than 40 million TL	3	2,9
Total	102	100,0	Total	102	100,0

Table 6 presents the types and target markets of the respondent firms. Approximately 93% of the participants are independent companies and remainders are subsidiaries of international companies. Additionally, 79 percent of the participants target both internal and external markets and there is only one firm that targets only external market.

Table 6. Firm Type and Target Market of the Respondent Firm

Firm Type	Frequency	Percent	Target Market	Frequency	Percent
A subsidiary of an international company	7	6,9	Only internal market	22	21,6
An independent company	95	93,1	Only external market	1	1,0
			Both internal and external market	79	77,5
Total	102	100,0	Total	102	100,0

Since the respondents are ICT companies, all of them operate in information technology and telecommunication sector. Almost half of the respondents are from software segment as depicted in the Figure 5.

Fig 5. Activity Area of the Respondent Firm

3.3. Data Analysis and Findings

According to the survey results, the most frequently used open innovation practices by STPs are shown in the Table 7. Customer immersion, collaboration and lead users are the most frequently used open innovation practices by STP companies. Hence, high-tech STP companies mostly prefer to observe customer-product interaction process to develop products and services, incorporate the ideas of lead users into their products and services, and also develop new products, services or other capabilities through collaborating with their suppliers, employees or other third parties. However, idea competitions are the least preferred open innovation practice.

Table 7. Open Innovation Practices of the Respondent Firms

Open Innovation Practices	N	Mean	Std. Deviation
Customer Immersion	102	4,34	,884
Collaboration	102	4,12	1,008
Lead Users	102	4,10	1,067
Platforming	102	3,79	1,084
Innovation Network	102	3,53	,951
IP or tech-out licensing or selling	102	3,53	,972
IP or Tech-in licensing or acquisition	102	3,50	1,150
Innovation Intermediaries	102	3,34	1,029
Idea competitions/Challenges	102	3,20	1,169

In order to ensure the construct validity of the survey, reduce the number of variables, and uncover some new structures, all items are pooled together and exploratory factor analysis is applied. How large the sample size should be to produce reliable solutions is a significant question that comes to mind. Hair et al. (1995) suggest that simple size should be 100 or greater and some researchers point out that even 50 cases may be adequate for performing factor analysis (Tabachnick & Fidell, 2001; Sapnas & Zeller, 2002). Therefore, our sample is adequate to perform

factor analysis. Before proceeding to the principal component analysis, appropriateness of items to exploratory factor analysis is evaluated. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy that measures the extent to which variables are suitable for factor analysis is found 0.857, indicating a meritorious level of adequacy (Hair et al., 1995) and the result of Bartlett's Test of Sphericity, which tests whether correlation matrix is equal to unit matrix, is significant to reject null hypothesis ($p<0.001$).

Using Kaiser's criterion (i.e. eigenvalue>1), principal component analysis extracts six factors. According to Buyukozturk (2002), factor loading between 0.30 and 0.59 is considered as moderately high and loadings higher than 0.60 are considered as high. On the other hand, difference between two factor loadings should be higher than 0.10 if factor loading of an item has high values in two factors (Tabachnick & Fidell, 2001). Considering these all criteria, factor analysis is performed until reaching the optimal result. Because of mentioned problems, "knowledge", "intellectual property rights", "user acceptance", and "too much time and resource requirements" are excluded from the factor analysis. Six factors explain 68.053% of the total variance of constraints to open innovation (Table 8). Factor 1, which is the most important dimension in explaining total variance, explains 35.583% of the total variance.

Table 8. Eigenvalues of the Factors

Factors	Eigenvalue	Variances, %	Cumulative, %
F1	8,184	35,583	35,583
F2	1,900	8,262	43,845
F3	1,564	6,799	50,644
F4	1,479	6,431	57,074
F5	1,388	6,033	63,108
F6	1,137	4,946	68,053
F7 (not included)	,846	3,677	71,731

Table 9 presents the factor loadings and communalities. According to Henson and Roberts (2006), "the meaningfulness of the latent factors is ultimately dependent on researcher's definition". Pett et al. (2003) emphasizes that the naming of the factors is a subjective, inductive, and theoretical process. For this reason, both items of each factor and the related literature are considered to name factors suitably.

Table 9. Factor Loadings and Communalities.

Factor	Loading	Communality	Factor	Loading	Communality
F1: Confidentiality, Conservativeness			**F4: Management and Organization**		
Not sold here syndrome	0,766	0,742	Commitment	0,737	0,656
The complexity of the intellectual property rights, fear of infringements	0,739	0,663	Organization/Culture	0,711	0,635
Fear of losing own innovation ability	0,696	0,660	Idea Management	0,595	0,576
Not invented here syndrome	0,664	0,713	**F5: Market, Partnership, Technology Sources**		
The difficulty of finding buyers	0,618	0,759	Customer demand	0,760	0,716
Employees are reluctant to share information	0,551	0,686	Partners	0,711	0,623
F2: Human Resources, Brand and Image			No adequate technologies on offer	0,684	0,637
Unpleasant works	0,821	0,745	**F6: Administrative Constraints**		
Unpleasant working conditions	0,764	0,695	Administration	0,792	0,701
Lack of skilled manpower	0,727	0,692	Finance	0,765	0,785
The high staff turnover	0,628	0,660			
The low image of the firm	0,568	0,635	*Extraction Method: Principal Component Analysis.*		
F3: Resources and Costs			*Rotation Method: Varimax with Kaiser Normalization.*		
Marketing	0,734	0,706			
High wage levels	0,670	0,603			
Resources	0,622	0,681			
Competent employees	0,586	0,681			

The first factor comprises six items which are "NSH syndrome", "the complexity of the IPR, fear of infringements", "fear of losing own innovation ability", "NIH syndrome", "the difficulty of finding buyers", and "employees are reluctant to share information". Hence, the first factor represents confidentiality and conservativeness. The second factor includes five items with factor loadings of at least 0.568. The items, which are "unpleasant works", "unpleasant working conditions", "lack of skilled manpower", "the high staff turnover", and "the low image of the firm", are related to human resources, brand and image. Third factor comprises four items – marketing, high wage levels, resources, competent employees- all with loadings of at least 0.586 and this factor is termed as management and organization. Fourth factor includes three items as "commitment", organization/culture",

and "idea management" and hence it represents constraints regarding management and organization. "Customer demand", "partners", and "no adequate technologies on offer" are included in fifth factor that is named as market, partnership, and technology sources. Finally, constraints regarding "administration" and "finance" are included in the sixth factor that is termed as administrative constraints.

Since most of the constructs are multidimensional and subjective, performing reliability analysis has a great importance. Cronbach's alpha internal consistency coefficients are used to assess the reliability or internal consistency of the factors (Cronbach, 1947). As shown in the Table 10, all coefficients are beyond 0.7 that is should be the minimum acceptable reliability (Nunnaly, 1978). Then, it is ensured that the factors are sufficiently reliable. It is seen that administrative constraints are the most frequently faced constraints to open innovation by STP firms (3.47). It is followed by constraints regarding "resources and costs" and "management and organization".

Table 10. Cronbach's alpha coefficients, mean and standard deviations of the factors

Factors	F1	F2	F3	F4	F5	F6
Cronbach's Alpha	0,872	0,838	0,777	0,747	0,704	0,700
Mean	2,9730	2,8569	3,4620	3,0404	2,7922	3,4730
Std. Dev.	0,8965	0,9232	0,9118	0,8689	0,9053	1,1063

4. Conclusion

This paper explores the factors that encumber the use of open innovation by ICT firms that operate in STPs in Turkey. After performing exploratory factor analysis, six factors that becloud the use of open innovation are extracted: (1) confidentiality and conservativeness, (2) human resources, brand and image, (3) resources and costs, (4) management and organization, (5) market, partnership, technology sources, and (6) administrative constraints, and it is seen that the most frequently faced constraints are constraints concerning administration, resources and costs, and management and organization. Based on findings, in particular, STP firms mostly benefit from the knowledge of their employees including non R&D workers and involve customers in innovation process to conduct an active market research to understand their needs, and non-pecuniary open innovation activities are more popular among them. Hence, the most frequently faced constraints may be considered as the main reason of why these firms are mostly focus on open innovation practices, which do not require conflicting rules, administrative burdens or financial resources. Also, as suggested by Gruber and Henkel (2006), small and new companies are prevented from the use of open innovation because of lack of financial resources, firm-specific roles, task and capabilities. Thus, these findings are not surprising because of the fact that companies that operate in STPs in Turkey are mostly young and small enterprises. Our findings are consistent with the findings of Van de Vrande et al. (2009), Savitskaya et al. (2010), Krause et al. (2012), and Rahman & Ramos (2013).

This study has several limitations that should require additional investigation by further research. Firstly, the sample of the study is limited to ICT companies that operate in STPs in Turkey and are mostly micro, small and medium-sized enterprises. Future research should broaden the scope of research to investigate constraints to open innovation in more extensive and broader sample and including companies from other sectors. Also, this research does not reveal differences between small and large companies in terms of constraints to open innovation and this gap should be filled by further research. On the other hand, factors are formed with the most common difficulties in open innovation. Obstacles to open innovation in future research should be subjected to wider and deeper investigation.

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