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Investigating the role of science and technology parks in the development of open innovation

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Investigating the role of science and technology parks in the development of open innovation

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Abstract

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. Knowledge, creativity and innovation have become increasingly important for those firms that wish to remain competitive in the marketplace, thus pushing them to tap into knowledge networks, either within or outside organizational boundaries. The important role that science and technology parks play in this area is the main focus of the present paper, which has tried to explore the concepts, processes and models of open innovation in the world and with regard to the effective work that has taken place in reputable parks in the world. A model that can be used in different parks in the world. The research method used is grounded theory. The data gathering method was a deep interview with managers, experts in Pardis Technology Park and Yas and Shezan Accelerated Center. Sampling was done using purposive sampling. The results of the interviews are divided into three main themes: the establishment of an open innovation system, the role of supportive parks in open innovation and support for the continuation of open innovation. In the end, open innovation mechanisms are also proposed to create an open ecosystem in two models.

Keywords: Open Innovation; Grounded Theory; Science and Technology Park

Introduction

While human societies are moving at an unprecedented pace to the knowledge society, global evidence and evidence suggests that the competitiveness of countries depends on their ability to create, deploy, and transfer knowledge, especially technological knowledge. Hence, globally, we are witnessing the adoption of various strategies to increase the effectiveness of scientific and technological activities and transfer their achievements to the industry and the market. One of these strategies is the implementation of technological programs focusing on a physical location, usually under titles such as "science park", "research town", "technological areas", etc. By attracting human, financial, and physical resources, these places will help the development and transfer of technological know-how to industrial enterprises on the one hand, and, on the other hand, will stimulate the formation and growth of new technology-driven and knowledge-based companies. Formation. Experiences from different countries show that these companies play a key role in the development of technology, economic prosperity, and generating productive employment, and according to most scholars, they are the base of knowledge economy economics (Mesa and Testa, 2009).

Nowadays, with the shorter life cycles of the goods and technology used in them, the category of innovation has become increasingly important in business (Jacobides and Billinger, 2006). But in today's dynamic and advanced environment, innovation is no longer in an organization, but it is spread beyond the boundaries of the organization, so organizations seek knowledge, information, and external partners as valuable sources of innovation. Recently, a change from the traditional model of innovation, which focuses mainly on R & D, has been seen in open innovation (Geum et al., 2013).

Falling factors behind the closed logic of logic can be the increase in the mobility of experienced and skilled individuals, the increasing trend of academic training, the increasing role of suppliers, and the shortening of technology life, pointed out against closed innovation, which depends on success for control and the organization They want to create their own ideas; then they develop, build, market, distribute, finance and provide after-sales services; open innovation requires organizations to use external ideas such as in-house ideas. Innovation will affect the organization's business model, allowing the organization to value its assets, resources, or positioning, not only from its own business, but also from other businesses. Reducing the cost and time of developing a new product,

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increasing product quality, generating new revenue sources from the sale of unused technologies by organizations and creating birth firms is influenced by the effects of this approach (Ades et al., 2013). Hence, the opening of the innovation process to goals involves sharing risk with others, integrating and completing competencies, increasing creativity, and reducing the time of supply to markets.

The paradigm of innovative innovation emphasizes the participation of non-organization entities in the company's activities, the creation of opportunities by integrating external and internal resources, and emphasizes the use of sources of research from external or internal sources (Ades et al., 2012). This paradigm, called open innovation, leads to profitability and, ultimately, industry leadership. Research indicates that open innovation from large firms to small firms, and from advanced industries to conventional industries is intrusive. If in the past decade, leading industries such as electronics, software communications have benefited from an open innovation approach, today other industries have also recognized their importance. Also, small firms are also engaging in high-risk ventures, because they consider it necessary to lead the industry. In addition, attention is paid to open innovation from manufacturing and product-oriented manufacturing companies to service-oriented organizations and organizations (Open Services Innovation Book). (Chesbrough, 2010).

On the other hand, international competition is constantly growing and moving with time, and the only way to survive in a competitive environment, which makes the business actors continually innovate in each sector. Live your life. For this reason, companies around the world are struggling to develop innovation. In other cases, regardless of how a company works efficiently, it stays with the development of innovation using its internal resources. In these situations, even companies that compete with each other use collaboration to reduce costs and share risks. In addition, companies include suppliers, customers and employees in the development of innovation. All these emerging developments show that this new paradigm, which is open innovation, is an important part of innovation management and shapes the future (Huizinga, 2011).

The open innovation initiated by Chesbrough (2003) is known as "the use of targeted currents and output knowledge in order to accelerate inward innovation and expand the market for the use of external innovation" (Chiesborough, 2006b). On the other hand, science and technology parks provide companies with an opportunity to innovate in an open system, due to the fact that they are the mediator between technology developers and technology publishers, and for the transfer of innovation from universities and laboratories Researchers operate in markets. The science and technology parks are open to universities, research laboratories, startups, small and medium-sized enterprises, and large corporations, according to their network nature, intermediaries, and open innovation providers. However, companies active in science and technology parks may tend to shut their innovation systems and keep their networks open for participation in innovation, and this orientation towards closed approaches will make companies It prohibits the use of the ecosystem of science and technology parks. Unfortunately, there are a limited number of studies on the role of science and technology parks in developing open innovation. To help the theory in this field, the present study aims to investigate the factors influencing the development of open innovation based on data collected from the administrators of the Pardis Technology Park plus managers of companies operating in the Pardis technology park. The study aims to provide insights on the role of science and technology parks in open innovation for professionals and researchers in various fields.

LITERATURE REVIEW

Open Innovation

The conceptual model of innovation is the result of this fundamental definition that, as valuable ideas can have internal or external origins, their commercialization can be either from within or outside organizations (Chesbrough and Wahanorbeck, 2006). Innovation simply does not lead to new markets, but it can provide a new way of responding to mature and established markets (Arasti et al., 2012).

Henry Chesbrough, a pioneer in open innovation theory, states that open innovation is based on the assumption that if companies are to upgrade their technology, they should take advantage of foreign technology ideas, such as internal ideas, and Different domestic and foreign routes can be used in the direction of the market (Safdari et al., 2014).

Despite the fact that companies that use closed innovation, especially based on R & D, consider their research and development laboratories as strategic assets as a barrier to entry of potential competitors, but The open innovation

paradigm argues that companies can no longer acquire innovation through research and development activities alone. In this case, open innovation is considered as an antithesis of closed innovation and considers research and development as an open system (Chesbrough, 2006a). The difference between open innovation and closed innovation is shown in Figure 1 and is listed in Table 1. In the open innovation model, which is based on knowledge, if it is to provide value for the company, it should be easy to use and the boundary between a company and its environment is easier and more flexible than the closed innovation model.

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

Table 1 .Contrasting principles of closed innovation and open innovation (chesbrough,2006c)

With regard to the definition of open innovation, provided by Chesbrough (2006), open innovation involves two aspects: technology exploration (outside) and exploitation of technology (inside out). While the exploitation of technology indicates that firms need to look for foreign organizations that are more suitable business models for commercialization of a particular technology, technology exploration refers to innovation activities to attract and exploit external sources of knowledge and technology (van de Vrande et al., 2009).

In a completely open system, companies combine both technology exploitation and technology exploration and invest to maximize value thanks to their technological abilities and complementary competencies (Kübra Şimşeka, Nihan Yıldırım, 2016).

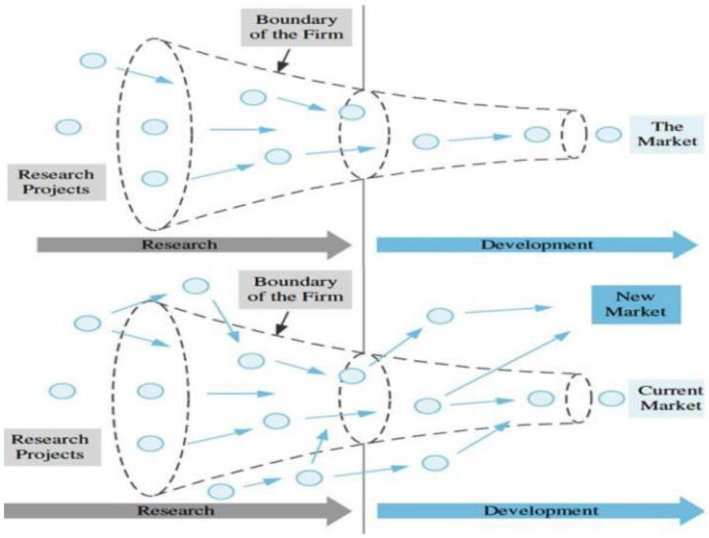


Fig 1. The closed innovation model versus open innovation model (Simic, 2013)

Dahlander & Gann (2010) presents a new category of open innovation that can be presented as a framework for open innovation as presented in Table 2. They identify four main modes of open innovation, namely the sale, purchase, and extraction of resources that are in line with the development of Enkel et al. (2009). They distinguish between the exploitation of technology where knowledge is outside the company and technological discoveries where foreign knowledge flows within the company. This means that openness is not necessarily an open binary classification versus closed (Chesbrough, 2006b), and the idea of open innovation can be seen in a sequence from open to closure (Dahlander & Gann, 2010).

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

	pecuniary	**Non-pecuniary**
Technologhy exploration(inbound open innovation)	Acquiring (cultural and strategic alinement)	Sourcing Incentives and preconditions for individuals involvement
Technologhy exploration(outbound open innovation)	Selling (management and tangible innovation outputs)	Revealing Incentives and preconditions for sharing

Chesbrough & Brunswicker (2013) categorizes open innovation modes and provides the most frequently used methods of these modes as shown in Figure 2.

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

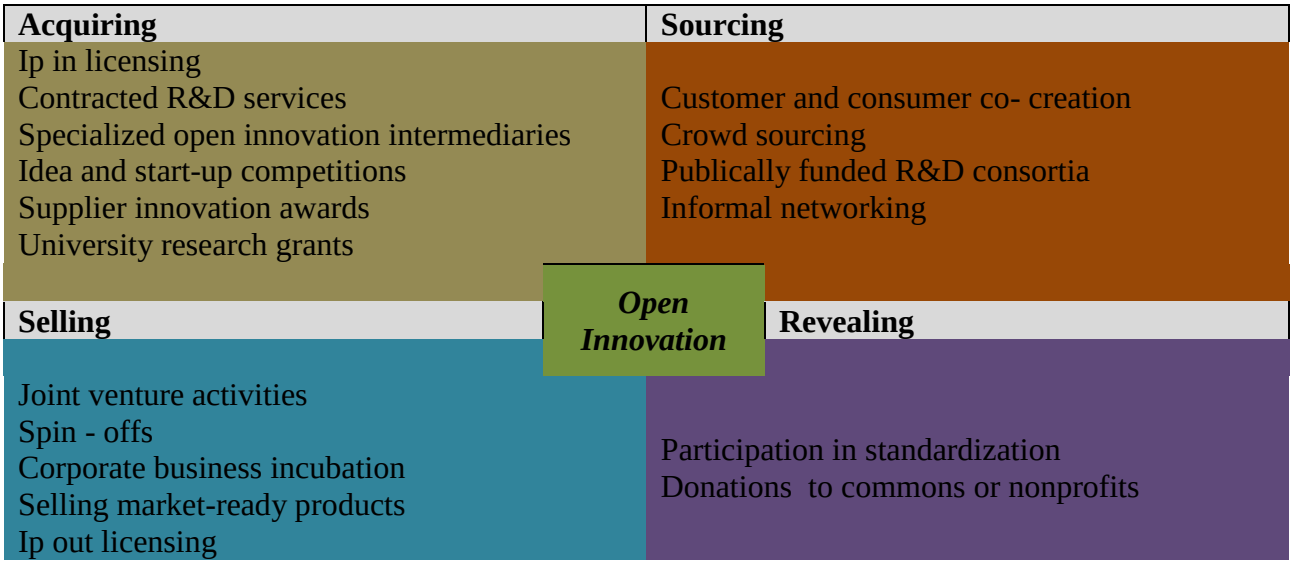
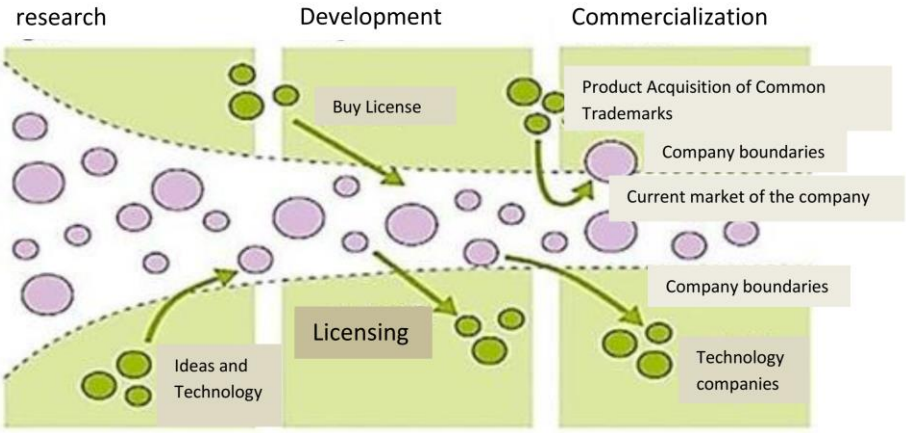


Fig 3. View the application of networking types in the innovation funnel



Research, development and commercialization. The funnel of innovation, from the production of ideas to the commercialization of products / technologies in the market, is shown with the line of China, which indicates the leakage of boundaries (Mortara et al., 2009).

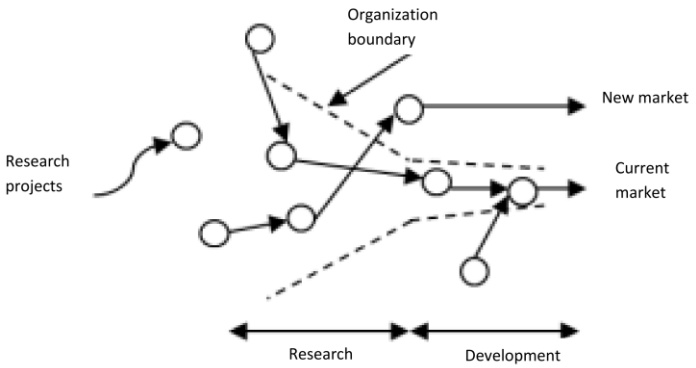
Today, innovation requires sophisticated knowledge that only the vast network of experts has the ability to do. In fact, in this period, one must either innovate or die (Chesbrough, 2006a). Therefore, in a world full of new ideas today, firms should be able to use all knowledge sources, whether external or internal, to value their firm.

Open innovation can be considered as a joint effort within the organization with outsourcing capabilities or a combination of several different ways to apply internal and external knowledge to increase the value of the chain economy, accelerating the development of new products (Safdari et al., 2015).

Companies that accept open innovation use external technology resources to empower their businesses. Also, Intellectual Property provides internalized technology that is not worthwhile for domestic use and provides other companies with different business models and benefits (anhaverbeke, 2006). Hence, the main aim of the innovation strategy is to improve the efficiency of the innovation process, leverage external knowledge and monetize the untapped patents through intellectual property management agreements (Waiyawuththanapoom et al., 2013).

The root of this pattern is the complexity and unprecedented change of the current competitive environment that imposes conditions on companies that need to share the ideas and knowledge of others. Based on this, in recent years, various processes have been developed for sharing ideas that can be used for methods of collaboration and unification, pooling, licensing, innovation networks, and so on. As shown in below Figure, both the research and development sections of the research and development of the organizational boundaries are diminished in the open innovation model and there is the ability to exchange and interact knowledge between the organization and the environment (haghighat, 2017).

Figure 4. Open Innovation Model (Mortara et al., 2009)



Open innovation has attracted many researchers in the last decade. The valuable results have been obtained that the recognition of their study can facilitate a better understanding of the concept of open innovation (Safdari et al., 2014); in Table 2, examples of studies and models developed in various industries in the field of open innovation Is brought.

Table 2. examples of studies and models developed in various industries in the field of open innovation

research findings	Society and statistical sample	Main model / variables	Issue	Year of research
The necessity and importance of the process of adopting and implementing innovative innovation in line with the management structure. The necessity of changing the culture on the implementation of open innovation	Case Study: HEINZ	Variables are defined based on the premier model	An effective managerial and organizational framework for open innovation support	2013
Review and compare innovative open innovation models in the food industry and find the most suitable model	Food industry	Review of 3 Applied Models: 1-the sharing is winning 2-the food machinery framework 3-(want*find*get*man age)model	Earn an open innovation model in the food industry	2013
Generalizing the Dominican Republic's strategic plan to other countries and creating a new understanding of the transfer of university / industry innovation	Case Study: International Cooperation for Innovation in the Dominican Republic (review from 2001-2007)	Triple helix model and Global open innovation model Variable: The relationship between the three elements of the university, industry and government and the transfer of technological knowledge	From triple helix model to model of global open innovation	2014

According to their requirements and conditions of each organization including activity, company size, strategic orientation and organizational culture, open innovation factors are in particular prioritization (Quinn, 2000).

One of the main reasons for using open innovation is the cost-sharing economy, a resource-centered approach, and the dynamic capability approach of open innovation. The cost-sharing economy focuses on reducing costs and the risk of collaborative entry, while the center-right perspective considers the acquisition of complementary assets (whether statically based on the perspective of the source or dynamic mode of dynamic capability approach) as a way of learning (Safdari et al., 2014).

Amara, and Landry (2005) argue that when organizations rely on a wide range of external knowledge resources, the probability of developing more innovative products is greater (Gassmann, 2006). With open innovation and technology management studies, successful implementation of the open approach to innovation is challenging, although its goals are well-defined and dominant (Amara, and Landry, 2005). Experts also state that evidence suggests that a desirable social organizational environment is necessary for the launch of open innovation, such as: company capability, human and organizational factors, enabling environment (Lazzarotti, and Manzini, 2009).

It should be noted that starting and launching an open innovation process is not just one solution and a tool, but its starting point, its use time, and appropriate changes tailored to it, are supported by appropriate management and organizational initiatives (Amara, and Landry, 2005). To define the root of open innovation, Chesbrough as the first person to define the concept of open innovation: the use of valuable internal and external knowledge flows accelerates domestic innovations and market development for the external application of innovation (Chesbrough, 2006a).

The two critical critique of open innovation has emerged as an ever-expanding field. Firstly, there are many comments that most of what innovation is opening up (for example, innovation participation or knowledge flow across the organization's boundaries) is old news. For example, Mowery (2009) shows that many elements of open

innovation were seen in the industrial revolution of the United States in the late nineteenth and early twentieth centuries. Trott, and Hartmann (2009) argue that the open innovation research community "long before the term" open innovation "has come to this concept in previous studies, and in this regard, have considered a unique credit for previous researchers because they For many of the fundamentals of open innovation, they presented, analyzed and argued. " Secondly, as a developing research base, the definition of open innovation is vague and inaccurate. Dahlander and Gann (2010) emphasize that researchers have given different definitions in their studies of the concept of openness in innovative innovation, which led to "conceptual ambiguity, with empirical papers focusing on different aspects, preventing the ability to make a nucleus Integrated knowledge ".

By accepting an open innovation approach, firms can apply three ways: first, they can engage in open innovation within the boundaries of innovation, such as enhancing in-house skills and knowledge from the integration of suppliers, customers and other actors in domestic innovation processes. (Liu, and Andersson, 2014). Otherwise, firms can acquire ideas and benefits from other open source initiatives such as bachelor's degree, patent (patents), other intellectual property rights (Enkel et al., 2009), and finally, firms can Combine the two processes of innovation (internal and external) and thus create complementary partnerships (Liu, and Andersson, 2014). In particular, the two features of open innovation distinguish it from previous approaches to innovation: first, the integration and integration of the transfer of internal and external knowledge, and the second feature is complementarity and completeness of activities related to domestic and foreign innovation in enterprises. (Lichtenthaler, 2008). It should also be noted that the key to gaining open innovation is knowledge and management (Lichtenthaler, 2011).

3. Implementing Open Innovation

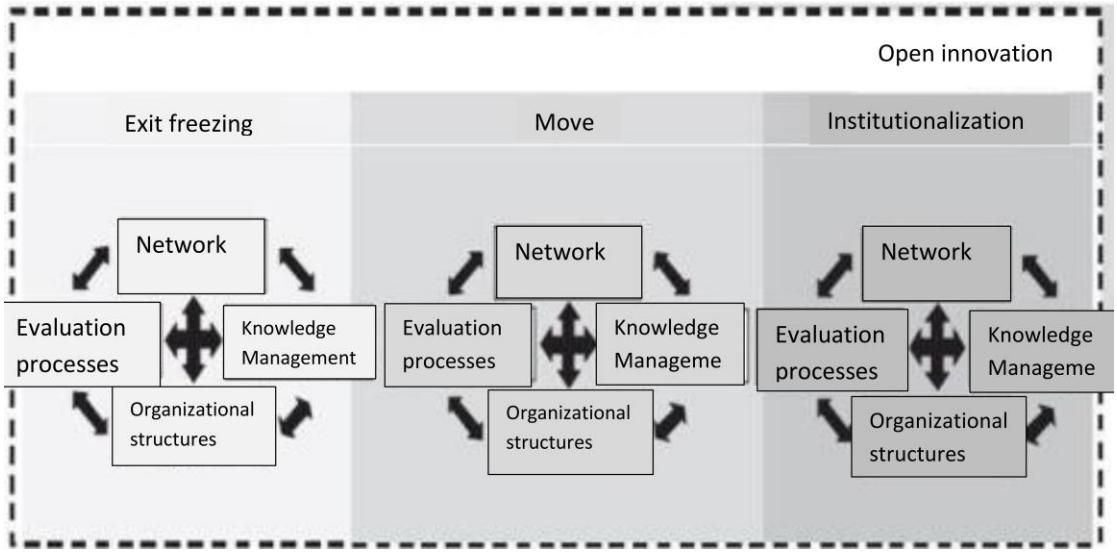
Adoption of open innovation requires a change in the company's paradigm of innovation. One of these changes is the transformation of the enterprise boundaries into permeable shells, which makes it easier to innovate between the external environment and the company's internal innovation process. Another change is the complete integration of external knowledge resources, which is a prerequisite for strengthening the internal knowledge base (Gassmann et al., 2004).

Henry Chesbrough (2006) suggests some of the organizational capabilities needed to move toward open innovation:

Product and technology planning, market intelligence, market forecasting, technology observation, intellectual management, knowledge management, networking and network management, and access to complementary assets (brand, financing, production equipment), distribution network, and more... (Liu, and Andersson, 2014).

Mortara and colleagues (2009) explored how to implement open innovation in large multinational corporations. According to their study, the change in structures, skills, incentives, and control methods helps to create a culture of open innovation in the organization (Mortara et al., 2009). 19. Chiaroni et al. (2010), who studied structured changes in open-ended innovation in four Italian firms, concluded that according to Armenakis and Bedeian (1999) study of organizational change literature, this result the open innovation as an organizational change process is implemented through the sequence of exit from freezing-movement-institutionalization, which are the three main phases of the process of change. As shown in below Figure, according to their research, on the journey of innovation Depending on the four main dimensions involved, are: networks, organizational structure, evaluation process, and Parida et al. (2011) Three key areas that organizations have to pay special attention to in the application of open innovation are three areas: people, process, and technology (Parida et al., 2011).

Figure 5. The change process of open innovation to the package



Ades et al. (2013) identified the implementation of open innovation in According to their research, the implementation of open innovation in the organization requires the development of activities that address the requirements for using open innovation, including the organization's culture, the skills of people involved in activities related to Open innovation and their motivation to achieve the desired results through innovation (Ades et al., 2013). According to the studies conducted in this area, the identified requirements for the development of closed-to-open innovation are: processes, organizational structure, networking and knowledge management system (Mateghi and HasanAbadi, 2016).

Key Factors Influencing Open Innovation

In the study of Haghighat (2017) in the literature of research in the field of key and successful factors in open innovation, the following factors have been identified:

1) Organizational readiness:

Organizational readiness includes organizational cultural openness, dynamic capabilities for organizational change and reconstruction, and organizational structure (Khosroparvar et al., 2013). The key word for readiness in the literature on innovation and technology is not new, but since the concept of readiness in the organization is more complex than the individual, the focus is on it, and there are many studies that have led to different findings (Bigliardi, B., & Galati, 2013). Organizational readiness for innovation depends on a wide variety of factors, many studies have been carried out, some of which are influenced by human factors, business and technology resources, and some highlight the importance of the role of senior management in organizational structures and environmental conditions. (King et al., 1994). Since innovation originates from those who form the core of the company, so the dominant culture must also be open (Vanhaverbeke and Cloodt, 2014).

2) Participatory Capacities:

Some of its resources as cooperative capabilities are the ability to integrate and leverage organizational factors to create an organizational capacity for open innovation, with three parts of internal collaboration, networking and collaboration from outside to And vice versa (Knudsen and Nielsen, 2008). One of the six major capacities for innovation companies is the ability to communicate and transfer knowledge between companies (Cohen and Levinthal, 2000).

3) Absorption Capacity:

The ability of a company to identify new value, external information and its use for commercialization is one of the key issues in the capabilities of innovation in the organization (Simard and West, 2006). Indeed, the necessity to

create a successful innovation performance is to find the potential of external and internal knowledge, so the transfer of such knowledge to the firm and its development in the context of the organization's innovation requires the cooperation and attraction of foreign knowledge resources (Herliana, 2015). Simard and West (2006) argue that two types of capabilities are needed to develop success in open innovation: the ability to transfer knowledge to the external environment and the communication capability that leads to the creation of strong networks. In fact, one of the three main indicators of the successful technology strategy is absorption capacity, which will improve the company's innovative performance (haghighat, 2017).

4) **Intellectual Property Management:**

In an open innovation model, organizational intellectual capital needs to be managed because it is the dynamic motor capital of a dynamic organization (Chesbrough and Vanhaverbeke, 2006). Therefore, the key to innovation is the ability to manage the most valuable innovation capital. In addition, the ability to sustainably increase economic growth in firms depends on innovation, and one of the criteria for assessing innovation, patenting in the firm, having experts and knowledge professionals in that field is the ability to invent inventions that is in the domain of intellectual property maturing in organizations (Von Hippel, 2007).

5) Mediator or Innovative Mediators:

Companies use innovation mediators to search for and solve their innovative and innovative issues (Lin, C. J., & Wu, 2008). Internet or electronic markets, which provide the necessary platform for the exchange of knowledge and technology between buyers and sellers, are a type of innovation intermediary that plays an important role in technology exchange and familiarity with companies (Azar et al., 2013).

6) Intelligence Technology:

The intelligence of technology is the monitoring and observation of the environment for the collection, analysis and dissemination of the application of information technology in order to improve the processes of planning and decision making in the areas of technology of the organization, intelligent technology, the ability to quickly and timely feedback of the company It provides the radical changes in technology, which is one of the most important failure factors (Lin et al., 2012). Research on the stages of the technology intelligence process varies according to industry and business conditions, but often includes three steps of acquisition, evaluation and communication with information, observation and observation of information are manifested (Forsman, 2011) .

7) Open Business Model:

The logic of creating value for stakeholders and creating a competitive advantage and profit for the company stems from its business model. Since the business model plays a significant role in creating value, companies need to adapt their business models to open innovation (Ashtianipour & Zandhessami, 2015). Since innovative companies combine in-house research with external ideas, then they apply those ideas within their own business and other companies, so which sectors should be provided from within the company and internal sectors and how to integrate external in the framework of systems and architectures is a key issue. In fact, the business model has to be innovated in order to create a way to create value. Considering the above mentioned issues and the research background, the conceptual model or framework of open innovation factors can be drawn up as follows: (Haghighat, 1396).

Table 3. Key Factors Influencing Open Innovation

Organizational readiness	Organizational cultural openness
	Dynamic ability to change organization
Intellectual Property Management	
Collaborative Capabilities	Domestic cooperation
	Networking
	Collaboration from the outside to the inside and vice versa
Open business model	
Innovative Mediators	
Technology intelligence	Proper infrastructure
	Optimal use of ICT
	The ability to transfer knowledge to the outside environment

	Communication capability

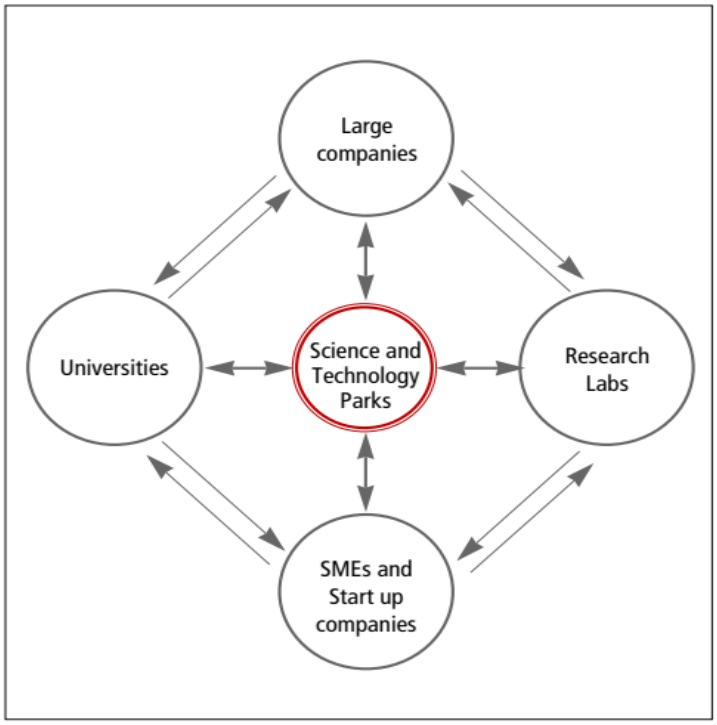
Science and Technology Parks and Innovation Partnerships

Science and technology parks guarantee geographical correlation and encourage other types of proximity that enhance collaboration between companies and research and technology organizations. Several empirical researches, with a central focus on academic links, analyzes the role of science and technology park in collaborating with innovators (Vásquez-Urriago et al., 2015).

In summary, studies and evidence suggests that a place in a park is promoting collaboration for innovation. However, none of these will address the impact of a science and technology park on the results of collaborative projects. These results are divided into two groups (Barge-Gil and Modrego, 2011) of economic outcomes (including sales, export costs, profits, employment, domestic research or development, or productivity) and intangible results (including the ability to increase strategy, increase human resources and better management of information and relationships). (Vásquez-Urriago et al., 2015).

Innovative innovation involves two-way intellectual property flows, perhaps in other words the transfer of human capital between people who are the main beneficiaries of science and technology parks. Natural science and technology parks are natural candidates for becoming multifunctional connectors for open innovation throughout universities, research labs, startups, small and medium enterprises and large companies as shown in below Figure.

Fig. 6. Science and Technology Parks as Connectors for Open Innovation.



Various types of networking sessions organized by science and technology parks can facilitate their tenants for licensing and licensing intellectual property licenses. These meetings and other network meetings can lead to a flow of human capital. For example, Silicon Valley's secret stream for success promotes the free flow of human capital from one company to another, and thus hires people and companies that are capable of enrichment (Narasimhalu, 2013).

Methodology

This research has a qualitative approach and the method of data theory theory is used as a research method. The grounded theory of theory or data theory is a qualitative research method that develops a theory using a data set. As such, the theory explains in a broad sense a process, action, or interaction. In this way, research never starts from a theory and then proves it, but a research is started from a study period and it is given the opportunity to show what is appropriate and relevant (Bazargan, 2008) .

The statistical population of this study is based on its subject matter including experts, Pardis technology park headquarters and Yas and Shezan innovation acceleration centers selected by chip referral method. The sampling method is purposive sampling. The method of collecting information is a deep interviewing method. In this study, 6 people were interviewed. From the third interview, there was a repeat of the information received, but to ensure that the sixth interview continued. The interview began with the question of "the role of science and technology parks in developing open innovation" (open interview), and the rest of the questions were based on the responses of the interviewee. All interviews were recorded and carefully analyzed for key point's extraction.

Coding steps in Foundation data

1. Open coding
2. Axial coding
3. Selective coding

Step 1: Open Coding

The open coding steps are:

1. Analysis and coding. At this stage, sampling should be done to a large extent so that the researcher can discover the concepts in the open position. In principle, the researcher should pay attention to the coding of any interesting event. It may be possible to extract a lot of code from within an interview (text), but when the data is reviewed periodically, the new codes are counted and the final codes are specified.

2. Discover the floors. At this stage, the concepts themselves are classified according to the same topics, which are referred to as "modification". The titles we assign to classes are more summary than the concepts that make up the class. Classes have high conceptual power because they can draw concepts on their axis. Selected titles have been chosen by the researcher themselves and they have tried to get the most relevance and consistency with the data that they represent. Other important sources (titles) are words and phrases that are used by researchers in the research (interviewers) and can be used by the researcher.

3. Describe categories according to their characteristics. In order to clarify the classes, in the next step their characteristics are expressed.

4. Open coding table. It consists of two parts: an extraction table of interview tables and a table of classes extracted from concepts with their secondary codes.

Initial coding: At this point, all key points of the interviews are titled, and then we put all of these titles in the following tables.

A sample of extracted codes from one of the interviewees is provided in the following table.

Table 4. Primary coding

Initial coding (first interview)
1. Establish a process-based system for open innovation by science and technology parks
2. Hub role play by science and technology parks in the open innovation debate
3. Covering possible risks by science and technology parks
4. Creating an infrastructure for monitoring technological responses by science and technology parks
5. Creating an infrastructure for monitoring technological needs by science and technology parks
6. Funding and resources needed for germination of ideas in the open ecosystem
7. Provide grants to universities as part of an open innovation ecosystem
8. Manage open innovation process
9. Parks as the interface between industry and university
10. Develop a guiding and regulatory system by parks
11. Establish a large open innovation network
12. Helping mature solutions and responses in open innovation to meet industry needs
13. Identifying and documenting the needs of the upstream of the open innovation system
14. Wrinkle downstream and upstream in open innovation
15. Create an open innovation culture
16. Holding open competitions and events
17. Parks focus on long-term ideas of open innovation
18. Creating valuable communications in open innovation using well equipped laboratories, appropriate restaurants and ...

Secondary coding and forming the main themes: In the next step, the primary codes are converted into secondary codes because of their abundance (the initial codes are in the same class form). A few secondary codes become a conceptual code. In the following table, for example, open coding results based on secondary code, conceptual codes, and themes are presented.

Table 5. Secondary coding and the formulation of conceptual codes and categories

Abundance	Secondary codes	Conceptual codes	
12	Create an ecosystem of open innovation by science and technology parks Creating an open innovation culture Parks focus on long-term ideas for open innovation Provide a model by the park in which companies, accelerators, universities and industries are present Park as an open source architecture Creating a system for scrutinizing ideas The lack of real science and technology in the park Breeding sub-disciplines of the field of open innovation Creating a private structure for open innovation	**Creating an Open Innovation Ecosystem**	
10	Manage the idea of it so much by park Parks are the main courtroom of innovation Managing open innovation process Establishing a guiding and regulatory system by parks Upstream and down wrists on open innovation Management of problem-solving teams by science and technology parks The role of parks regulation and management in the open ecosystem Use the park from people for coaching (Mentoring) in the open innovation ecosystem	**Managing open innovation process**	
8	Creating an infrastructure suitable for open innovation by parks The Necessity Of Legislation To Keep Information In Secrecy In The Open Ecosystem Strengthen intellectual property rights	**Provide adequate infrastructure for open**	

	Creating Knowledge Transfer Brokerage Infrastructure Support the creation of brokers for the evaluation of licenses Creating an infrastructure for monitoring technological responses by science and technology parks Identifying and documenting the needs of the upstream of the open innovation system Creating valuable communications in open innovation using well equipped laboratories, convenient restaurants and ...	**innovation**	
12	Park help companies and industries to clarify their own needs Helping to mature solutions and responses to open innovation to meet industry needs Conduct competitions and open innovation events Supportive role, regulatory supervision of parks and the creation of infrastructure by parks Support and create a brokerage layer in the field of research and development Support the creation of brokers for the evaluation of licenses Getting megaproject from industry and crushing it between park companies Transfer of open innovation from supply side to demand Content marketing in the field of ideas	**Supportive Roles of Parks**	
4	The role of Parks in conducting an open innovation process Contributing to creating a positive image for companies to succeed in the open ecosystem Creating rules in the area of insurance and licensing by parks	**parks facilitating role**	
4	Funding and resources needed for germination of ideas in the open ecosystem Covering possible risks by science and technology parks Providing Grant to Universities as part of an Open Innovation Ecosystem	**Financial support**	
9	Creating a link between open innovation components and balancing supply and demand Establishing a relationship between industry and university in the context of open innovation The role of the hub by science and technology parks in the open innovation debate Creating a Great Innovation Open Network	**parks relational role with open innovation components**	
6	Introducing all components of the ecosystem from the concept of open innovation Training in the field of open innovation debate to the factors involved in open innovation Qualifying people involved in open innovation by parks Carrying out knowledge management by park for empowerment of manpower Support and advice for the owners of the idea Teaching the industry to identify its needs in an open innovation network	**Provide in-service training in the field of open innovation**	

The formation of the main classes

After determining the categories, the construction phase of the theory is presented in the table below.

Table 6. Formation of general classes of categories

Main classes	Categories (subcategories)
Management mechanisms	Managing open innovation process Providing facilities Human resource training
Financial mechanisms	Providing facilities and facilities Covering possible risks Grants to universities
Educational mechanisms	Identification of ecosystem components with the concept of open innovation Educate Open Innovative Debate on Involving Factors Qualifying people involved in open innovation Teaching the industry to capture its needs
Communication mechanisms	Creating a link between open innovation components Establishing a link between industry and university The role of a hub by science and technology parks Creating a Great Innovation Open Network
Facilitation mechanisms	The role of Park Parks in conducting an open innovation process Help create a positive image for companies Establishment of rules in the area of insurance and warranty of licenses
Supportive mechanisms	Park help companies and industries to clarify their own needs Helping to mature solutions and responses to open innovation to meet industry needs Support and create a brokerage layer in the field of research and development Support the creation of brokers for the evaluation of licenses Getting megaproject from industry and crushing it between park companies
Design and deployment of open ecosystems by science and technology parks	Creating an Open Innovation Ecosystem Managing open innovation process Creating an open innovation culture Parks focus on long-term ideas for open innovation Park as an open source architecture Establishing a guiding and regulatory system by parks Upstream and downstream connections in open innovation Creating an infrastructure suitable for open innovation by parks Provide adequate infrastructure for open innovation

Step Two: Axial Encoding

The axial coding is the second step of analysis in the database theory. The purpose of this step is to make a relation between the created classes (in the open coding step). This process is done based on the paradigm model and helps the theorist to do the theorization process easily. The fundament of the relating process in axial coding is based on expansion of one the classes (Danaifar et al 2005).

Step Three: Theorization Step (Selective Coding)

As said before, the basic theorization purpose is to create a theory, but to describe a phenomenon merely. In order to convert the analyses to a theory, the classes should be correlated to each other regularly.

The selective coding (according to the result of the last two steps) is the main steps of theorization. Somehow the axial class is related regularly to other classes and presents this as a framework and modifies the classes which need to improve. In this step, the scholar provides a framework of paradigm model according to his/her view of the study, or disassembles the paradigm model and shows the final theory, graphically (Danaifar & Azar 2010).

Fig7. Axis coding based on the model (picture of completing model)

Research findings

The results of the interviews in the form of three main themes, the establishment of an open innovation system, the paramount support role in open innovation and support for the continuation of open innovation, are as follows:

Creating an open innovation ecosystem, managing the open innovation process, and providing the appropriate infrastructure for open innovation. Each of these three sections also includes the following subcategories. To the point where the creation of an ecosystem of open innovation involves creating an ecosystem of open innovation by science and technology parks, creating an open innovation culture, focusing parks on long-term ideas for open

innovation, providing a park model where companies, accelerators , Universities and industry, the park opens as a framework for open innovation, the creation of a system for scrutiny of ideas, the lack of real science and technology in the park, the development of open innovation subnets, and the creation of a private infrastructure for innovation. Management of the open innovation process involves managing the idea to its effectiveness by parks, parks as the main driver of open innovation, managing open innovation process, creating a parks guidance and control system, downstream and upstream innovation in open innovation, management Problem-solving teams by science and technology parks, the role of parks regulation and management in the open innovation ecosystem, using the park from people for mentoring in the ecosystem of innovation, and ultimately providing the appropriate infrastructure for open innovation Including the creation of appropriate infrastructure for open innovation by parks, our regulatory requirement for our confidentiality Information on open ecosystems, strengthening intellectual property rights, creating knowledge transfer brokerage infrastructure, supporting the establishment of licensing agencies, setting up an infrastructure for monitoring technological responses by science and technology parks, identifying and documenting the needs of the upstream system. Open innovation, creating value-added communications in open innovation, using well-equipped labs, will be good restaurants.

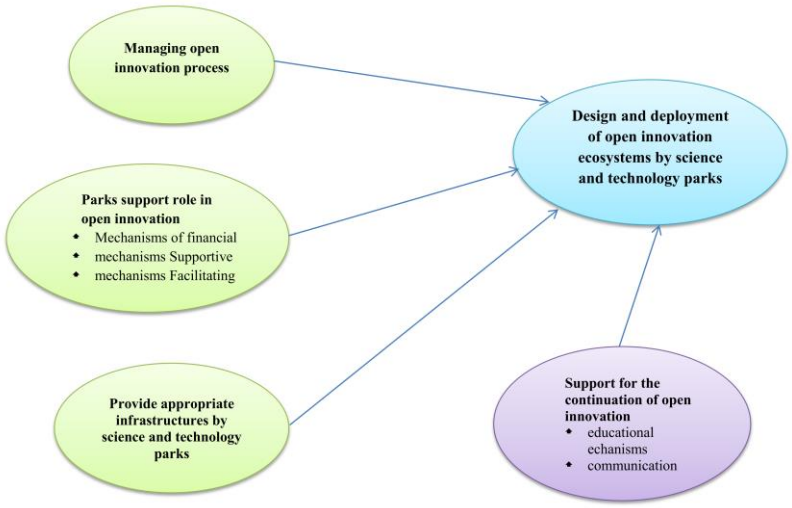
Parks support role in open innovation is as follows: park support roles, parks facilitating role and financial support. Each of these three sections also includes the following subcategories. As Park Parks support itself, including Park Assistance to companies and industries to clarify their needs, to help mature solutions and responses to open innovation to meet industry needs, hold competitions and open innovation events, support role, park parks And the creation of infrastructure by parks, support and creation of a brokerage layer in the field of research and development, support for the creation of brokers for licensing, the capture of megaprojects from the industry and crushing it among the park companies, taking innovation from the supply side to the side Demand and marketing generate content in the realm of ideas. The role of facilitating parks includes the role of facilitating the park to open up the process of innovation, helping to create a positive image for companies for a successful presence in the open ecosystem and creating regulatory systems in the area of insurance and licensing by parks. Finally, financial support includes financing and resources for germination of ideas in the open ecosystem, covering potential risks of science and technology parks, and providing grants to universities as part of the innovation ecosystem.

Supporting the continuation of open innovation is as follows:

The role of parks with the components of open innovation and the provision of applied training in the field of open innovation. As the role of parks' communication with their open innovation components, including the establishment of the link between open innovation components and the balancing of supply and demand between the two sides, the establishment of a link between industry and the university in the context of open innovation, the role of the hub through science and technology parks The issue of open innovation and the creation of a large innovation network opens up, and the provision of applied training also includes the recognition of all components of the ecosystem from the concept of open innovation, the training in the field of open innovation debate to the factors involved in open innovation, the qualification of those involved in open innovation by parks , Carrying out knowledge management by park for human resource empowerment, support and counseling Vote owners of ideas, education to industry needs in order to reckon it opens in Innovation Network.

This model describes the mechanisms by which the target community (executive agencies, industries, technology parks, knowledge-based companies, accelerators, etc.) recognizes its needs, and by creating an ecosystem of open innovation by science parks. And technology will get enough of it. A general model for the development of open ecosystem design theory is presented by the science and technology parks.

Fig 8. The final model of the role of science and technology parks in the development of open innovation



Discussion and conclusion

As illustrated in the diagram above, the availability of infrastructure is one of the essential elements for establishing an open ecosystem by science and technology parks. To this goal, parks managers are required to provide the necessary infrastructure for the creation of appropriate infrastructure, including financial, laboratory and workshop infrastructures, as well as some legal infrastructures.

Parks should also be portrayed as the main promoter of open innovation and the necessary conditions for effective ideas, the establishment of a regulatory system, high-level innovation in open innovation, which is the industry, and downstream, which will provide the same answers to these needs.

In open innovation, support debate is of paramount importance, in other words, park managers must take steps to support open innovation in terms of financial mechanisms, facilitating mechanisms, and other supporting mechanisms.

It is worth mentioning that, for continuing the openness of open educational mechanisms, such as training in the field of open innovation discussions, the factors involved in open innovation, the management of knowledge by the park to empower the workforce, and support and advice for the owners of the idea, and also the communication mechanisms Particular attention should be paid, in other words, administrators of Pardis technology park as a bridge between the environment and the open ecosystem of innovation and by establishing a strong network of all the factors involved in open innovation in the context of synergy.

Based on this model, in science and technology parks, which want to do their job well in developing open innovation, it is well structured and, by providing the appropriate infrastructure, will create an ecosystem of innovation. This is only the case where the park is well thought out as a connecting point between all the factors involved in open innovation, and using the supporting arms that it has in hand and can, with the help of other platforms, like accelerators, be able to process well Sometimes the complexity of open innovation is well managed.

Most importantly, the head of the science and technology parks should, with the cooperation of all their assistants and managers, expand the open innovation culture in all its organization and organizational layers, and take advantage of all the park's capabilities and manpower in the development of open innovation.

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