

## How Networking Empirically Influences the Types of Innovation? Pardis Technology Park as a Case Study

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### ABSTRAKSI

Saat ini, inovasi dapat disebut sebagai salah satu praktik terbaik sebagai kualitas, kecepatan, kehandalan, fleksibilitas dan biaya yang membantu organisasi masukkan ke pasar baru, meningkatkan pangsa pasar yang ada dan memberikan itu dengan keunggulan kompetitif. Selain itu, organisasi telah bergerak maju dari "bersembunyi ide (Inovasi Tertutup)" untuk "membuka mereka (Inovasi Terbuka)". Oleh karena itu, konsep-konsep seperti "inovasi terbuka" dan "jaringan inovasi" telah menjadi penting dan menguntungkan kedua sivitas akademika dan pasar. Oleh karena itu, penelitian ini mencoba untuk mempelajari secara empiris pengaruh jaringan inovasi. Dalam hal ini, untuk secara empiris mengeksplorasi bagaimana jaringan mempengaruhi inovasi, makalah ini digunakan jenis inovasi berdasarkan definisi OCED sebagai organisasi, pemasaran, proses dan produk dan membandingkan perubahan sebelum dan setelah jaringan dari 45 perusahaan di jaringan Taman Teknologi Pardis sebagai studi kasus. Hasil dan temuan menunjukkan bahwa semua jenis inovasi meningkat setelah penggabungan perusahaan ke jaringan. Bahkan, kami mengatur ini mengubah proporsi dari yang paling perubahan setidaknya sebagai pemasaran, proses, organisasi dan inovasi masing – masing produk. Meskipun, ada beberapa pertumbuhan negatif di beberapa langkah inovasi ini setelah penggabungan jaringan.

Kata kunci: Jaringan Inovasi, Jenis Inovasi, OCED, Taman Teknologi Pardis

### ABSTRACT

Nowadays, innovation can be named as one of the best practices as quality, speed, dependability, flexibility and cost which it helps organization enter to new markets, increase the existing market share and provide it with a competitive edge. In addition, organizations have moved forward from "hiding idea (Closed Innovation)" to "opening them (Open Innovation)". Therefore, concepts such as "open innovation" and "innovation network" have become important and beneficial to both academic and market society. Therefore, this study tried to empirically study the effects of networking on innovations. In this regard, in order to empirically explore how networking influences innovations, this paper used types of innovations based on OCED definition as organizational, marketing, process and product and compared their changes before and after networking of 45 companies in the network Pardis Technology Park as a case study.

The results and findings showed that all of the innovation types were increased after jointing the companies to the network. In fact, we arranged these changing proportions from the most to the least change as marketing, process, organizational and product innovation respectively. Although, there was some negative growth in some measures of these innovations after jointing the network.

**Keywords:** Innovation, Networking, Types of innovation, OECD, Pardis Technology Park

## 1 INTRODUCTION

Nowadays, Innovation can be named as one of the best practices as quality, speed, dependability, flexibility and cost which it helps organization enter to new markets, increase the existing market share and provide it with a competitive edge. Thus, innovations help organizations with applying more productive manufacturing processes, performing better in the market, seeking positive reputation in customers' perception and as a result gaining sustainable competitive advantage. In addition, organizations have moved forward from "hiding idea(Closed Innovation)" to "opening them(Open Innovation. Thus, the innovation model has changed from "simple linear model(Technology Push or Market Pull)" to "networking interactions(Innovation Network)"[1]. Recently, concepts such as 'open innovation' and innovation network' have become important and beneficial to both academic and market society due to intensive global competition. Actually, the logic of open innovation is that organizations need to open up their innovation processes and use external entities which are involved in innovation networks[2]. An 'innovation network' can be consisting of a number of positions or nodes, occupied by individuals, firms, business units, universities, governments, customers or other actors, and links or interactions between these nodes [2] to achieve shared innovation goals[3]. In fact, there are four major advantages for networking in innovation such as: collective efficiency, collective learning, collective risk taking and intersection of different knowledge sets[2].

Innovation as a term is not only related to products and processes, but is also related to marketing and organization. For example, from a point of view, there are different types of innovation as new products, new methods of production, new sources of supply, the exploitation of new markets, and new ways to organize business[4]. In addition, Based on OECD Oslo Manual (2005), four different innovation types are introduced as product innovation, process innovation, marketing innovation and organizational innovation. Product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. Process innovation is the implementation of a new or significantly improved production or delivery method. Marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations[5].

Recently, innovation has been considered as an interesting area of studies to define, categorize and investigate its impact on organization performance. A study investigated the relationship between firms' performance, innovation and research and found out that the inclination of firm to innovations was of vital importance in the competitive environments for getting higher competitive advantage[6]. Another research examined the effects of the major innovations and patents to various corporate performance measures and observed the direct

effects of innovations on firm performance are relatively small, and the benefits from innovations are more likely indirect[7]. In addition, in another paper, the relationship between innovation as products, processes and administration systems and performance was examined and analyzed among Spanish manufacturing SMEs. The results showed that innovation positively impacts SMEs performance in low and high technology industries. Innovation was more important to achieving a competitive advantage to high technology firms than low technology firms[8]. Recently, the effects of the organizational, process, product, and marketing innovations were explored on the different aspects of firm performance, including innovative, production, market, and financial performances in some firms in Turkey. The findings supported the claim that innovations performed in manufacturing firms have positive and significant impacts on innovative performance [9]. Moreover, a paper studied and analyzed the connection between different types of innovation as incremental, competence developing, market developing and radical innovation and forms of networking proposed that these types correlate with various innovation network dimensions, including the volume of networks, the strength and content of ties, and the specificity of ties[10]. Also , Valk, Chappin and Gijsbers offered a framework to evaluate and assess innovative performance of network wholly through two kinds of stream in literature as social network analysis: cohesion, cohesive sub-groups and centralization and resource-based view: business model and knowledge field[11]. Finally, a research empirically explored the relationships between different cooperation networks and Innovation performance of SME, which found significant positive relationships between inter-firm cooperation, cooperation with Intermediary institutions, cooperation with research organizations and innovation performance of SMEs[12].

Although there are numerous studies which examined different types of innovation in the firm, but a few studies have examined the effects of networking on innovations. Therefore, this study tries to empirically explore how networking influences innovations through comparing changes of innovations before and after networking. In this regard, this paper uses types of innovations based on OCED definition as organizational, marketing, process and product and compares their changes before and after networking of 45 companies in the network Pardis Technology Park as a case study.

## 1.1 TYPES OF INNOVATION

Reasonable risk management mechanism is an important requirement for applying BOT in subway projects successfully because private investors usually care much whether higher risks existing in their investments and whether can achieve their anticipated profits. Evaluating risks and framing corresponding measures to guarantee the realization of returns-maximization, is most concerned issue of private investors in subway projects, so risk management is the precondition to deal with this issue productively. However, it is usually a contention focus between two parties of BOT contract and also the most difficult issue to deal with. The earlier stage of negotiations between the public and private is often highly time-consuming, which induces higher transaction costs due to different objectives owned by them. Efficient risk allocation may achieve targets of timely and cost-effective delivery, instead of transferring duty of paying a risk premium to private contractors merely, hence could reduce project costs and lead to greater VFM. It is necessary to introduce systematic risk management concept in subway

projects due to their traits of extensive-investment, complex technical system support and longer project lifecycle.

Here, OECD Oslo Manual (2005), which is the primary international basis of guidelines for defining and assessing innovation activities as well as for compilation and use of related data, has been taken as the fundamental reference source to describe, identify and classify innovations at firm level. In the OECD Oslo Manual (2005), four different innovation types are introduced[5]. These are product innovation, process innovation, marketing innovation and organizational Product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics. Process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products. Process innovations also cover new or significantly improved techniques, equipment and software in ancillary support activities, such as purchasing, accounting, computing and maintenance. Marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales. Organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations can be intended to increase a firm's performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labor productivity), gaining access to non-tradable assets (such as non-codified external knowledge) or reducing costs of supplies. Table 1 shows these innovations with their types.

TABLE 1.  
Innovation types based on OECD

Types of innovation	
Product innovation	Introduction of new product
	Development of new use for product with a minor change to technical specifications
	Significant improvement to existing product
	Minor changes or improvement to existing product
Process innovation	Production method
	Delivery method
Marketing innovation	Product design or packaging
	Product placement (sales channels)
	Product pricing
Organizational innovation	Product promotion
	Business practice
	Workplace organization
	External relation

## 1.2 INNOVATION NETWORK

Identify Risks is the process of determining which risks may affect the project and documenting their characteristics. This is an iterative process because new risks may evolve or become known as the project progresses through its life cycle. The frequency of iteration and who participates in each cycle will vary by situation [6].

Lately, due to intensive global competition, both academic and market society have paid more attention to the concepts such as ‘Open Innovation’ and ‘innovation network’. Actually, the logic of open innovation is that organizations need to open up their innovation processes and use external entities which are involved in innovation networks[2]. An ‘innovation network’ can be thought of “consisting of a number of positions or nodes, occupied by individuals, firms, business units, universities, governments, customers or other actors, and links or interactions between these nodes” [2] to achieve shared innovation goals[3]. There are four major arguments pushing for greater levels of networking in innovation[2]:

- Collective efficiency - it is hard for all but the largest firm to hold the competencies in-house in a complex environment requiring a high variety of responses. Networking offers a way of getting access to different resources through a shared exchange process.
- Collective learning - networking offers the opportunity to share scarce or expensive resources as well as facilitates a shared learning process in which partners exchange experiences, challenge models and practices, bring new insights and ideas and support shared experimentation. ‘Learning networks’ have proved successful vehicles in industrial development in a variety of cases.
- Collective risk taking – it permits higher levels of risk to be considered than any single participant might be prepared to undertake based on the idea of collective activity. This is the rationale behind many pre-competitive consortia around high-risk R&D.
- Intersection of different knowledge sets - it also allows for different relationships to be built across knowledge frontiers and opens up the participating organization to new stimuli and experiences.

## 2 RESEARCH METHOD

The main purpose of this paper is to empirically explore how networking influences innovations through the methodology including some steps as follows:

- Studying Literature Review and Theoretical Aspects: firstly, this paper studied the literature review and theoretical aspects related to innovations and networking.
- Collecting the data from a network as a case study: at this step, in order to explore how networking influence types of innovations empirically, compares innovation changes before and after networking of 45 companies in the network Pardis Technology Park as a case study.
- Analyzing the data and presenting the findings: at the last step, the data will be analyzed and accordingly results and findings will be presented.

## 3 DATA AND CASE STUDY

In order to explore empirically how networking influences the types of innovations (based on OECD definition as product, process, marketing and organizational innovations), it was decided to examine and analyze this by collecting the data of 2 periods of last 3 years of companies condition and qualification right before (1997-2000) and after (2008-2011) joining into the network. In this regard, the data was collected by a qualified and standard questionnaire including about 100 questions [9] and the survey was conducted in the year 2012 within a period of 5 months to measure types of innovations. Companies to be contacted were selected randomly from the database of Pardis Technology Park (PTP) [13]. Pardis Technology Park is a technology park, based in Pardis outside of the Tehran metropolitan area, in the Islamic Republic of Iran. PTP is as the region's technology paradise, under supervision of Presidency and a fourteen-entity Board of Trustees from ministries, science centers and academies. So far, PTP has had 100 Hi-Tech companies. The sample consists of 60 companies drawn from 3 main sectors as Mechanics and Automation, Information and Communication Technologies and Chemistry, Biotechnology and Advanced Materials. Table 2 depicts a profile of the resulting sample, illustrating its diversity in terms firm size (in terms of number of employees as up to 50: small; between 50 and 250: medium; 250 and above: large) and firm age (before 1975: old; between 1975 and 1992: moderate; 1992 and later: young). Afterwards, the questionnaire was applied simultaneously through face-to-face interviews to the sample and only 45 acceptable ones were received.

TABLE 2.  
Sample profile

Sectors		Firm Size			Firm Age		
		<50	50<<250	>250	<75	75<<92	>92
Mechanics and Automation	10%	25%	70%	5%	5%	55%	40%
Information and Communication Technologies	80%	100%					
Chemistry, Biotechnology and Advanced Materials	10%		100%			100%	

Innovation measures for each innovation types were designed by considering theoretical and operational definitions of the four innovation types as stated in the OECD Oslo Manual (2005) and they already were validated. Each innovation construct is measured by original measurement items [9], which are shown in table 3, 4, 5 and 6. In addition, for innovation measures, the respondents are asked to indicate on a 5-point Likert scale to what extent the related applications and practices were implemented in their organizations.

#### 4 ANALYSIS AND FINDINGS

As mentioned before, this study used a qualified and standard questionnaire [9], then the principal component analysis of innovations (PCA) in order to reduce the larger set of variables into a more manageable set of scales, are shown in table 3, 4, 5 and 6 for the data before and after networking for innovations as product, process, marketing and organizational ones respectively. Also, figure 1 illustrates these changes for innovation types before and after networking.

TABLE 3.  
Product innovation measures before and after networking

Product innovation measures	Before		After	
	Mean	S.D	Mean	S.D
Increasing manufacturing quality in components and materials of current products	3.18	1.08	3.28	1.1
Decreasing manufacturing cost in components and materials of current products	3.75	1.21	3.56	1.05
Developing newness for current products leading to improved ease of use for customers and to improved customer satisfaction	3.61	1.20	3.74	1.23
Developing new products with technical specifications and functionalities totally differing from the current ones	3.08	1.08	3.21	1.21
Developing new products with components and materials totally differing from the current ones	3.16	1.35	3.15	1.20
Total result	3.36	1.10	3.39	1.15
Changing proportion	3.39/3.36 = 1.01			

TABLE 4.  
Process innovation measures before and after networking

Process innovation measures	Before		After	
	Mean	S.D	Mean	S.D
Determining and eliminating non value adding activities in production processes	3.00	1.32	3.10	1.33
Decreasing variable cost components in manufacturing processes, techniques, machinery and software.	2.95	1.11	3.15	1.30
Increasing output quality in manufacturing processes, techniques, machinery and software.	2.96	1.41	3.14	1.38
Determining and eliminating non value adding activities in delivery related processes	3.38	1.39	3.35	1.40
Decreasing variable cost and/or increasing delivery speed in delivery related logistics processes.	3.35	1.32	3.40	1.15
Total result	3.13	1.22	3.22	1.26
Changing proportion	3.22/3.13 = 1.03			

TABLE 5.  
Marketing innovation measures before and after networking

Marketing innovation measures	Before		After	
	Mean	S.D	Mean	S.D
Renewing the design of the current and/or new products through changes such as in appearance, packaging, shape and volume without changing their basic technical and functional features.	3.50	1.25	3.59	1.35
Renewing the distribution channels without changing the logistics processes related to the delivery of the product.	3.40	0.98	3.55	1.52
Renewing the product promotion techniques employed for the promotion of the current and/or new products	3.20	1.41	3.30	1.44
Renewing the product pricing techniques employed for the pricing of the current and/or new products	3.35	1.30	3.50	1.32
Renewing general marketing management activities	3.00	1.47	3.10	0.80
Total result	3.29	1.23	3.41	1.20
Changing proportion	3.41/3.29 = 1.04			

TABLE 6.  
 Organizational innovation measures before and after networking

Organizational innovation measures	Before		After	
	Mean	S.D	Mean	S.D
Renewing the routines, procedures and processes employed to execute firm activities in innovative manner	3.55	1.14	3.50	1.50
Renewing the supply chain management system	2.95	1.14	3.15	1.27
Renewing the production and quality management systems	2.96	0.94	3.13	1.13
Renewing the human resources management system	3.45	1.18	3.40	1.11
Renewing the in-firm management information system and information sharing practice	3.28	1.18	3.15	1.11
Renewing the organization structure to facilitate teamwork	3.40	1.07	3.45	1.24
Renewing the organization structure to facilitate coordination between different functions such as marketing and manufacturing	3.19	1.16	3.00	1.42
Renewing the organization structure to facilitate project type organization	2.55	1.12	3.00	1.14
Renewing the organizational structure to facilitate strategic partnerships and long-term business collaborations	2.75	1.23	2.95	1.48
Total result	3.12	1.00	3.18	1.05
Changing proportion	3.18/3.12 = 1.02			

As you see in figure 1, it is understood that all types of innovation as product, process, marketing and organizational have changed and increased after joining into the networking as their changing proportion shows this fact. However, the amount of each changing proportion is different. In fact, we can arrange these changing proportion from the most to the least change as marketing, process, organizational and product innovation respectively.

In other words, the companies had the most changes in the marketing innovation after jointing into the network PTP(changing proportion=1.04) that mostly this changing goes back to “renewing the product pricing techniques employed for the pricing of the current and/or new products”. Although all the marketing innovation measures have increased after joining into the network, but we observed the least improvement about “renewing the design of the current and/or new products through changes such as in appearance, packaging, shape and volume without changing their basic technical and functional features”.

Process innovation has had the biggest changing after marketing innovation (changing proportion=1.03). More precisely, in this type of innovation two measures have had the most changing as “decreasing variable cost components in manufacturing processes, techniques, machinery and software” and “increasing output quality in manufacturing processes, techniques, machinery and software”. But it is noticeable that the changing proportion of the measure “determining and eliminating non value adding activities in delivery related processes” has decreased after jointing into the network.

After innovations as marketing and process, organizational innovation is placed from the point of changing proportion(1.02). Actually, this changing comes mostly from the measures as “Renewing the organization structure to facilitate project type organization” and “renewing the organizational structure to facilitate strategic partnerships and long-term business collaborations”. But some of the measures have had negative growth after jointing into the network as “renewing the routines, procedures and processes employed to execute firm activities in innovative manner”, “renewing the human resources management system”, “renewing the in-

firm management information system and information sharing practice” and “renewing the organization structure to facilitate coordination between different functions such as marketing and manufacturing”.

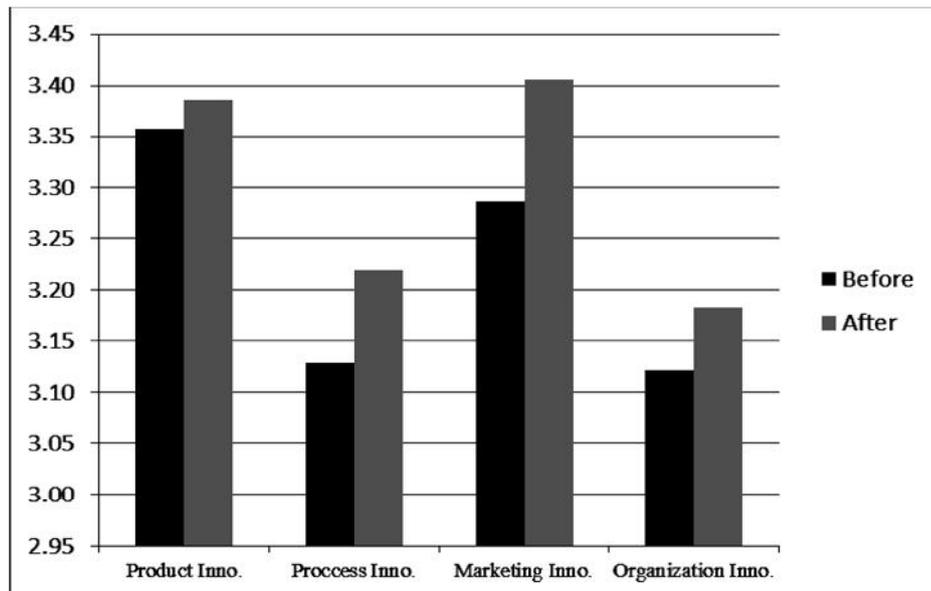


FIGURE 1. Chart of the changing of types of innovation after and before jointing into the network

Finally, the companies have had the laest changing proportion(1.01) about product innovation after jointing into the network. Most of this improvement goes back to the measure “developing new products with technical specifications and functionalities totally differing from the current ones” and “developing newness for current products leading to improved ease of use for customers and to improved customer satisfaction”. But companies have had negative growth after jointing into the network from the point of “decreasing manufacturing cost in components and materials of current products”.

## 5 CONCLUSION

The main purpose of this paper was examining and analyzing the effects of networking on types of innovations empirically through comparing changes of innovations before and after networking. Actually, There are four major arguments pushing for greater levels of networking in innovation as collective efficiency, collective learning, collective risk taking and intersection of different knowledge sets. In this regard, the paper used types of innovations as product, process, marketing and organizational one (based on OCED definition) and the innovation network as Pardis Technology Park as a case study to conduct this research. The results and findings showed that all of the innovation types were increased after jointing the companies to the network. In fact, we arranged these changing proportioin from the most to the least change

as marketing, process, organizational and product innovation respectively. Actually, in marketing innovation most of changing was related to “renewing the product pricing techniques employed for the pricing of the current and/or new products”. Also, it is noticeable that the companies have had big negative growth about “determining and eliminating non value adding activities in delivery related processes”, “renewing the organization structure to facilitate coordination between different functions such as marketing and manufacturing” and “decreasing manufacturing cost in components and materials of current products” according to the innovation as process, orgazational and product respectively.

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