

# Testing the Mediating Role of Open Innovation on the Relationship between Intellectual Property Rights and Organizational Performance: A Case of Science and Technology Park

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## ABSTRACT

The present study was conducted in Semnan Science and Technology Park and aimed to analyze the relationship among intellectual property rights, open innovation, and organizational performance of 30 New Technology Based Firms (NTBFs). Senior managers, middle managers, and business owners were considered as appropriate respondents for study. A total of 140 questionnaires were distributed among the respondents, and 126 filled questionnaires were returned. The research method used in this study is descriptive-correlation and the analysis was carried out utilizing Structural Equation Modeling. The factors analysis and the findings show that intellectual property rights have a significant positive relationship with open innovation. Further, open innovation has a significant positive relationship with organizational performance. Moreover, no significant relationship between intellectual property rights and organizational performance was established. But, intellectual property rights affect organizational performance positively, through open innovation acting as a mediator.

**Keywords:** intellectual property rights, open innovation, organizational performance

## INTRODUCTION

Open Innovation is a fact that has become more and more important for both practice and theory over the last few years, especially after 2003 (Chesbrough, 2013). The main reasons are to be found in shorter innovation cycles, industrial R&D increasing costs in addition to the rarity of resources. Subsequently, the open innovation has attracted innovation researchers and practitioners. Intellectual property rights (IPRs), or intellectual property (IP), are assuming increasing importance, especially for innovative firms. One of the reasons for this, is the increasing importance of knowledge management in firms. Because, innovation processes depend strongly on knowledge (Gloet & Terziovski, 2004) and profiting from knowledge is an essential aspect of innovation & technology

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### **Contribution of this paper to the literature**

- Researchers have studied the relationship between intellectual property rights and organizational performance, but the current study expands the literature by considering the mediating role of open innovation on the relationship between intellectual property rights and organizational performance.
- The results of the current study show the important role of open innovation which leads to superior organizational performance.
- The current study provides further insights for managers of organizations, academicians, and practitioners about intellectual property rights open innovation and organizational performance.

management, especially in high-tech firms and new technology based firms (NTBF's) (Sullivan, 1999; Carneiro, 2000).

Intellectual property rights are used to create income, to defend the firm's competitive status and to address competitiveness (Allen, 2003; Blomqvist et al., 2004; Candelin-Palmqvist et al., 2012). There is a need for more clarified understanding of IPR in innovation management for lots of reasons. Firstly, R&D is increasingly being conducted in countries where IPR protection is still weak (countries like Iran) (Zhao, 2006). Secondly, patents, copyrights and trade secrets are of critical importance to research partnerships and projects (Hertzfeld et al., 2006). Thirdly, the open-innovation paradigm is shaking up the conventional understanding of IP protection (West & Gallagher, 2006).

The recent era of open innovation commenced when practitioners recognized that firms that wished to commercialize both their own ideas as well as other firms' innovation should seek new ways to bring their in-house ideas to market. They need to organize pathways outside their current businesses and should realize that the focus where knowledge is created does not necessarily always equal the focus of innovation - they need not both be found within the company (Gassmann & Enkel, 2004). Experience has furthermore shown that neither the focus of innovation nor exploitation need lie within companies' own boundaries. Although, imitation of the open innovation approach transforms a company's boundaries into a semi-permeable membrane that enables innovation to move easily between the external habitat and the company's internal innovation process. How far the open innovation approach is implemented in practice and whether there are identifiable with respect to intellectual property patterns is the main goal of our study.

## **LITERATURE REVIEW**

In this section we're going through the elements of our conceptual framework.

### **Intellectual Property Rights**

The increasing importance of intangible assets such as intellectual property (IP) has moved the management of IP from a legal matter to a strategic and organizational issue. Present global competitive environment requires that firms increasingly generate and capture value from IP. Although these challenges have recently been the subject of a growing amount of research, there is still lack of practical evidence indicates how firms defeat these issues (Granstrand, 2000 & 2004; Smith & Hansen, 2002). Therefore, this paper investigates how firms manage and leverage their IP to improve the effectiveness of their IP management and how it can affect firm's performance.

The role of IP has increasingly been the topic of debate in research and practice. Creating knowledge and capturing it in IP rights such as patents, trademarks, and industrial designs are key competitive elements for firms (Carlaw et al., 2006; Hall, 1992). In lots of successful firms, IP and particularly patents serve as influential instruments of corporate strategy to protect innovation and to strengthen the firm's technological leadership (Grindley & Teece, 1997; Sullivan, 2001). The growing number of patent applications over the last decades, sometimes called the 'pro patent era' (Granstrand, 2000), reflect this development.

Intellectual property management is widely understood as the management of a firm's IP rights consisting of patents, trademarks, industrial designs, and copyrights. Among all these IP rights, patents are considered to be the most tangible form enjoying the strongest legal protection and generating the most significant effect on a firm's commercial performance (Rivette & Kline, 2000; Lerner, 1994). Various studies have analyzed the patent management and related patenting issues and behaviors of firms considering geographical locations (Cohen et al., 2000; Duguet & Kabla, 1998; Granstrand, 1999; Granstrand & Holgersson, 2012; Zaripova et al., 2015; Khuziakmetov & Gabdrakhmanova, 2016; Khuziakmetov & Nasibullov, 2016; Khuziakmetov et al., 2016; Kirillova et al., 2017; Galiullin et al., 2017), firm size (Audretsch, 2002; Blind et al., 2009; Blind et al., 2006; Greenhalgh et al., 2001), industry sectors (Cohen et al., 2000; Arora, 1997; Hall & Ziedonis, 2001; Levin et al., 1987; Thumm, 2001), and the positive effects of patent strategy on firm performance (Lerner, 1994; Lerner & Tirole, 2002; Ernst,

**Table 1.** Literature overview on IP strategy and management

Author(s) (Year)	Topic	Methods	Key Findings
<b>Somaya (2012)</b>	Patent strategy and management: an integrative review and research agenda	Conceptual paper based on Literature review	<ul style="list-style-type: none"> <li>• Framework of generic patent strategies and strategic patent management</li> <li>• Three generic patent strategies: proprietary, defensive, and leveraging strategy</li> <li>• Patent management is closely linked to a firms' overall value creation strategy</li> </ul>
<b>Carlsson et al. (2008)</b>	Intellectual property management: organizational processes and structures, and the Role of the IP donations.	Interviews with 15 technology-based firms in the US Online survey	<ul style="list-style-type: none"> <li>• Three organizational archetypes of IP management: centralized, decentralized, comprise structure</li> </ul>
<b>Daizadeh (2007)</b>	Intellectual property management in R&D intensive firms	Qualitative survey with 58 firms Six interviews	<ul style="list-style-type: none"> <li>• Managing patent information increases efficiency of converting R&amp;D into commercial technologies</li> <li>• Development of an IP- specialized coordination device to optimize transaction costs</li> </ul>
<b>Ernst (1995)</b>	Patenting strategies in the German mechanical engineering industry and their relationship to company performance	Quantitative survey from 50 German mechanical engineering firms	<ul style="list-style-type: none"> <li>• Identification of four types of patenting strategies</li> <li>• Patent active firms reach higher economic performance</li> <li>• The number of international patent applications, the rate of valid and highly cited patents positively impacts firm performance</li> </ul>

2001 & 1995). Also the basis for patenting have been comprehensively analyzed. The major justification for filing a patent is to protect innovation from being impersonated (Cohen et al., 2000; Hall & Ziedonis, 2001; Giuri et al., 2007; Zaipova et al., 2015; Kurbanov et al., 2016; Shcherbakov et al., 2017). So we can conclude that IPRs is a very important issue and of special importance in firms performance. To successfully appropriate returns through managing IP, scholars focus the value of aligning IP strategy to business strategy (Granstrand, 2000; Smith & Hansen, 2002; Reitzig, 2004).

Somaya (2012) in his recent review, categorizes patent strategies into proprietary (e.g., protection), defensive (e.g., blocking), and leveraging (e.g., licensing) approaches impacting the firms IP management. Overview of IP strategy and Management is presented in [Table 1](#).

## Open Innovation

There is a continuum of innovation approaches, with closed approaches on one end and open approaches on the other (Trott & Hartmann, 2009). These two extremes were captured by Chesbrough (2003) when he asserted that "Firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology". This original understanding was further developed in 2006, when Chesbrough et al. (2006) stated that "open innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively". Inbound open innovation is an outside-in process and involves opening up the innovation process to knowledge exploration. Here, external knowledge exploration refers to the acquisition of knowledge from external sources. For instance, many large pharmaceutical firms now acquire a substantial portion of their technologies from external partners such as nano-technology firms (Schwartz & Huff, 2010). In contrast, outbound open innovation is an inside-out process and includes opening up the innovation process to knowledge exploitation. External knowledge exploitation relates to the commercialization of technological knowledge.

Open innovation means that a firm is increasingly using external knowledge to speed up its own, internal innovation process. More particularly, open innovation can be explained as 'the proportion of innovations generated in cooperation / collaboration with universities, research organizations, customers and / or suppliers, other NTBFs, venture capitalists and industry / cluster associations or business assistance centers as opposed to innovations that are entirely generated within the company' (Chesbrough, 2006). Open innovation can occur at the different stages of innovation, namely the front end of innovation / idea generation phase (discovering market opportunities, envisioning areas for technical breakthrough, developing initial insights, basic and applied research), the idea realization or development phase (developing a deeper conception of products or services, building a model of a product or service, and product or process testing) and the commercialization phase (production, promotion, distribution, and sales of a product or service) (Dries et al., 2013) (see [Figure 1](#)).

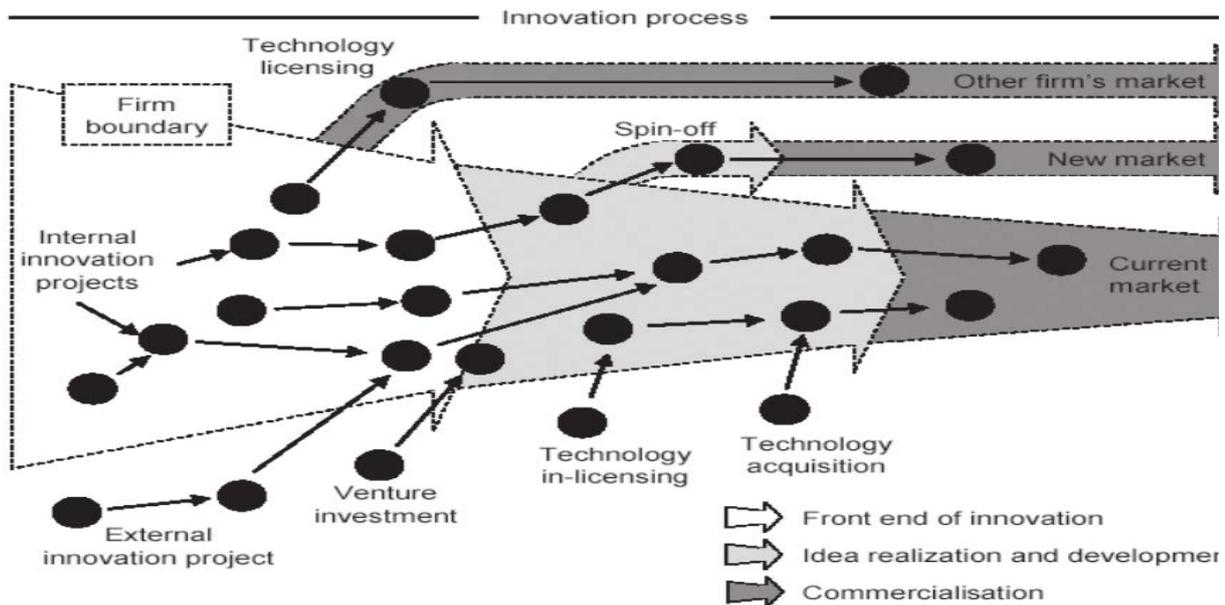


Figure 1. Open innovation in Innovation process (Chesbrough, 2003)

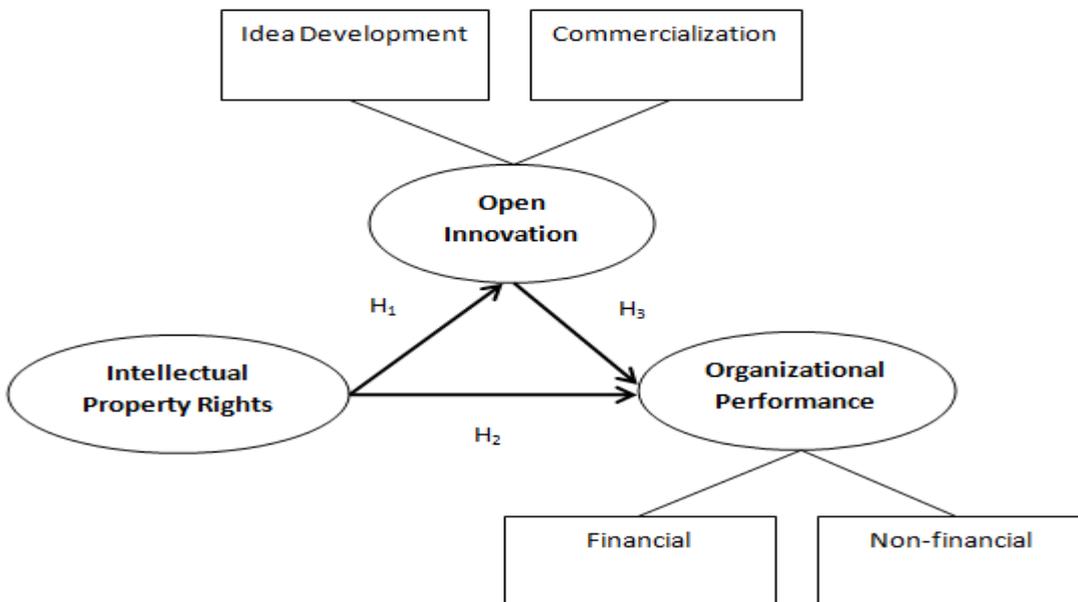


Figure 2. Research Proposed Model

### CONCEPTUAL FRAMEWORK

According to mentioned literature we define article conceptual framework as **Figure 2**, with three variables of open innovation as mediator variable, intellectual property rights as independent variable and organizational performance as dependent variable. Our four hypothesizes are as follows:

- H<sub>1</sub>:** Intellectual Property Rights has a significant relationship with Open Innovation.
- H<sub>2</sub>:** Intellectual Property Rights has a significant relationship with Organizational Performance.
- H<sub>3</sub>:** Open Innovation has a significant relationship with Organizational Performance.
- H<sub>4</sub>:** Intellectual Property Rights has a significant relationship with Organizational Performance, through Open Innovation as a Mediator.



**Figure 3.** Semnan Science and Technology Park

**Table 2.** Description of Respondents

Item	Description	Frequency	Percentage
<b>Gender</b>	Male	126	100%
	Female	0	0%
<b>Age</b>	Below 30	9	7%
	31-50	94	75%
	Above 50	23	18%
<b>Education</b>	Diploma	12	9%
	STP	15	12%
	Bachelor	75	60%
	Master and above	24	19%

## METHODOLOGY

### Statistical Population

Statistical population in this research includes 30 companies of Semnan Science and Technology Park (as shown in [Figure 3](#)). Senior managers, middle managers, and business owners were considered as appropriate respondents for this study. After distribution of 140 questionnaires among respondents, 126 filled questionnaires were returned. [Table 2](#) illustrates the descriptive statistics of the respondents.

### Instrument

In order to collect the necessary data, a questionnaire was used to test the hypotheses of the study. The questionnaire consists of three sections. First section includes 3 questions about demographic information of respondents (see [Table 3](#)). In the second section, we used 5 questions developed by Luoma et al. (2010) and Enkel et al. (2011) to measure the status of intellectual property rights. Further, the 7 questions developed by Dries et al. (2013) was used to measure 2 dimensions of open innovation; i.e. idea development and commercialization. Finally, in the third section, the 6 items scale developed by Yang et al. (2012) was used to measure 2 dimensions of organizational performance; i.e. financial and non-financial performance.

We used five-point Likert type scale for all the items. Response categories range from 1 (strongly disagree) to 5 (strongly agree).

### Reliability

The summary statistics of formal survey are shown in [Table 3](#). For reliability evaluation we utilized Cronbach's alpha. The Cronbach's alpha reliability of all variables are more than 0.7 ( $\alpha > 0.7$ ), which indicates all the scales demonstrate good reliability.

### Validity

For evaluating the validity of the questionnaires, we used content validity and construct validity. Content validity deals with how representative and comprehensive the items were in creating the scale. It is assessed by examining the process by which scale items are generated (Moon & Kim, 2001). Content validity assured us that all aspects and parameters that impact on main content were evaluated. In order to test the content validity after devising a framework for the questionnaire, we asked 10 experts to modify it if needed. These experts evaluated all the implemented criteria in the questionnaire and confirmed it.

**Table 3.** The Summary Statistics of Formal Survey

NO	Research Questions	Mean	Cronbach's Alpha
	1→ Intellectual Property Right		
	2→ Open Innovation		
	3→ Organizational Performance		
1	1. Firm wants to keep everything for themselves	3.8810	.....
	2. Minimal IP given away under strict conditions	4.3889	.....
	3. Trust-based legal & IP attitude	4.3095	.....
	4. Legal & IP departments of firm encouraged to take long-term view	4.2619	.....
	5. Does your firm demonstrate an open attitude?	4.6508	.....
	<b>Intellectual Property Rights</b>	<b>4.29842</b>	<b>0.842</b>
2	1. The firm has intensive info exchanges with buyers	4.0556	.....
	2. The firm has intensive info exchanges with suppliers	4.2063	.....
	3. Reciprocity in sharing know-how with competitors	4.6111	.....
	4. Do employees screen the external environment for new opportunities?	4.5159	.....
	<i>Idea Development</i>	4.34722	0.788
	5. Presence of high-skilled & English-speaking workers & familiar with ICT	4.3889	.....
	6. The firm is dependent on specific knowledge	4.2143	.....
	7. The firm owns specific know-how	3.8651	.....
	<i>Commercialization</i>	4.1561	0.794
		<b>Open Innovation</b>	<b>.....</b>
3	1. The cost objectives of firm were met.	4.6429	.....
	2. Total installed cost of the firm was under authorized budget.	4.2857	.....
	3. The budget for each of firm's projects was the same and under as planned.	3.9762	.....
	<i>Financial Performance</i>	4.3016	0.744
	4. All firm's assignments were proceeding as planned and delivered on time.	4.0317	.....
	5. The quality objectives of firm were achieved for each project.	4.0238	.....
	6. The firm's deliverables complied with the contractual requirements.	4.4921	.....
	<i>Non-Financial Performance</i>	4.1825	0.763
	<b>Organizational Performance</b>	<b>.....</b>	<b>0.812</b>

**Table 4.** SEM Fitness Indices

Fitness Indices	Measure of Index	Principle
Root Mean Square Error of Approximation (RMSEA)	0.050	< 0.1
Chi-Square/df	1.3104	< 3
P-Value	0.01	< 0.05
Normed Fit Index (NFI)	0.92	> 0.9
Non-Normed Fit Index (NNFI)	0.96	> 0.9
Comparative Fit Index (CFI)	0.97	> 0.9
Incremental Fit Index (IFI)	0.98	0 < IFI < 1
Goodness of Fit Index (GFI)	0.95	> 0.9
Adjusted Goodness of Fit Index (AGFI)	0.90	> 0.9

Construct validity determines the extent to which a scale measures a variable of interest (Moon & Kim, 2001). In this research we used factor analysis for considering the structure of research. Confirmatory factor analysis was used to investigate the construction of the questionnaire. Factor analysis depicted that all the mentioned criteria are measured in these questionnaires.

### Measurement Model of Research Variables

In the next step, we applied Confirmatory Factor Analysis in LISREL 8.8 and eventually conducted path diagram of research models. We have tested the relationship between the three models and their indicators. Fitness's indices show good fitness of our models, proving that the selected indicators are good representatives for dimensions of Intellectual Property Rights, Open Innovation, and Organizational Performance. Based on Joreskong & Sorbom (1989), Chi-Square/df<3, RMSEA ≤ 0.10, P-Value < 0.05 show that the measurement model provides a reasonable fit to the data.

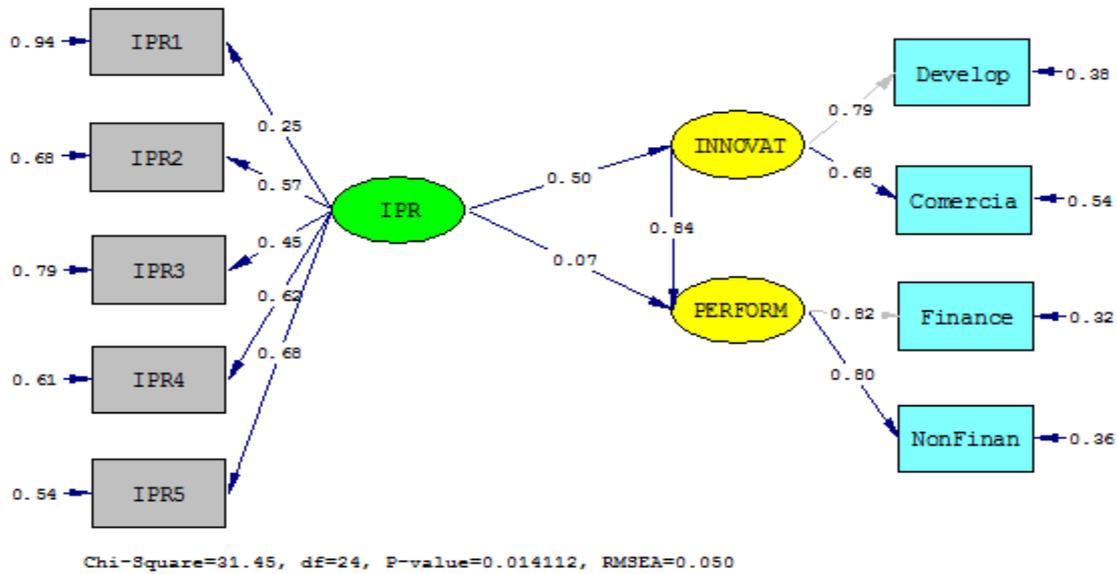


Figure 4. Structural Equation Model

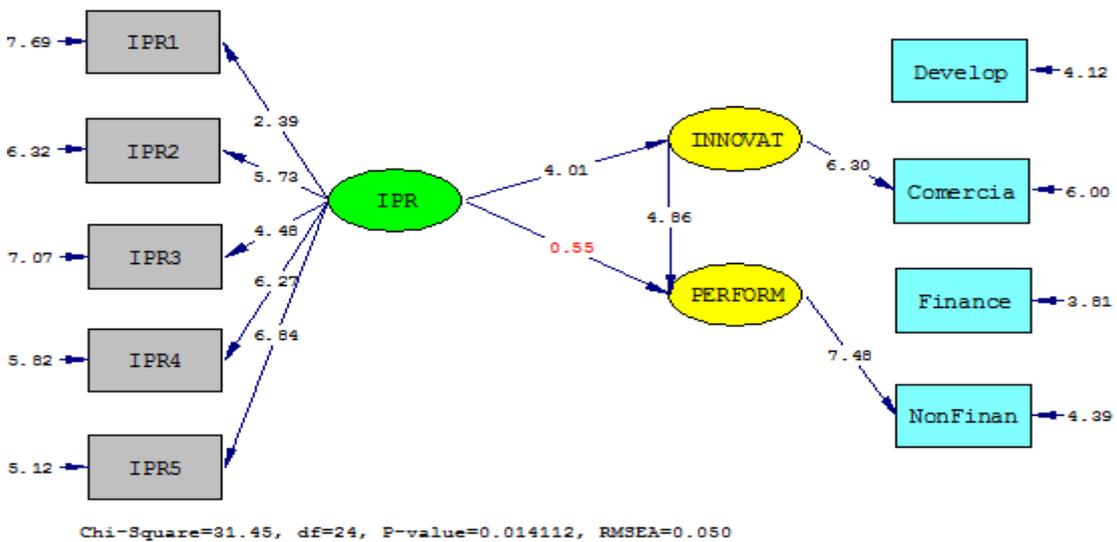


Figure 5. T-Value Analysis

Table 5. The Results of the Hypothesis Test

No	Hypothesis	Path Coefficient	T-Value	Result
H <sub>1</sub>	Intellectual Property Rights → Open Innovation	0.50	4.01	Confirmed
H <sub>2</sub>	Intellectual Property Rights → Organizational Performance	0.07	0.55	Rejected
H <sub>3</sub>	Open Innovation → Organizational Performance	0.84	4.86	Confirmed
H <sub>4</sub>	Intellectual Property Rights → Organizational Performance (Through Open Innovation as a Mediator)	0.42	3.14	Confirmed

## RESULTS

For testing our hypotheses, we performed our Structural model applying 5 questions of intellectual property Rights, 2 dimensions of open innovation, and 2 dimensions of organizational performance. Figure 4 and 5 show the results of the Structural Equation Model (SEM) analysis. Fitness's indices also show good fitness of the Structural Model as per Table 4. Table 5, show the result of paper hypothesis analysis. Three of four hypotheses were confirmed via confirmatory factor analysis. The one that was rejected, was predictable; because IPRs cannot strongly influence performance without some other factors, and open innovation is one of them.

## CONCLUSION

The aim of the present study is to investigate the relationship among intellectual property rights, open innovation and organizational performance of 30 NTBFs in Semnan Science and Technology. Any organizations try to survive in today's competitive global market. Therefore, identifying factors contribute to achieving superior performance has always been of particular interest of researchers in organizational studies; which was the main reason of conducting this study.

As it mentioned, Open innovation has become a widely discussed fact in all over the world in the ten years that have passed since the publication of Henry Chesbrough's book, *Open Innovation* is defined as "... the purposive use of inflows and outflows of knowledge to accelerate innovation in one's own market, and expand the use of internal knowledge in external markets, respectively." (Chesbrough, 2003; Chesbrough et al., 2006). Further, because of the important role of intellectual property rights in today's business world, identifying the positive consequences of intellectual property rights is an interesting issue need to be understood by managers and business owners which was another reason to carry out this study.

According to Mean analysis of the study, the context of 30 NTBFs enjoys a high level of intellectual property rights, open innovation, and organizational performance; as all the Means are more than 3 ( $\mu = 3$ ). Furthermore, according to the results of structural equation modeling of study, intellectual property rights has a significant positive influence on open innovation. It implies that IPRs is one the most influential factors of open innovation and to make most of open innovation, IPRs must exist play their role properly.

Further, intellectual property rights has no significant relationship with organizational performance. Whereas, open innovation has a significant positive influence on organizational performance. Also, it is established that open innovation mediating the relationship between intellectual property rights and organizational performance. Therefore, intellectual property rights will affect organizational performance positively, through open innovation acting as a mediating variable. This study, like every other study has some limitations. One of them is concerned with the statistical population of this study. Future studies could select other contexts i.e. manufacturing, service, educational, virtual, electronic, etc. organizations. Another limitation of the study is associated with cause and effect relationship among research variables. There might be other variables affect the relationship among research variables. Therefore, future studies should focus on identifying other factors to expand and refine the model of this study.

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