MODESTUM
OPEN ACCESS
EURASIA Journal of Mathematics, Science and Technology Education
ISSN: 1305-8223 (online) 1305-8215 (print)
2018 14(4):1497-1507 DOI: 10.29333/ejmste/84835

The Impact of Technology Acquisition & Exploitation on Organizational Innovation and Organizational Performance in Knowledge-Intensive Organizations

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Received 15 June 2017 ▪ Revised 29 October 2017 ▪ Accepted 28 November 2017

ABSTRACT

The present study was conducted in Iran and aimed to analyze the relationships among technology acquisition & exploitation, organizational innovation, and organizational performance. We selected 80 knowledge-intensive organizations as statistical population of the study. Executive managers, senior managers, operational managers, and R&D managers of the companies were considered as appropriate respondents for this study. After the distribution of 320 questionnaires among the respondents, 280 usable questionnaires were gathered. The analysis was done utilizing Structural Equation Modeling (SEM) methodology by LISREL software. The factors analysis and the findings show that technology acquisition & exploitation has a significant positive influence on both organizational innovation and organizational performance. Further, organizational innovation has a significant positive impact on organizational performance.

Keywords: knowledge-intensive organizations, organizational innovation, organizational performance, technology acquisition, technology exploitation

INTRODUCTION

The business environment is becoming increasingly dynamic, complex and unpredictable (Davoudi & Fartash, 2012; Coopers, 1997; Shcherbakov et al., 2017), where technology, globalization, knowledge and changing competitive approaches impact on overall performance (Hitt et al., 2001; Scott, 2000). Change is the reason why many firms are seeking new ways of conducting business to create wealth (Stopford, 2001). Technology management is also on the most important issues of organizational in order to cope with dynamic situation of markets and organized management of technology as a source of competitive advantage is of great importance for many organizations. Technology management and generally technology management system consists of some modules. Two of them was selected as the most important modules for iranian companies during a survey with 50 R&D managers. In this paper we're going to examine the role of two called modules of technology management on organizational performance and organizational innovation.

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Contribution of this paper to the literature

- Researchers have studied organizational performance in many studies; but no study has been studied the relationship among technology acquisition & exploitation, organizational innovation and organizational performance at the same time.
- This study shows how to improve organizational performance by improving technology acquisition & exploitation.
- The results of the current study show that organizational innovation can be also improved by increasing in the level of technology acquisition & exploitation.
- The findings of this study confirm that technology acquisition & exploitation will also affect organizational performance positively through improving organizational innovation.

LITERATURE REVIEW

In this section of article we discuss three area of literature related to this paper. First discuss technology management and its modules. Then we cover organizational innovation and performance.

Technology Management

The role of technology as a source of competitive advantage for industries especially manufacturing industries is widely confirmed by both governments and academics. In order to realise this competitive advantage, it is essential to understand both the specific technologies, and the ways in which organizations can best organize technology (Phaal et al., 2001).

Technology management define the effective identification, selection, acquisition, development, exploitation and protection of technologies (including product, process and even infrastructural) needed to attain, maintain a business position and performance in alignment with the firm's objectives (Phaal et al., 2004; Gregory, 1995; Galiullin et al., 2017; Kirillova et al., 2017).

Since about 1980 technology management has been inclined towards strategic issues such as integrating technology strategy with marketing and other corporate strategies (Drejer, 1996). Mitchell (1985) has developed a matrix linking strategic technology areas to business areas. Further, Wet (1996), developed two-dimensional matrix, linking markets, products, processes and technologies, leading to market-focused technology planning. Bitondo & Frohman (1981), Birnbaum (1984), McGee & Thomas (1989), Pavitt (1990), Stacey & Ashton (1990), Abetti (1994), Matthews (1992) are the examples of approaches to the development of technology management strategies However, no particular approach has been widely accepted.

Effective implementation of a technology management requires organizing the associated processes at the operational level (lowest level); ''A strategy is only of value if mechanisms for its implementation and renewal are in place'' (Gregory, 1995). There are some technology management framework & systems such (Phaal et al., 2001; Dilek et al., 2009; Badawy, 1998, Ozgur, 1999).

We selected two framework of Dilek et al. (2009) and Gergory (1995) for examining MOT[1] system as in **Figures 1** and **2**.

These two frameworks both focus on 5 main modules of identification, selection, acquisition, exploitation and protection. According to our survey we decided to choose two modules of acquisition and exploitations as a representative of MoT system in our conceptual model.

Technology management process framework Gregory (1995) has suggested that management of technology is comprised of five generic modules (see **Figure 1**):

(1) Identification of technologies which are (or may be) of importance to the business.

(2) Selection of technologies that should be supported by the organization.

(3) Acquisition and assimilation of selected technologies.

(4) Exploitation of technologies to generate profit, or other benefits.

(5) Protection of knowledge and expertise embedded in products and manufacturing systems.

[1] Management of technology

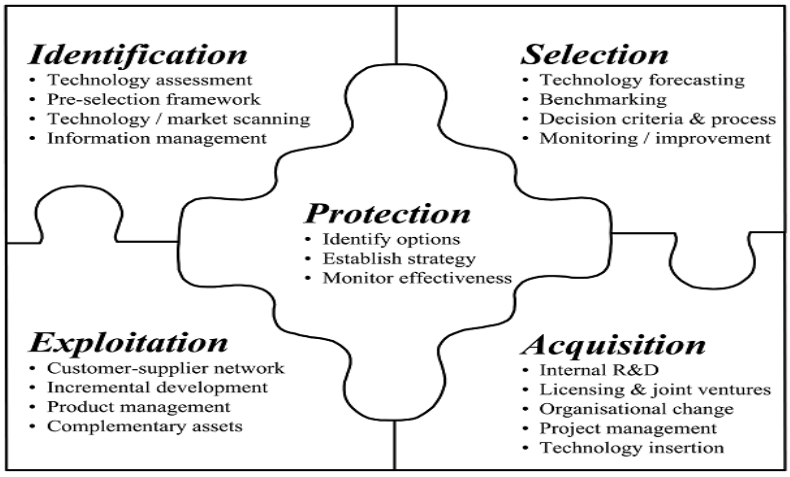

Figure 1. Gregory MOT framework (Gregory, 1995)

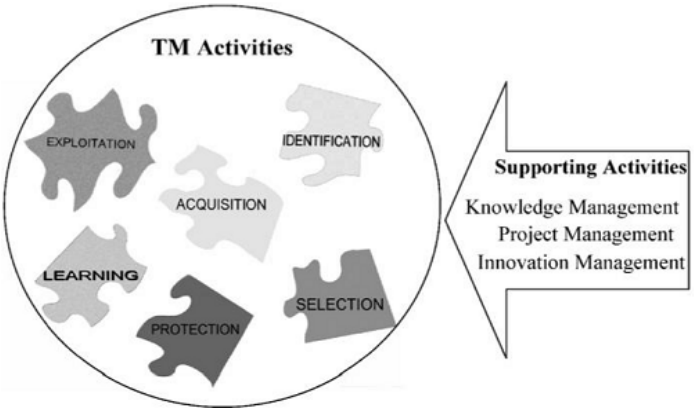

Figure 2. Phaal MOT framework (Dilek et al., 2009)

Technology Acquisition

Impact of acquisitions on the innovation performance firms is undeniable. This evaluation is important from the organizational learning and innovation perspective, and aids to clarify how organizations absorb and use external knowledge. Some concepts of technological change propose that innovativeness is an outcome of increases in its knowledge base (Griliches, 1984; Griliches, 1990; Pakes, 1984; Henderson R, Cockburn, 1996). Acquisitions can be motivated by the willing to access to distribution channels, to gain entry into new markets, or to obtain financial synergies or market power (Lubatkin, 1983; Balakrishnan, 1988; Haspeslagh & Jemison, 1991; Capron, 1998; Ahuja & Katıla, 2001). Impact of acquisitions on the firm's innovation output can be understood in the context of the technological inputs provided by the acquisition (Ahuja & Katıla, 2001).

Acquisitions can affect the subsequent innovation capacity through two possible mechanisms. First, an acquisition of another firm can be viewed as an absorption of the acquired firm's knowledge base into the acquiring firm's knowledge base (Ahuja & Katıla, 2001; Jemison & Sitkin, 1986; Haspeslagh & Jemison, 1991).

Technology Exploitation

Proper timing of exploitation is important for firms specially high-technology firms (Katila & Mang, 2003). In hi-tech industries windows of opportunity close quickly, and obtaining early access to know-how or resources that enable fast exploitation can make the difference between finishing first and dropping out (Reinganum, 1989; Eisenhardt & Schoonhoven, 1996).

Previous research has shown that realizing technological opportunities can obtain resources for exploitation most effectively through collaboration (e.g. Mitchell & Singh, 1996). Companies that collaborate early can establish n access to vital resources. Collaborating early can also free the firm's own resources for a range of uses (Mosakowski, 1991).

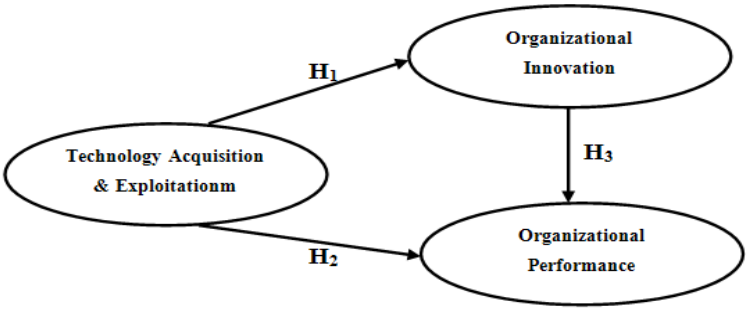

Figure 3. Research proposed model

Organizational Performance

The concept of performance has been described as follows (Brumbach, 1988): It means both behaviors and results. Behaviors emanate from the performer and transform performance from abstraction to action.

Organizational performance consists of the obvious behaviors that people do in their jobs that are relevant to the goals of [their] organization (Campbell et al., 1990). Organizational performance is of interest to organizations because of the importance of high productivity in organizations (Hunter & Hunter, 1980). Performance definitions emphasis on behaviors rather than outcomes (Murphy, 1989), because a focus on outcomes could lead employees to find the easiest way to attain desire results, that is likely to be intentional or strongly desirable to the organization because other important behaviors will not be performed. Campbell et al. (1993) state that, performance consists of the behaviors that employees actually engage in which can be observed. Despite the strictly behavioral definitions of Organizational performance, Motowidlo et al., (1997) state that rather than solely the behaviors themselves, performance is behaviors with an evaluative aspect. This definition is in agreement with the dominant methods used to measure Organizational performance, namely performance ratings from supervisors and peers (Newman et al., 2004). Although Motowidlo et al. (1997) highlight this evaluative idea in defining the performance domain, they still maintain that job performance is behaviors and not results (Newman et al., 2004). One further element of performance is that the behaviors must be in agreement with goals of the organization (Campbell et al., 1993).

Organizational Innovation

Innovation has a connotation of "newness", "success", and "change" (Assink, 2006) and can be defined as "the generation, development, and adaptation of an idea or behavior, new to the adopting organization" (Damanpour, 1996). Cumming (1998) states "innovation is conceived as a means of changing an organization, either as a response to changes in the external environment, or as a pre-emptive action to influence the environment". From another view, innovation is something that is invented for the first time and is a commercial success (Kumar et al., 2000; Fartash & Davoudi, 2012). Innovation involves the adoption of new products or processes to increase competitiveness and overall profitability. It involves new methods of identifying needs of new and existing clients (Rogers, 1995). Innovation is one of the principal challenges to the management of firms. Hitt et al. (2001) state that innovation is critical to enable firms to compete in domestic and global markets. The importance of innovation for firms and start-up is encapsulated when they state that head to head competition with established players is bound to result in failure due to resource shortcomings, scale diseconomies, and questionable reputation. They state that innovation is the key to competition as competitors cannot easily mimic innovativeness (Fartash & Davoudi, 2012; Lee et al., 2001; Khuziakhmetov & Gabdrakhmanova, 2016; Khuziakhmetov & Nasibullov, 2016; Kurbanov et al., 2016).

Many authors (i.e. Tidd et al., 2005) regarded innovation as a key factor for a company to sustain and grow on the long run. In despite of the successful implementation of innovations, only a few companies understand what is necessary for successful innovation. Shepherd and Ahmed (2000) say that the ways in which firms achieve these challenges depends on the nature of the business they are in, the dynamic forces of the market in which they operate, and the resources and skills that can be applied to ensure their business objectives are met. According to Pratali (2003), managing innovation involves two simultaneous, interrelated fundamental objectives of competitiveness: improving product quality (a prerequisite to success), and improving the company's overall technological quality (a prerequisite to lasting success) (Davis, S.M., and Moe, 1997; Cottam et al., 2001).

Table 1. Description of the respondents

Item	Description	Frequency	Percentage
Gender	Male	154	55%
	Female	126	45%
Age	Below 30	59	21%
	31-40	83	30%
	41-50	75	27%
	Above 51	63	22%
Education	STP	12	4%
	Bachelor	89	32%
	Master	166	60%
	PhD	13	4%
Organizational Status	Executive managers	86	30%
	Senior managers	78	29%
	Operational managers	64	23%
	Research & Development managers	52	18%

RESEARCH MODEL AND HYPOTHESES

Taking into account the above mentioned literature, **Figure 3** shows the conceptual model of the study which involved the relationship among technology acquisition & exploitation, organizational innovation, and organizational performance.

H_1: Technology acquisition & exploitation has a significant positive influence on organizational innovation.

H_2: Technology acquisition & exploitation has a significant positive influence on organizational performance.

H_3: Organizational innovation has a significant positive influence on organizational performance.

METHODOLOGY

Statistical Population

Statistical population in this research includes 80 knowledge-intensive organizations in Iran. Executive managers, operational managers, senior managers, and research & development managers of companies were considered as appropriate respondents for this study. After the distribution of 340 questionnaires among the respondents, 280 usable questionnaires were gathered. **Table 1** 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 four sections. The first part includes 4 questions about demographic information of the respondents (**Table 1**). In the second part, we used 5 questions developed by TechRepublic company to measure technology acquisition & exploitation. In the next part, we used 5 questions to measure organizational innovation of companies (www.techrepublic.com). We extracted these 5 questions from the original scale developed by Gratton (2000). Further, in the next part, we used 5 questions developed by Campbell et al. (1993) and Armstrong & Baron (1998) to measure organizational performance. We used five-point Likert type scale for all the items. Response categories range from 1 (strongly disagree) to 5 (strongly agree).

Reliability and Validity

The summary statistics of formal survey are shown in **Table 2**. For reliability evaluation we utilized Cronbach's alpha. The Cronbach's alpha reliability of the scales are more than 0.7 (a>0.7), which indicates the scales demonstrate good reliability.

Table 2. The summary statistics of formal survey

Dimensions of conceptual model of research	Mean	Std. Deviation	α
T.A.E.1	4.5071	0.81647	
T.A.E.2	4.6821	0.66319	
T.A.E.3	4.4536	0.84114	
T.A.E.4	4.2607	1.09735	
T.A.E.5	4.3964	0.95226	
Technology Acquisition & Exploitation	**.....**	**.....**	**0.755**
O.INNO.1	4.4964	0.82955	
O.INNO.2	4.6143	0.70924	
O.INNO.3	4.4964	0.84666	
O.INNO.4	4.5071	0.83384	
O.INNO.5	4.4536	0.82826	
Organizational Innovation	**.....**	**.....**	**0.764**
PRF.1	4.1500	1.20884	
PRF.2	4.3143	1.03754	
PRF.3	4.1643	1.17690	
PRF.4	4.2643	1.06499	
PRF.5	4.2250	1.14351	
Organizational Performance	**.....**	**.....**	**0.882**

Table 3. The structural model fitness indices

Fitness Indices	Measure of Index
Chi-Square/df	1.9031
P-value	0.0000
Root Mean Square Error of Approximation (RMSEA)	0.057
Normed Fit Index (NFI)	0.96
Non-Normed Fit Index (NNFI)	0.98
Comparative Fit Index (CFI)	0.98
Incremental Fit Index (IFI)	0.98
Relative Fit Index (RFI)	0.95
Goodness of Fit Index (GFI)	0.93
Adjusted Goodness of Fit Index (AGFI)	0.90

For evaluating the validity of the questionnaires, we used construct validity (Moon & Kim, 2001). 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. Based on Joreskong & Sorbom (1989), Chi-Square/df≤3, RMSEA ≤ 0.10, NFI, NNFI, CFI, GFI, AGFI, and RFI > 0.9, and 0 <IFI< 1 show that the measurement model provides a reasonable fit to the data (Joreskong & Sorbom, 1989) (**Table 3**).

RESULTS

This study tends to investigate the relationships among technology acquisition & exploitation, organizational innovation, and organizational performance in Iran. The relationships among research variables were tested using the SEM technique that is explained below. For testing our hypotheses, we performed our structural model applying 5 questions of technology acquisition & exploitation, 5 questions of organizational innovation, and 5 questions of organizational performance. **Table 4** shows the questions of research variables. Further, it shows the status of the respondents' answers to each question in a Likert scale.

Table 4. Status of respondents' answers to each question

Questions First part: Technology Acquisition & Exploitation Second part: Organizational Innovation Third part: Organizational Performance	LikertScale 1	2	3	4	5
1: Technological need & required budget are available	3	9	13	73	182
2: Relative value of acquisition vs. other products and services been established	2	3	10	52	213
3: Your company has a management of technology system and all MOT procedures are defined clearly	3	5	31	64	177
4: Technology acquisition & exploitation is analyzed and a recommendation complete periodically	5	27	30	46	172
5: There is strong tendency to align technology system procedures with other organizational perspective	4	12	33	51	180
1: Employees pay close attention to change management -communicate, involve and train	3	7	22	64	184
2: Employees don't follow fashion & do their own thing.	1	6	13	60	200
3: Employees ensure that what you do fits the strategy, culture and circumstances of the organization.	3	9	20	62	186
4: Employees keep things simple over complexity	2	7	29	51	191
5: Employees don't rush – it will take longer than they think.	2	8	25	71	174
1: Success depends on what the organization is and needs to be in its performance culture.	13	28	24	54	161
2: Organizational Performance only interested in things you can do something about and get a visible improvement.	9	12	30	60	169
3: Organizational Performance focus on changing behaviour rather than paperwork.	10	28	30	50	162
4: Organizational Performance focus on development not pay.	8	18	29	62	162
5: Organizational Performance focus on changing behaviour rather than paperwork.	12	20	26	57	165

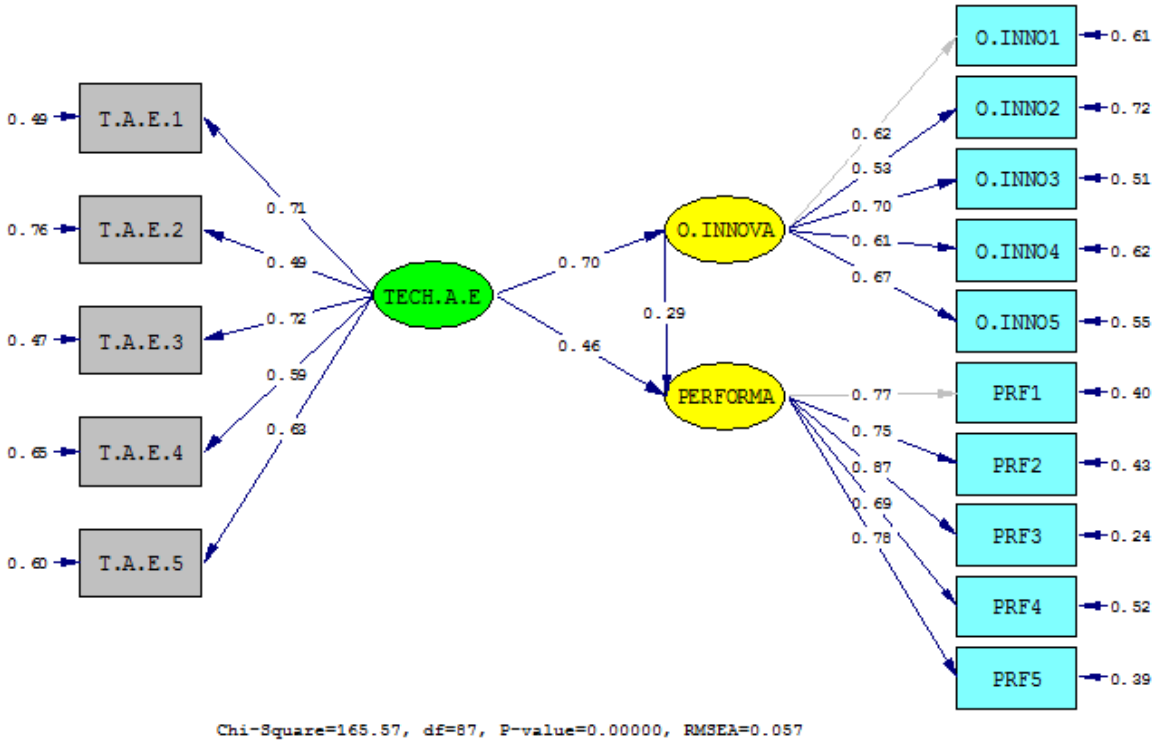

Figure 4. Structural equation model for core competencies

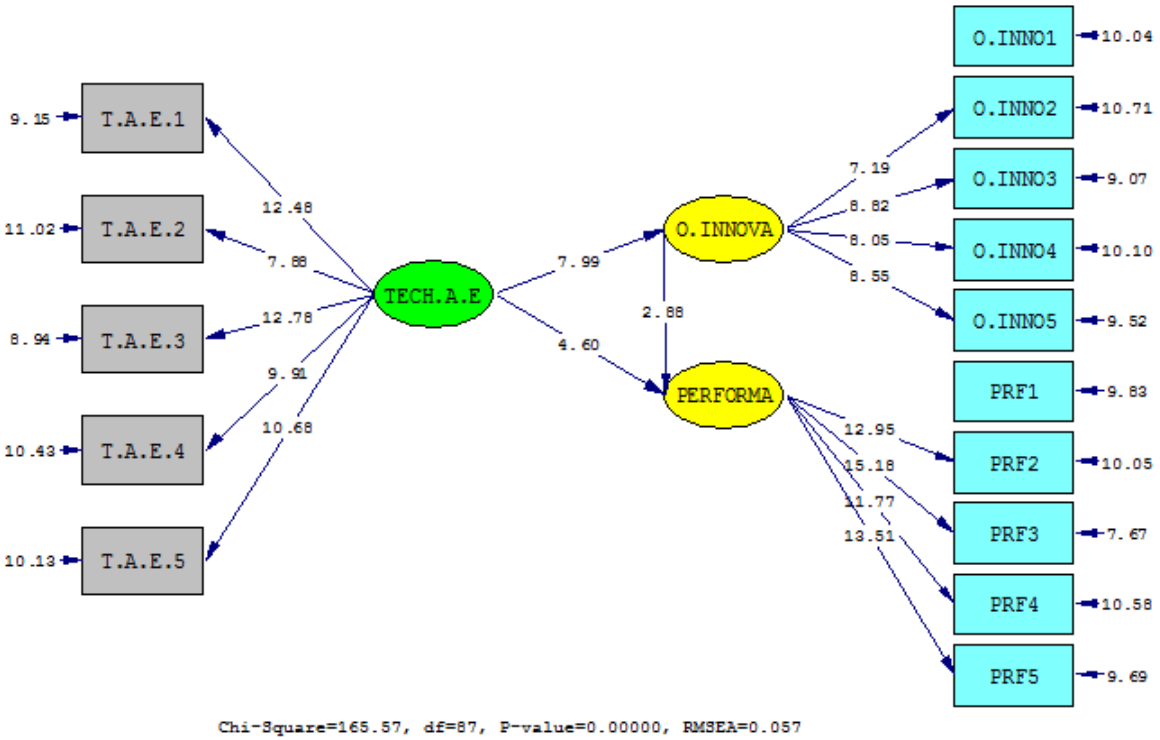

Figure 5. T-value test

Table 5. The result of the hypothesis test

No	Hypotheses	Path coefficient	t-value	Results
H_1	Technology Acquisition & Exploitation→ Organizational Innovation	0.70	7.99	Accept
H_2	Technology Acquisition & Exploitation→ Organizational Performance	0.46	4.60	Accept
H_3	Organizational Innovation→ Organizational Performance	0.29	2.88	Accept

Figure 4 shows the results of the SEM analysis of the study. Moreover, **Figure 5** shows the t-value of the analysis. Based on the results of SEM analysis, the three hypotheses of the study are confirmed.

Table 5 summarizes the hypotheses test result in terms of path coefficient (standardized) and t-value in significance level of 0.05.

DISCUSSION

The aim of the present study is to investigate the relationships among technology acquisition & exploitation, organizational innovation, and organizational performance of 80 knowledge-intensive organizations of Iran. Previous studies have examined the relationships among these variables with other variables; however, lack of sufficient research, studying the relationships among these three variables, especially in Iran, was the reason this research was carried out. Further, because of the positive consequences of organizational innovation, examining factors lead to increasing the level of this factor is an important issue for managers of organizations which was another reason this research was carried out.

The findings show that, in the context of Iranian organizations, results confirmed the findings of previous studies about research variables. All three hypotheses of research verified and it shows in Iranian knowledge-intensive organizations, technology acquisition & exploitation has a significant positive role on organizational innovation. Further, technology acquisition & exploitation has a significant positive role on improving organizational performance. Moreover, organizational innovation has also a significant positive role on improving organizational performance.

CONCLUSION

The results of the current study showed that in order to improve organizational performance, managers of organizations can focus on management of technology, specially, technology aquisition & exploitation. Further,

managers of organizations can also improve the organizational performance by improving in the level of organizational innovation.

Further, it is important to note that organizational innovation can be also affected positively by technology acquisition & exploitation. Therefore, technology acquisition & exploitation, and organizational innovation are important factors need to be considered by managers of organizations and business owners to achieve competitive advantages.

ACKNOWLEDGEMENT

1. The authors appreciate the support of the managers and the personnel of selected organizations in filling out the questionnaires and accomplishing this study.
2. The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

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