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The Role of Science and Technology Parks in Productivity of Organizations

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ABSTRACT

The purpose of the creation of technology parks, increasing technological innovation, economic development and employment of experts and policy makers technological park as part of a thoughtful and coordinated strategy for national or regional development are named .and the impact on productivity of the organization. In this study, a questionnaire based on theoretical principles and objectives ¬ Park and efficiency of the five institutions (educational services, advising, attracting inward investment, come on Institutions and Entrepreneurship) with twenty-three items in the Likert scale has been designed , validated questionnaire, the Cronbach's alpha 87/8 has been calculated in two parts: descriptive statistics and inferential statistics with SPSS software has been examined. The questions related to training , consulting and entrepreneurship / 0 95 under the null hypothesis is rejected and the assumption violation is confirmed , so the result is the education and counseling through the park technology to increase efficiency, enterprises, effective as well as the park cause Entrepreneurship (work) individuals but the questions about fundraising investments and increase revenue agencies through the park with 0/95 under the null hypothesis is confirmed by the results of investment Park and increased revenue through organizations increase their productivity is not . In addition to questions about their views of the park, science - technology increases the productivity of enterprises according to their education level, assistants and managers and found no significant differences in gender, confirming the null hypothesis in all three questions Unlike scientific hypothesis was rejected for all those involved Park - the same technology assessment.

KEYWORDS: International science and technology Park; productivity; Entrepreneurship.

1. INTRODUCTION

Science and technology parks, as one of the social institutions and part of the economic development chain, have been established aiming at increasing technological innovation, economic development, and providing job opportunities for experts and scholars (Edquist, 1997).

A science and technology park is an organization that is managed by professional experts and its main purpose is to increase the wealth of a society through promoting a culture of innovation and competitiveness among the companies in the park and knowledge-based institutions (Sanz, 2002). To achieve this goal, a science and technology park stimulates and manages the flow of knowledge and technology among universities, Research & Development institutions, private companies, and markets and also facilitates the growth of innovation-based companies through growth centers and reproductive processes (Davis, 2009). In addition, these parks provide other services with high added value and high

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quality facilities and spaces (Khaleghian, 2003). Many emerging technological phenomena come out and develop within these parks. Governments try to provide working conditions for small and medium businesses by creating a conducive environment. Thus, the role of governments, particularly in countries like Iran, is very effective and vital in development and success of science and technology parks (Salimi, 2003). Using the structure of science and technology parks, governments will be able to implement their policies in order to support innovation and entrepreneurship and develop research and development activities in academia and industry. These parks can be considered as a strategy for sustainable economic development by supporting the businesses in the vicinity of universities, creating new jobs in modern and advanced industries, and helping the establishment of a synergy between industries and companies (Grant, 2006). Science and technology parks are of the infrastructures of knowledge-based economy which help the establishment and growth of innovative, knowledge-based companies (Mahboubi, 2004). Considered a driving force for regional economic growth and development, the fundamental purpose of science and technology parks is to generate wealth in a society (Sedigh, 2000). These parks are places for attraction, innovation, development, and expansion of new technologies and also for increasing the capacity and optimizing the domestic technologies in order to enhance innovation capabilities of a country and creating jobs by centralizing the main elements involved in the innovation cycle, that is, universities, research centers, and knowledge-based small and medium industries (Keshmiri, 2007).

According to Gridding, Grant, and Davis, science and technology parks, as the supportive infrastructures, support creative people with innovative ideas through creating the conditions necessary for the growth and development of the knowledge-based companies and new technology-based firms and also reducing their risks. The main mission of science and technology parks is to support knowledge-based companies and institutions in order to develop technology and create new knowledge (Gridding, 2005).

By providing educational and consulting services, providing appropriate facilities for attraction of human and material capital to meet the needs of companies, creating jobs for individuals, and increasing the income of institutions, these parks promote the culture of competition and innovation among the companies and facilitate the transfer of knowledge between the institutions producing and consuming the knowledge (Salimi, 2003).

Science and technology parks also play a role in productivity of organizations. Productivity is the effective and efficient use of inputs or resources to produce or deliver outputs. Inputs include resources such as energy, raw materials, capital, and labor that are used to produce outputs which include the goods produced or the services provided by an organization. Productivity is necessary for each country and organization and is considered the platform of economic growth. Productivity increases gross domestic production (GDP), promotes competitiveness, and finally leads to a better life (Alaei, 2004). All industrial, service, and agricultural institutions and companies that are willing to use research and scientific projects and updated technologies in order to increase and improve their products and services enroll in these parks to get use of their facilities for training their managers and employees and finance their projects (Saffari, 2003).

Research parks can be regarded a complement to two main parts of a society, that is, education & research sector and the manufacturing sector (Sedigh, 2003). Figure 1 schematically shows the position of research parks among the other known social structures.

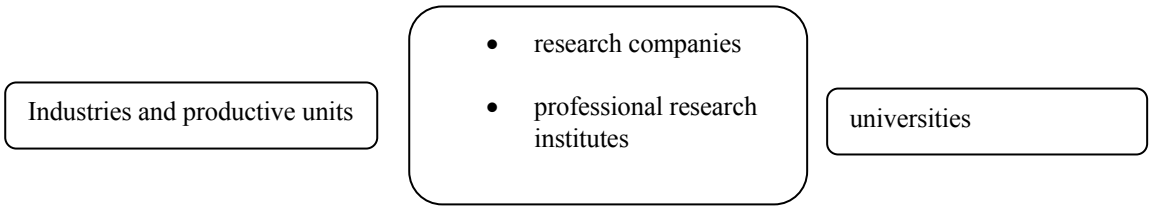

Fig. 1. Position of research parks among the main and known structures of a society

In above figure, professional research institutions represent organizations that are responsible for transforming academic research into industrial samples or laboratory production. On the other hand, the duty of research companies is to develop and innovate the required tools and technologies for introducing the industrial samples to production line.

2. Previous studies

Mousavi (2003) studied the role of government, universities, and science and technology parks in development of industries and concluded that the most valuable production of educational centers and universities is the training of thoughtful, innovative, and creative manpower who are the main factor for the development and growth of any country. Human resources, as the main core of development, are the output of educational systems and universities. Accordingly, the infrastructures for converting science into product must be taken into account very carefully. Hence, government as the supporter and director in major decisions, universities as sources of knowledge generation, and science and technology parks as centers of transforming ideas into products, must extensively support and complete each other. Investment in and appropriate management of research sector increases the production of knowledge and science and this leads to improved level of technology, innovation, and inventions.

Bank et al. (2003), in a paper entitled "Necessity of designing a national innovation system for national development", stated that the relationship between government, academia, and industry is the key to national growth and development. They also cited four models that do the tasks in different periods in the formation and development of the national innovation system. Government-industry-research relationship model plays a key role when the economic system of a country is governmental. When investment laws and regulations related to national innovation system are prepared, regulated, and improved by the legal authorities, financial-industries-research model could be used which is very useful in the effectiveness of the national innovation system (Bank, 2003).

When the social and economic conditions of countries have been prepared enough to join the World Trade Organization, industry-research-university and industry-research-park models can be applied, because at time there is a competitive market in these countries, laws and regulations related to the development have been prepared, and the conditions have been provided to achieve new technologies (Mojib, 2005).

Lewis, the Director General of the International Association of Science Parks, in a study entitled "The role of science and technology parks in economic development", concluded that these parks can be taken into account as a key factor for success in emerging economies that can help the establishment of innovation-based industries and start-ups, creating new jobs, increasing the competition power among the firms in the region in order to enhance the quality and increase income, and attracting foreign investors by establishing a set of manufacturing and service companies related to the needs of investors. Science and technology parks offer the best and the most advanced services to companies located in these parks and encourage them to get the optimum use of these services and technologies. In this regard, more attention should be paid to the implementation and use of information technology (satellite communications, Internet, etc.) (Sanz, 2003).

Tajvidi (2001) stated that the performance of science and technology parks, centers of entrepreneurship, and fledgling technology institutions in many countries indicates the positive and effective role of these centers in technology promotion and economic development, increasing the technological innovations, employment of specialists, supporting the individuals and companies for investment, helping the college graduates entering the job market, and resolving the problem of employment.

Lindev, in a study entitled "The role of science and technology parks in research and development of industry in Sweden", concluded that relationships between the companies in these parks cause the information related to research activities to be exchanged between the employees of these companies and increase the possibility of interdisciplinary innovations.

The present paper aimed to determine the role of science and technology parks in increasing the productivity of institutions and organizations (Chakrebarti, 2002).

In order to achieve this objective, the following questions were raised:

1- Does providing educational services by science and technology parks increase the productivity of institutions and organizations?
2- Does providing consulting services by science and technology parks increase the productivity of institutions and organizations?
3- Does science and technology parks attract investment to increase the productivity of institutions and organizations?
4- Does science and technology parks cause increased income of institutions and organizations?
5- Does science and technology parks create job opportunities for individuals?
6- Is there any relationship between the education level of the respondents and their views about the role of science and technology parks in increasing the productivity of institutions and organizations?
7- Is there any relationship between the views of managers and directors about the role of science and technology parks in increasing the productivity of institutions and organizations?
8- Is there any relationship between the gender of the respondents and their views about the role of science and technology parks in increasing the productivity of institutions and organizations?

3. METHODOLOGY

The present study is a descriptive-survey research. Statistical population included all member companies in Science and Technology Park of Kermanshah Province. According to Morgan Table, 80 companies were selected as the sample. An author-made questionnaire was prepared covering 5 main components including providing educational services, providing consulting services, investment attraction, increasing the income, and creating jobs. Consisting of 23 questions, this questionnaire was based on Likert rating scale (very poor, poor, good, and very good). Reliability of this questionnaire was determined by Cronbach's alpha, which was equal to 87.8. The validity of the questionnaire was also confirmed by taking the opinions and views of several experts and professionals. After data collection, the obtained data were analyzed using descriptive statistics (frequency, mean, standard deviation, and mean error of the standard deviation) and inferential statistics (Kolmogorov-Smirnov test, One-sample test, t-test, ANOVA, and Leven test).

4. Findings

4- 1- Descriptive statistics

Description of mean distribution of productivity factors is as follows:

Table 1: Mean distribution of productivity factors

Income	Investment	Creating jobs	Consulting services	Educational services	
2/1287	2/1300	2/7900	2/8031	2/6406	Mean

The first question of research: Does providing educational services by science and technology parks increase the productivity of institutions and organizations?

The first four questions of the questionnaire were used to answer this questions.

Table 2: Correspondence of the first question

Total	**Very good**	**Good**	**Poor**	**Very poor**	**Choice / Question**
80	15	42	19	4	Number
%100	%18.75	%52.5	%23.75	%5	Percentage

The second question of research: Does providing consulting services by science and technology parks increase the productivity of institutions and organizations?

The questions 5 to 8 in the questionnaire were used to answer this question.

Table 3: Correspondence of the second question

Total	Very good	Good	Poor	Very poor	Choice / Question
80	23	40	15	2	Number
%100	%28.75	%50	%18.75	%2.5	Percentage

The third question of research: Does science and technology parks attract investment to increase the productivity of institutions and organizations?

The questions 9 to 14 in the questionnaire were used to answer this question.

Table 4: Correspondence of the third question

Total	Very good	Good	Poor	Very poor	Choice / Question
80	12	26	33	9	Number
%100	%15	%32.5	%41.25	%11.25	Percentage

The fourth question of research: Does science and technology parks cause increased income of institutions and organizations?

The questions 15 to 18 in the questionnaire were used to answer this question.

Table 5: Correspondence of the fourth question

Total	Very good	Good	Poor	Very poor	Choice / Question
80	11	27	36	6	Number
%100	%13.75	%33.75	%45	%7.5	Percentage

The fifth question of research: Does science and technology parks create jobs for individuals?

The questions 19 to 23 in the questionnaire were used to answer this question.

Table 6: Correspondence of the fifth question

Total	Very good	Good	Poor	Very poor	Choice / Question
80	24	31	18	7	Number
%100	30%	38.75%	22.5%	8.75%	Percentage

4- 2- Inferential statistics

Kolmogorov-Smirnov test was used to test the normality of data distribution.

Table 7: Kolmogorov-Smirnov test

80	Number
	Studied parameters
2/6484	Mean
0/45264	Standard deviation
0/091	Absolute value of the maximum deviation
0/069	Maximum positive deviation
-0/091	Maximum Negative deviation
0/814	Z-value
0/521	Level of significance (two-sided)

According to Table 7, level of significance (0.521) is more than α=0.05, so the null hypothesis is confirmed. This means that the studied variable is in the normal range and parametric statistical methods must be used in calculations.

The first question: Does providing educational services by science and technology parks increase the productivity of institutions and organizations?

Comparison of means was used to study this question, as the mean scores given to options 2 and 3 of the questionnaire (poor and good) about educational services were investigated separately. One-sample t-test was used to examine the above hypothesis.

Table 8: Mean scores

Mean error of standard deviation	Standard deviation	Mean	Number	
0.06683	0.59779	2.6406	80	Educational services

Table 9: T-test of the group which chose the option "Poor"

Test value = 2						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.7737	0.5076	0.64063	0.000	79	9.585	Educational services

Table 10: T-test of the group which chose the option "Good"

Test value = 3						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.2263	0.4924	0.35938	0.000	79	5.377	Educational services

Analysis of the first question:

The mean scores given to the first question is equal to 2.6406. This figure was compared with figure 2 which indicates the option "Poor". At a significance level of 0.000 and a degree of freedom of 79, t-value was obtained equal to 9.58. Since the calculated significance level is less than α=0.05, the null hypothesis is rejected and the contrary hypothesis is confirmed, at a confidence level of 95%. This means that there is a significant difference between the calculated mean and the figure 2 (poor). The mean was also compared with figure 3 which indicates the option "Good". As it is observed, at a significance level of 0.000 and a degree of freedom of 79, there is also a significant difference between the calculated mean and the figure 3 (good). This suggests that the extent of educational services provided by science and technology parks is more than the option "Poor" but does not reach the option "Good" (figure 3). Accordingly, educational services provided by science and technology parks ranging from poor to good (moderate) increase the productivity of enterprises.

The second questions: Does providing consulting services by science and technology parks increase the productivity of institutions and organizations?

Comparison of means was used to study this question, as the mean scores given to options 2 and 3 of the questionnaire (poor and good) about consultation were investigated separately. One sample t-test was used to examine the above hypothesis.

Table 11: Mean scores

Mean error of standard deviation	Standard deviation	Mean	Number	
0.06269	0.56070	2.8031	80	Providing consulting services

Table 12: T-test of the group which chose the option "Poor"

Test value = 2						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.9279	0.6783	0.80313	0.000	79	12.811	Providing consulting services

Table 13: T-test of the group which chose the option "Good"

Test value = 3						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.0721	0.3217	0.19687	0.002	79	3.141	Providing consulting services

Analysis of the second question:

At a significance level of 0.000 and a degree of freedom of 79, t-value was obtained equal to 12.811. Since the calculated significance level is less than α=0.05, the null hypothesis is rejected and the contrary hypothesis is confirmed, at a confidence level of 95%. This means that there is a significant difference between the calculated mean and the figure 2 (poor). The mean was also compared with 3 which indicates the option "Good". As it is observed, at a significance level of 0.002 and a degree of freedom of 79, there is also a significant difference between the calculated mean and the figure 3 (good). This suggests that the extent of consultation provided by science and technology parks is more than the option "Poor" but does not reach the option "Good" (figure 3). Accordingly, providing consulting services by science and technology parks ranging from poor to good (moderate) increases the productivity of enterprises.

The third question: Does science and technology parks attract investment to increase the productivity of institutions and organizations?

Comparison of means was used to study this question, as the mean scores given to options 2 of the questionnaire (poor) about investment attraction was investigated separately.

Table 14: Mean scores

Mean error of standard deviation	Standard deviation	Mean	Number	
0.07208	0.64467	2.1300	80	Investment attraction

Table 15: T-test of the group which chose the option "Poor"

Test value = 2						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.2735	0.135	0.13000	0.075	79	1.804	Investment attraction

Analysis of the third question:

At a significance level of 0.075 and a degree of freedom of 79, t-value was obtained equal to 1.804. Since the calculated significance level is more than α=0.05, the null hypothesis is confirmed, at a confidence level of 95%. This means that there is no significant difference between the calculated mean and the figure 2 (poor). This indicates that performance of science and technology parks in attracting foreign investment is poor.

The fourth question: Does science and technology parks cause increased income of institutions and organizations?

Comparison of means was used to study this question, as the mean scores given to options 2 of the questionnaire (poor) about increased income was investigated separately.

Table 16: Mean scores

Mean error of standard deviation	Standard deviation	Mean	Number	
0.06874	0.61478	2.1288	80	Increased income

Table 17: T-test of the group which chose the option "Poor"

Test value = 2						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.2656	0.0081	0.12875	0.065	79	1.873	Increased income

Analysis of the fourth question:

At a significance level of 0.065 and a degree of freedom of 79, t-value was obtained equal to 1.873. Since the calculated significance level is more than α=0.05, the null hypothesis is confirmed, at a confidence level of 95%. This means that there is no significant difference between the calculated mean and the figure 2 (poor). This indicates that performance of science and technology parks in increasing the income of institutions and organizations is poor.

The fifth question: Does science and technology parks create job for individuals?

Comparison of means was used to study this question, as the mean scores given to options 2 and 3 of the questionnaire (poor and good) about consultation were investigated separately.

Table 18: Mean scores

Mean error of standard deviation	Standard deviation	Mean	Number	
0.08328	0.74487	2.7900	80	Job creation

Table 19: T-test of the group which chose the option "Poor"

Test value = 2						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.9558	0.6242	0.79000	0/000	79	9.486	Job creation

Table 20: T-test of the group which chose the option "Good"

Test value = 3						
95% confidence interval for mean difference		Mean difference	Level of significance	Degree of freedom	T-value	
Maximum	Minimum					
0.0442	0.3758	0.21	0.014	79	2.522	Job creation

Analysis of the fifth question:

At a significance level of 0.000 and a degree of freedom of 79, t-value was obtained equal to 9.486. Since the calculated significance level is less than α=0.05, the null hypothesis is rejected and the contrary hypothesis is confirmed, at a confidence level of 95%. This means that there is a significant difference

between the calculated mean and the figure 2 (poor). The mean was also compared with 3 which indicates the option "Good". As it is seen, at a significance level of 0.014 and a degree of freedom of 79, there is also a significant difference between the calculated mean and the figure 3 (good). This suggests that the extent of the performance of science and technology parks in creating job for individuals is better than the option "Poor" but does not reach the option "Good" (figure 3). Accordingly, creating job by science and technology parks ranging from poor to good (moderate) increases the productivity of enterprises.

The sixth question: Is there any relationship between the education level of the respondents and their views about the role of science and technology parks in increasing the productivity of institutions and organizations?

All the respondents were divided into three groups of Associate's degree, Bachelor's degree, and Master's degree or higher. Then, three types of ANOVA test were used to compare the mean scres of these groups.

Table 21: ANOVA test (mean difference between the groups)

Level of significance	F-value	Mean squares of treatments	Degree of freedom	Sum of squares of treatments	Variance
0/685	0/505	0/105	3	0/316	Intergroup
		0/209	76	15/87	Intragroup
			79	16/186	Total

Analysis of the sixth question:

ANOVA test and comparison of the mean of the three groups showed that with intergroup and intragroup degrees of freedom of 3 and 76, respectively, F value was calculated 0.505. Since the calculated significance level (0.68) is less than α=0.05, the null hypothesis is rejected and the contrary hypothesis is confirmed, at a confidence level of 95%. This means that there is no significant difference between three groups in terms of the scores given to the role of science and technology parks in increasing the productivity of institutions and organizations.

The seventh question: Is there any relationship between the views of managers and directors about the role of science and technology parks in increasing the productivity of institutions and organizations?

Independent t-test was used to compare the mean scores given by the managers and directors.

Table 24: Comparison of the mean scores given by the managers and directors

Standard deviation error	Standard deviation	Mean	Number	Organizational position
0/05468	0/36274	2/6314	44	Manager
0/09129	0/54773	2/6691	36	Director

Table 25: Independent t-test

Independent t-test							Leven test		
Confidence interval (95%)		Standard deviation difference	Mean difference	Level of significance	Degree of freedom	T-value	Level of significance	f	
Maximum	Minimum								
0/16597	-0/24129	0/10229	0/03766	0/714	78	-0/368	0/071	3/362	Equality of variance
0/17531	-0/25063	0/10641	0/03766	0/725	58/495	0/0354			Inequality of variance

Analysis of the seventh question:

The mean scores given by managers and directors was equal to 2.6314 and 2.6691, respectively. Since the significance level of Leven test (0.071) is more than α=0.05, the difference of variances of managers and directors is not significant. The first column of the table (equality of variances) was used.

Table 23 shows that, as the t-value is equal to 0.368 at a degree of freedom of 78 and a significance level of 0.714, the null hypothesis is confirmed at a confidence level of 95%. This means that there is no significant difference between the scores given by managers and directors and both groups have a similar evaluation about the performance of science and technology parks in increasing the productivity of institutions and organizations.

The eighth question: Is there any relationship between the gender of the respondents and their views about the role of science and technology parks in increasing the productivity of institutions and organizations?

All the respondents were divided into two groups of men and women and mean scores assigned by each group was calculated using independent t-test.

Table 22: Comparison of the mean scores given by the men and women

Standard deviation error	Standard deviation	Mean	Number	Organizational position
0.09954	0.49771	2.7078	25	Women
0.05835	0.43274	2.6213	25	Men

Table 23: Independent t-test

Independent t-test							Leven test		
Confidence interval (95%)		Standard deviation difference	Mean difference	Level of significance	Degree of freedom	T-value	Level of significance	f	
Maximum	Minimum								
0.30436	0.13140	0.10944	0.08648	0.432	78	0.79	0.491	0.479	Equality of variance
0.31948	0.14651	0.11538	0.08648	0.458	41.167	0.75			Inequality of variance

Analysis of the eighth question:

The mean scores given by women and men was equal to 2.7078 and 2.6213, respectively. Since the significance level of Leven test (0.491) is more than α=0.05, the difference of variances of managers and directors is not significant. The first column of the table (equality of variances) was used. Table 25 shows that, as the t-value is equal to 0.79 at a degree of freedom of 78 and a significance level of 0.432, the null hypothesis is confirmed at a confidence level of 95%. This means that there is no significant difference between the scores given by women and men and both groups have a similar evaluation about the performance of science and technology parks in increasing the productivity of institutions and organizations.

5. DISCUSSION AND CONCLUSION

Today, a large volume of education in developed countries is allocated to science and technology parks, as one of the most important functional organizations and this is one of the most important factors for the development of entrepreneurship and job creation. In addition, entrepreneurs can get the most use of the existing capabilities and facilities in science and technology parks and growth centers. Science and technology parks are also active in attraction of new ideas and applying them in industry, commercialization of research achievements, establishment of a relationship between academia, industry, and research centers to address the needs of enterprises, creating jobs, establishment of small and medium enterprises, and providing training and consulting services to institutions.

Since the increase in GDP has been associated with of productivity institutions, the role of science and technology parks in increasing the productivity of institutions and organization was studied in the present paper and the result showed that the performance of these parks in providing educational services, offering consulting services, and creating jobs in the range from poor to good (moderate) increases the

productivity of institutions and organization. In contrast, the performance of these parks in increasing the income was evaluated weak.

6. Recommendations

1- It is recommended that establishment and development of science and technology parks be taken into account as a top priority, because these centres increase the productivity of organizations and institutions by providing educational services, offering consulting services, and creating jobs.

2- Determining the position and importance of research parks requires a proper understanding of the philosophy of existence and their functions. Increased gap between education & research sector and manufacturing & services sector in today's world makes it necessary to establish organizations in order to fill this gap.

3- Science and technology parks must be used to upgrade industry, research, and technological innovations at all levels.

4- Science and technology parks should promote operational competitiveness and commercial credit of a region, pave the way for more investment, and set increasing the productivity of organizations and institutions as their main objective.

5- Science and technology parks should act as an effective mechanism for cooperation between industries and universities and also as a center for technology transfer.

6- Science and technology parks should play an important role in local economic development through creating new jobs, attracting foreign investment, and increasing the national and regional competitiveness. This developmental role is of great importance especially in economic changes. These parks must focus on productivity of local institutions and then national productivity.

7- It is recommended that science and technology parks underlie the presence and cooperation of foreign technology units in national parks in order to develop the technological level of domestic companies and their productivity. In addition, science and technology parks should help the institutions and organizations develop their knowledge-based economy.

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