A study on the role of science and technology parks in development of knowledge-based economy

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Abstract

Purpose – Science parks play an important role in development of technology and are able to stimulate economic growth of the countries. The purpose of this paper is to study the role that science and technology parks (STPs) play in growth of knowledge-based economy.
Design/methodology/approach – Key factors affecting the competitive advantages and the World Bank indicators resulting in knowledge-based economy were displayed in the form of a questionnaire which was examined by experts. The questionnaire was designed to evaluate main factors and sub-factors of competitive advantages of the institutions, including aspects of human resources, research and development and technology transfer, facilities, market development and to assess the main criteria of knowledge-based economy known as pillars of the overall economic performance, the institutional regime and economic incentives, innovation system, education and information technology and communications.
Findings – The obtained results from the study on competitive advantages were evaluated and analyzed by using SPSS software and the results of the review on development of knowledge-based economy were modeled by SmartPLS software with partial least squares method. Eventually, the obtained model was tested and analyzed.
Originality/value – This study is an original contribution to the theory of STPs and knowledge-based economy. It was initiated to examine the role of STPs in development of knowledge-based economy and presentation schematic model.

Keywords Science and technology parks, Knowledge-based economy, PLS method
Paper type Research paper

1. Introduction

Of the 1970s, science and technology parks (STPs) were identified as part of national development strategies. Technology parks are considered as a panacea to overcome the national and regional problems, to reduce unemployment and improve the competitiveness of enterprises and quality of life as well as the factor to encourage the restructuring of the region in which they operate (Nummela *et al.*, 2005; O'Shea *et al.*, 2006). The parks have been a central part of the solution to the difficult and complex problems of regional economic development, employment and the creation of new businesses (Hansson, 2007). The first research based on the technology companies has been conducted by Little (1979). Porter *et al.* stated that the technological companies, companies that have been established, rely on innovation and scientific inventions and aimed at innovations commercial exploitation of the technology.

Felsenstein (1994) examined the role of technology parks as the development of technology-based firms. Ferguson (1999) researched on the company's growth that shows technology companies located in the park have greater profitability compared to companies outside the park.

Lofsten and Lindelof's (2006) study show that STPs have a positive effect on the growth and profitability of companies in the field of sales and number of employees. Other researchers (Ferguson and Olofsson, 2004) tested growth rate of companies with sales variables, employment and survival of companies inside and outside them.

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Knowledge-based economy is product of economic globalization, market competition and the information explosion. In the knowledge-based economy, major capital of organizations are not only equipment, material and physical assets, but also is knowledge (Jafari *et al.*, 2012).

Furthermore, KM includes organizational knowledge, and may be distinguished from that by a greater focus on the management of knowledge as a strategic asset and a focus on encouraging the sharing of knowledge.

Entrepreneurship involves recognizing and seizing opportunities, transforming those opportunities into marketable goods or services, assuming risk and realizing rewards, and may occur in a variety of settings, including new and old ventures, non-profit institutions and the public sector (Hafezieh *et al.*, 2011). Technology parks have been formed with the aim of strengthening the spirit of entrepreneurship in universities and scientific societies and considered in order to achieve as institutional comprehensive development (Segal, 1986).

According to reports of Bank of Boston (1997) , activities of technology parks led to the development of national- and regional-level economy and in all cases have been widely led to job creation directly or indirectly.

In addition to mentioned cases, there have been important studies in the fields of knowledge-based economy, incubators and technology parks, but so far, no study has been conducted on the role or effectiveness of these institutions to achieve the knowledge-based economy. Hence, the main issue in this research that we have concentrated on is the role of STPs to achieve knowledge-based economy.

2. Literature review

2.1 STPs

Basic STPs were established in America in 1950s. The first STPs were formed in Europe in the late 1960s. STPs are very different in terms of physical dimensions and populations. Available data indicate that parks have approximately 3,200 hectares vastness and between 100 and 32,000 populations (Technology Deputy Minister of Science, Research and Technology and Vice President of the Center for Research and Documentation, 2009).

There are several definitions of STPs. The official definition adopted by the International Association of Science Parks (IASP) in February 2002 goes as follows. A science park is an organization managed by specialized professionals, whose main aim is to increase the wealth of their community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a science park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high-quality space and facilities (www.unesco.org).

Similarly, other authors define STPs as institutions that play an incubator role, nurturing the development and growth of new, small, high-technology firms, facilitating the transfer of university, encouraging the development of faculty-based spin-offs and stimulating the development of innovative products and processes. STPs are sources of entrepreneurship, talent and economic competitiveness for nation and are key elements of the infrastructure supporting the growth of global knowledge economy. They enhance the development, transfer and commercialization of technology. As STPs harness the combined power of education, research and private investment, the results are new jobs, new industries and solutions to age-old problems of mankind. They connect the innovative thinkers of old ages and harness the most powerful resource of the twenty-first century: mind power (Chen *et al.*, 2000).

Sources of STP's funding are usually supplied from universities, local authority, governmental development agencies, private sector institutions and companies' beneficiaries (Monck, 1988).

In this research, we have used the literature of industrial clusters and other studies in the field of STPs, to identify factors affecting the capacity to create competitive advantage of science parks for the knowledge-based enterprise foundation.

Competitive advantage for any organization is to its ability to create more value for customers than other competitors and to achieve a better position than the competitors (Peter, 2000).

So far, models created to determine the factors that affect the competitive advantage offered by STP. Some of the mentioned factors have been proposed for their acquisition and importance in all models. Researchers have studied the main factors influencing the creation of competitive advantage in STPs. After completion of the study, 12 factors were identified as influential factors in creating competitive advantage through STPs (Table I).

2.2 Knowledge-based economy

In recent years, knowledge-based economy has become a very conventional subject in economic development and public policy (Clarke, 2001). According to Landvall (2000), in the new economy the main attention would be paid to creating knowledge, new products and services not to allocate available sources, therefore it would be irrational for individuals and businesses if they apply their intellectual capacity to re-allocate resources because they can use their intellectual capacity to create new ideas (Mortazavi and Bahrami, 2012). The conceptual framework discussed in the international literature implies a distinction between knowledge-based economies and resource-based economies. According to Organization for Economic Co-operation and Development (OECD) (1996), knowledge-based economies are economies which are directly based on production, distribution and use of knowledge and information, with an important role given to information, technology and learning in economic performance (cf. OECD, 1996). In contrast, a resource-based economy is the economy of a country whose gross national product or gross domestic product to a large extent comes from natural resources (e.g. oil and gas). Gorzelak (2001) defined a framework

Factors	Models
Skilled and educated workforce in technical fields	Porter; Foreman; Shiv Lai; Lin; Sun; Lin and Tseng
Skilled and educated manpower in the fields of management (management, marketing, finance, marketing, etc.)	Porter; Foreman; Shiv Lai; Lin; Sun; Lin and Tseng
The use of reference laboratories	Wested and Stow; Leung and Wu; Wested; Wested and Betson; Porter; Shiv Lai; Lin; Sun; Lin and Tseng; Zeng
Communicating with universities and R&D centers	Wested and Stow; Leung and Wu; Wested; OECD; Wested and Betson; Filimore; Foreman; Lofsten and Lindelof; Hugh; Shiv Lai; Filimore; Lin; Lin and Tseng; Zeng; Ratinho and Henricks
Cooperation with other similar companies	Porter; Filimore; Porter; Foreman; Shiv Lai; Lin; Sun; Lin and Tseng
Access to the information required in the field of IT	Porter; Foreman; Shiv Lai; Lin; Sun; Lin and Tseng; Rust; Sun
The use of customs and tax exemptions	Zeng; Sun
The use of funds (venture capital and funds financing …	Vodolo; Porter; Foreman; Chan and Lau; Shiv Lai; Lin; Wonglimpiyarat; Sun; Lin and Tseng; Zeng; Sun
Provision of physical infrastructure	Porter; Lin; Sun; Lin and Tseng; Zeng
Appropriate share of the market	Chan and Lau; Lin; Sun; Lin and Tseng; Sun
Export power	Chan and Lau; Sun; Lin and Tseng; Sun
Access to the information required in the market	Porter; Foreman; Chan and Lau; Shiv Lai; Sun; Lin and Tseng; Zeng; Sun

Table I.
Important factors influencing the creation of competitive advantage in STPs

for knowledge-based economy based on the distinction between the old paradigm (resource-driven economies) and the new paradigm (knowledge-driven economies). Gorzelak (2001) argued that applying the concepts of the knowledge economy to urban management suggests the need for a paradigm shift from resource-driven urban economies to knowledge-driven urban economies.

Moreover, the World Bank uses the Knowledge Index (KI) and the Knowledge Economy Index (KEI) to compare knowledge across the world's countries. According to the World Bank, the KI measures a country's ability to generate, adopt and diffuse knowledge. This is an indication of the overall potential of knowledge development in a given country.

One of the possible ways of knowledge economies evaluation is the Knowledge Assessment Methodology which represents the approach created and applied by the World Bank. At present, it consists of 109 structural and qualitative variables for 146 countries to measure their performance on the four knowledge economy (KE) pillars: the economic incentive and institutional regime, education and human resources, the innovation system, and information and communications technologies (Table II).

These days, the focus of the Iran's economy is on making the economy independent of its petroleum products. Hence, the national economy must be strengthened by concentrating on modern production methods, knowledge-based firms and focusing on entrepreneurship. Entrepreneurship can be considered as a process of increasing wealth through identifying and innovation opportunities (Hanny *et al.*, 2011). Entrepreneurship definitions cover a wide range of activities and processes that include creating a new idea, innovation, establishing an organization, identifying opportunities and risk taking (Ziyae and Mobaraki, 2014). The study of Robert found that social power, social relations and collectivism create a setting for entrepreneurial motivation, which is almost directly counter to western ideologies of entrepreneurial motivation. Therefore, STPs act as the bridge between universities and industry and are the best place for technological and economic development that they will bring an entrepreneurial spirit to the society (Zhou, 2008). Furthermore, STPs are obliged to provide opportunity for small- and medium-sized enterprises. Governments are making a major effort to develop innovative infrastructures such as STPs in order to establish systems that support innovation. The existence of STPs is an important factor in the competitiveness of the economy of a region or country. Thus, appropriate management of these infrastructures can help to develop the innovative potential of a country.

Pillar		Variables
Overall economic performance		Annual growth in GDP (%)
		Human Development Index
The economic incentive and institutional regime	Economic regime	Tariff and non-tariff barriers
	Reign	Quality adjustment
		Rule of Law
The innovation system		Total receipts and payments which are related to the copyright
		Patents awarded by UPST
		Scientific and technical articles published in the journals (per one million people)
Education		Rate of literacy adult (percentage of people over 15 years)
		Gross enrollment in secondary education (% gross)
		Gross enrollment in tertiary education (% gross)
Information and communications technologies		Access to computers per thousand
		Access to telephones per thousand
		Access to internet per thousand

Table II. The components methodology to estimate the knowledge-based economy by the World Bank

3. Methodology

Based on the literature review and gaps identified, a questionnaire was designed in two parts including the study of effective factors of the competitive advantages as well as the realization of knowledge-based economy. In order to assess the dimensions of competitive advantages for institutions, Likert scale has been used for 12 items ranging from 1 to 5 (1 completely disagree) to (5 strongly agree) for each application. Also, for evaluation of knowledge-based economy, Likert scale has been applied for 20 items within a range of 1-5 (1 very little to 5 a lot). Each number is a representative of 20 percent, for example, number 1 which is very little means (0-20) percent and pretty much means (80-100) percent to facilitate people's response. The factors examined in the study of competitive advantages were derived from the research questions extracted from Sadeghi (2013), also the second part of questions relating to the evaluation of the implementation of knowledge-based economy in STPs is taken from the World Bank indicator. It should be noted that all of the questions of each part of the questionnaire will be mentioned in the result's tables. Pillars raised at the World Bank indicators have been designed in national and macro dimension, while the population in this study has organizational size and is relatively smaller, so according to professors and experts, all the pillars have undergone minor changes raised to fit better with the type of sample. Questionnaires have been distributed via mail or in person in all of the STPs. Although there are 32 STPs in the country, based on the calculation done by Cochran formula, only 29 samples were considered to be enough for study to be conducted.

Having said that, in order to achieve a better result, 70 questionnaires have been completed by the STPs' managers, managers of companies based in STPs and the relevant authorities at the Ministry of Science and Technology Research of Iran. To test the hypotheses generated for knowledge-based economy, the partial least squares (PLS) approach was adopted and data were analyzed by the SmartPLS. On the other hand, to have the hypotheses related to competitive advantages tested, data were analyzed by SPSS software.

We used the bootstrapping method (500 resamples) to determine the significance of levels of loadings, weights and path coefficients, and then we employed the blindfolding method to determine quality measurement tools (Wah Yap *et al.*, 2012).

We asked some experts' opinion to assess the appearance and content validity of the method used. Additionally, Cronbach's α was applied to evaluate the reliability of the questionnaire.

4. Review of results

4.1 Testing the reliability of questionnaire

The reliability of the model was examined and approved, and the results are presented in Table III. As can be seen, the reliability of the questionnaire was 0.9 for both parts, which was an acceptable level of reliability.

4.2 Analysis responses of the questionnaires

Results from the first division of the factors affecting the competitive advantages are demonstrated in Table III.

Results from the second division of the factors affecting the knowledge-based economy are displayed in Table IV.

After having the questionnaires collected, they were precisely examined by the SPSS software. The figures related to the standard deviation of two parts of questionnaire turned to be satisfactory. As a result, the high correlation was observed among the responses. Totally, obtained results for data's mean in each part of questionnaire were approximately 4. We can conclude that the institutions have huge competitive advantages, also suitable features of knowledge-based economy. Therefore, high quantity for the mean resulted

Factors	Sample size	Mean	SD
Skilled and educated workforce in technical fields	70	3.50	0.847
Skilled and educated manpower in the fields of management (management, marketing, finance, marketing, etc.)	70	3.77	0.726
The use of reference laboratories	70	4.40	0.875
Communicating with universities and R&D centers	70	4.19	0.921
Cooperation with other similar companies	70	4.14	0.952
Access to the information required in the field of IT	70	3.43	0.772
The use of customs and tax exemptions	70	3.59	0.712
The use of funds (venture capital and funds financing…)	70	4.30	0.874
Provision of physical infrastructure	70	4.23	0.871
Appropriate share of the market	70	3.27	0.947
Export power	70	3.59	0.860
Access to the information required in the market	70	4.34	0.720

Table III.
Factors influencing the creation of competitive advantage in science park's analysis

from competitive advantages in all the aspects of STP is very reasonable considering the present circumstances.

Hence, to achieve a graphical model which shows the details of the relationship between STPs and knowledge-based economy, we designed the model with the help of SmartPLS software which is based on PLS method. The model for STPs is shown in Figure 1.

We used the SmartPLS (PLS) software package to estimate the path coefficients, composite reliability, average variance extracted and R^2, applying bootstrap re-sampling.

The PLS technique is based on an iterative combination of principal components analysis and regression. The objective is to explain the variance of a model's constructs. One of its advantages is that it simultaneously estimates all the path coefficients and individual item loadings in the context of a specified model, and thus enables researchers to avoid biased and inconsistent parameter estimates. This technique is well known among consumers and service researchers due to the mentioned pros. Recent studies (Chin and *et al.*, 2003) have shown that, by reducing type II errors, PLS is an effective analytical tool for testing interactions. By creating a latent construct which represents the interaction term, a PLS approach significantly reduces the type II error problem by accounting for the measure-related error. In particular, PLS models are based on prediction-oriented measures, not on covariance fitting which is used by covariance structure models (or the LISREL program).

As Roy *et al.* (2012) suggested, the PLS approach lends itself well to modeling formative constructs. This is primarily because of three reasons. First, using PLS, a researcher can test a formative latent variable in isolation. Second, there are less stringent constraints on sample size, residual distributions or assumptions about the normality of the data; and third, the recent availability of software based on the PLS approach (such as PLS Graph, VisualPLS, SmartPLS, SPAD-PLS) has led to better understanding of the associated requirements and issues. The adequacy of the measurement scale is assessed by evaluating the reliability of the individual items and the discriminant validity of the constructs (Hulland, 1999). In the present case, the factor loadings of each item were above 0.877, indicating that more than 50 percent of the variance in the observed variable is explained by the construct (Carmines and Zeller, 1979). Figure 1 shows the results of the structural model. The standardized path coefficients are shown alongside the corresponding causal arrows. The bootstrap re-sampling technique, considering 500 sub-samples, was applied to assess the *t*-test values and determine whether or not each causal order was significant. All the path coefficients were found to be significant at the 0.001 level, with signs in the expected direction. The quality of the fit was good as evaluated by the overall goodness-of-fit index proposed by Tenenhaus *et al.*. The model also demonstrated a high level of predictive power since the modeled constructs

Factors				Sample size	Mean	SD
Overall economic performance		Annual growth in GDP (%)	Percent growth in monetary value of total final goods and services which are produced within the center from knowledge production	70	3.14	1.026
			The effect of increasing the level of knowledge of the country on the knowledge level of the center	70	3.17	0.916
		Human Development Index	Job satisfaction in the center	70	4.04	1.096
			The job enrichment in the center	70	3.54	1.073
			The job rotation in the center	70	3.27	0.962
			The job promotion route in the center	70	3.16	0.973
The economic incentive and institutional regime	Economic regime	Tariff and non-tariff barriers	The impact of tariff and non-tariff barriers on self-reliance in the center	70	2.39	0.827
			The impact of tariff and non-tariff barriers on global competitiveness motivation	70	2.46	0.973
	Reign	Quality adjustment	Covering fields such as foreign trade and business development by the rules and regulations available in the center	70	2.67	1.113
		Rule of Law	The loyalty of staff to the laws of the center	70	3.30	0.953
			Enforcement of laws, conventions and standards in the center	70	4.30	0.787
The innovation system		Total receipts and payments which are related to the copyright		70	2.10	1.060
		Patents awarded by UPST	Observance of intellectual property	70	4.21	0.849
		Scientific and technical articles published in the journals (per one million people)		70	3.40	0.907
Education		Rate of literacy adult (percentage of people over 15 years)	The percentage of literate people which are working in the center	70	4.30	0.874
		Gross enrollment in secondary education (% gross)	The percent of persons with secondary degree which are working in the center	70	2.10	0.965
		Gross enrollment in tertiary education (% gross)	The percentage of highly educated people working in the center	70	4.49	0.697
Information and communications technology		Access to computers (per thousand)		70	4.47	0.653
		Access to telephones (per thousand)		70	4.66	0.535
		Access to internet (per thousand)		70	4.63	0.569

Table IV.
Factors influencing the development of knowledge-based economy in science park's analysis

explained 97.2 percent of the variance in knowledge-based economy (Miranda and Chamorro, 2012). Considering the above suggested model, it can be concluded that STPs have a significant also positive impact on the development of the knowledge-based economy in Iran. Actually, STPs around the world are based on the rationale of resources concentration. They usually have significant spillover effects on their region economy

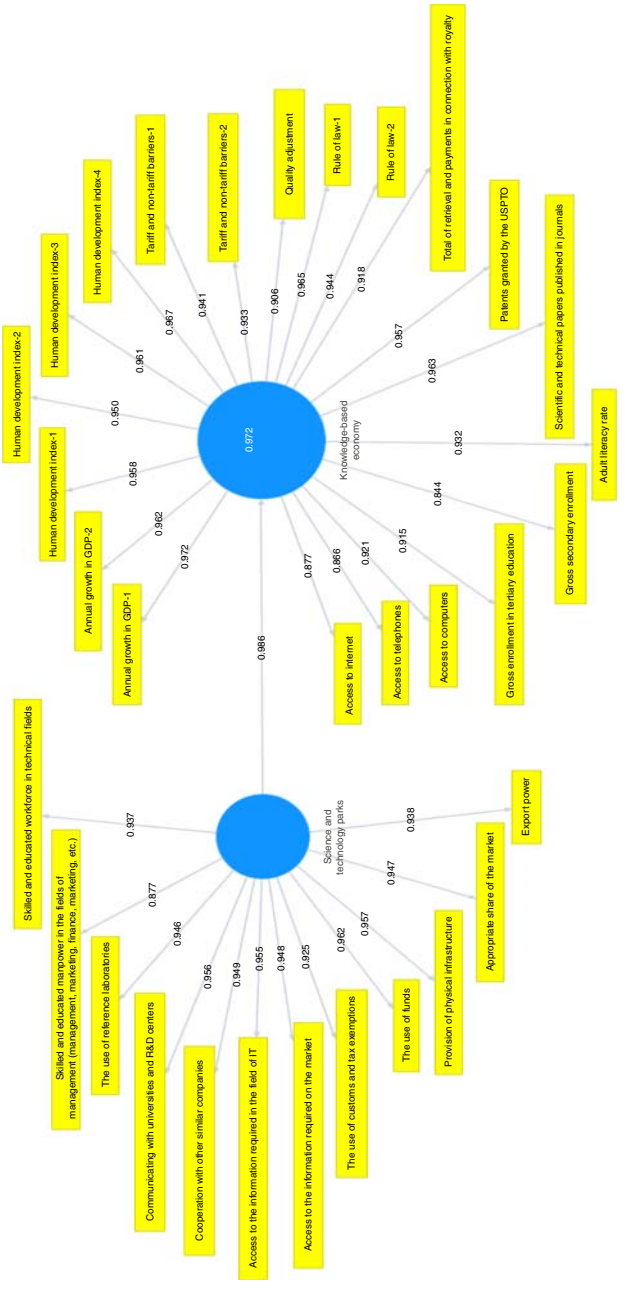

Figure 1.
Proposed model for the role of STPs to develop knowledge-based economy

(Jolly and Zhu, 2012). Johan have explained that the STP's success in terms of fostering the creation of new firms, raising the level of technological sophistication thereby fostering growth and access to external financing and stimulating knowledge transfer thereby fostering growth and access to external financing.

5. Discussion

STPs are designed to provide value-added services together with high-quality space and facilities and to promote interaction amongst universities, R&D institutions, companies and markets (Triadó-Ivern *et al.*, 2015). A plot of GDP per capita against KEI suggests that Ireland, the USA and Norway are at the pinnacle of countries currently harnessing the benefits of a knowledge economy. It is safe also to argue that Kenya and India are miles ahead of countries like Nigeria that are yet to be listed. The headquarter of the IASP[1] is a further signal of the weight of the Spanish STPs movement that is located in Spain (Albahari *et al.*, 2016). As well, in the 13th General Assembly Meeting of COMSTECH (April 2008, Islamabad) the preliminary decision for establishing INSTP[2] has been made. This step has been taken for technological development among Muslim countries and strengthens the inter-relationships between STPs, also to promote cooperation among Islamic countries. Fortunately, in the 14th General Assembly Meeting of COMSTECH[3] (January ۲۰۱۱, Islamabad) the proposal of INSTP establishment in Islamic Republic of Iran was approved (www.instp.ir). Therefore, GSTP[4] was selected as headquarter of INSTP. Iran has made considerable advances in science and technology through education and training, despite international sanctions in almost all aspects of research during the past 30 years (https://en.wikipedia.org). Luckily, many countries and foreign companies are willing to participate in STPs situated in Iran, because of theirs potentials and abilities (www.irna.ir). Recently, both Tajikistan and Azerbaijan wanted GSTP to attend and provide services to them (www.iikss.com). The important role of STPs of Iran in the region can confirm the suitable results of this research.

6. Conclusion

The concept of a science park model is a simplification of the complex set of relationships which foster economic development and job growth related to high technology. In truth, several approaches to business development, as well as several approaches to planning, have been used. More often than not, research consortia, incubators and business centers are targeted toward similar regional development objectives. They share the objective of economic development, but they differ in several respects. In this communication, we have proposed a modified approach to the role of STPs to develop knowledge-based economy. A review of the literature showed that no published study has been in this field. The model comprised all dimensions related to development of knowledge-based economy.

The path values resulting from the use of PLS path modeling provided a direct assessment of the importance of each of these dimensions. Our model also provides STP's top managers with a tool for the measurement of functional quality in their organization. The results show the importance of STPs for the perception of knowledge-based management. Our model can also be used to measure how STP's top managers believe in their firms and their facilities and services. This allows the potential gap between the provider's view and the customer's view to be assessed and monitored. The findings have clear implications to manage primary purposes of STPs. The study showed that the perceived quality of STP depends mainly on dimensions closely linked to competitive advantages.

Finally, it should be borne in mind that the present model is designed to measure the role of STPs to develop knowledge-based economy considering the effective factors of the

competitive advantages. Hence, to understand the real institutional value of practices such as quality management in STPs, technical dimensions also are needed to be taken into account.

7. Suggestions for further research

A study on the role of incubators to develop knowledge-based economy would be a perfect recommendation for future research. The results of the suggested study can be finally compared with the results of the current study. The role of STPs in the development of the relation between industry and academia should be examined.

Notes

1. International Association of Science Parks and Areas of Innovation.
2. Inter-Islamic Network on Science and Technology Parks.
3. Ministerial Standing Committee on Scientific and Technological Cooperation.
4. Guilan Science and Technology Park.

References

Albahari, A., Pérez-Canto, S., Barge-Gil, A. and Modrego, A. (2016), "Technology parks versus science parks: does the university make the difference?", Technological Forecasting & Social Change, TFS-18770, Munich, 16pp.

Bank of Boston (1997), *The Impact of Innovation*, Economics Department, MIT, Boston, MA.

Carmines, E.G. and Zeller, R.A. (1979), *Reliability and Validity Assessment*, Sage, London.

Chen, C.J., Wu, H.L. and Lin, B.W. (2000), "Evaluating the development of high-tech industries: Taiwan's Science Park", *Technological Forecasting & Social Change*, Vol. 6 No. 2, pp. 973-987, available at: www.unesco.org/new/en/natural-sciences/science-technology/university-industry-partnerships/science-and-technology-park-governance/concept-and-definition/

Chin, W.W., Marcolin, B.L. and Newsted, P.R. (2003), "A partial least squares latent variable modeling approach for measuring interaction effects: results from a Monte Carlo simulation study and an electronic mail emotion/adoption study", *Information Systems Research*, Vol. 14 No. 2, pp. 189-217.

Clarke, T. (2001), "The knowledge-based economy", available at: www.knowledg.com.au

Felsenstein, D. (1994), "University-related science parks – 'seedbeds' or enclaves of innovation?", *Technovation*, Vol. 14, pp. 93-110.

Ferguson, R. (1999), "What's in a location? Science parks and the support of new technology-based firms", The Swedish University of Agricultural Sciences, Sweden, pp. 5-17.

Ferguson, R. and Olofsson, C. (2004), "Science parks and the development of NTBFs", *The Journal of Technology Transfer*, Vol. 29 No. 1, pp. 5-17, available at: https://doi.org/10.1023/B:JOTT.0000011178.44095.cd

Gorzelak, G. (2001), "Warsaw University, cited in World Bank, discussion paper incorporated in Cleaver, Kevin (2002): a preliminary strategy to develop a knowledge economy in European union accession countries, World Bank", available at: http://lnweb18.worldbank.org/ECA/ECSSD.nsf/ECADocByLink/Knowledge+Economy?OpenDocument (accessed July 4, 2014).

Hafezieh, N., Akhavan, P. and Eshraghian, F. (2011), "Exploration of process and competitive factors of entrepreneurship in digital space: a multiple case study in Iran", *Education, Business and Society: Contemporary Middle Eastern Issues*, Vol. 4 No. 4, pp. 267-279.

Hanny, N., Felix, T., Margaret, J. and Nelson, O. (2011), "Entrepreneurship: its relationship with market and learning orientation", *Industrial Marketing Management*, Vol. 40, pp. 336-345.

Hansson, F. (2007), "Science parks as knowledge organizations – the 'ba' in action?", *European Journal of Innovation Management*, Vol. 10 No. 3, pp. 348-366, available at: http://dx.doi.org/10.1108/14601060710776752

Hulland, J. (1999), "Use of partial least squares in strategic management research: a review of four recent studies", *Strategic Management Journal*, Vol. 20, pp. 195-204.

Jafari, M., Akhavan, P. and Akhtari, M. (2012), *Knowledge Management: A Comprehensive Overview of the Tools and Techniques*, Rasa Cultural Services Institute, Tehran.

Jolly, D. and Zhu, F. (2012), "Chinese S&T parks: the emergence of a new model", *Journal of Business Strategy*, Vol. 33 No. 5, pp. 4-13, available at: http://dx.doi.org/10.1108/02756661211282740

Landvall, B.A. (2000), "The learning economy: some implication for the knowledge base of health and education system", *knowledge Management in Learning Society*, OECD Press, Paris, pp. 125-141.

Lofsten, H. and Lindelof, P. (2006), "Science parks in Sweden – industrial renewal and development?", *R&D Management*, Vol. 31, pp. 309-322.

Miranda, J.M. and Chamorro, A. (2012), "Primary health care services quality in Spain a formative measurement approach using PLS path modeling", *International Journal of Quality and Service Sciences*, Vol. 4 No. 4, pp. 387-398.

Monck, C.S.P., Porter, R.B., Quintas, P.R., Storey, D.J. and Wynarczyk, P. (1988), *Science Parks and the Growth of High-Technology Firms*, Croom Helm, London, p. 270.

Mortazavi, S.H. and Bahrami, M. (2012), "Integrated approach to entrepreneurship – knowledge-based economy: a conceptual model", Vol. 41, pp. 281-287, available at: https://doi.org/10.1016/j.sbspro.2012.04.032

Nummela, N., Pumalainen, K. and Saarenketo, S. (2005), "International growth orientation of knowledge-intensive SMEs", *International Entrepreneurship*, Vol. l3, pp. 5-18.

O'Shea, R.J., Allen, T., O'Gorman, C. and Roche, F. (2006), "Universities and technology transfer: a review of academic entrepreneurship literature", *The Irish Journal of Management*, Vol. 29, pp. 11-29.

Organization for Economic Co-operation and Development (OECD) (1996), "The knowledge-based economy", General Distribution OECD: OCDE/GD(96)102, OECD, Paris, pp. 3, 7, 9, 18-19, available at: www.oecd.org/science/sci-tech/1913021.pdf (accessed July 4, 2014).

Peter, M.E. (2000), "Location, competition and economic development: local cluster in a global economy", *Economic Development Quarterly*, Vol. 14 No. 1, pp. 15-34.

Roy, S., Tarafdar, M., Ragu-Nathan, T.S. and Marsillac, E. (2012), "The effect of misspecification of reflective and formative constructs in operations and manufacturing management research", *The Electronic Journal of Business Research Methods*, Vol. 10 No. 1, pp. 34-52.

Sadeghi, M. (2013), "Propose a framework for assessing the capacity of science parks and technology to create competitive advantage for companies based in their", MSc thesis, Iran University of Science and Technology, Tehran.

Segal, N.S. (1986), "Universities and technological entrepreneurship in Britain: some implications of the Cambridge phenomenon", *Technovation*, Vol. 4, pp. 189-205.

Technology Deputy Minister of Science, Research and Technology and Vice President of the Center for Research and Documentation (2009), "According to the President of Science and Technology Parks and Incubators in the Ninth, Approaches and Achievements", President of Research and Documentation Center, Tehran.

Triadó-Ivern, X.M., Aparicio-Chueca, P. and Jaría-Chacón, N. (2015), "Value added contributions of science parks – the case of the Barcelona scientific park", *International Journal of Innovation Science*, Vol. 7 No. 2, pp. 139-152.

Wah Yap, B., Ramayah, T. and Nushazelin Wan Shahidan, W. (2012), "Satisfaction and trust on customer loyalty: a PLS approach", *Business Strategy Series*, Vol. 13 No. 4, pp. 154-167.

Zhou, C. (2008), "Emergence of the entrepreneurial university in evolution of the triple helix: the case of Northeastern University in China", *Journal of Technology Management in China*, Vol. 3 No. 1, pp. 109-126.

Ziyae, B. and Mobaraki, M.H. (2014), "The deployment and internationalization speed of e-business in the digital entrepreneurship era", *Journal of Global Entrepreneurship Research*, Vol. 4, pp. 1-11, avialable at: https://doi.org/10.1186/s40497-014-0015-2

Further reading

Adamantia, S. (2017), "Knowledge management in doctoral education towards knowledge economy", *International Journal of Educational Management*, Vol. 31 No. 3, pp. 320-331, available at: https://doi.org/10.1108/IJEM-11-2014-0143

Cumming, D. and Johan, S. (2013), "Technology parks and entrepreneurial outcomes around the world", *International Journal of Managerial Finance*, Vol. 9 No. 4, pp. 279-293, available at: http://dx.doi.org/10.1108/IJMF-02-2013-0018

Eueng, A. (1999), *Organizational Learning Capability*, Oxford University Press Inc., New York, NY.

Lussier, R.N., Bandara, C. and Marom, S. (2016), "Entrepreneurship success factors: an empirical investigation in Sri Lanka", *World Journal of Entrepreneurship, Management and Sustainable Development*, Vol. 12 No. 2, pp. 102-112, available at: http://dx.doi.org/10.1108/WJEMSD-10-2015-0047

Mohamed Nour, S.S.O. (2014), "Prospects for transition to a knowledge-based economy in the Arab region", *World Journal of Science, Technology and Sustainable Development*, Vol. 11 No. 4, pp. 256-270, available at: https://doi.org/10.1108/WJSTSD-07-2014-0017

Monck, C.S.P., Porter, R.B., Quintas, P., Storey, D.J. and Wynarczyk, P. (1988), *Science Parks and the Growth of High Technology Firms*, Croom Helm, London.

Ogundeinde, A. and Ejohwomu, O. (2016), "Knowledge economy: a panacea for sustainable development in Nigeria", *Procedia Engineering*, Vol. 145, pp. 790-795.

Russell, M.G. and Moss, D.J. (1989), "Science parks and economic development", *Interdisciplinary Science Reviews*, Vol. 14 No. 1, pp. 54-63, doi: 10.1179/isr.1989.14.1.54.

Ziyae, B. and Tajpour, M. (2016), "Designing a comprehensive model of entrepreneurial university in the science and technology parks", *World Journal of Entrepreneurship, Management and Sustainable Development*, Vol. 12 No. 3, available at: http://dx.doi.org/10.1108/WJEMSD-04-2016-0022

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