

THE EFFECT OF TECHNOLOGY TRANSFORM ON COMPETITIVE ADVANTAGES IN SOFTWARE COMPANIES

Mahboube Tourian

Master of Business Administration, University of Tehran

Rouh Allah Naiej

Master of Industrial Engineering, Islamic Azad University, FiroozKouh

Ceyede Fateme Tofghi

Bachelor of Industrial Engineering, Shomal University, Amol

Abstract

The present research studies the effect of technology transfer on the competitive advantage of software companies. So, technology transfer and competitive advantage were studied based on the Sharif model and Hill et al model, respectively. The participants containing 87 individuals were all managers of software companies. 72 individuals were selected as sample based on Cochran model. This study is regarded as an applied, survey research. The reliability and validity of the questionnaire were determined through Cronbach' alpha coefficient and the experts' opinions, respectively. Data were analyzed by PLS smart software. Results obtained from analyzing research hypotheses show that there is a casual relationship between the research variables.

Key words: Technology transfer, competitive advantage

Introduction

Studies show that technology as the practical function of science and experience in meeting human requirements significantly contributes in countries' economic and industrial development and the competitive advantages of enterprises.

Any company, in its life time, requires technology in order to improve its efficacy and competition ability; it means that this object may achieve through producing and or purchasing from an external source. Technological developments are rapidly growing in the present world; so, it is not necessarily needed that the technology user be the creator or owner (Khalil, 2000).

The twenty first century is a century in which prodigious technological and scientific developments along with globalization have caused close competition of countries and economic enterprises to stay in the world market. Indeed, managements and policy makers of developing countries, in a world influenced by political and technological issues, are faced with the challenge of more knowledge and smarter interaction with technological empowerments according to limited sources, dynamic environment, serious global competitions as well as technological backwardness. On the other hand, studying social outcomes of national policy makers in developing technology is also considered as one of the issues revealing the necessity and significance of applying technology management at this level.

Moreover, managements and decision makers are also encountering a new, different environment (context) different at the segment or a particular industry level. Competitive companies are merging together and supporting the entrepreneurship development at the active industrial small and medium enterprises is regarded as the main responsibility of these sectors. Creating industrial clusters, technology distribution networks and developing widely-used industrial general technologies are considered as the main challenges of managements and policy makers. Acquiring technology transfer through transferring technology includes short-and long-term advantages. Lower production cost, the product higher quality and developing new products are advantages of short-term technology transfer; on the other hand, enhancing enterprise competitive status in long-term depends on developing capabilities, learning skills and innovation of the enterprise receiving technology which requires concentrated and directed activities of the research and develop unit to localize the transferred technology. The present research intends to study the effect of technology transfer on competitive advantage in software companies.

Significance of the study

Global growing production in recent years has critically made the technology transfer as one of the most important promoting processes of competitiveness. Studies present that active companies in the developing countries try to enhance their competitiveness position in domestic (national) and international markets by applying increased quality strategies and reducing product price through developing national (domestic) competencies, variety of products and or target market as well as learning during implementation based on working with leading foreign companies. It is clear that effective technology transfer occurs based on complete transferring of all aspects (Dastjerdi et al, 2010). Technology is the symbol of wisdom in industrial development and the main source of increasing enterprises' competitiveness; and in conclusion, the competitiveness of the country's whole economy. So, technology-oriented industrial development is the major approach in achieving economic premier ranks in the area and around the world. As the main competition in the global markets are done by enterprises; therefore, increasing country's competitive potential requires moving toward enhancing competitive ability in enterprises. Applying technology in other places needs some tools to deliver the technology to the desired place. In other words, transferring the technology is a necessity; once the technology is transferred into another place, the resident community takes its benefits, too.

Studies in research journals, national conferences, MA and PhD thesis in the technology management domain reveal that though the relatively long years of the globalization of technology transfer to achieve competitive advantage by enterprises, is still obsolete and ignored among Iranian scholars and researchers.

Research Objectives

Research main objective

Studying the effect of technology performance on competitive advantage by enterprises

Research secondary objectives (sub-objectives)

- Studying the effect of technology transfer on the quality of enterprise's competitive performance
- Studying the effect of technology transfer on decreasing the cost of enterprise's

- competitive performance
- Studying the effect of technology transfer on on-time delivery of the enterprise's competitive performance
- Studying the effect of technology performance on the flexibility of enterprise's competitive performance

Research main question

- Does technology transfer influence on achieving competitive advantage by enterprises?

Research sub questions (secondary questions)

- Does technology transfer influence on the quality of enterprise's competitive performance?
- Does technology transfer influence on decreasing the cost of enterprise's competitive performance?
- Does technology transfer influence on on-time delivery of the enterprise's competitive performance?

Research hypotheses

Research main hypothesis

The technology transfer influences on achieving competitive advantage by enterprises.

Research sub-hypotheses

- Technology transfer influences on the quality of the enterprise's competitive performance.
- Technology transfer influences on reducing the cost of enterprise's competitive performance.
- Technology transfer influences on the on-time delivery of the enterprise's competitive performance.
- Technology transfer influences on the flexibility of enterprise's competitive performance.

Theoretical framework

Technology transfer

Technology is referred to all knowledge, products, processes, tools, methods and systems being applied in making goods or delivering services. Technology transfer can be defined as transferring technological intellectual properties including skills, knowledge, and equipment as well as production methods from manufacturing or developing site to another place through standard legal or illegal procedures. Strengthening production and establishing a dynamic, empowered economy involve extending and deepening industrialization in which technology plays the key role. Technology is transferred by two ways: vertical transfer and horizontal transfer. In the vertical transfer or transferring research and development, technical information and applied research findings are transferred into engineering and development stage; then, entered into production process through technology commercialization. Technology in the horizontal transfer is transferred from an empowerment level in one country to the same

empowerment level of another area. In this case, the higher technology level of receiver causes the less technology transfer cost and much effective attraction.

Competitive advantage

Competitive advantage, in recent years, has been the focus of competitive strategies discussions and many discussions have been presented on the competitive advantage. However, it is difficult to provide a precise definition of competitive advantage. It refers, on one side, to the yield more than usual; and on the other side, it relates to capital market and expectations. However, the most common definition of competitive advantage will manifest in the strategic domain and in the value creation framework, anything that makes income to increase more than cost.

Research history

Talebi (2013), in a research named studying technology transfer in improving industries' performance; a case study: Food industries of industrial states, Khorasan Razavi, indicated that technology is the symbol of knowledge in industrial development; the main source of increasing enterprises' competitiveness; and finally, the result of the country's whole economic competitiveness. So, technology- based industrial development is considered as the main strategy of achieving economic paramount ranks in the region and throughout the world. Regarding that main competition in global markets is done by enterprises; thus, enhancing the competitive potential necessitates increasing the competitive ability of enterprises as well as improving the technological ability of enterprises which are counted as the major policies of country's innovative industry center. Applying technology in other places requires some tools to transfer; in other words, technology transfer is a necessity. By transferring technology, the resident community also takes benefit. Food industries performance is measured by studying the role of technology transfer. Developing technological empowerments is of the effective ways of improving enterprises' performance. The success of technology transfer to enterprises is assessed through the factor of enterprises' performance improvement. This research tried to study the role of technology transfer in improving the performance of food industries in industrial states of Khorasan Razavi County. The research results show that technology transfer directly influences on the performance of active companies in food industries in Khorasan Razavi which lead to higher quality, reduced production costs, increased servicing, flexibility and on-time delivery. The technology aspects (dimensions) are initially identified; next, performance dimensions are introduced to study the performance. Sharif, N., Scope and some others consider four dimensions for technology including hardware, software, human resource, organizing and management. The researcher, first, selected the Garvin model to measure performance dimensions; later, followed by interviewing professors and food industries' authorities, concluded that apply Garvin model only for quality dimension; and for others including cost, flexibility, on-time delivery and services use the table provided in the research literature. So, five dimensions are mentioned in the theoretical framework through the presented questions. The required data to maintain or reject the questions were collected through a closed questionnaire containing 20 five-option questions. Technology dimension is evaluated based on Sharif model; since this thesis do not much focus on technological dimension, only 9 questions are used. Data distribution normality is studied through Kolmogorov- Smirnov test as the interval research variables. Following maintaining data distribution normality, Student paired T-test and Wilcoxon test were applied (Talebi, 2013). According to Hampson (1995) and Narayanan (1994), technology transfer enhances

organizations' competitive performance. These studies demonstrate the strong relation between technology acquiring (including external transferred technology and internal developed technology) and competitive priorities (Karimi Dastjerdi et al, 2010).

Research methodology

This research is an applied, descriptive, survey study. The participants include managements of software companies which are directly related to technology transfer. 72 individuals were selected as sample through using Cochran formula. Data were gathered through questionnaire. The questionnaire was distributed among samples; collected with 100% return rate; and, was analyzed using PLS smart software.

Data analysis

Central tendency, dispersion and variable distributions are provided in the following table.

Table 1- Central tendencies, dispersion and variable distribution (research data)

Variables	Mean	Median	Standard deviation	Variance	Skewness	Kurtosis
Technology transfer	3.16	3.19	0.39	0.15	0.26	0.44
Human ware	3.17	3.25	0.61	0.37	-0.15	-0.45
Software	3.07	3.00	0.69	0.48	- 0.35	0.12
Hardware	2.80	3.00	0.93	0.86	0.40	-0.26
Organization ware	3.12	3.33	0.65	0.42	-0.18	-0.25
Competitive advantage	2.97	3.00	0.46	0.21	0.05	-0.61
Competitive advantage flexibility	2.82	3.00	0.68	0.46	0.24	-0.80
Decreasing competitive performance cost	3.12	3.00	0.61	0.37	-0.35	-0.37
Competitive performance quality	3.07	3.00	0.59	0.35	-0.15	-0.37
On-time delivery	2.86	3.00	0.59	0.35	0.03	-0.15

According to Table 1, of the research main variables technology transfer variable has the largest mean (3.16) and competitive advantage variable has the least mean (2.97). In addition, of the research sub-variables, human-ware (3.17) and hardware (2.80) has the highest and least mean, respectively.

Moreover, data dispersion of hardware variable regarding higher standard deviation (0.93) is also larger. According to skewness coefficients, most of research variables are left-skewed (negative skewness coefficient). Other variables are slightly different from normal distribution. The kurtosis coefficient of most variables is negative indicating the shorter distribution (higher dispersion) in comparison to normal distribution.

Kolmogorov- Smirnov test

This test studies data normality. According to Kolmogorov- Smirnov test table, if significance level of all variables is larger than test significance level (0.05), data is normally distributed. This test result is shown in Table 2.

Table 2- Significance level of Kolmogorov- Smirnov test

Variables	Test statistic value	Significance level	Test result
Technology transfer	0.593	0.873	Maintained
Human-ware	1.15	0.144	Maintained
Software	1.17	0.129	Maintained
Hardware	1.90	0.001	Rejected
Organization-ware	1.44	0.031	Rejected
Competitive advantage	0.527	0.944	Maintained
Competitive performance flexibility	2.30	0.000	Rejected
Decreasing competitive performance cost	1.47	0.027	Rejected
Competitive performance quality	1.49	0/024	Rejected
On-time delivery	2.91	0/000	Rejected

Testing research hypotheses

As the sample small volume (less than 100), data were analyzed through pls software. Research hypotheses were individually analyzed through using partial least square technique. Furthermore, the final total research model is tested by using this technique. There are some critical points in partial least square technique as follows:

The strength of relationship between the factor (latent variable) and the visible variable is shown by factor load which is in the range of 0 and 1. If factor load is smaller than 0.3, the relation is assumed poor and disregarded. Range of 0.3-0.6 is acceptable; and if it is larger than 0.6, it is highly desired.

Once the variables correlation is determined, the significance test is required. Correlations' significance is studied through Bootstrap methods and or Jackknife cross-section. This research used Bootstrap method leading to t-statistics. If Bootstrapping t-value is larger than 1.96 at the error level 5%, the observed correlations are significant.

Generally, the relations between variables in partial least square technique are classified into two classes:

Outer model: it is equivalent to measuring model (maintaining factor analysis) in structural equations revealing the relations between latent variables with seen variables.

Inner model: it is equivalent with structural model (path analysis) in the structural equations studying the interrelations between latent variables (Davari and Reza Zade, 2013).

Table 3- Outer model of partial least square

Variables	Technology transfer	Competitive advantage
Hardware	0.83	
Software	0.72	
Organization-ware	0.77	
Human-ware	0.63	

Flexibility		0.89
On-time delivery		0.85
Decreasing cost		0.55
Performance quality		0.75

Table 4- Bootstrapping value of partial least square

Variables	Technology transfer	Competitive advantage
Hardware	31.91	
Software	12.52	
Organization-ware	14.35	
Human-ware	7.44	
Flexibility		48.42
On-time delivery		33.63
Decreasing cost		6.78
Quality performance		14.97

The observed factor load is bigger than 0.3 in all demonstrating that there is a proper correlation between observable variables and latent variables.

Also, according to the results of measuring Bootstrapping value (t-value) which is larger than the critical value 1.96, it is revealed that there is a significant correlation between observable variables and latent variables.

Table 5- The results of structural equations model

Raw	Path		Path coefficient	T	Result
1	Technology transfer	Competitive advantage	0.52	6.92	Maintain
3	Technology transfer	Reducing the cost	0.53	6.72	Maintain
4	Technology transfer	Flexibility	0.48	6.62	Maintain
5	Technology transfer	Competitive performance quality	0.46	5.84	Maintain
6	Technology transfer	On-time delivery	0.45	6.45	Maintain

Freedman test

Table 6- Ranking technology transfer aspects

Raw	Technology transfer aspects	Rank means	Priority
1	Organization ware	2.70	second
2	Human ware	2.72	First
3	Hardware	2.06	Fourth
4	Software	2.52	Third

Table 7- Freedman test significance level

Raw	Statistics	Calculated values
1	Numbers	72

2	Chi- square	13.526
3	Degree of freedom	3
4	Significance level	0.004

Table 8- Ranking competitive advantage aspects

Raw	Aspects of Competitive advantage	Ranks mean	Priority
1	Flexibility of the competitive performance	2.18	Fourth
2	Reducing competitive performance cost	2.81	First
3	Competitive performance quality	2.74	Second
4	On-time delivery of competitive performance	2.27	Third

Table 9- Freed Man test significance level

Raw	Statistics	Calculated values
1	Numbers	72
2	Chi square	18.281
3	Degree of freedom	3
4	Significance level	0.000

Conclusion and recommendations

The results obtained from analyzing research hypotheses show that there is a casual relation in the studied variables in all research sub-hypotheses between the components of performance quality, decreasing cost, on-time delivery with technology transfer in software companies.

Managements in developing enterprise’s technology transfer-oriented competitive performance do not merely suffice to achieving the physical aspect of technology; rather, focus on obtaining technological capabilities and empowerments.

The enterprise may increase its attraction potential concentrating on training and research and development oriented activities in order to effectively utilize the transferred technology.

References

- Khalil, T. (2002). “Technological management: secret of accomplishment in competition and wealth creation”. Translated by Bagheri, C. K. First edition, Payam E Matn Pub.
- Karimi Dastjerdi, D., Mokhtar Zade, N., Yazdani, H.R. (2010). “Studying the effect of technology transfer on enterprise’s competitive performance; A case study of Iranian auto-manufactures, Tondar”. Journal of Industrial management, Faculty of management, University of Tehran, Volume 2, Issue 4, pp 111-124.
- Sharif, N. (1988). “Managing technology transfer and development”. Translated by Aslani, R. Ministry of Planning and Budget Pub; the center of socioeconomic documentation.
- Talebi, M. (2013). “Studying the effect of technology transfer on improving industries’ performance: A case study: Food industries of industrial estates in Khorasan Razavi”; M.A. thesis.
- Davari, A., Reza Zade A. (2013). “Modeling structural equations by pls software”. Jahad Daneshgahi Pub, Tehran.
- Chiesa V. (2001). R&D Strategy and Organization, Imperial College Press.
- Sharif, N. (1995). The evolution of technology management studies: Techno economics to techno metrics. Technology Management: Strategies and Applications for

Practitioners, Vol. 2, No.3: 113-148.

- Cetindamar, D., Phaal, R. & Probert, D. (2009). Understanding technology management as a dynamic capability: A framework for technology management activities, *Technovation*, Vol. 29, No. 4: 237-246.
- Prahalad, C., Hamel, G. (1994). *The Future of Competition: Co-Creating Unique Value with Customers*, Harvard Business Press.
- Salinger, B. Lynn, (2001) *Productivity, Competitive Advantage and Competitiveness in Africa*, USAID.