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Representing Technology Management Model on Resilient Economy Condition in High Tech Industries. (Case Study: Telecommunications Industry)

Abstract

Iran's economic environment today has witnessed special and unique economic events, some of which have never happened before. The Supreme Leader of the Revolution has named 2016 as the year of " Resilient Economy, Movement, and Action" it can be said that the resilient economy is the country's most important issue regarding getting rid of economic crises. Technology management examines and analyzes the technological orientation of the organization according to the existing conditions and presents solutions regarding decision-making in front of managers and officials. This research investigates the effects of technology management in a resilient economy using structural equation modeling. It offers a model using the concepts of technology management in a resilient economy to reduce the effects of sanctions and improve the economic activities of organizations and companies. The current research is practical in terms of purpose and has a case study method. This research is also a survey in terms of the data collection method. The sources used in this research were theses, Latin, and Persian articles. The presented model determined a two-way relationship between technology management and a resilient economy, indicating that their components are directly and indirectly related. The important indicators of the resilient economy, its subsets, and the important technology management components were determined. Technology development, training, and human resources were among the most important technology management components, and executive management was the most important component of the resilient economy.

Keywords: *Technology management, Telecommunications, Structural equation modeling, Complex technology industries.*

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1. Introduction

In recent years, the peak of the pressures caused by international economic sanctions has put the country's economy in special condition. In this situation, the resilient economy strategy reduces dependencies, emphasizes the advantages of domestic production, and strives for self-reliance. In this economy, the country's progress is maintained, and the vulnerability of the economic system is reduced to the enemy's tricks. Based on the Islamic perspective and lifestyle, a resilient economy is a type of economy that can achieve its goals in the long and short term without any dependency on war, threats, sanctions, or natural disasters. One of the resilient economy's central axes is reducing dependencies, emphasizing the advantages of domestic production, and striving for self-sufficiency. In this regard, technology management and domestic production can be effective in people's lifestyles. Therefore, the current research presents a technology management model in the conditions of a resistant economy in industries with complex technology and can take an effective step towards the progress and self-reliance of the country by relying on the domestic economy.

Theoretical foundations

2-1 **Resilient economy**

A resilient economy means identifying pressure areas and controlling and neutralizing them. It is also turning such pressures into opportunities in ideal conditions. In addition, foreign dependencies should be reduced, and domestic production and efforts for self-reliance should be more emphasized to achieve a resilient economy (Akbaripour and Maleki, 2015). The necessity of resilience in the definition of economic resilient is rejecting pressures and going through hardships to reach positive national points. After the intensification of sanctions against Iran in recent years, a resilient economy has been promoted in Iran to use internal power and resist sanctions by creating the least crisis. Financial, economic, and political problems create risks and uncertainties that are mostly beyond the control of a particular country. Countries implement many policies and measures in such conditions to continue their growth and development. It seems that the general policies of the resilient economy are a response to the increasing risks and uncertainties of the world and the region (Azadi and Dosti, 2015). A resilient economy is an economy that can determine the growth and prosperity of the country in the conditions of sanctions, pressure, enmities, and severe hostilities. The set of general policies of the resilient economy emphasizes that the economy should be managed to use its strengths in the long-term progress of the country (including the vision document). It also emphasizes moving stably, continuously, and rapidly, covering its weak points in facing internal and external shocks, suffering the least damage, and returning to its normal functions after meeting the shock.

This resilient economy interpretation state that the country's economy should be planned and directed to take the least impact in the face of internal and external shocks. To achieve this issue, the economy must become endogenous, use its maximum capacities and turn the threats into opportunities (Owlyaei Nesab et al., 2017). Table 1 shows the components of the resilient economy.

Table 1. Components of a resilient economy

Component	Indicator
planning	Move by schedule
	Avoiding short-term vision
	Economic surveillance and accurate statistics
Executive Management	Reforming the education system
	Creating a competitive environment and expanding alliances
	Attracting public participation
	The active presence of the private sector
	Correct currency management
	People's economy and fight against economic corruption
	Respecting domestic products
Development and productivity	Taking advantage of neighboring countries and expanding alliances
	Strengthening non-oil products and ending dependence on oil
	Creating and strengthening knowledge-based companies
	Entrepreneurship and attention to inventions

Perhaps it can be said that a resilient economy is the most important concern of the country to get rid of the economic crisis. Therefore, there is a need for comprehensive research due to the implementation of a resilient economy in various fields. Engineering and economics are very important areas in which little research on resilient economies has been conducted. Technology management examines and analyzes the organization's technology direction according to the existing conditions and presents solutions to managers and officials about decision-making. The resilient economy also has its specific components that must be examined. Technology research is necessary because advanced industries do not have many possibilities for market development without interaction with global trade. The domestic market is insufficient to increase the supply of products with advanced technologies effectively. Therefore, the industries in this field need to connect with global markets to develop their market. It significantly affects the quality of products and, as a result, increases production capacity.

2-2. Technology management

Technology is all knowledge, goods, processes, tools, methods, and systems used to create and manufacture goods and provide services. Technology is a way of doing things for humans and a mechanism by which humans can achieve their goals. Technology is the practical implementation of knowledge that comes with the help of human effort (Lee et al., 2007). Technology has always played an important role in influencing standards, creating wealth for countries, and creating quality of life. When early man used a tree branch to climb and reach the fruit or turned it into a spear by carving a piece of stone, he discovered the technology necessary for survival. It took years of trial and error, creativity, and perseverance until the man could design tools, build cities and buildings, and learn the knowledge of agriculture. Also, invent methods to move materials and goods and implement methods to turn the government around. Therefore, man has always used technology for his progress. Technology has such a strong impact on human life that the progress of civilization is identified and evaluated based on the dominant technology of that era. Throughout the period, technology has had a profound impact on human development and the progress of civilization. The activities of governments, global companies, private companies, and individuals are highly dependent on technology. Even though technology is the biggest and most effective factor in human survival today, it is still a mystery for many people, and many people and properties cannot precisely define it (Lee et al., 2009). Khalil (2000) stated five stages for the technology management process, which start from the selection stage and ends with the protection stage, according to Figure 1.

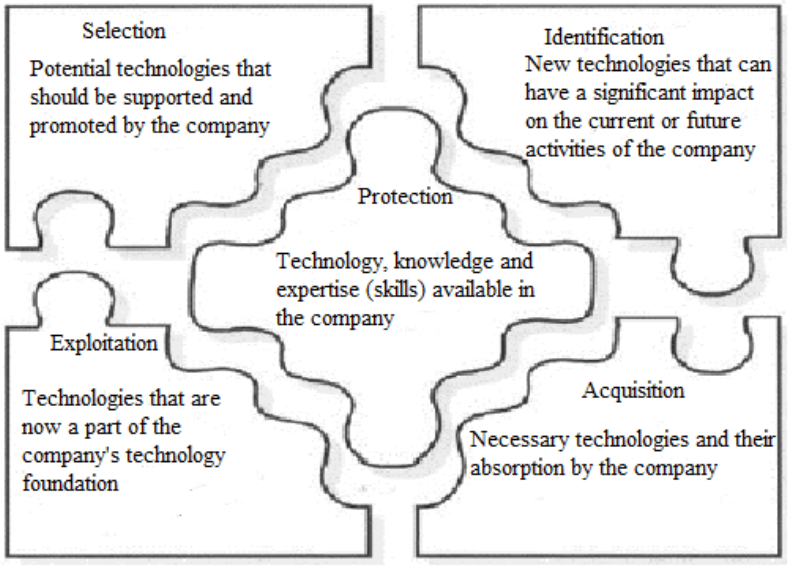

Figure 1. Technology management process

Technology management is an interdisciplinary topic that connects science, engineering, and management. Based on technology management, technology is the main factor of wealth production, which can include elements such as knowledge promotion, intellectual capital, effective use of resources, conservation of natural resources, and other effective factors in improving the standard and quality of life (Pourreza, 2012).

Table 2 shows the components of technology management.

Component	Indicator
Identify technology	Knowledge and analysis of technology markets
	Detailed knowledge of all technology suppliers
	Categorize customers at any technological level
	Identifying vital national technologies
Technology assessment	Analysis of the life cycles of existing technologies
	Examining the compatibility of new technologies with current conditions
	Continuous assessment of technology development actors
	Predicting the rate of technology substitution
Technology choice	Targeting specific technologies
	Buying shares of technology supply companies
	Expansion of studies regarding the choice of technology
	Development of various scenarios for technology forecasting
Education and human resources	Skilled and expert human resources
	Training of small industries with modern technologies
	Strengthening industry and university cooperation
	Hiring technology experts
	Sending troops to countries with technology
	Employing technology auditors in organizations
Technology development	Joint venture with technology owners
	Integration with technology-holding companies
	Expansion and construction of science and technology parks
	Conducting research and development in line with business objectives
	Concentrated investment instead of balance in all sectors
	Expanding the business environment and participating in international projects

	Expansion of information technology infrastructure

Technology management will be successful when there is a proper connection between business strategy and technology. Integrating technological innovation with production, marketing, finance, and human power aims to achieve the set goals (Mao et al., 2011).

2-3. Background research

Owlyaei Nesab et al. (2017) conducted a study entitled strengthening the foundations of a resilient economy using electronic commerce tools. They concluded that the implementation of e-commerce leads to the development of the export of goods and services. The possibility of international exchange of goods and services is created by setting up e-businesses and providing the export and e-commerce environment. Yazdan Panah and Chenari (2017) conducted a study entitled the position of international trade in the conceptualization of resilient economy. They stated that the main business strategy in the resilient economy of the Islamic Republic of Iran is to pay serious attention to the dimensions of resilient culture in business and economic leadership. Akbaripour and Maleki (2015) conducted a study entitled evaluation and the role of the knowledge-based economy in resilience economy and sustainable development. They concluded that all the elements of the knowledge-based economy have a positive relationship with sustainable economic growth and development. The consequences of these relationships will be unemployment reduction, a better quality of products and services, cost reduction, consumption pattern modification, and the realization of resilient economic components. Li et al. (2010) conducted a study entitled evaluation framework for technology transfer of new equipment in the high-tech industry. They concluded that the product life cycle is continuously shortened with the rapid development of technology. The company must continue developing new technology to differentiate itself from others and compete with other companies in highly competitive global markets. Sahoo et al. (2011) conducted a study entitled Strategic Management of Technology in the Auto Parts Industry in India. They concluded that two different organizations had adopted different technology strategies. In contrast, both have a strong link between business strategy and technology. Cetindamar et al. (2016) studied technology management as a profession and the challenges ahead. They stated that focusing on the long-term perspective allows technology management professionals to consider their existing knowledge and skills so that they can prepare for the challenges they face in the future.

3. Problem design

A resilient economy seeks self-sufficiency and localization of the economy, and one of the most important components of economic prosperity is technological progress. The main issue is whether the characteristics of technology management can strengthen the resilient economy. This research's main problem is presenting the structural model of technology management in the conditions of a resilient economy. Therefore, the research questions are as follows.

1. What are the key factors of technology management and their priority in a resilient economy?
2. How do the key factors of technology management and a resilient economy affect each other?
3. Do companies with advanced industries (telecommunications) and related to it perform poorly in the technology management sector during the resilient economy?

4. Research method

The current case study is practical in terms of purpose. In addition, it has a survey data collection method and quantitative and qualitative data. The relevant experts' opinions were used with interviews and questionnaires to collect information. The present research was conducted in the country's top technology-oriented universities, companies, and organizations between 2015 and 2016. This study's statistical population includes professors and experts in management and economics, managers of companies and technology-oriented organizations to provide a desirable model of technological management, and telecommunication managers to evaluate the state of telecommunications in the conditions of a resilient economy, who are about 223 people. The sample size was calculated using Cochran's formula equal to 142 people, and these people were determined by the random sampling method. The sample answered the questionnaire questions according to the 5-point Likert scale. A factor analysis and correlation matrix from Spss 24 software was used to check the reliability of the questionnaire with Cronbach's alpha. Lisrel 10 software was also used to analyze the structural equation model and determine the influence coefficients.

5. Research Reliability

To check the reliability of the questionnaire, Cronbach's alpha method was used, whose formula is as follows.

$$ra = \frac{\mathrm{j}}{\mathrm{j}-1}\left(1 - \frac{\sum \mathrm{S}_{\mathrm{i}}^{2}}{S^{2}}\right)$$

Table 3 is related to the reliability of the questionnaires.

Table 3. Questionnaire reliability

Questionnaire	Cronbach's alpha
Technology management	0.925
Resilient economy	0.909

Cronbach's alpha value of the technology management questionnaire equals 0.925, and the resilient economy questionnaire equals 0.909, which is more than 0.70. Therefore, it can be said that the present questionnaire has acceptable reliability.

6. Descriptive findings

The descriptive indicators of the research are given in Table 4.

Table 4. Frequency and percentage of research indicators

Indicator	Subindex	Abundance	Percentage
gender	Man	76	53.5%
	Female	66	46.5%
Age	Less than 30 years	116	81.7%
	Between 31 and 40 years	14	9.9%
	Between 41 and 50 years	7	4.9%
	Above 50 years	5	3.5%
Work Experience	Less than 5 years	128	90.1%
	Between 5 and 10 years	2	1.4%
	Between 11 and 20 years	8	5.6%
	Between 21 and 30 years	4	2.9%
Education	Masters	89	62.7%
	P.H.D	53	37.3%

According to the above table, the gender of the respondents was male and female, and most were male. In addition, people were less than 30 years old in the dominant age group. In terms of work experience, most people had less than 5 years of experience. In addition, they have master's degrees and Ph.D. in education, but most respondents were at the master's level.

7. Heuristic findings

Table 5 shows the variables' mean and standard deviation and the Kolmogorov-Smirnov (K-S) test results to check whether the research variables follow a normal distribution.

Table 5. The results of the Kolmogorov-Smirnov (K-S) test are to check whether the variables follow a normal distribution.

Variables	Average	Standard deviation	Kolmogorov-Smirnov value	Significance level
Technology Identification	3.66	0.592	0.694	0.219
Technology assessment	3.64	0.634	0.798	0.148
Technology choice	3.80	0.515	0.715	0.104
Education and human resources	3.72	0.574	0.925	0.359
Technology development	3.69	0.612	0.667	0.205
planning	3.75	0.543	0.835	0.124
Executive management	3.78	0.522	0.672	0.313
Development and productivity	3.70	0.603	0.532	0.289

As observed in Table 5, the significance level for all variables was greater than 0.05. Therefore, it is concluded that the research variables have a normal distribution. Pearson's correlation coefficient was used to check the correlation

between the variables due to the normality of data distribution. Pearson's correlation coefficient also investigated the main and sub-hypotheses of the research, which is considered the most important part of statistical analysis. Table 6 shows the Pearson correlation coefficient between the variables.

Table 6. Pearson correlation coefficient between variables

Variable	Component	The correlation coefficient	Significance level
technology management	Identify technology	0.768	0.000
	Technology choice	0.866	0.000
	Technology assessment	0.596	0.000
	Education and human resources	0.558	0.000
	technology development	0.661	0.000
resilient economy	planning	0.849	0.000
	Executive Management	0.863	0.000
	Development and productivity	0.557	0.000

According to the above table, in examining the correlation of technology management variables in 142 collected samples, it was found that the highest and lowest correlation was among the factors of choosing technology and education and human resources, respectively, which is equal to 0.866 and 0.558. Also, for the resilient economy variable, the highest and lowest correlations were in executive management and development and productivity, respectively, equal to 0.863 and 0.557.

7-1. Research conceptual model

Lisrel 10 software was used to analyze the structural equation model. In the first step, independent and dependent variables are determined. In model estimation or model measurement, relationships between variables are tested. The conceptual model of this research is as follows.

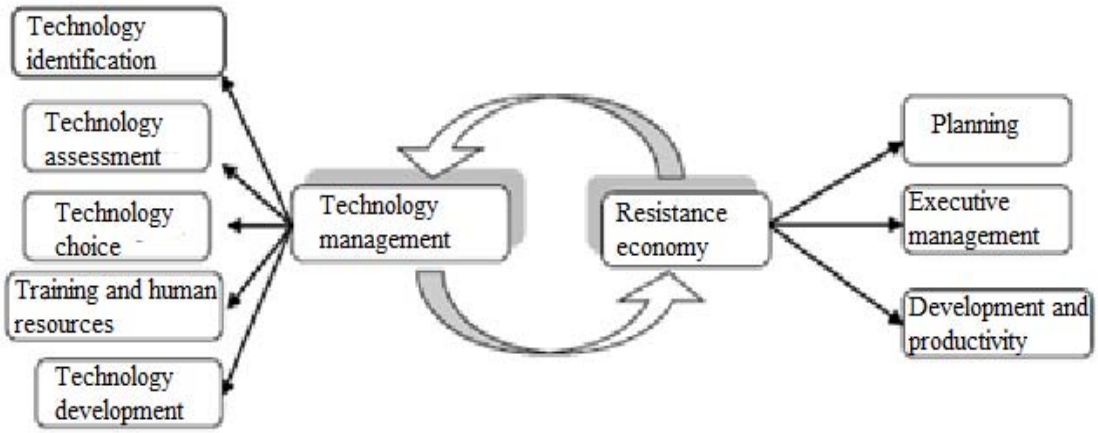

Figure 2. Research conceptual model

7-2. Sample adequacy index and Bartlett's test

In conducting factor analysis, the existing data is used for analysis. It is possible to ensure sampling adequacy using Bartlett's test. This index is in the range of zero to one. The desired data are suitable for factor analysis if the value of the index is close to one. Otherwise, the practical analysis results are unsuitable for the desired data. First, the suitability of the data for factor analysis is examined. There are various methods for this work, among which the KMO test can be mentioned, whose value always fluctuates between zero and one. The data is unsuitable for factor analysis if the KMO value is less than 0.70. If its value is between 0.50 and 0.69, factor analysis can be done with more caution. If its value is greater than 0.70, the existing correlations between the data will be suitable for factor analysis. On the other hand, Bartlett's test is used to ensure the appropriateness of the data in which the correlation matrix is not zero in society which is the basis of the analysis. In other words, it is possible to ensure sampling adequacy using Bartlett's test.

Table 7. Sampling adequacy of KMO data and Bartlett's test

Statistical index		Technology management	Resilient economy
KMO sampling adequacy criterion		0.754	0.792
Bartlett's test	Chi-square	364.09	296.13
	Freedom degrees	142	142
	Significant level	0.000	0.000

As observed in the above table, the value of KMO obtained for technology management is equal to 0.754, and for the resilient economy is equal to 0.792, which is more than 0.70. Therefore, the existing correlations between the data are suitable for factor analysis. This test accuracy can be trusted with a confidence factor of 0.95 when the significance obtained for both variables is less than 0.05

7-3. The results of structural equation model analysis

A model expresses the relationship between variables, and path coefficients also represent how much each dependent variable is affected by a unit change in the independent variable. That is, it shows the correlation and the amount of load an obvious variable has on the hidden one, and it should be more than 0.30. The amount of error shown in each variable indicates the error in predicting hidden variables from each other. Figure 3 shows the general model of the research, i.e., the technology management model in the conditions of the resilient economy, which is obtained from the combination of the components of the variables.

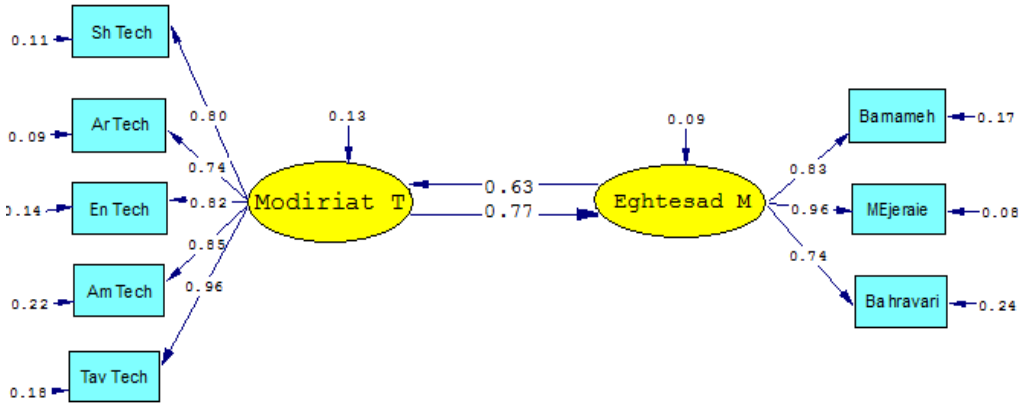

Figure 3. Analysis of the conceptual model of the research with the structural equation model method

The model-fitting results show numerical relationships between variables and their components. The obtained model shows a statistically significant relationship between technology management and a resilient economy. Table 9 shows the fit indices of the model.

Table 8. Structural equation model fit indices

Indicator	symbol	Index value	Result
The chi-squared ratio of degrees of freedom	$\frac{x^2}{df}$	2.364	Confirmed model
The root mean square error of approximation	RMSEA	0.071	Confirmed model
root mean square residual	RMR	0.049	Confirmed model
Goodness fit index	GFI	0.911	Confirmed model
Adjusted Goodness-of-Fit Index	AGFI	0.923	Confirmed model
Normalized fit index (Bentler-Bonet)	NFI	0.941	Confirmed model
Comparative fit index	CFI	0.910	Confirmed model
Incremental fit index	IFI	0.929	Confirmed model

According to the obtained results and comparing them with the optimal range presented in the table, it can be acknowledged that all the fit indices of the above model are in this range. Therefore the fit of the collected data with the model is optimal. Thus, the suitability of the structural equation model is confirmed.

8. Conclusion

The supreme leader of the revolution first proposed the idea of a resilient economy. According to them, the enemy seeks to separate the people from the Islamic system in terms of economic threats. The components and axes of the resilient economy can be extracted carefully from the statements of the Supreme Leader. He states that a resilient economy will preserve the country's economic growth and prosperity in the face of pressure and reduce its vulnerability. The formation of a resilient economy will have important results that have been specified in the statements of the Supreme Leader. Also, the resilient economy has conditions and requirements that include the use of all government and people's capacities, changes in the economic conditions through implementing Article 44 policies, empowering the private sector, and reducing dependence on oil. Based on the components extracted from the statements of the Supreme Leader, it is possible to propose a model of Iran's resilient economy with four basic components: economic growth, economic justice, economic stability, and economic resilience. Economic recovery strategies include deterrence strategies, neutralization strategies, absorption and restoration strategies, and diffusion and weakening strategies.

According to the present research results, in response to the first research question, "What are the key factors of technology management and their priority in the conditions of a resilient economy?" It should be said that according to the former model, technology management is the most important factor in the technology development component Expansion of the business environment and participation in international projects, and expansion of information technology infrastructure were the most important factors. In the second component, i.e., education and human resources, strengthening cooperation between industry and university were the most important. In the third component, i.e., technology selection, the most important factor was targeting specific technologies. The fourth component was technology identification, recognition, and analysis of technology markets. And finally, in the fifth component of technology evaluation, the most important factor was checking the compatibility of new technologies with current conditions. Executive management was also the most important component in the resilient economy sector. Then it was planning and, finally, development and productivity. In response to the second question of the research, "How are the key factors of technology management and economic resilient related to each other?" It should be said that according to the opinions of experts and the results of inferential statistics, it was determined that among the components of technology management in the model, the component of technology development is the most important. Among the components of a resilient economy, executive management is more important than the others. In response to the third follow-up question, "Do companies with advanced industries (telecommunications) and their affiliates perform poorly in the technology management sector during the resilient economy?" The answer is positive, and according to the results obtained from the statistical analysis, it was concluded that the studied company either does not apply the basics of technology management properly or does not perform some of them at all. Realizing a resilient economy requires the all-around efforts of officials and people. Giving value to national production is necessary to save the country's economy from the single-product situation. Domestic products and localism should be valued, and the country's economic infrastructure should be developed. Based on the Islamic economy, the resilient economy model should be explained by the country's economic conditions and situation. Finally, examining the different styles of technology management and how to use it in various organizations and identifying the potential and actual capabilities of the country regarding technology management in the conditions of a resilient economy or economic crisis are suggested for future research.

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Conflict of interest

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Ethics statement

None.

References

Akbaripour Ali, Maleki Hossein, and Maryam (2015), evaluation and role of the knowledge-based economy in resilience economy and sustainable development, National Conference on New Approaches in Management, Economics and Accounting Sciences, Mazandaran, Kome Alam Avaran Danesh Scientific Research Institute.

Owlyaei Nesab, Marzieh and Miri Ledari Seyedah Soheila, (2017), strengthening the foundations of a resilient economy using electronic commerce tools, the second international community empowerment congress in the field of management, economics, entrepreneurship, and cultural engineering, Tehran, Center for Empowerment of Cultural Skills and Social society.

Azadi, Abbas and Dosti Jafar, (2015), Resilient Economy, Solutions, Challenges and Requirements, National Conference on New Approaches in Management, Economics and Accounting Sciences, Mazandaran, Kome Alam Avaran Danesh Scientific Research Institute.

Pourreza, Nader, (2012), Strategic Management of Technology, First National Accounting and Management Conference, Noor, Noor Islamic Azad University.

Yazdan Panah, Kyomarth and Chenari Samira (2017), the position of international trade in the conceptualization of resistance economy, International Conference on Challenges and Solutions of Management and Economic Development, Emirates-Dubai, Institute of Management and Development of Culture and Art Research Institute.

Hongyi Mao, Shan Liu, Jinlong Zhang, Zhaohua Deng (2016). Information technology resource, knowledge management capability, and competitive

advantage: The moderating role of resource commitment International Journal of Information Management, Volume 36, Issue 6, Part A, Pages 1062-1074.
Khalil, T. M. (2000). Management of Technology: The Key to Competitiveness and Wealth Creation. New York: Irwin McGraw-Hill.
Lee H., Lee, S., and Park, Y. (2009). Selection of technology acquisition mode using the analytical network process. Mathematical and Computer Modelling, 49 (5-6): 1274-1282.
Lee, H.I., Wang, W., in, T. (2010). An Evaluation Framework for Technology Transfer of New Equipment in High Technology Industry. Technological Forecasting & Social Change, 77, 135–150.
Li-Hua, R. (2007). What is technology management? Journal of Technology Management in China 2(3): 193-197.
Sahoo, T., Banwet, D. K., and Momaya, K. (2011). Strategic technology management in the auto component industry in India: A case study of selected organizations. Journal of Advances in Management Research 8(1): 9-29.
Dilek Cetindamar, Robert Phaal, David R. Probert (2016). Technology management as a profession and the challenges ahead Journal of Engineering and Technology Management, Volume 41, Pages 1-13.