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Identifying The Effect of Technology Intelligence on the Technological Planning of the Organization Case Study: Technical Vice President for the Raja Rail Transportation Company

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Abstract: Technology Intelligence (TI) is a process which has been introduced to improve the performance of technology development along with creativity by identifying potential options of new technologies as well to reduce the probability of failure due to the technological discontinuities. Technology planning is an integral part of a company's macro trading plan which is essential at both macro and micro levels of company's strategic activity. This study has tried to identify the effects of TI on the technology planning due to the intertwining of these concepts. Given that railway is as one of the fundamental indicators of economic growth, this research has studied these concepts in one of the important passenger subsets of this industry, i.e., technical assistant for the RAJA rail transportation company. Data are collected by census method and then are analyzed by using inferential methods including Kolmogorov-Smirnov test, pearson correlation coefficient and regression analysis. Results showed that TI has a positive and significant effect on the technological planning.

Key words: Intelligence, technology intelligence, technology planning, technology evaluation, technology acquisition

INTRODUCTION

The speed of technological developments is the most important difference between today's world and the past. Competitive techniques are also changing with moving towards globalization and losing the economic borders. Technology as the main factor of change have a major impact on competitiveness in the world and this matter specifies the role and position of technology in the industry and trade. Technology is acquired and promoted by less developed countries to make up their backwardness and by developed countries to establish their authority and position. So, one of the important tasks of technology management is the technology and proper planning in order to use it and our country has paid attention to it in recent years. Modern organizations are required to respond quickly to the needs of stakeholders (internal and external) and they should be able to take advantage of modern tools to accelerate the decision making process. For decision making, first, it is required to gather information in different ways and to have the ability to analyze them (Ahmadi, 2006). As new technologies emerge, the existing technologies expand. The impact of technology on organization and the society is increasing. TI is a process that has been introduced to improve the performance of technology development along with creativity by identifying potential options of new technologies; as well to reduce the probability of failure due to the technological discontinuities (Tarooq, 2004).

Economic globalization, accelerated technological changes, as well as the information explosion have caused organizations to bear more pressure to stay in the competition. On the other hand, Information and Communication Technology (ICT) through making available various ways for gaining superiority has enabled organizations overcome their competitors better by increasing the level of competitive intelligence, their organizational intelligence and the use of information (Navaaz, 2007). Today, the competitive ability is the basis for survival of the companies. On the other hand, taking advantage and maintaining this ability needs information more than anything. TI helps organizations to make informed decisions about their affairs including marketing, research and development, investment and business strategy. Over recent years, TI has become as one of the important concepts of the management and has been integrated with culture of leading companies (Mo'meni and Aaqa, 2001). Planning is a central task and process for managers. The organization should be intelligent during

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this period. In the intelligent era, competitive companies are facing many complexities and difficulty in gathering information for further the intelligence, since they need to survive. Managers will learn that the most major assets including staff's thoughts, their analysis tools and abilities are effective in making decisions. They will need to the intelligent for being complete. In the information age organizations were used the available data and information. An intelligence organization moves beyond the information and knows that information is not as valuable as the intelligence which is needed for using these data. This study aimed at identifying the effects of the TI process on the technological planning in the organization and it mainly has studied the industry wide planning given that the intended organization is The RAJA rail Transportation Company which is an industrial organization.

Theoretical framework

The definition of technology: Technology (in French, technologie) refers to a collection of techniques, tools, machines, materials and processed which used to solve human problems. Technology is a human-based activity and therefore it has a much longer history than knowledge as well as than engineering. The term refers to a set of available "knowledge" to make any kind of requirements and artifacts, to deal with manual skills and crafts (except for religion, magic, military and cooking activities) and to extract or collect a variety of materials (except for the material that used for food or magical or religious ceremonies).

- In societies that are industrial or societies are getting industrialized, the term refers to all or a regular part of the "knowledge" which relates to the following items:
- Discoveries and scientific principles
- Current and former industrial processes, materials and power sources and the methods of transfer and communication which is believed to be associated with the production and improvement of their goods and services
- The concept of technology as the knowledge that is concerned with making and using tools and equipment and the knowledge of using raw materials

The definitions of TI: TI is a process which has been introduced to improve the performance of technology development along with creativity by identifying potential options of new technologies; as well to reduce the probability of failure due to the technological discontinuities (Tarooq, 2004). TI can be referred as commercially sensitive information about threats, opportunities and external scientific developments or technology that has the potential of influencing on the competitive position of the companies. Also, it can be considered as an analytical process that converts the usable technological data which are related to the situation, the amount of effort and competitors procedures. It has emphasized the performance of research and development in the organization; but also has focused on other activities stimulating technology such as strategic planning, technology acquisition and equipment investment process. Many decisions which are encountered with external factors such as entering foreign markets or new business, investing or purchasing new technologies, large investments and selecting strategic partners, need to intelligence support. Intelligence is based on help to make better and timely decisions, what could have strategic usages for the survival of the organization. By this definition, TI includes technology monitoring, technology assessment and technology forecasting.

Technology planning Now a days, businesses need to the timely development of products, services, infrastructures and technologies for their survival that make possible their competitiveness in the future. Diversified demands of customers, rapid changes in technology, increased cost pressures, increasing the pressure of demand for products and shortening the time which is needed to introduce the products has caused the competitive environment to be more complex and the development of empowering technologies to be more critical for companies. On the other hand, the high cost of research and development activities, the lack of resources and inherent risk of technology development activities have made the independent and non-cooperative efforts of companies to develop the key technologies very challenging. The industry has defined as a systematic set of subsections and various specialized parts. Low integration of sector systems and the level of industrial association's ability in Iran have caused the only technology-driven industries that are structurally more concentrated, move toward the planning technology to prioritize their research and development activities. The industry need to a systematic process of technology planning will be more obvious whatever paid more attention to the importance of industry-wide technology planning. The extent and complexity of the industry, the diversity of the technological requirements of different subsections, the need to determine the appropriate method for the development of technological capabilities of industry, the need to select responsive technologies for driving forces and market and industry trends and the industry's need to

determine topics for technology development and research, requires the industry a comprehensive process for technology planning. Reviewing the previous studies showed that those studies aimed at prioritizing research activities and technological development at the industry level have often conducted by industrial departments and governmental organizations which aimed at removing the priority on research and development activities of industry and there is no theoretical or scientific and systematic framework for designing or evaluating the model. Methods used in these studies indicate that the applied models or frameworks have been obtained from the development of firm's technology strategy development models (micro level) or changes in technology policy making frameworks at the national level (macro level). Accordingly, the specific requirement of the industry level which is an intermediate level between micro and macro levels, is not considered.

Technology Needs Assessment (TNA): In a general sense, technology assessment refers to a process in which the impact of introducing, developing and modifying a technology in an enterprise or a community is measured in a systematic manner. According to UNIDO (United Nations Industrial Development Organization) guidelines, TNA is a framework which has been developed to help identify the technology needs and priorities of developing countries and ensure the successful implementation of the technology transfer. TNA is a consultative process that involves a wide range of stakeholders. UNIDI has developed three levels of TNA which are as follows:

National level: it has generally focused onpolicy formulation.

Sector level: It is similar to the ational level, except that it works in the field of public technology and industry.

Enterprise level: It is at the firm level and generally technology transfer (Transfer of Technology (TOT) is associated with this level.

TOT concepts: TOT is one of the areas for applying technology management that involves a holistic and introspection approach. Now a days, industrialization is profoundly dependent on the TOT. It is not required that a technology user is its creator or inventor by him/herself. In fact, most innovations are created out of companies that benefit from it. Innovation may even occur outside the frontiers of the company or may be limited in a department or a sector. TOT is an essential process for the application and the widespread use of technology by one or more users. TOT is a complicated process. Purchasing TOT without the required study not only will be useless, but may also waste money and time in addition to weakening national technology. The transfer should be considered as a process through which imported technology is achieved in such a way that not only used for product manufacturing but also be a platform to create a new technology. Of course, the process of TOT as the technology itself is extremely complex and involves many aspects. TOT is not only a just a physical transfer, but also involves technical equipment and machinery, human capabilities, technical knowledge and information organization and management.

Technological innovation: Obviously, industries that concern about their growth and survival in the arena of competition should bring new products to the market day-to-day. Technology should be considered more carefully, since the industry is inextricably linked with technology; indeed, technology is a vital part in the life of industrial-commercial organizations and communities. Technology is at the heart of wealth creation and change is one of its features. Technology is constantly changing and evolving due to two important factors, i.e., internal logic of science and technology and economic force (Zade, 1997, 2000). The process of technological innovation is the process of transforming a new idea into goods (product, service) or a new process or fully developed. According to Freeman, innovation is a set of industrial, commercial and technical operations. Therefore, it cannot easily be defined in a simple linear form. Before the 80s, it was thought that innovative models based on a simple linear process were begun with fundamental researches and led to idea creation and finally manufacturing a product or new process. But by doing broader researches and studying innovation process behaviors in different situations more carefully, it was observed some complexities that they can no longer be summarized in a linear process. Therefore, non-linear processes were evaluated; thereby several researchers have attempted to identify the innovation processes. A complex set of activities that turned the ideas and scientific knowledge into physical reality and some applications in the real world. Technological innovation refers to a technology or a new or fully improved technological product which is offered to the market for a commercial transaction.

Literature review: Buede in a research entitled "The Role of Open Innovation Approach on Acquiring TI" have found that identifying, creating and developing a network of industrial and research collaborators using an open innovation approach and TI to observe and monitor technological developments in technology-based organizations and progress in science and technology that has a direct impact on the business scope of these organizations is critical. Then, they concluded that organization strategy has a crucial role in identifying and acquiring a suitable process of TI which organization needs to it in integrating the innovation and idea from outside of the organization with the main advantages within the organization.

Navaaz (2007) have studied the role and impact of TI cycles on the networking between industrial firms, research centers and universities and its barriers. They found that providing a conceptual model for TI activities is associated with theoretical supports and offers a principle based on the design and construction of this issue for social networking in the triple helix of university, government and industry. Yoon in a study entitled "The Development of a Technology Intelligence Tool for Identifying Technology Opportunity, Expert Systems with Applications", aimed at supporting the decisions of managers, researchers and technologists in the technology development planning. One of the important points in this system is that innovative ideas are very important to identify the potential settings of technology which may a market and technology of future regime, though new needs it.

Ahmadi (2006) have studied the technology planning in the transport sector of the UK automotive industry by using map tool. They have identified the strategic technologies of industry and studied the prioritization of issues in 2004. The process of this planning includes six main steps which was conducted to resolve the technological and competitive needs of the automotive industry as well as the creation of value and wealth in the UK road transport sector.

Objectives of the study: According to the descriptions provided in the statement of the problem part and due to the significance of the study, the following objectives are considered in this study which are listed in two parts: the main objective and the secondary objectives. These objectives are as follows:

The main objective: Identifying the impact of TI on the technological planning of the organization.

The secondary objectives:

- Identifying the impact of TI on the technological needs and opportunities assessment
- Identifying the impact of TI on technology acquisition
- Identifying the impact of TI on technology transfer mechanisms
- Identifying the impact of TI on technological innovations
- Identifying the impact of TI on technology strategic planning

MATERIALS AND METHODS

It is a survey-applied research. After researcher's studies and estimations, the size of the population was estimated approximately sixty active managers and experts which is done by the census method; in other words, the entire population was selected as the sample size. This study is done in fieldwork method and Data were gathered through questionnaires and by interviewing with the experts; then, the proper software was used to analyze data. Consistent with studied variables and the type of collecting data, this study has used appropriate indicators of frequency distribution tables, dispersion and central indexes and bar graph to describe them in the descriptive statistics and the Kolmogorov-Smirnov, Pearson correlation coefficient and regression analysis in the inferential statistics.

RESULTS AND DISCUSSION

Descriptive statistics: Table 1-4 shows the descriptive statistics on sex, educational level, position of organization and work experience.

Inferential statistics

Evaluating the research hypotheses

The main hypothesis: There is a significant relationship between TI and the technological planning of the organization.

The null hypothesis: TI has no significant impact on the technological planning of the organization. Since, the variables were quantitative and normality of data was not violated, Pearson correlation coefficient was used to answer to the hypothesis. The results are given in Table 5.

Pearson correlation coefficient results in the table indicate that there is a significant relationship between TI and technological planning ($p<0.05$, $r = 0.862$). The positive correlation means whatever the TI increases, the technological planning will also increase. This finding suggests that the null hypothesis is rejected and the research hypothesis is accepted. So, it can be said that

Table 1: Frequency distributions of respondents based on sex

Sex	Frequency	Percentage
Male	44	44
Female	16	16
Total	60	60

Table 2: Frequency distributions of respondents based on education level

Education level	Frequency	Percentage
Associate	18	30.00
Bachelor	32	53.30
Master and above	10	16.70
Total	60	100.0

Table 3: Frequency distributions of respondents based on the position in the organization

Position	Frequency	Percentage
President	6	10.0
Assistant	8	13.3
Manager	10	16.7
Head of department	11	18.3
Expert	25	41.7
Total	56	100.0

Table 4: Frequency distributions of respondents based on work experience

Work experience (year)	Frequency	Percentage
1-5	15	25.0
6-10	23	38.3
11-15	15	25.0
15 and more	7	11.7
Total	56	100.0

Table 5: Pearson correlation coefficient for the relationship between TI and technological planning

	Technological planning	
Variables	Pearson correlation coefficient	Sig.
TI	0.862	0.001

there is a significant and positive relationship between TI and technological planning in The RAJA rail transportation company.

Sub-hypotheses

Hypothesis one: TI has a significant impact on the technological needs and opportunities assessment.

The null hypothesis: TI has no significant impact on the technological needs and opportunities assessment. Regression analysis was used to answer the above hypothesis, since the variables were quantitative and normality of data was not violated. The TI correlation with technological needs and opportunities assessment was 0.674. Indeed, the level of TI effect on technological needs and opportunities assessment was 4.45 percent. These values were significantly correlated (Table 6).

ANOVA results of the regression sum of squares are shown in Table 7. With regard to $p<0.0001$ and $F = 48.302$ in analyzing the sum of squares in the regression, it can be concluded that the relationship between TI and technological needs and opportunities assessment in the

Table 6: Pearson correlation coefficient for the relationship between TI and technological needs and opportunities assessment

Correlation	χ^2 significance	Sig.
0.674	0.454	0.001

Table 7: ANOVA results of the regression sum of squares

Effects	Sum of squares	Degree of Freedom (DF)	Mean square	F value	Sig.
Regression	14.890	1	14.890	48.302	0.001
Residuals	17.880	58	0.3080		
Total	32.770	59			

Table 8: The regression analysis of TI effect on the technological needs and opportunities assessment

Variables	B values	SE	Beta	T values	Sig.
Constant	2.049	0.265		7.730	0.001
TI	0.514	0.074	0.674	6.950	0.001

Table 9: The correlation coefficient for relationship between TI and technology acquisition

Correlation	χ^2 significance	Sig.
0.778	0.606	0.001

Table 10: ANOVA results of the regression sum of squares

Effects	Sum of squares	Degree of Freedom (DF)	Mean square	F value	Sig.
Regression	22.872	1	22.872	89.170	0.001
Residuals	14.877	58	0.256		
Total	37.748	59			

RAJA rail Transportation Company is significant (the significance level was less than 0.05). The following table shows the results of regression analysis (Table 8).

As it can be seen in the above table, equation of TI effect on technological needs and opportunities assessment is as follows: Technological needs and opportunities assessment = (TI) 0.514+2.049. The results suggest that TI in The RAJA rail Transportation Company has caused the improvement in opportunities assessment and discovering the technological needs.

Hypothesis two: TI has a significant impact on the Technology acquisition in the organization.

The null hypothesis: TI has no significant impact on the Technology acquisition in the organization. Regression analysis was used to answer the above hypothesis, since the variables were quantitative and normality of data was not violated. The TI correlation with technology acquisition was 0.778. In fact, the level of TI effect on technology acquisition was 60.6%. These values were significantly correlated (Table 9). ANOVA results of the regression sum of squares are shown in Table 10.

Since in analyzing the sum of squares in the regression analysis the values of $p<0.0001$ and $F = 89.170$ were obtained, it can be said that the relationship between TI and technology acquisition in The RAJA rail transportation company is significant (the significance

Table 11: The regression analysis of TI effect on the technology acquisition

Variables	B values	SE	Beta	T values	Sig.
Constant	1.380	0.242		5.707	0.001
TI	0.637	0.067	0.778	9.443	0.001

Table 12: The correlation coefficient for relationship between TI and the technology transfer mechanisms

Correlation	χ^2 significance	Sig.
0.778	0.621	0.001

Table 13: ANOVA results of the regression sum of squares

Effects	Sum of squares	Degree of Freedom (DF)	Mean square	F value	Sig.
Regression	26.066	1	26.066	94.978	0.001
Residuals	15.918	58	0.274		
Total	41.983	59			

Table 14: The regression analysis of TI effect on the technology transfer mechanisms

Variables	B values	SE	Beta	T values	Sig.
Constant	1.220	0.250		4.879	0.001
TI	0.680	0.070	0.778	9.746	0.001

level was <0.05). Table 11 shows the results of regression analysis. The results in Table 11 indicate that the equation of TI effect on technology acquisition is as follows: Technological acquisition = (TI) 0.637+1.380. The results suggest that TI in The RAJA rail transportation company has caused the improvement in the process of technology acquisition.

Hypothesis three: TI has a significant impact on the technology transfer mechanisms.

The null hypothesis: TI has no significant impact on the technology transfer mechanisms.Regression analysis was used to answer the above hypothesis. The TI correlation with the technology transfer mechanisms was 0.778. Indeed, the level of TI effect on the technology transfer mechanisms was 62.1%. These values were significantly correlated (Table 12). ANOVA results of the regression sum of squares are shown in Table 13. Since in analyzing the sum of squares in the regression analysis the values of $p<0.001$ and $F = 94.978$ were obtained therefore, the relationship between TI and the technology transfer mechanisms in The RAJA rail transportation company is significant (the significance level was <0.05). The results of regression analysis are given in Table 14.

According to the results in Table 14, the equation of TI effect on the technology transfer mechanisms is as follows: Technology transfer mechanisms = (TI) 0.680+1.220. The results indicate that TI in the RAJA rail transportation company has caused an improvement in the process and the optimum selection of a technology transfer mechanism.

Hypothesis four: TI has a significant impact on the technology innovation.

Table 15: The correlation coefficient for relationship between TI and the technology innovation

Correlation	χ^2significance	Sig.
0.823	0.677	0.001

Table 16: ANOVA results of the regression sum of squares

Effects	Sum of squares	Degree of Freedom (DF)	Mean square	F value	Sig.
Regression	24.251	1	24.251	121.321	0.001
Residuals	11.594	58	0.200		
Total	35.844	59			

Table 17: The regression analysis of TI effect on the technology innovation

Variables	B values	SE	Beta	T values	Sig.
Constant	1.503	0.213		7.044	0.001
TI	0.656	0.060	0.823	11.015	0.001

Table 18: The correlation coefficient for relationship between TI and the technology strategic planning

Correlation	χ^2significance	Sig.
0.862	0.744	0.001

The null hypothesis: TI has no significant impact on the technology innovation. Regression analysis was used to answer the above hypothesis. The TI correlation with the technology innovation was 0.823. Indeed, the level of TI effect on the technology innovation was 67.7%. These values were significantly correlated (Table 15).

Table 16 is given the ANOVA results of the regression sum of squares. Since in analyzing the sum of squares in the regression analysis the values of $p<0.001$ and $F = 121.321$ were obtained; thus, the relationship between TI and the technology innovation in The RAJA rail transportation company is significant (the significance level was <0.05). Table 17 shows the results of regression analysis.

The results of the above table indicate that the equation of TI effect on the technology innovation is as follows: Technology innovation = (TI) 0.656+1.503. The results suggest that TI in the RAJA rail transportation company has caused increased technology innovation.

Hypothesis five: TI has a significant impact on the technology strategic planning of the organization.

The null hypothesis: TI has no significant impact the technology strategic planning of the organization. Regression analysis was used to answer the above hypothesis. The TI correlation with the technology strategic planning was 0.862. Indeed, the level of TI effect on the technology strategic planning was 52.8%. These values were significantly correlated (Table 18).

ANOVA results of the regression sum of squares are shown in Table 19. Since in analyzing the sum of squares in the regression analysis the values of $p<0.001$ and $F = 168.217$ were obtained, it can be said that the

Table 19: ANOVA results of the regression sum of squares

Effects	Sum of squares	Degree of Freedom (DF)	Mean square	F value	Sig.
Regression	23.913	1	23.913	168.217	0.001
Residuals	8.245	58	0.142		
Total	32.158	59			

Table 20: The regression analysis of TI effect on the technology strategic planning

Variables	B values	SE	Beta	T values	Sig.
Constant	1.430	0.180		7.947	0.001
TI	0.651	0.050	0.862	12.970	0.001

relationship between TI and the technology strategic planning in The RAJA rail transportation company is significant (the significance level was <0.05). The results of regression analysis are given in Table 20.

According to the results in Table 20, the equation of TI effect on the technology strategic planning is as follows: Technology strategic planning = (TI) 0.651+1.430. The results indicate that TI in The RAJA rail transportation company has caused an improvement in the technology strategic planning.

CONCLUSION

It can be concluded that TI has a positive and significant impact on the technological planning. In other words, TI has caused the improvement in the technological planning of the organization. With regard to the direct and indirect activities of the TI and its cycle and the previous studies as well as the research questions, it is clarified that accurate and continuous process of TI will lead to the following consequences:

- Better understanding and prediction of procedures and changes in the technology and science and in the broader level foresight for technology
- Increasing the capacity and capability of applying the principles of change management
- More specific and accurately analyzing the results of continuous controlling and monitoring the organization and the information received from the environment and the surrounding market
- Analyzing the market for technologies available at the international level and trying to coordinate with it

SUGGESTIONS

The RAJA rail transportation company would put on its agenda continuous and specialized training on planning concepts and TI for technical personnel at all levels of management and professional. Thereby, it will cause facilitating the process of entering and exiting the technological information into the TI process, developing a precise technological planning; and finally, increasing the power of decision-making at all organizational levels.

It is recommended to study the TI effect on networking technological decision-making between rail transportation companies and academic research centers and its obstacles. Also, a quantitative model should be provided to explain the role of TI cycle in networking the technological decision-makings between rail transportation companies and universities.

The RAJA rail transportation company can empower its technology sector and technological knowledge by establishing specialized sectors of technology in the organization's research and development department (as market analysis sectors, technology research and development, technology assessment, technology archives and technology planning) and by using the educated elites in the field of technology management.

The RAJA rail transportation company can cause practical innovations at the technical level of the organization by optimum use of engineering knowledge in all technological topics and combining it with the investment in order to transform their rail experts ideas and innovations for creating superior technologies in this regard.

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