Journal of Applied Sciences

ISSN 1812-5654

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Applied Sciences 8 (17): 2983-2990, 2008
ISSN 1812-5654

Applying Multi-Criteria Decision Methods and SWOT Factors to Analyze the Role of Information Technology in Industry Development in Iran

[1]Iraj Mahdavi, [2]Hamed Fazlollahtabar, [2]Mohammad Mahdi Paydar and [3]Armaghan Heidarzade
[1]Department of Industrial Engineering, Mazandaran University of Science and Technology, Babol, Iran
[2]Young Researchers Club, Islamic Azad University, Babol Branch, Iran
[3]Department of Industrial Engineering, Payam-e-Noor University, Sari, Iran

Abstract: In this study, the effort has been made to manage IT infrastructure and to support it for IT industry development. Here proposed a framework of IT strategic planning based on SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis which is used for industry development in Iran. The Analytical Hierarchy Procedure (AHP) is applied to quantify the qualitative parameters of SWOT criteria for more effective decision making in IT environment. The TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) method is used to identify the best strategy of developing the industry of Iran by the results gained by AHP method. To validate the proposed framework, a case study of industry in Iran has been illustrated.

Key words: Information technology, industrial development, SWOT analysis, AHP, TOPSIS

INTRODUCTION

The exchange of tacit knowledge is not necessarily confined to face-to-face social interaction as may be the case in the discourse underlying a strategic planning process (Bernroider, 2007) but can be facilitated electronically as well (Newkirka and Ledererb, 2005). From an information processing perspective in industry and economy, the higher uncertainty and complexity associated with multi-nationality increase the amount of information decision makers must process to monitor environmental changes and coordinate tasks between subunits (Hainesa and Leonard, 2007). However, the use of computerized information systems in industries can accommodate these communication needs and support the exchange of unstructured and non-quantifiable soft information. In the dynamic environments surrounding multinational industrial organizations, non-routine responses imposed by uncertain task environments call for more autonomous actions coordinated through mutual adjustment processes. Hence, the central planning as well as autonomous actions are found to be instrumental for achieving superior corporate performance. Computer-based information systems can accommodate the associated exchange of soft and unstructured information and facilitate the required informal communication among managers in multinational subunits of industries and thereby reduce coordination cost (Grovera and Segars, 2004).

Information Technology (IT) has the potential to transform the means by which we learn and access information in two important ways. First, IT enables us to do many of the things we already do faster, more flexibly, more efficiently and with greater access for all. Second, IT enables us to do things that we cannot now do, or to do them in ways that are significantly different. IT makes possible an entirely new environment and experience of learning that goes well beyond the classrooms, curricula and text-based formats to which we are accustomed. Like any other information system, the success of e-learning depends largely on user satisfaction and other factors that will eventually increase users' intention to continue using it.

In the Information Systems (IS) domain, we find a considerable amount of academic research examining the determinants of IT acceptance and utilization among users (e.g., Heo and Han, 2003; Hsu and Chiu, 2004; Shih, 2004). There are some theoretical models that attempt to explain the relations between user attitudes, satisfaction and behavioral intention to use and system usage. Some studies have re-examined the IS success model including service quality as another important antecedent to user satisfaction (e.g., Negash *et al*., 2003; Landrum and Prybutok, 2004).

IT is a key tool in addressing managerial challenges in industries as it facilitates information processing, which may translate to enhanced decision-making (Melville *et al*., 2007). IT enables the storage,

Corresponding Author: Iraj Mahdavi, Department of Industrial Engineering, Mazandaran University of Science and Technology, Babol, Iran

communication and processing of information-a fundamental competency in the information age. It is a General Purpose Technology (GPT), i.e., it is multifunctional, flexible and adaptable and used pervasively in a wide range of sectors. The relevant findings are further confirmed that the investigations of specific IT applications and different industry settings have revealed the benefits of IT in a variety of contexts, including transactional IT in valve manufacturing, inter organizational systems in metals, automation in insurance and computerized reservation systems in the airline industry (Melville *et al*., 2007). Therefore, it's evident that information technology investment is associated with enhanced organizational performance. However, generating productivity gains and sufficient adjustment between IT strategy and business strategy can be difficult and costly to achieve. Empirical studies at the firm level have provided strong evidence of positive and significant returns to IT investment in both the manufacturing and service sectors (Melville *et al*., 2007). For firms in industries undergoing rapid change and fierce competition, the ability to respond quickly and adapt to new business conditions is especially critical challenge. Organizational redesigns may not be adopted uniformly across industries. Some industries may contain a higher proportion of technologically proficiency whereas others may use different type of IT foe different purpose. But it's evident that producing information technology addresses to economy and subsequently, the growth of IT industries is ahead of other economic sectors.

Management scholars have developed additional perspectives that offer insight into how the industry context might shape the productive use of information technology. Totally, the theory of Iranian Industrial Organization is concerned with the interplay among firm behavior, market structure and economic performance. Given the pervasiveness and strategic importance of IT, its economic impact is likely to be shaped by the competitive environment. Thereby, great innovation will be required for firms to remain competitive on a global scale.

It is well recognized that the IT industry is a key driver of economic growth. Given the dynamism of IT, it is mandatory that both the economic and social adaptations be carried out in time to be worthwhile. This is why it is critical for policy makers to detect emerging trends in the IT industry and not be surprised by technological changes. Although, a domestic industry's growth potential rest on the existence of the favorable condition in several areas. These include communication, software, IT infrastructure and the research and development environment. IT environment combines scale and quality in the key areas that promote competitiveness including education, infrastructure, encouragement of innovation and industry growth potential. Developing in software and services represents the best chance of moving up the index table. The more IT services, the better to domestic industry and labor productivity growth. In this new environment, IT employee will require expertise in project management, change management and business analysis among other areas. Moreover, encouraging widespread technology adoption, providing strategic direction for the educational system and also by spending wisely on IT and R&D, the competitiveness of IT industry can be improved. Effective planning should go some way to reduce the current gap between output and expectation from IT investment.

In this study, initially an outline of the SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is described and then SWOT factors in Iranian industry is discussed. AHP method is applied for decision making about varied strategies of developing industries based on SWOT analysis and TOPSIS method is used to identify the ranking of the strategies accompanied with a case study.

THE SWOT ANALYSIS

SWOT analysis has proved to be an effective tool and has constituted a suitable baseline to diagnose current problems and to sketch future action lines. However, pinpointing SWOT factors is too often imprecise listing or an incomplete qualitative examination of factors. Thus, this gives rise to the need of more efficient use of SWOT (Stewart, 2007). The multi-criteria methods are considered the most appropriate analytical method for development of a method with SWOT (Yu *et al*., 2002). SWOT analysis has resulted in a successful tool when experts' discussion and interaction is needed and a set of strategies should be agreed upon. This activity is important because it defines the way the organizations are managed and the criteria under which strategies are evaluated.

SWOT analysis is a commonly used tool for analyzing internal and external environments in order to attain a systematic approach and support for a design situation. There is no standard list of factors that apply for all construction organizations because of the specificity of each set. However, strengths tend to relate to the competitive advantages and other distinguishing competencies, which can be exploited by the organization on the market. Weaknesses are limitations which hinder the process of an organization in a certain direction. Opportunities relate, for example, to the technology enabled advantages that can be obtained by the uptake of IT. Threats relate to an array of macroscopic and

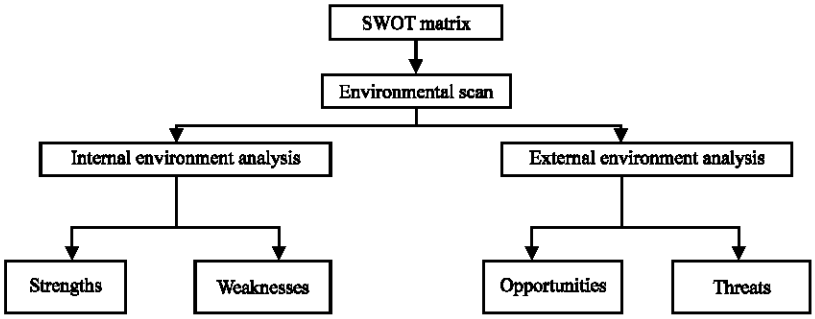

Fig. 1: Environmental SWOT analysis

microscopic problems that exist or may arise which can potentially jeopardize the successful implementation of proposed IT projects.

If used correctly, SWOT can provide a good basis for successful IT implementation strategy formulation. When undertaking SWOT, the analysis lacks the possibility of comprehensively appraising the strategic decision-making situation; merely pinpointing the number of factors in strength, weakness, opportunity or threat groups (Djamasbi and Stronga, 2007). In addition, SWOT includes no means of analytically determining the importance of factors or of assessing the fit between SWOT factors and decision alternatives. Thus, it can be concluded that the result of SWOT analysis is too often only a superficial and imprecise listing or an incomplete qualitative examination of internal and external factors.

Swot factors: Central to this step is the incorporation of the scale of values of the corporate management of the organization (e.g., objectives, perceptions, beliefs and challenges). This activity is important because it defines the way the organization is managed and the criteria under which strategies are evaluated. Keeping in mind the scale of values of the organization's corporate management, the industry needs to undertake an external and internal analysis. The former examines the environment in which the organization is participating to study the potential opportunities and threats whereas the latter identifies the weaknesses and strengths of the organization. Combining the results of the external and internal analysis and taking into account the scale of values, the Strengths, Weaknesses, Opportunities and Threats (SWOT) factors are identified. Figure 1 represents an environmental SWOT analysis.

External environment analysis: The changing business environment and increased IT capabilities are translating into more focused emphasis on strategic integration. Increased global competition on one hand and availability of communication-tools on the other, have enhanced\ opportunities for design and construction organizations to establish joint ventures, partnering and long term relationships with clients and/or suppliers. Also, integrations between planning, design and construction organizations are gaining increased attention from practitioners and researchers alike focusing upon increased productivity and improved quality of construction. Therefore, the main purpose of this analysis is to identify IT enabled integration and alliancing opportunities/threats. It is not sufficient though to concentrate the external analysis at the macroscopic level of the industry alone. This is because even at the microscopic level of construction projects, IT spending has grown rapidly with operations and maintenance costs dominating the budget. In addition, an external analysis can capture the dynamic nature of project participants in a large-scale construction project. To better understand the relationship of all components of an IT strategy on construction projects and within strategic business units of an organization, it is helpful to examine the strategy in a systematic way, looking at the various investments and the tangible as well as intangible returns from these investments.

Internal environment analysis: Several researchers have articulated the need to consider how the internal organizational environment is determinant of the strategic IT implementation planning process. For example, the organization's corporate culture can facilitate its strategic IT planning by being congruent with it. The organization's planning and control style, is perhaps in part a function of corporate culture, similarly influences strategic IT implementation planning. Likewise, organizational size, organizational structure (mechanistic vs. organic) and management style (entrepreneurial vs. conservative) may influence strategic IT implementation planning. The primary role of the internal analysis is to identify the weaknesses and strengths of the organization.

Responding to the internal strengths and weaknesses is therefore an essential component of the strategic management process. By collating all the opportunities and threats obtained through external analysis, combined with strengths and weaknesses obtained through internal analysis the organization can undertake SWOT analysis as explained below.

THE QUANTIFICATION APPROACHES

The AHP method: The AHP method is used to face complex decision-making problems which is one of the main techniques for the Multi-Attributes Decision Making (MADM). The AHP is deemed the most appropriate analytical method for development of SWOT. AHP is an effective tool in structuring and modeling multi-criteria problems and has been successfully used in a variety of construction management applications (Hasemana *et al*., 2004). Fundamentally, AHP works by developing priorities for goals in order to value different alternatives. This multi-criteria method has become very popular among operational researchers and decision scientists. The idea in utilizing AHP within a SWOT framework is to systematically evaluate SWOT factors and commensurate their intensities, adding value to SWOT analysis. This value can be achieved by pair wise comparison between SWOT factors. This offers a good basis for examining the present or anticipated situation more comprehensively. After carrying out these comparisons, decision-makers will have quantitative information about the decision making situation; for example, whether there is a specific weakness requiring all the attention, or if the organization is expected to be faced with future threats exceeding the organization's combined opportunities. The overall hierarchical procedure for SWOT analysis is shown in Fig. 2.

The selection of the strategy is based on the qualitative criteria on each strategy. To achieve this, we had to transform the qualitative criteria to numerical values based on the preferences of the decision maker (Table 1).

We applied AHP method to identify the weights for strengths, weaknesses, opportunities and threats. The notations that we used in this paper are as follows:

Notations:

S_i : The i-th strength ($i = 1, 2, ..., m$)
W_j : The j-th weakness ($j = 1, 2, ..., n$)
O_k : The k-th opportunity ($k = 1, 2, ..., q$)
T_l : The l-th threat ($l = 1, 2, ..., r$)
ST_c : The c-th strategy ($c = 1, 2, ..., p$)
W_{Si} : The i-th strength weight
W_{Wj} : The j-th weakness weight
W_{Ok} : The k-th opportunity weight
W_{Tl} : The l-th threat weight
A_{bc} : Numerical value for the strategy preference
B_{de} : Numerical value for the attractiveness score

Table 1: Strategy preferences with their numerical values

Preferences	Numerical value
Extremely preferred	9
Very strongly preferred	7
Strongly preferred	5
Moderately preferred	3
Equally preferred	1
Preferences among the above preferences	2, 4, 6, 8

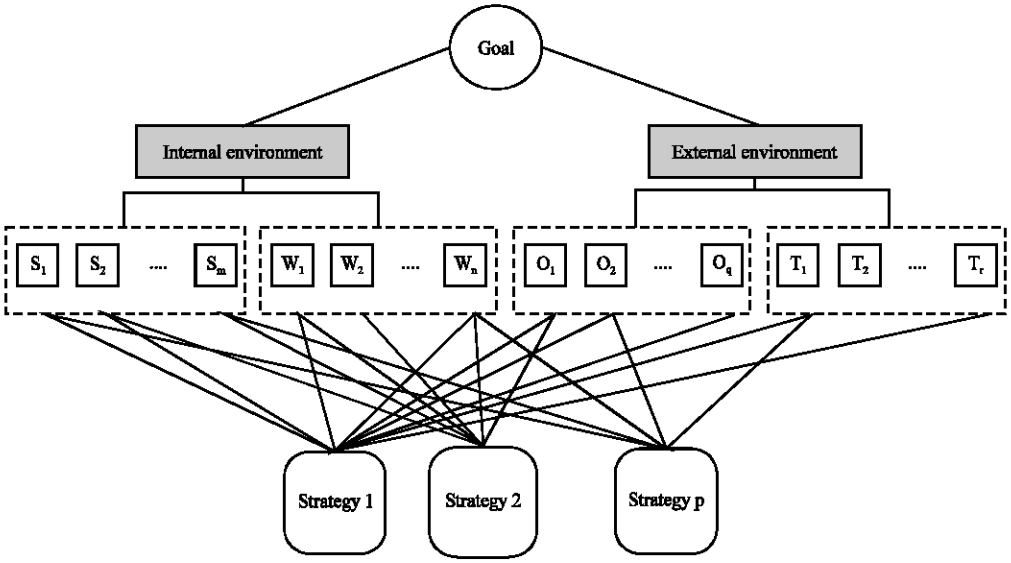

Fig. 2: The overall hierarchical procedure for SWOT analysis

After that the pair-wise comparison matrix to strengths is configured as follows (Table 2):

The pair-wise comparison matrix to weaknesses, opportunities, threats are as same as the preceding matrix.

Now the weight of each criterion by the pair-wise comparison matrixes has been calculated, i.e., W_{Si}, W_{Wj}, W_{Ok}, W_{Tl} have been achieved.

After that the TOPSIS method is applied to determine the best strategy. The TOPSIS method is described in next section.

The TOPSIS method: TOPSIS, known as one of a classical MADM method, has been developed for solving the MADM problems. The basic principle of the TOPSIS is that the chosen alternative should have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution. The TOPSIS introduces two reference points, but it does not consider the relative importance of the distances from these points.

To choose the best strategy by TOPSIS method we use the attractiveness scores matrix. The attractiveness scores are the numerical values which present the attractiveness of any strategies in a set of strategies that is shown in Table 4. The required data to fill the following matrix is based on Table 3.

Table 2: Pair-wise comparison for strengths

	S_i			
S_i	S_1	S_2	…	S_m
S_1	1	$A_{S1\,S2}$	…	$A_{S1\,Sm}$
S_2	$1/A_{S1\,S2}$	1	…	A_{S2Sm}
…	…	…	1	…
S_m	$1/A_{S1\,Sm}$	$1/A_{S2Sm}$	…	1

Table 3: The attractiveness scores

Preferences	Numerical value
Not accepted	1
Could be accepted	2
Probably accepted	3
Accepted	4
No relationship	-

The weighted attractiveness score matrix is achieved based on the following equations that are shown in Table 5.

$$WB_{ST_cS_m} = W_{S_m} \times B_{ST_cS_m}$$
$$WB_{ST_cW_n} = W_{W_n} \times B_{ST_cW_n}$$
$$WB_{ST_cO_q} = W_{O_q} \times B_{ST_cO_q}$$
$$WB_{ST_cT_r} = W_{T_r} \times B_{ST_cT_r}$$

In Table 5 in each column the best and the worst strategies are selected by the following equations.

$$\text{Best-Strategy} = \left\{\text{Max } WB_{ef};\quad e = ST_1,...,ST_p,\quad f \in J\right\} = \left\{r_f^*;\quad f \in J\right\}$$

$$\text{Worst-Strategy} = \left\{\text{Min } WB_{ef};\quad e = ST_1...ST_p,\quad f \in J\right\} = \left\{r_f^-;\quad f \in J\right\}$$

where, $J = \{S_1,...,S_m, W_1,...,W_n, O_1,...,O_q, T_1,...,T_r\}$.

The separation measure, using the n-dimensional Euclidean distance, is calculated. The separation of each strategy from the best-strategy is given by:

$$d_e^+ = \left\{\sum_{f\in J}\left(WB_{ef} - r_f^*\right)^2\right\}^{\frac{1}{2}}, \qquad e = ST_1,...,ST_p.$$

Similarly, the separation from the worst-strategy is given by:

$$d_e^- = \left\{\sum_{f\in J}\left(WB_{ef} - r_f^-\right)^2\right\}^{\frac{1}{2}}, \qquad e = ST_1,...,ST_p.$$

The relative closeness to the best-strategy then is calculated. The relative closeness of strategy ST_c (CC_e) with respect to the best-strategy is defined by:

Table 4: The attractiveness score matrix

	S_i			W_j			O_k			T_l		
ST_c	S_1	…	S_m	W_1	…	W_n	O_1	…	O_q	T_1	…	T_r
ST_1	$B_{ST1\,S1}$	…	$B_{ST1\,Sm}$	$B_{ST1\,W1}$	…	$B_{ST1\,Wn}$	$B_{ST1\,O1}$	…	$B_{ST1\,Oq}$	$B_{ST1\,T1}$	…	$B_{ST1\,Tr}$
ST_2	B_{ST2S1}	…	$B_{ST2\,Sm}$	$B_{ST2\,W1}$	…	$B_{ST1\,Wn}$	$B_{ST2\,O1}$	…	$B_{ST2\,Oq}$	B_{ST2T1}	…	$B_{ST2\,Tr}$
…	…	…	…	…	…	…	…	…	…	…	…	…
ST_p	$B_{STp\,S1}$	…	$B_{STp\,Sm}$	$B_{STp\,W1}$	…	$B_{STp\,Wn}$	$B_{STp\,O1}$	…	$B_{STp\,Oq}$	$B_{STp\,T1}$	…	$B_{ST2\,Tr}$

Table 5: The weighted attractiveness score matrix

	S_i			W_j			O_k			T_l		
ST_c	S_1	…	S_m	W_1	…	W_n	O_1	…	O_q	T_1	…	T_r
ST_1	$WB_{ST1\,S1}$	…	$WB_{ST1\,Sm}$	$WB_{ST1\,W1}$	…	$WB_{ST1\,Wn}$	$WB_{ST1\,O1}$	…	$WB_{ST1\,Oq}$	$WB_{ST1\,T1}$	…	$WB_{ST1\,Tr}$
ST_2	WB_{ST2S1}	…	$WB_{ST2\,Sm}$	$WB_{ST2\,W1}$	…	$WB_{ST1\,Wn}$	$WB_{ST2\,O1}$	…	$WB_{ST2\,Oq}$	WB_{ST2T1}	…	$WB_{ST2\,Tr}$
…	…	…	…	…	…	…	…	…	…	…	…	…
ST_p	$WB_{STp\,S1}$	…	$WB_{STp\,Sm}$	$WB_{STp\,W1}$	…	$WB_{STp\,Wn}$	$WB_{STp\,O1}$	…	$WB_{STp\,Oq}$	$WB_{STp\,T1}$	…	$WB_{ST2\,Tr}$

$$CC_e = \frac{d_e^-}{d_e^- + d_e^+}, \qquad e = ST_1,...,ST_p.$$

Since $d_e^- \geq 0$ and $d_e^+ \geq 0$, then clearly, $CC_e \in [0, 1]$.

Rank the preference order. For ranking strategy using this index, we can rank strategy in decreasing order.

CASE STUDY

A project of developing industry in Iran is proposed. Managerial decision is concerning about selecting the best strategy among four strategies that are possible to implement (Nguyen, 2005). Here use proposed model to judge which strategy is better. To implement the survey, some generated data have been used. The SWOT matrix of industry in Iran is given in Table 6. The matrix is outlining the IT role in Iran.

Based on the above SWOT matrix the following strategies could be proposed to develop Iranian industries:

- Establishing an integrated information system to facilitate data transfer among industrial segments. (S_3, S_4, W_1, W_4, O_2, O_3, T_3)
- The consolidated link between universities, industries and technology production. (S_2, W_3, O_1, O_4, T_3)
- Entering modern information technologies in industry from developed countries to Iran. (S_1, W_2, T_1, T_2)
- Investing on educating human work force with modern methods in various industries. (S_2, W_3, O_4, T_1)

The Table 7-10 indicate the results of the survey:

EXPERT CHOICE software has been applied to analyze the preceding tables and the following Figures (Fig. 3, 4) are resulted which indicate the weights of the criteria.

The following results are yielded based on Table 11 and 12 to select the best strategy using TOPSIS method.

Best-Strategy = [0.73, 0.2, 0.96, 0.29, 0.9, 0.49, 0.75, 0.96, 0.77, 0.24, 0.14, 0.38, 0.58, 0.52, 0.33, 0]

Worst-Strategy = [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0].

The distance from the Best-Strategy and from the Worst-Strategy and also the relative closeness is represented in Table 13.

Table 6: SWOT matrix

Strengths

S_1: The most up-to-date facilities in configuring industries
S_2: The well educated employees
S_3: Flexible management by adopting new strategies
S_4: The strong link between industry and market

Opportunities

O_1: Paying attention to research projects in industries
O_2: Special attention to software revolution in industries
O_3: International communication growth with lower costs
O_4: Establishing R&D centers in industries

Weaknesses

W_1: Concentration of industries in specific points
W_2: Using traditional method in industry
W_3: Loss of relationship between industry and IT educational centers
W_4: Lack of integrated information and statistics within industrial domains

Threats

T_1: Lack of investment and economic stagnation
T_2: Existence of nonproductive and noncompetitive activities in Iran
T_3: No attention to scientific findings in industries
T_4: Irrelevance of educational system of Iran with industries and technologies requirements

Table 7: Pair-wise comparison for strengths

	S_i			
S_i	S_1	S_2	S_3	S_4
S_1	1	3	1	2
S_2	1/3	1	1/4	1/3
S_3	1	4	1	4
S_4	1/2	3	1/4	1

Table 8: Pair-wise comparison for weaknesses

	W_j			
W_i	W_1	W_2	W_3	W_4
W_1	1	1/4	2	¼
W_2	4	1	5	1/3
W_3	1/2	1/5	1	1/8
W_4	4	3	8	1

Table 9: Pair-wise comparison for opportunities

	O_k			
O_k	O_1	O_2	O_3	O_4
O_1	1	5	4	3
O_2	1/5	1	3	1
O_3	1/4	1/3	1	1/4
O_4	1/3	1	4	1

Table 10: Pair-wise comparison for threats

	T_l			
T_l	T_1	T_2	T_3	T_4
T_1	1	1/3	3	3
T_2	3	1	2	5
T_3	1/3	1/2	1	2
T_4	1/3	1/5	1/2	1

According to the relative closeness (CC_e), the best strategy is ST_1 and the ranking order is shown in Table 13. Therefore, strategy 1 provides more benefit for implementations.

Fig. 3: The weights of strengths and weaknesses

Fig. 4: The weights of opportunities and threats

Table 11: The attractiveness score matrix

	S_i				W_j				O_k				T_l			
ST_c	S_1	S_2	S_3	S_4	W_1	W_2	W_3	W_4	O_1	O_2	O_3	O_4	T_1	T_2	T_3	T_4
ST_1	-	-	4	3	2	-	-	3	-	3	4	-	-	-	3	-
ST_2	-	4	-	-	-	-	4	-	3	-	-	3	-	-	4	-
ST_3	4	-	-	-	-	4	-	-	-	-	-	-	-	2	4	-
ST_4	-	3	-	-	-	-	3	-	-	-	-	4	4	-	-	-

Table 12: The weighted attractiveness score matrix

	S_i				W_j				O_k				T_l			
ST_c	S_1	S_2	S_3	S_4	W_1	W_2	W_3	W_4	O_1	O_2	O_3	O_4	T_1	T_2	T_3	T_4
ST_1	0	0	0.96	0.29	0.9	0	0	0.96	0	0.24	0.14	0	0	0	0.25	0
ST_2	0	0.2	0	0	0	0	0.1	0	0.77	0	0	0.29	0	0	0.33	0
ST_3	0.73	0	0	0	0	0.49	0	0	0	0	0	0	0	0.52	0.33	0
ST_4	0	0.15	0	0	0	0	0.75	0	0	0	0	0.38	0.58	0	0	0

Table 13: Values of d_e^+, d_e^- and CC_e

ST_c	d_e^+	d_e^-	CC_e	Rank
ST_1	2.7130	2.8770	0.5147	1
ST_2	4.6249	0.8359	0.1528	4
ST_3	4.4907	1.1523	0.2042	2
ST_4	4.5622	1.0658	0.1894	3

CONCLUSIONS

Organizations are investing substantial funds into IT as they aim to re-engineer traditional business processes and add value to their economic growth. Information Technology (IT) has the potential to transform the means by which we learn and access information in various ways. Industrial effects of information technology are a significant factor in the process of strategic decision making for policy makers in industrial domains.

In this study, we have discussed how the AHP and TOPSIS approaches can support the strategic IT implementation based on SWOT factors. AHP method is applied to identify the weights of the criteria and TOPSIS method is used to transform the results obtained by AHP to the weights of the strategies. As a matter of fact, the key areas for developing industry in Iran as a hierarchical structure have been foresighted. At the end we have illustrated a case study for the applicability of the proposed model. The consequences of the case study indicate the effectiveness of the proposed model by utilizing the financial resources and time as an important element in managerial decisions.

ACKNOWLEDGMENT

The second author appreciates Mazandaran Telecommunication Research Center for supporting this research.

REFERENCES

Bernroider, E.W.N., 2007. IT governance for enterprise resource planning supported by the DeLone-McLean model of information systems success. Inform. Manage., 45: 257-269.

Djamasbi, S. and D.M. Stronga, 2007. The effect of positive mood on intention to use computerized decision aids. Inform. Manage., 45: 43-51.

Grovera, V. and A.H. Segars, 2004. An empirical evaluation of stages of strategic information systems planning: Patterns of process design and effectiveness. Inform. Manage., 42: 761-779.

Hainesa, R. and L.N.K. Leonard, 2007. Situational influences on ethical decision-making in an IT context. Inform. Manage., 44: 313-320.

Hasemana, W.D., D.L. Nazaretha and S. Paul, 2004. Implementation of a group decision support system utilizing collective memory. Inform. Manage., 42: 591-605.

Heo, J. and I. Han, 2003. Performance measure of information systems (IS) in evolving computing environments: An empirical investigation. Inform. Manage., 40: 243-256.

Hsu, M. and C. Chiu, 2004. Internet self-efficacy and electronic service acceptance. Decision Support Syst., 38: 369-381.

Landrum, H. and V.R. Prybutok, 2004. A service quality and success model for the information service industry. Eur. J. Operat. Res., 156: 628-642.

Melville, N., V. Gurbaxani and K. Kraemer, 2007. The productivity impact of information technology across competitive regimes: The role of industry concentration and dynamism. Decision Support Syst., 43: 229-242.

Negash, S., T. Ryan and M. Igbaria, 2003. Quality and effectiveness in Webbased customer support systems. Inform. Manage., 40: 757-768.

Newkirka, H.E. and A.L. Ledererb, 2005. The effectiveness of strategic information systems planning under environmental uncertainty. Inform. Manage., 43: 481-501.

Nguyen, T.N., 2005. A decision model for managing software development projects. Inform. Manage., 43: 63-75.

Shih, H., 2004. Extended technology acceptance model of Internet utilization behavior. Inform. Manage., 41: 719-729.

Stewart, R., 2007. A framework for the life cycle management of information technology projects: Project IT. Int. J. Project Manage., 26: 203-212.

Yu, H.C., Z.Y. Lee and S.C. Chang, 2002. Using a fuzzy multi-criteria decision making approach to evaluate alternative licensing mechanisms. Inform. Manage., 43: 517-531.