

Assessing the Impact of Information Technology on Organizational Agility in South Khorasan Province (I.R.IRAN)



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Abstract: Organizational agility is one of the management concepts associated with business activities in the twenty-first century. Organizational agility along with other management theories plays a key role in the success of companies in turbulent market environments. In this regard, information technology effect on the agility of organizations and has a fundamental role in understanding and reacting to the environment. In this research, the relationship between information technology and the organizational agility was investigated in several organizations (regional water company, urban water and wastewater company, rural water and wastewater company, electricity distribution department and agricultural jihad organization) in South Khorasan province, Iran. The random sampling method was used and the population of the case study consisted of 300 people (60 questionnaires from each of the departments). The used questionnaire consists of two sections; the first part is used to measure the use of information technology in organizations, and the second part evaluated various organizational agility capabilities (speed, competence, accountability and flexibility). The collected data were analyzed using SPSS software. The results of the research showed the highest impact of information technology on speed, competence and accountability in agricultural jihad organization and on flexibility in regional water organization. In general, it can be said that the average impact of information technology on agility indicators in all organizations is almost in average range. This indicates the positive impact of information technology on the agility of the studied organizations and it is expected that the mechanized and intelligent systems be replaced with traditional systems in the future.

Keywords : Organizational agility, Impact of Information Technology, Information Production, Information Transmission

I. INTRODUCTION

Civilization has already reached the age of Information Technology (IT). The information technology including

internet, e-government and e-commerce have made a fundamental change in communication and information transfer processes. The expansion of technology and the growing new technologies have made competition in providing services and products for customer satisfaction. Providing different services according to needs and expectations in the shortest time with the least cost is necessary to become successful in technology markets. In these circumstances, only organizations which have such capabilities can survive in competitive markets. Reaching these capabilities depends on the type of organizational structure and its flexibility. Organizational structure defines organizational activities and organizes activities among personnel. The organizational structure leads to achieve high efficiency in performing activities in the organization. It is one of the important factors influencing the organizational agility which is an important capability to change or adapt in response to changes in the market. Organizational agility refers to the ability of an organization to adapt in response to changes and to use emerging opportunities arising from the changes in market [1]. An important feature of a proper system is the rapidity and flexibility in dealing with environmental changes and responding predicted and unpredicted changes [2]. Organizational structure is defined by appointing personnel to different jobs in the organizational chart. Different tasks for are determined to achieve the goal of the system. These tasks are determined, controlled and coordinated based on the interaction between the members [3]. In other words, organizational agility is the ability to generate the information needed to make decisions in a turbulent environment [4]. In order to equip organizations with IT, considerable resources are spent on equipping, designing and maintaining information systems in the form of hardware, software and personnel training. Based on these processes, it is expected that providing such equipment and information technology systems as well as the costs of training staff will improve the organizational agility. Organizations are inevitably faced with rapid, sudden and dynamic changes. Dynamic environments create challenges for organizations in achieving their goals [5,6]. Management experts have proposed a series of new approaches called organizational developments to achieve and maintain competitiveness in a turbulent environment [7].

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In these circumstances, identification of organizational facts is not practical and many experts have been interpreted this circumstances with the concept of a paradigm [7-11]. The paradigm concept rather than focusing on a particular period at a particular time, considers a continuous and sustained process. In today's world, competition is debated in a variety of aspects. Many factors effect on organizational competition including delivery speed in providing products or customer service, product or service quality and price. Worldwide manufacturers are trying to deliver high-quality products with maximum speed, so steps should be taken to improve agility in supply chain. In this regard, organizations should focus on production and fast information distribution. Organizations should be designed in an agile manner to respond to a set of internal and external forces [12]. The great rate of change, increased levels of competition and change in the field of competition has led organizations to create more opportunities and make more appropriate strategies in order to better understanding of internal and external environments. Information technology helps to make changes in organizations, which are mainly changes in the nature of work, the integration of organizational tasks and transformation of competitive forces. In recent years, one of the most prevalent attitudes has been to make changes in the business of organizations and to increase the speed of responding to interactions and environmental changes. The use of information technology serves as a facilitator for this attitude. In order to study the nature and rate of usage of IT, various researches have been done on the adoption and acceptance of computers and the contribution of technology to competitiveness of organizations in developed countries [13]. According to the above mentioned issue, this research evaluates technology usage rates and examines the impact of information technology on speed, competence, responsiveness and flexibility abilities in organizational agility concept.

II. MATERIAL AND METHODS

A. The Concept of Organizational Agility

In the early 1990s, a new solution called agility was presented for the management of organizations that have a dynamic and variable environment [14]. In this regard, Goldman, Nagel and Preiss (1995) [15] conducted an investigation into agility that expressed the following benefits for an organization:

1. Shortening the time from concept to sales, while time is a key competitive factor;
2. Gaining leadership at the subsequent price and benefits;
3. Increase in people's productivity and higher employee morale;
4. Increasing customer satisfaction and thus increasing market share;
5. A better use of assets that will result in less needed capital;
6. A more competitive environment and moving ahead of the rivals;

7. A clear distinction between companies and their rivals.

Since then, agility has been introduced as a relatively new concept in business [16, 17], and has been discussed as a way of gaining competitive advantage and improving innovation capabilities [16-18]. Gunasekaran(1999) proposed the use of information systems for agile manufacturing and the use of Decision Support Systems (DSS) to plan and control inventories like material requirements planning, product design, resource planning and production scheduling [19].

Ren et al. (2000) found that some of the competitive basis such as speed, proactivity and flexibility has the most impact on the competition. This study showed that among the relationships between agility and competitive aspects, the highest values are between the following components: strategic relationship with customers and speed, quality during lifetime and cost, value added product and quality, the first right decision and innovation, organizational coherence and flexibility, the speed of participation and prediction.

Among the results, the strategic relationship with the customer had the greatest weight [20]. Mondragon et al (2004) in a research entitled "Assessing the value of information systems in supporting agility in high-tech manufacturing enterprises" introduced the information systems as an important factor in enhancing the agility of manufacturing organizations [21]. Li et al. (2006) in a study showed that timely information sharing through improving the stability and performance of the production chain would enhance the organizational agility [22].

B. The Role of Information Technology in Organizational Agility

The main feature of today's issues is the magnitude and extent of data and information that should be collected, maintained, produced, processed, retrieved and analyzed. Today, experts point to information as the most important feature of the modern world. Despite the relatively short record of information technology, various definitions and perceptions have been presented about IT which a careful look indicates inconsistencies between these perceptions [23]. More than 90% of senior managers believe that information technology leads to innovation [24,25] and contributes to creating value for the business and eventually creating value for stakeholders [26].

Therefore, it can be said that those organizations that coordinate themselves with the realities and requirements of IT will succeed in future. Frayret et al. argued that information technology has applications in Enterprise Resource Planning (ERP), and communications by agile manufacturing reduce time and improve product design and development [27,28]. Chung et al. indicate a high degree of convergence between IT infrastructure agility and strategic coordination of information and business technology. They concluded that the information technology strategy should have a high degree of organizational strategy so that information technology infrastructure can facilitate organizational agility [29].

Hismanoğlu has defined information technology to multimedia technologies such as computers, software, Internet, telephone, television, Internet projects, e-mail, blogs, satellites, etc. [30]. The IT infrastructure agility helps companies to develop new processes and applications and thus realize organizational agility [31-36]. But today's changes are at a much higher rate than ever [5,6,37]. Turbulence and uncertainty in the business environment are the main cause of failure in manufacturing industry [5,38]. The radical trend of changes has prepared the environment for the emergence of new businesses superior to its traditional types such as mass production and lean manufacturing [39]. Literature review showed that different studies have been performed on agile manufacturing [40-48], organizational strategic agility [49-50], supply chain agility [51-53] and the effect of IT on organizational agility [54-55].

III. METHODOLOGY

In order to evaluate the role of information technology on organizational agility the questionnaire analysis were used. This research was carried out at the level of all employees of regional, urban and rural water companies, power distribution company and agricultural Jihad organization of South Khorasan Province (Located in Iran). After preparing questionnaire, 350 questionnaires were completed among the employees of the mentioned companies. Then, the initial analysis and categorization of the questionnaire were done and 300 questionnaires were selected for statistical analysis. The questionnaire of this research consists of two parts: the first part is related to the rate of people's use of information technology in organizations, and the second part is related to evaluate the various indicators of organization's agility including speed, competency, accountability and flexibility. In order to analyze the results, five hypotheses were considered for the statistical evaluation as follows:

- The rate of employee's use of IT is high.
- Information technology has a positive impact on the capability of speed in organizational agility.
- Information technology has a positive impact on the capability of competency in organizational agility.
- Information technology has a positive impact on the capability of accountability in organizational agility.
- Information technology has a positive impact on the capability of flexibility in organizational agility.

IV. RESULTS

The results obtained by questionnaires were analyzed using SPSS v18 software. The normality test was first used. This test was based on the maximum correlation between observational values and its probability distribution at 95% confidence level. The results of this test have been presented in Figure 1. As seen in this figure, the obtained data set is normal and it can be used for statistical analysis.

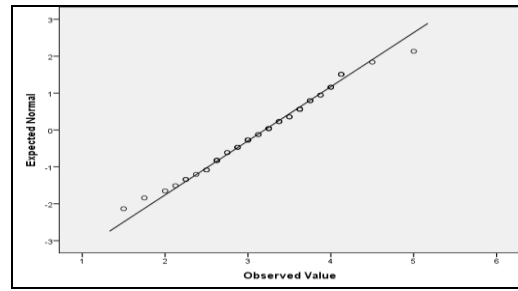


Fig 1. Normality Test of Questionnaire Data

In this regard, *T* test was used to establish the normality hypothesis. Regarding the number of recorded data, Kolmogorov-Smirnov test was used. The results have been presented in Tables I to IV. Results indicate that the normality of each agility indicator with regard to P -value > 0.05 condition is accepted.

Table I. Results of Normality Test for the Capability of Speed in Organizational Agility

Parameter	Kolmogorov-Smirnov Test		
	Statistic	dF	P-Value
Organization			
Regional Water	0.139	60	0.05
Rural Water and Wastewater	0.162	60	0.09
Urban Water and Wastewater	0.141	60	0.10
Agricultural Jihad	0.097	60	0.20
Electricity Office	0.143	60	0.06

Table II. Results of Normality Test for the Capability of Competency in Organizational Agility

Parameter	Kolmogorov-Smirnov Test		
	Statistic	dF	P-Value
Organization			
Regional Water	0.163	60	0.06
Rural Water and Wastewater	0.081	60	0.20
Urban Water and Wastewater	0.105	60	0.09
Agricultural Jihad	0.090	60	0.20
Electricity Office	0.125	60	0.06

Table III. Results of Normality Test for the Capability of Accountability in Organizational Agility

Parameter	Kolmogorov-Smirnov Test		
	Statistic	dF	P-Value
Organization			
Regional Water	0.114	60	0.05
Rural Water and Wastewater	0.115	60	0.07
Urban Water and Wastewater	0.089	60	0.20
Agricultural Jihad	0.134	60	0.09
Electricity Office	0.149	60	0.10

Table IV. Results of Normality Test for the Capability of Flexibility in Organizational Agility

Parameter	Kolmogorov-Smirnov Test		
	Statistic	dF	P-Value
Organization			
Regional Water	0.120	60	0.13
Rural Water and Wastewater	0.067	60	0.20
Urban Water and Wastewater	0.082	60	0.20

Agricultural Jihad	0.115	60	0.08
Electricity Office	0.147	60	0.09

The frequency of respondents' gender in all organizations indicates that 63% of them are male and 37% of them are female (Table V).

Table V. Frequency Distribution of Respondents' Gender

Gender	Number	Average	Standard Deviation
Male	193	2.98	1.416
Female	107	3.03	1.424
Sum	300	3.00	1.417

The rate of employee's use of information technology with regard to their age was investigated in seven categories separately. The value of Test was assumed as 3.5 (test value=3.5), and since the value of 3 is the average level, this value and more values indicate that the employee's use is higher than the average. The results have been presented in Table (VI).

Table VI. Employee's Use of Information Technology with Regard to their Age

Age	Internet Portal	Web-based System	Database	MIS	External Relationship	Internet	Mechanized System
Average 25 years or less	3.50	3.88	3.50	3.12	3.25	3.87	3.50
Standard Deviation	1.06	0.99	1.06	1.24	1.16	0.99	0.92
Average 26-30	3.51	3.47	3.02	2.95	3.17	3.53	3.21
Standard Deviation	1.17	1.06	1.05	1.08	1.00	1.12	0.93
Average 31-35	3.35	3.19	3.05	2.70	3.06	3.62	3.32
Standard Deviation	1.02	1.12	0.96	1.08	1.11	1.07	0.94
Average 36-40	3.51	3.33	3.13	3.08	3.25	3.63	3.48
Standard Deviation	0.91	0.89	0.93	0.88	0.89	0.99	0.78
Average 41-45	3.38	3.44	3.13	3.13	3.28	3.53	3.35
Standard Deviation	0.96	0.96	1.03	1.03	1.07	1.03	1.041
Average 46-50	2.82	2.82	3.09	3.00	2.63	3.45	3.36
Standard Deviation	0.98	0.98	1.04	1.18	1.02	1.12	0.50
Average 51 or greater	3.29	3.14	3.14	2.85	3.42	4.00	3.57

Standard Deviation	0.75	0.90	0.90	1.06	0.78	0.81	0.78
Total	3.41	3.31	3.10	2.94	3.16	3.61	3.36
Standard Deviation	1.00	1.02	0.97	1.03	1.02	1.04	0.89

The obtained results indicate that:

- The highest use of Internet portals is among the age group of 26-30 years and 36-40 years with statistically significant relationship and the lowest use is among the age group of 46-50 years.
- The highest and lowest use of web-based system is for the age group of below 25 years and 46-50 years. This relationship is statistically significant.
- The employee's use of databases, management information systems and external communications are less than determined default, and this relationship is not statistically significant.
- The highest use of Internet and mechanized systems is for the age group of 51 years and more and this relationship is statistically significant.

The results of the statistical analysis showed that the highest rate of employee's use of Internet portals and web-based systems is for Agricultural Jihad organization with the average of 3.75 and 3.60, respectively. While this value is lower than default average in other organizations. This difference and being lower than average mean that the use of these technologies is in the medium range. Employee's use of databases, management information system and external communication is also less than the defined amount for all organizations. While the average employee's use of Internet for all organizations is higher than the defined average except the South Khorasan Electricity Distribution Company which is lower than the average. Mechanized systems are also used only by employees of the Agricultural Jihad Organization of the province at a low distance from the average. The analysis of the results has been presented in Table (VII).

Table VII. Employee's Use of Information Technology in the Organization

Organization	Internet Portal	Web-based System	Database	MIS	External Relationship	Internet	Mechanized System
Average Regional water company	3.45	3.25	2.98	2.76	3.03	3.78	3.38
Standard deviation	0.81	1.05	0.94	1.12	1.08	0.80	0.73
Average urban water and wastewater company	3.37	3.28	3.25	3.08	3.21	3.66	3.33
Standard deviation	0.92	1.05	0.95	0.94	0.92	0.95	0.95

Average rural water and wastewater company	3.23	3.28	3.02	2.90	3.33	3.53	3.23
Standard deviation	1.19	1.05	0.91	1.00	1.14	1.21	1.09
Average agricultural jihad organization	3.57	3.60	3.28	3.16	3.18	3.76	3.55
Standard deviation	1.11	0.92	1.02	1.04	1.04	1.16	0.878
Average electricity distribution department	3.42	3.15	2.95	2.78	3.05	3.30	3.33
Standard deviation	0.94	0.98	1.03	1.02	0.90	0.97	0.79
Total	3.41	3.31	3.10	2.94	3.16	3.61	3.36
Standard deviation	1.00	1.02	0.97	1.03	1.02	1.04	0.89

In order to investigate the impact of technology on speed, competence, accountability and flexibility in organizational agility, the questionnaires was analyzed statistically. The results showed that the highest impact of information technology on speed, competence and accountability is in Agricultural Jihad Organization and on flexibility is in the regional water organization of South Khorasan. Tables VIII to XI show the statistical analysis of the results.

Table VIII. The Impact of Information Technology on the Speed Capability of the Organizations

Organization	Average	Standard deviation	Min	Max
Regional Water Company	3.54	0.64	1.83	5.00
Rural Water and Wastewater Company	3.46	0.70	2.33	5.00
Urban Water and Wastewater Company	3.54	0.83	1.00	5.00
Agricultural Jihad Organization	3.92	0.66	2.17	5.00
Electricity Distribution Department	3.21	0.51	1.83	4.33

Table IX. The Impact of Information Technology on the Competence Capability of the Organizations

Organization	Average	Standard deviation	Min	Max
Regional Water Company	3.39	0.63	1.67	4.83
Rural Water and Wastewater Company	3.40	0.64	1.67	5.00
Urban Water and Wastewater Company	3.30	0.79	1.67	5.00
Agricultural Jihad Organization	3.66	0.69	1.50	5.00
Electricity Distribution Department	3.01	0.65	1.17	4.00

Table X. The Impact of Information Technology on the Accountability Capability of the Organizations

Organization	Average	Standard deviation	Min	Max
Regional Water Company	3.45	0.70	2.17	4.67
Rural Water and Wastewater Company	3.44	0.54	2.33	5.00
Urban Water and Wastewater Company	3.38	0.85	1.67	5.00
Agricultural Jihad Organization	3.47	0.64	2.50	5.00
Electricity Distribution Department	3.06	0.66	1.00	4.00

Table XI. The Impact of Information Technology on the Flexibility Capability of the Organizations

Organization	Average	Standard deviation	Min	Max
Regional Water Company	3.37	0.63	2.00	4.88
Rural Water and Wastewater Company	3.40	0.68	1.50	5.00
Urban Water and Wastewater Company	3.02	0.81	1.13	5.00
Agricultural Jihad Organization	3.11	0.67	1.00	5.00
Electricity Distribution Department	3.02	0.58	1.50	4.13

Next, each of the agility capabilities was investigated using the T test. In this test, the average value of each index was compared to the default value of 3.5. For recognizing the effects of information technology on agility indicators the p-value and obtained confidence intervals were used. In this research, it is assumed that information technology has a positive effect on the agility of the organization, so the zero values in this section does not mean that they have a negative effect; it is indicated that they may be much larger than 3.5, and of course it's possible that they be lower than 3.5. It can be recognizable by the results of the previous and negative effect cannot be concluded only by zero p-value. Also, this problem can be solved with the help of the confidence interval. If the confidence interval include zero, then it can be said that it has a positive effect, but if zero is not within the confidence interval this does not mean a negative effect; instead, it should be investigated with the help of previous tests, as it may be also much higher than determined average. Tables XII to XV present the results.

Table XII. Test on Speed Capability

Organization	t	dF	P-value (2-tailed)	Difference Average	Confidence Interval Bottom	Confidence Interval Top
Regional Water Company	0.53	59	0.59	0.044	-0.12	0.21

Rural Water and Wastewater Company	-0.42	59	0.67	-0.03	-0.22	0.14
Urban water and Wastewater Company	0.41	59	0.68	0.04	-0.17	0.26
Agricultural Jihad Organization	4.93	59	0.00	0.42	0.25	0.59
Electricity Distribution Department	-4.27	59	0.00	-0.28	-0.41	-0.15

V. CONCLUSION

Considering the fact that information technology has recently entered into the organizational systems, it is expected that traditional systems are still not fully replaced by intelligent systems. Also, assuming that the employees of these organizations completed questionnaires honestly, it can be deduced that the agricultural Jihad organization has the highest use of information technology than other organizations, and in general all organizations have benefited from the indicators of information technology. The highest use of Internet portals and Web-based systems is related to agricultural Jihad organization with a mean of 3.75 and 3.60, respectively. While these values in other organizations are lower than the default average; this means that these organizations have moderate use of these technologies. In the organization's use of databases, the management information system and external communication is also less than the defined amount. While the average use of internet by all organizations is higher than the defined value except the South Khorasan Electricity Distribution Company which is lower than the average. Mechanized systems are also used only in the South Khorasan Agricultural Jihad organization with a little distance from the average (P-value > 0.05). In assessing the impact of information technology on agility indicators, it can be concluded that the positive impact of information technology is statistically significant on speed, competence, and accountability in agricultural jihad organization and on flexibility in the regional water organization (P-value > 0.05). Generally, it can be said that the average impact of information technology on agility indicators in all organizations is almost in average range and this indicates the positive impact of information technology on the agility of the studied organizations, so it is expected that the mechanized and intelligent systems be replaced with traditional systems in the future.

Table XIII. Test on Competence Capability

Organization	t	dF	P-value (2-tailed)	Difference Average	Confidence Interval	
					Bottom	Top
Regional Water Company	-1.31	59	0.19	-0.10	-0.27	0.05
Rural Water and Wastewater Company	-1.13	59	0.25	-0.09	-0.26	0.07
Urban water and Wastewater Company	-1.85	59	0.06	-0.19	-0.39	0.01
Agricultural Jihad Organization	1.82	59	0.07	0.16	-0.01	0.34
Electricity Distribution Department	-5.71	59	0.00	-0.48	-0.65	-0.31

Table XIV. Test on Accountability Capability

Organization	t	dF	P-value (2-tailed)	Difference Average	Confidence Interval	
					Bottom	Top
Regional Water Company	-0.51	59	0.60	-0.04	-0.23	0.13
Rural Water and Wastewater Company	-0.83	59	0.40	-0.05	-0.19	0.08
Urban water and Wastewater Company	-1.01	59	0.31	-0.11	-0.33	0.10
Agricultural Jihad Organization	1.74	59	0.08	0.14	-0.02	0.30
Electricity Distribution Department	-5.13	59	0.00	-0.43	-0.60	-0.26

Table XV. Test on Flexibility Capability

Organization	t	dF	P-value (2-tailed)	difference Average	Confidence interval	
					Bottom	Top
Regional Water Company	-1.48	59	0.14	-0.12	-0.28	0.04
Rural Water and Wastewater Company	-3.40	59	0.00	-0.30	-0.47	-0.12
Urban water and Wastewater Company	-2.53	59	0.01	-0.26	-0.47	-0.05
Agricultural Jihad Organization	-2.37	59	0.02	-0.20	-0.38	-0.03
Electricity Distribution Department	-6.20	59	0.00	-0.47	-0.62	-0.31

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