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# The Effect of Application of Information Technology on Organizational Agility Using the Fuzzy Method

**(Case Study of the Informatics Services Corporation)**

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**Abstract.** Agility has an undeniable effect on organization success in the present changing markets, and information technology (IT) is a major facilitating factor in business activities of organizations nowadays, as about more than a half of present organizations capitals is based on IT. Therefore, assessment of the IT application level and organizational agility, and study of the effect of application of IT on organizational agility will enable organizations to identify solutions to maximize their investments and utilization of IT in order to achieve agility or improve organizational agility and gain competitive advantages. According to previous studies, no codified and well-known method has been presented to determine the effect of IT on organizational agility. For instance, an organization may be able to adapt to changes of business environment using IT, but may lack agility due to enormous costs it bears. Hence,

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application of IT brings about agility to an organization where it not only is effective for keeping up with changes [14], but also is cost effective to have a greater share of the market. The present study was aimed to evaluate the effect of application of IT on organizational agility. To this end, components and indexes were first identified to measure application of IT application and organizational agility levels through desk studies and using expert opinions. Next, two questionnaires were prepared whose validity was confirmed by the experts and whose reliability was confirmed by calculating the Cronbach's alpha. Since the organization under study was the Informatics Services Corporation (ISC), a 50-member statistical sample was selected from a statistical population of about 70 members, the questionnaires were distributed among the participants, and 41 of them were used finally. The level of application of IT to ISC was "tested" and its agility was calculated to be agile using fuzzy logics. Secondary fuzzy hypotheses were formulated using the obtained levels and the hypotheses were examined through the fuzzy hypothesis test and fuzzy deduction test. The primary and secondary hypotheses were studied and proved in the next step. Finally, the effect of application of IT on organizational agility of ISC was assessed to be high.

**Keywords:** Information technology, agility, formulating alternative fuzzy hypotheses, fuzzy deduction.

## 1. Introduction

Technological and professional changes threaten organizations' survival. Few organizations can change their internal forces and control the effective external ones. Adaption to unpredictable changes has led to the evolution of one of the demonstrations of contemporary business strategies known as agility. Agility has evolved rapidly into a key to motivate business in organizations and a vital factor for organization's ability to grow and survive in the insecure and turbulent environment of today's markets [14].

In any event, the conditions and environments expecting modern organizations have changed. Organizations environment has changed from an enclosed and static environment to an open and ever-changing one. Organizations must equip themselves with IT in such conditions so as to be flexible and instantly response to environmental changes because IT is a necessity in organizational development and gaining competitive

advantages in the age of information. Many changes and reforms have been made by IT (as the means and platform of development) to organizations which have led to an increase in accuracy, speed, and quality of services and products and a decrease in costs.

Hence, a primary step toward achievement of agility is moving customers from costly service access channels (such as local offices or postal forms) to low cost channels (such as the Internet or telephone systems). However, application of IT to an organization goes beyond supply of online services, because IT redefines business methods employed in organizations. By replacing tiresome paper works with electronic communications organizations have changed the business trends in organizations and have integrated different organizational divisions. Therefore, application of IT as the cause of change and evolution is one of the bases of agility. The improvement of business operations is the result of application of IT to agility. IT is the factor that provides for and facilitates agility [13].

Therefore, this research was necessary due to the following reasons:

✓ The pressure and intensified competition in service provision and the need for organizational agility;

✓ Managers' need for a simple, applicable, and accurate methodology to measure application of IT and organizational agility levels as well as also the effect of IT on organizational agility which finally leads to the improvement and enhancement of IT and organizational agility in organization;

✓ The weakness of non-fuzzy traditional methods in evaluating the effect of application of IT on organizational agility;

✓ Presenting an applicable fuzzy method to formulate secondary fuzzy hypotheses and studying the research hypotheses using the fuzzy method.

## 2. Literature Review

Technology is a set of processes, methods, techniques, tools, equipment, mechanical devices, and skills through which a good is produced or a

service is provided. Science analyzes the natural and physical behavior and seeks to discover phenomena through studying the nature. However, technology governs goods and services required by human through employing ideas and scientific achievements. Information is the data organized so as to be understandable and valuable for the receptor. Data types are usually processed into information using applications [2]. IT is a collection of hardware, software, man ware, and NetWare making the dynamic information process possible. In other words, the dynamic communication of information between human beings and the effective and applicable information exchange is possible through functionality and effectiveness of technology. In the instrumental approach, anything that leads to the collection, circulation, process, and exchange of information and message regardless of temporal and spatial limitations is called IT [5].

Information Technology is a strategy, thought, and instrument for human that is accompanied by innovation. By recognizing the opportunities and possibilities created by IT, it has been simulated as a strategy rather than a formula or applied prescription. Accordingly, IT is a new guideline for a different access to what is defined by organizations. Some consider IT to be a thought or idea for optimized and effective accomplishment of tasks. They consider it to be a thought that optimally combines software and hardware to establish and develop communications and optimally attain goals.

Tools employed in IT include computer programs, databases, applications, communication networks, method analysis and design, programming languages, and knowledge bases. IT is used to solve a wide range of problems through designing and using computers and communications [6]. The word "agile" is defined as "nimble, graceful; quick, fast; lively; able to move quickly and easily; and able to think quickly and in an intelligent way" in the dictionary [14]. Nowadays each organization must be able to produce different products with short lifetime, redesign products, change production methods, and able to react effectively towards changes in order to be known as agile organization. Agility is the outcome of a comprehensive knowledge of changes (recognition of opportunities and challenges) in the internal and external environments [15].

Despite the presence of the ability to respond to changes in a timely and flexible manner by the organization [12]. According to Sharifi & Zhang, agility is the ability of any organization to sense, perceive, and predict existing changes in the workplace. It includes the following four qualities:

1. Speed: the ability to perform activities in the shortest possible time.

2. Competence: the ability to attain organization goals.

3. Response: the ability to distinguish changes, react rapidly, and benefiting from changes.

4. Flexibility: the ability to conduct different processes, and attain different goals using the same facilities [16].

Evidently, many definitions of agility have been presented, but none of them is in contrast with another or contradicts the others. These definitions generally reflect the idea of speed and change in business environment.

Since human has started thinking, he has always tongued words and expressions like cold, warm, weak, strong, short, long, old, young, good, and bad, which lacked clear definitions. It is obvious that no distinct definitions can be assigned to adverbs such as rarely, somehow, often, and usually, and adjectives such as beautiful, intelligent, and happy. However, in many sciences such as mathematics and reasoning it is assumed that borders and limits are defined precisely and thus a specific subject is either included in or excluded from the scopes. Examples include words such as all or no, perishable or imperishable, alive or dead, male or female, white or black [1]. Unlike certain sets, entities are not divided into member or nonmember groups in fuzzy sets while their membership level varies between 0 and 1 according to our definition of the entities. Understanding fuzzy sets is the first step to introduce fuzzy mathematics, which contrasts classic mathematics. Classic mathematics (certain and frank mathematics) is based on Aristotelian logics where different phenomena have only two sides: they are either 0 (rare) or 1 (true). On the other hand, there is no middle mode in Aristotelian logics. Fuzzy reasoning is based on Approximate Reasoning where logics are compatible

with the nature and temperament of humane systems. Here, the 0 and 1 models are the only definitions. It is a generalized form of certain and frank Aristotelian reasoning [7]. Fuzzy deduction must be applied to the study of fuzzy hypotheses. Fuzzy deduction is the process of finding a numeral response to numeral inputs based on a fuzzy principle. Methods of fuzzy deduction include reasoning using methods by Larsen, Mamdani, Lokasivich, and Sogino, reasoning through cutting and reasoning through scale change [4]. In this research, the method by Mamdani was used due to its simplicity, intuitiveness, popularity, and appropriateness for inputs defined by human [9].

Table 1. Research performed as background for this study

| Row | Research Title | Researcher | Date | Findings |
|---|---|---|---|---|
| 1 | Studying the Effect of Modern Banking Technologies on Organizational Agility (Case study: Bank Melli in Sanandaj, Iran) | Abdi, N.; Salavati, A.; and Ghasemi, Sh. | 2011 | The highest correlation was found between employee knowledge and skills in implementing modern banking technologies using agility dimensions [11]. |
| 2 | Evaluating the Effect of Application of IT on Organizational Agility | Tanha, A. | 2012 | It measured the IT application level in Social Security Organization, examined the hypotheses using statistical methods, and measured agility level in organizations using the Yong and Lin's fuzzy method [8]. |
| 3 | Achieving the Agility of Supply Chain through Integration of IT and Flexibility | Swafford | 2008 | It explained the effect of IT on organizational flexibility and thus its agility, which brings about competitive advantages to organizations [17]. |
| 4 | A Study of the Effect of IT and Information Systems on the Supply Chain Agility | White | 2005 | It stated that the agile information systems is an fundamental factor in the improvement and development of organizational agility considering that information is regarded as an organizational resource, and achievement of speed and agility is impossible in organizations without them[18]. |
| 5 | The Effect of Information Systems on Agility | Coronado | 2002 | This study was performed in UK on several corporations from aerospace, electronic equipment, and car manufacturing industries. The results indicated that information systems support organizational agility in areas such as close relationship with suppliers, team operations, rapid production cycle, agency integration, and performing simultaneous commercial activities [13]. |

## 3. Methodology

This study was an applied study regarding its objective and was a correlational-descriptive study regarding its data collection method. After a desk study and identification of components and indexes of IT and organizational agility through expert opinions and approval, two questionnaires were prepared using the 7-point range to collect the data both on indexes weight and indexes performance.

The main objective of this study was to analyze the effect of application of IT on organizational agility. This study was also aimed to study

and identify IT components and indexes, study and identify organizational agility components and indexes, study the application of IT to ISC, and study the level of organizational agility at ISC.

1. How is the current condition of application of IT at ISC?
2. How is the current condition of organizational agility at ISC?
3. How is the relationship between application of IT
4. And organizational agility at ISC?

The primary and secondary research hypotheses were as follows: Primary hypothesis:

✓ Application of IT enhances organizational agility at ISC. Secondary hypotheses:

✓ Application of IT enhances speed at ISC.

✓ Application of IT enhances competence at ISC.

✓ Application of IT enhances responsiveness at ISC.

✓ Application of IT enhances flexibility at ISC.

Content validity was used in this study. Therefore, after preparing the questionnaires, attempts were made to take measures such as studying different research and theses, implementing valid indexes for assessment of IT application and organizational agility, and consulting experts and scholars. Next, validity of the questionnaires was confirmed by omitting and correcting some questions with respect to contents. Reliability of both the importance and performance parts of the questionnaires was confirmed using Cronbach's alpha and was assessed in SPSS. Regarding the data presented in the following table, which are more than 0.7, both questionnaires have the required reliability.

Table 2. The results of CH's Alpha test

| Variable | Index | Cronbach's alpha for the performance part of questionnaires | Cronbach's alpha for importance part of questionnaires | Total Cronbach's alpha for the performance part of each questionnaire | Cronbach's alpha for the importance part of each questionnaire |
|---|---|---|---|---|---|
| IT | Computer | 0.96 | 0.969 | 0.991 | 0.997 |
| | Internet | 0.97 | 0.976 | | |
| | Intranet | 0.981 | 0.966 | | |
| | User Satisfaction | 0.959 | 0.959 | | |
| Agility | Speed | 0.988 | 0.988 | 0.991 | 0.997 |
| | Competence | 0.969 | 0.991 | | |
| | Response | 0.962 | 0.984 | | |
| | Flexibility | 0.988 | 0.99 | | |

The statistical population for this study was the Informatics Services Corporation (ISC). It included the chief managers, counselors, experts with at least an Associate Degree in computer science, chief experts and headquarters employees (with a diploma in computer sciences or information technology management and at least 3 years of service at ISC). The stratified random sampling method was applied. A group of about 50 members were selected from a population of about 70 members with the described characteristics. The questionnaires were distributed among them and 45 were returned. 41 questionnaires were useful in the end.

## 4. Findings

First, application of IT in the organization was measured using the fuzzy method. The levels of each agility quality and the organizational agility level were calculated next. Following calculations, secondary hypotheses were formulated and analyzed using the fuzzy reasoning using Mamdani's fuzzy deduction method and the fuzzy hypothesis test. The secondary hypotheses were analyzed and on their basis the research hypotheses were formulated.

In order to measure the IT application level in the organization using the fuzzy method, the following four components were considered based on expert opinions: computer, internet, intranet, and user satisfaction.

If NJ stands for weight and rij stands for the value of each index, the score of each IT unit from the IT application test is obtained as follows:

$$Score(unit) = \sum_{i=1}^{n} rij^{*}nj / \sum nj$$

$$i = 1, 2, 3, m$$

Where, j is the number of indexes and i is the number of options. The maximum score was determined to be 100 while the minimum score was 0. A semi-metric ten-point distance scale was applied to show these numbers. Quality indexes (weights) of the quantitative values are defined as follows:

Table 3. the fuzzy values for responding to indexes of application of IT

| Fuzzy values for the Performance of Each Index | | Fuzzy values for the importance (weight) of Each Index | |
|---|---|---|---|
| Very Poor | (0,1,10) | Very Low | (0,0,0.1) |
| Poor | (0,10,30) | Low | (0,0.1,0.3) |
| Relatively Poor | (10,30,50) | Relatively Low | (0.1,0.3,0.5) |
| Normal | (30,50,70) | Medium | (0.3,0.5,0.7) |
| Relatively Good | (50,70,90) | Relatively high | (0.5,0.7,0.9) |
| Good | (70,90,100) | High | (0.7,0.9,1.0) |
| Very Good | (90,99,100) | Very high | (0.9,1.0,1.0) |

In the next step, the obtained fuzzy number is multiplied by the normalized importance:

$$(Agility\ index) = I^*(nj/n)$$

Where, I is the fuzzy average of the performance of each component, which is multiplied by the normalized importance to obtain the level of application of IT (the weight of each component is divided into the number of questions (n)). Finally, the fuzzy average of the obtained IT components is calculated again to calculate the level of IT application in the organization. Moreover, following the fuzzy calculations and defuzzification, FIT (Fuzzy Information Technology) is obtained which can be set to the most similar linguistic value to determine the level of application of IT. The following IT application levels were taken into account: the primary, repeatable, managed, tested, and optimized levels. Each of these terms has a fuzzy equivalent number presented in Table 6. Various methods have been proposed to match the linguistic words with function members. The following three techniques are available: (1) the Euclidean Distance Method, (2) Successive Approximation, and (3) Piecewise Decomposition [7]. The Euclidean Distance Method was used in this research since it gives the highest intuitiveness and human understanding of approximation. The following relation is used in this method:

$$d(FAI, Al_i) = d(FAI, Al_i) = \left\{ \sum_{x \in p} ( \int_{FAI} (x) - \int Al_i(x)^2 ) \right\}^{\frac{1}{2}}$$

Table 4. The IT application levels in the organization

| Verbal Variable | Fuzzy Values |
|---|---|
| Primary Level | (0,5,10) |
| Repeatable Level | (10,25,40) |
| Managed Level | (40,55,65) |
| Tested Level | (65,75,85) |
| Optimized Level | (85,95,100) |

Based on the calculations, the IT application levels were 87.86 and 79.08 and 59.50 at ISC. According to the Euclidean method and Table 7, the IT application level at ISC was "tested".

The following relation is used to calculate the performance level for each agility quality in the organization. In this relation, Wj is the weight of the j fuzzy parameter and Rj represents fuzzy rank:

$$\int = \sum_{j=1}^{n} (W_j(\bullet)R_j) / \sum_{j=1}^{n} W_j$$

Next, the obtained fuzzy number is multiplied by the normalized importance number:

$$(Agility\ index) = f^*(W_i/n)$$

Where, f is the fuzzy mean performance of each component. In order to calculate the levels of agility, f is multiplied by the normalized importance (weight is divided into the number of questions (n)).

Finally, the fuzzy average of the resulting organizational agility levels is calculated to achieve the Fuzzy Agility Index (FAI) for the organization. Following the fuzzy calculations and defuzzification, FAI is

matched with similar linguistic values to determine the organizational agility level. FAI and organizational agility for the organization are presented in Table 9.

Table 5. fuzzy numbers for linguistic variable value approximation

| Performance Rank | | Weight Importance | |
|---|---|---|---|
| **Linguistic Variable** | **Fuzzy Numbers** | **Linguistic Variable** | **Fuzzy Numbers** |
| Very Poor | (0,0.5,1.5) | Very Low | (0,0.05,0.15) |
| Poor | (1,2,3) | Low | (0.1,0.2,0.3) |
| Relatively Poor | (2,3.5,5) | Relatively Low | (0.2,0.35,0.5) |
| Medium | (3,5,7) | Medium | (0.3,0.5,0.7) |
| Relatively Good | (5,6.5,8) | Relatively High | (0.5,0.65,0.8) |
| Good | (7,8,9) | High | (0.7,0.8,0.9) |
| Very Good | (8.5,9.5,10) | Very High | (0.85,0.95,1.0) |

Table 6. Agility quality levels and organizational agility

| Verbal and Fuzzy Values of Agility Qualities | | Verbal and Fuzzy Values of Agility | |
|---|---|---|---|
| Fuzzy Number Scale | English Term | Fuzzy Number Scale | English Term |
| (7,8.5,10) | Very Agile(VA) | (7,8.5,10) | Very High (VH) |
| (5.5,7,8,5) | Agile(A) | (5.5,7,8.5) | High(H) |
| (3.5,5,6.5) | Fair(F) | (3.5,5,6.5) | Fair(F) |
| (1.5,3,4.5) | Slow(S) | (1.5,3,4.5) | Low(L) |
| (0,1.5,3) | Very Slow( VS) | (0,1.5,3) | Very Low( VL) |

According to the calculations, the organizational agility levels were obtained to be 9.14, 6.96 and 5.82 at ISC. Based on the Euclidean method and Table 6, the organizational agility level at ISC was at an agile level. The organizational agility levels for the organization were calculated as follows:

Table 7. The agility Quality levels at ISC

| Agility Qualities | Fuzzy Values | Agility Quality Level in Organization |
|---|---|---|
| Speed | (4.10,5.67,7.29) | Medium |
| Competence | (4.15,5.60,7.60) | Medium |
| Responsiveness | (4.3,5.95,7.97) | High |
| Flexibility | (3.77,5.50,7.05) | Medium |

The secondary fuzzy hypotheses were formulated in the form of "if-and-then" conditional sentences as follows:

**R: If A and B Then C**

If A is the level of IT application and B is organizational agility, then the value of C (as the effect of IT application) is determined as follows:

Table 8. The Fuzzy Values for Options

| Verbal Values μc(x) | Fuzzy Membership Values |
|---|---|
| Very Low | (0,0.05,0.15) |
| Low | (0.1,0.2,0.3) |
| Relatively Low | (0.2,0.35,0.5) |
| Medium | (0.3,0.5,0.7) |
| Relatively High | (0.5,0.65,0.8) |
| High | (0.7,0.8,0.9) |
| Very High | (0.85,0.95,1.0) |

Secondary fuzzy hypotheses are formulated in the form of $(\tilde{A} * \tilde{B}) = \tilde{F}$. However, definition of a secondary fuzzy

Hypothesis in the form of a different conditional mixture of fuzzy extension definitions is an essential step in creating the aforementioned mixtures. Since the research model includes two conditions, the mixture varieties are as follows:


Figure 1. Mixture Varieties of Alternative Hypotheses

All results must be considered for every condition when defining the research model using fuzzy sets and deducing alternative hypotheses. For instance, consider A and B to be conditions and F to be the result. If each of the above sets can be extended to two fuzzy sets, then:

✓ H0: If condition 1 = $\tilde{A}_1$ and condition 2 = $\tilde{B}_1$ then the result= $\tilde{F}_1$

✓ H1: If condition 1 = $\tilde{A}_2$ and condition 2 = $\tilde{B}_2$ then the result= $\tilde{F}_2$

✓ and ...

As seen, all the secondary hypotheses are definable by the fuzzy hypothesis test and no infinite number of secondary hypotheses results from rejection of the null hypothesis. In the test all (including null and alternative hypotheses) hypotheses are 2 2 2 =8, it is possible to easily examine all hypotheses, select one as the null hypothesis and assume other hypotheses to be secondary hypotheses [1,3].

Since 5 extensions are considered for IT and 5 are also considered for organizational agility, and since each agility quality has 5 extensions and the effect of IT application on organizational agility has 7 hypotheses, eight hundred and seventy five extended alternative hypotheses are available for screening (5*5*5*7=875):

✓ 1 tested extension for IT level (the IT application level in the organization),

✓ One agile extension for the organizational agility (the agility level in the organization),

✓ One extension for each agility quality in the organization (the agility quality level in the organization),

✓ Seven extensions for the effect of IT on organizational agility.

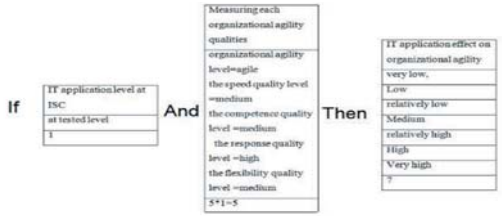


Figure 2. Various final alternative hypotheses mixtures at ISC

Therefore we will have 35 secondary hypotheses, one is as follows:

✓ If the IT application level is tested at ISC, and the speed level of the agility quality is medium at ISC, then the effect of IT application on the speed quality will be very low at ISC.

The following steps are necessary to study the fuzzy rules and preferences among them.

1. Calculating fuzzy membership numbers for IT application, agility, and organizational agility levels using the triangular fuzzy function

2. Fuzzy reasoning using the Mamdani reasoning method [4].

$$\mu R(x,y) = Min\{\mu A(x), \mu B(y)\}(Minimum\ Mamdani)$$

3. Defuzzification using the average value method: Assume $A = [a1, a2, a3]$ for $i = 1, l$. The defuzzified value of $A_1$, which is shown by $S(A_1)$, is defined as follows. $SR(A_1)$ and $s_1(A_1)$ are the left and right sides of $A_1$, respectively [10].

$$S(\tilde{A}_1) = \frac{1}{2}(St(\tilde{A}_1) + S_R(\tilde{A}_1))$$

$$S(\tilde{A}_1) = \frac{1}{2}\left((a_{2i} - \int_{a_{11}}^{a21}\int_{A1}(x)) + (a_{21} + \int_{a21\int A1}^{a31}(x))\right) = \frac{a_{11} + 2a_{21} + a_{31}}{4}$$

The above values for ISC are calculated and obtained as follows:

Table 9. Fuzzy values for IT application level at ISC

| Fuzzy Values | IT application level in the organization | Fuzzy membership values μA(x) |
|---|---|---|
| Tested | (59.5,79.8,87.86) | (0.55,0.59,0.25) |

Table 10. Fuzzy values of agility at ISC

| Organizational agility | Fuzzy values | Fuzzy membership values μB(x) |
|---|---|---|
| Agile | (5.82,6.96,9.14) | (0.45,0.97,0.45) |

Table 11. Fuzzy values for the agility level at ISC

| Agility qualities | Level of agility qualities in the organization | Fuzzy values | Fuzzy membership values μC(x) |
|---|---|---|---|
| Speed | Medium | (4.10,5,67,7.29) | (0.26,0.55,0.8) |
| Competency | Medium | (4.15,5.60,7.60) | (0.23,0.6,0.6) |
| Responsiveness | High | (4.3,5.95,7.97) | (0.13,0.36,0.35) |
| Flexibility | Medium | (3.77,5.50,7.05) | (0.48,0.0.96) |

Regarding the fuzzy membership values presented in tables 10 to 12, and fuzzy deduction using the Mamdani method, the obtained values for each fuzzy rule (secondary hypotheses) are presented in Table 13.

Table 12. Obtained values for the fuzzy rules

| Number of secondary fuzzy hypothesis | Value of R fuzzy rule | Number of secondary fuzzy hypothesis | Value of R fuzzy rule | Number of secondary fuzzy hypothesis | Value of R fuzzy rule |
|---|---|---|---|---|---|
| 1 | 0 | 13 | 0.415 | 25 | 0.137 |
| 2 | 0.1 | 14 | 0.415 | 26 | 0.182 |
| 3 | 0.2 | 15 | 0 | 27 | 0.182 |
| 4 | 0.277 | 16 | 0.1 | 28 | 0.182 |
| 5 | 0.402 | 17 | 0.185 | 29 | 0 |
| 6 | 0.402 | 18 | 0.245 | 30 | 0.1 |
| 7 | 0.402 | 19 | 0.275 | 31 | 0.2 |
| 8 | 0 | 20 | 0.275 | 32 | 0.287 |
| 9 | 0.1 | 21 | 0.275 | 33 | 0.425 |
| 10 | 0.2 | 22 | 0 | 34 | 0.425 |
| 11 | 0.27 | 23 | 0.05 | 35 | 0.425 |
| 12 | 0.415 | 24 | 0.1 | | |

According to the above tables, as the rule value increases for each quality (and are equal in relatively high, high, and very high values) and fuzzy hypotheses are prioritized based on their values, on average it is concluded that:

Secondary Hypothesis 6: If IT application level is tested at ISC, and the speed quality among the agility qualities is medium, then the effect of IT application on the speed quality is high at ISC.

Secondary Hypothesis 13: If IT application level is tested at ISC, and the competence quality among the agility qualities is medium, then the effect of IT application on the competence quality is high at ISC.

Secondary Hypothesis 20: If IT application level is tested at ISC, and the responsiveness quality among the agility qualities is high, then the effect of IT application on the responsiveness quality is high at ISC.

Secondary Hypothesis 27: If IT application level is tested at ISC, and the flexibility quality among the agility qualities is medium, then the effect of IT application on the responsiveness quality is high at ISC.

Secondary Hypothesis 34: If IT application level is tested at ISC, and the agility level is agile, then the effect of IT application on agility is high at ISC.

According to the approved secondary fuzzy hypotheses, it can be concluded that the primary and secondary hypotheses of the research (Application of IT at ISC has led to an increase in organizational agility) are approved and the level of IT application effect on the agility qualities and organizational agility are assessed as follows:

✓ The effect of IT application at ISC on the speed quality is high.

✓ The effect of IT application at ISC on the competence quality is high.

✓ The effect of IT application at ISC on the responsiveness quality is high.

✓ The effect of IT application at ISC on the responsiveness quality is high.

✓ The effect of IT application on the organizational agility is high at ISC.

## 5. Conclusion

In general, it can be said that application of IT was "tested" at ISC, and the organizational agility was evaluated to be "agile". It is worth mentioning that the effect of IT application on organizational agility was evaluated "high" while the IT application level was also high regarding all four qualities of speed, competence, response, and flexibility. According to the results, this effect was high on competence, speed, and responsiveness. Finally, it had the least effect on flexibility. Therefore, the intensity of the IT application effect is lowered on competence, speed, response, and flexibility qualities of agility in this organization. The research suggestions are presented as follows:

1. As the IT application effect is evaluated to be high and positive on the organizational agility at ISC, the managers are advised to improve IT indexes (such as the shared data, use of information management system, necessary IT trainings, shared printers and hardware used in the network, mechanized services and systems in the corporation for increasing the speed and flexibility qualities, the effectiveness and efficiency of the internal portal, increasing or omitting internet access limitations for the employees, broad band internet for the experts for staying up-to-date and innovation in the network, increasing virtual private networks in customer relationship, and improving the band width and the required quality) to increase organizational agility and to enhance the agility level which is now at the agile level.

2. As the IT application effect is evaluated high on the speed quality at ISC, it is suggested that ISC managers pay attention to the improvement of speed quality (which is now at the medium level) using the IT tools. They are also recommended to enhance the speed indexes in personnel training, process effectiveness and efficiency, the activity speed among units, speed in problem solution, and speed in process changes.

3. As the IT application effect is evaluated high on the competence quality at ISC, it is suggested that ISC managers increase the competence quality level (which is now at a medium level) using IT tools. They are also recommended to improve the service quality improvement indexes,

increase the error tolerance, decrease the costs, and break the limitations and barriers to create an organization where cooperation is possible and observable at any point.

4. As the IT application effect is evaluated high on the responsiveness quality at ISC, it is suggested that ISC managers increase the responsiveness quality level (which is now at a high level) using IT tools. They are recommended to improve the medium decrease indexes of the response time to customer problems, and increase the response to market opportunities and threats.

5. As the IT application effect on the flexibility quality is assessed to be high at ISC, it is suggested that ISC managers increase the flexibility quality level (which is now at a medium level) using IT tools. They are recommended to increase the flexibility indexes of flexible employees towards the competitors, and the possibility of commercial strategy changes due to changes in the commercial environment.

6. As The IT level is evaluated tested at ISC, it is suggested that ISC managers strengthen and enhance the following qualities in the organization to improve to the optimization level: the applied band width, internet access limitation, virtual private networks, in organization communications, intranet effectiveness and efficiency, database application, the shared data, the information management system level, computer and network server capacities and capabilities, mechanized systems in the organization network, administration automation, and the required IT trainings.



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