



**IMPACT OF SOFTWARE AND HARDWARE INFRASTRUCTURE  
ON CUSTOMER'S SATISFACTION OF AHWAZ  
TELECOMMUNICATION COMPANY (IRAN) AND  
THE MEDITATIVE ROLE OF FLEXIBILITY**

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**Abstract:**

Living in meta-information age beside the everyday acceleration of information technology lead customers to utilize electronic facilities and services fort doing their tasks quickly and easily. Customers would be satisfied with services always available to be used and to encourage customers to reuse them. To this end, the present study scrutinizes the influence of telecommunication hardware and software services with the relevant components on customer satisfaction with respect to the function of flexibility taken by the company. The main goals of the research are as follows: 1. investigating the influence of software infrastructures on customer satisfaction, given the mediative role of flexibility, 2. investigating the influence of hardware infrastructure on customer satisfaction, given the mediative role of flexibility. The method is survey research, library research along with note-taking tools. SPSS software is employed for information analysis. According to the findings, there is a significant relationship between software agents (transaction speed, ease of use, access speed, safety and teaching method) and hardware agents (environment, facilities, adornment and equipment) in customer satisfaction. The results revealed that hardware and software agents influence customer satisfaction indirectly.

**Keywords:** flexibility; software infrastructure; software agents; hardware agents

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## 1. Introduction

Given the ever-increasing growth of technology, the role of communication and information and their increased application in everyday activities is undeniable and in order not to remain behind others, countries proceed to earn experience and get involved in the latest achievements of information application and communication.

Nowadays, investing in information and communication technology is essential, since it directly or indirectly influences all market categories namely, determination of the type and the method of production, the amount and the place of selling goods and services. Thus, it can be perceived that benefiting from information and communication technology, by means of an accurate strategy planning, helps developing modern technologies with high efficiency. Countries and organizations should peruse their life in situations with constant changes. All these changes are based on knowledge. Organizations involved with the emerging challenges of the age of knowledge, have perceived that knowledge is the most strategic organizational source and the axis of competition and even survival in non-competitive environments (Gibert 2002). That is why the need for knowledge management has been addressed to them. Knowledge management does not only bring the knowledge of every single person together, but also it reveals and enriches people's latent knowledge. Information and communication technology somewhat takes and retains knowledge in order to help the organization working more efficiently and to achieve competitiveness. Organization's ability to adapt the needs of customers is one of the requirements of competitiveness. Information technology is one of the key factors of competitions in global economic, but to access a higher position in today's dynamic market, it should consider an important element like customer. Information technology provides the organizations with this possibility to better determine the emerging opportunities in market and its competitive advantage. But it should be highly noted that an effective communication with customers is impossible without applying information technology. To increase the efficiency of the organization and ensure the good presentation of goods and services to customers and get their satisfaction, we should manage our knowledge about customers. Therefore, in the present research, first an introduction of information technology is presented and then, the main subject, customer satisfaction, will be elaborated on.

## 2. Problem statement

Information and communication technology (ICT) refers to technologies such as internet, intranet, extranet and all other technologies maintaining a wide range of underlying infrastructure to technologies that upgrade services and operations of an organization. Development and application of information technology in various fields, especially in banking, telecommunication, resulted from capabilities of information technology which comes a long way nowadays in business. Third millennium man is in attempt to keep his distance from the cliché by accelerating the process of development

and implication of information technology in different parts of social systems to create an up to date pattern. In this regard, like most service providers, connectivity to customers in the last decades has grown rapidly towards investing in new technologies meeting customer requirements, as a way to control costs, attract new customers and meet customer expectation and regards the usage of these technologies as a strategic necessity in its agenda (Yaghoubi and Shakeri, 1388).

Customer's comfort and satisfaction provoke him to reuse the services. Many scientists reveal the relationship between satisfaction and behavior of customer, especially while being influenced by new technologies. Utility of modern technologies, in turn, satisfies the customers. Information and communication technology insists on the highlights of information, storage devices, transmission devices and access to information. Obviously in this regard, in addition to telecommunication potentials, other media such as radio and television are included in the list of communication devices (channel of information publication and distribution). Infrastructures of information and communication technology firstly demand an information infrastructure in which all communication devices namely, telecommunication equipment, radio and television will be placed. Information infrastructure acts as a foundation for infrastructure of information and communication technology which provides highly qualified information services.

In order to enhance the quality, speed and precision of services offered to the staff and to get employers satisfaction, the telecommunication company proceeds to offer human resources supply services and machinery by means of new features and tools of information and communication technology and hardware and software infrastructure. Hardware dimensions include (environment, facilities, adornment and equipment) and software dimensions (manner and respect, speed, services variety, providing information and mastery). The question now arises as to whether software infrastructures can affect customer satisfaction. The present study investigates the influence of these dimensions on customer satisfaction regarding function of flexibility taken by telecommunication company. Company managers regard providing software infrastructures in implementing related work processes not as a cost but as an investment which has an influential role in offering services with quality, speed and desirable accuracy. Internet infrastructure, intranet internal networks, payroll software, company website and mailbox can be taken as examples. Multiple studies represent that the cost of attracting a new customer is 9 times more than the cost of retaining the existing customer. And also it is noted that one percent reduction in customer's satisfaction leads to 9 percent reduction in return of organization investment (Nouri and Fathi, 1390). Since one of the main targets of company is customer satisfaction, satisfaction or dissatisfaction is significant in designing an electronic service system. Providing services by company is divided into two groups of old and new customers. The cost of attracting new customers is usually more than the cost of retaining the old customers. Therefore, retaining the old customers is more important to the company than the new customers. Retaining the old customers depends on their satisfaction with

the offered services by the telecommunication company. A satisfied customer not only reutilizes the offered services but also encourages people to be new customers. Satisfied customers are the source of profitability for the organization. Providing highly qualified services continuously develops competitive advantage for organizations and companies. Thus, in this study the effects of hardware and software infrastructures on customer satisfaction are explored.

The ultimate goal of every organization is attracting more customers. Therefore, customer satisfaction or dissatisfaction is remarkable in designing offered services system by organizations. There are different researches done on the relationship between the quality of services and customer satisfaction. Most of them put emphasis on the correlational relationship between dimensions of service quality and customer satisfaction (Rezaei Golabadi, 1385).

Studies demonstrate that customer satisfaction and his loyalty to the organization lead to more revenues. Customer purchase repetition, buying new goods with the least advertising cost and purchasing goods by new customers, who are encouraged by satisfied customers, enhance the revenues (Rahmani and Varedi, 1991). Offering highly qualified services continuously improves competitive benefits which are entitled as follows:

- Creation of complete obstacles: Each organization, through studying the market, should select sections for activity in which more strengths exist to better meet customer's requirements. If an organization intends to provide customers with highly qualified services, firstly it should recognize customers' demands and benefits and then meet the demands efficiently, comparing to other competitors so that welfare of the community and customers would be provided.
- Distinctive services: If the offered service resembles the competitors, convincing the customer to select that service is impossible. Providing distinctive services is one of the crucial ways should be followed.
- Customer's loyalty: If an organization regards customers' loyalty, it should also consider retaining them. Organizations and companies should take customers as valuable property and do their best to retain their loyalty.
- Reduction of marketing costs: Providing highly qualified services might reduce marketing costs. Since the cost of attracting new customer firstly might reach five times more than the cost of retaining old customers; secondly old customers, through encouraging others to buy goods, can be the best source of propaganda for the bank (Sadegh Chigani, 1381).

### **3. Significance of the Study**

Various studies have shown that the cost of attracting new customer is ten times retaining the existing customer and also it is noted that one percent reduction in customer satisfaction causes 9 percent reduction in return of organization fund (Nouri and Fattahi, 1350). Since one of the main targets of the telecommunication company is

customer satisfaction, satisfaction or dissatisfaction is significant in designing the system of electronic services. Offering telecommunication services is divided into two groups of old and new customers. The cost of attracting new customers is usually more than the cost of retaining the old customers. Therefore, telecommunication concerns about keeping old customers more than attracting new customers. Retaining old customers depends on their satisfaction with the received services from the telecommunication company. A satisfied customer not only reutilizes the services but also helps encouraging others to be new customers. Satisfied customers are the source profitability for organization. Offering highly qualified service constantly helps enhancing competitive benefits for organizations or companies. Therefore, in the present study, the influence of hardware and software infrastructure on customer satisfaction with the company is considered.

#### **4. Theoretical Foundations**

Countries and organizations should adapt themselves to the quick and main changes. All these changes are based on information. Organizations involved with the emerging challenges of the age of knowledge, have perceived that knowledge is the most strategic organizational source and the axis of competition and even survival in non-competitive environments (Gibert, 2002). That is why the significance of information infrastructures are addressed to them. Generally, information management encourages the employees to share knowledge and ideas to increase the value added of products (Haji Karimi and Mansourian, 1391).

Information management should keep information in a way that it would help the organization working more efficiently. This way, it achieves competitiveness. Organizations' capability to adapt with customer's needs is one of the requirements of competitiveness. Today is the age of knowledge-based organization. Knowledge management along with access to new sources of knowledge has paid serious attention to new methods such as community-based knowledge management which proceeds to achieve vast resources of knowledge (Retna and Tee, 2011). Nowadays communication with customer and sustain the communication is a novel concept not only in selling goods and services, but also in accessing to their information and knowledge, which is studied in the form of information management systems (Winer, 2001).

The quality of services acts as an effective factor to access organization's strategic interests such as maintaining customer rate or increasing effectiveness and gaining profits (Sohail Sadiq and Shaikh, 2008). Convenience and speed in usage is one of the effective factors in customer perceptions of electronic services which have a direct and positive influence on customer satisfaction (Kumar and Charles, 2010). Electronic services may increase the quality of service from customer's point of view and it would be possible only through providing the required service with high speed (Ganguli and Roy, 2010). Generally, customers prefer different services based on a basic service offered as multiplied services. Customer's confidence in one service is one of the crucial

issues in both traditional and electronic services (Bruce and Lean 2010). Three variables can be mentioned as important characteristics for customers when utilizing services: level of preference over traditional services, experience electronic services and the perceived policies in terms of electronic services.

Quality of services is attached to customer satisfaction and improving the quality of services increases the possibility of customer satisfaction which leads to behavioral outcomes such as commitment, tendency to stay, creation of two-way link between service provider and customer, increase of customer tolerance toward the drawbacks of offering and advertising the services (Samadi and Nourani, 2005). Quality is defined through different approaches. In a philosophical approach, quality equals inherent excellence. In a technical approach, it is compared to product compliance level technical standards. In customer-based approach, quality is subjective which is signified by its receivers and seriously depends on customer's perceptions (Schneider and White, 2004). According to the studies, concepts of customer satisfaction and its measurement were first announced in 1577 by Oliver. He suggests customer satisfaction as a pleasant experience of the purchased product or service. Many scientists confirm the relationship between satisfaction and customer's behavior, especially when they get influenced by new technologies. Bitner, in 2002, claims that easy access to services causes customer's satisfaction with modern technologies. But multifunctional and complex hardware and software dissatisfy the customers. In other words, simplicity and easy access to services lead to customer satisfaction (Pronsa et al. 2011). A sudden development of technology has led to new strategies bearing profitability for telecommunication and customers. Direct channels are created for telecommunications which plays a significant role in communication and service delivery. E-serving offers the customers more efficiency and safety and it brings customer satisfaction and service flexibility. However, the evidence reveal that personal communications and social emotions constantly change depending on receiving services. In electronic services, customers do not communicate and isolation is their main priority. Yet, customers tend to use electronic services for having tranquility, flexibility and confidence. Therefore, they are the main factors in customer satisfaction (Foo, Daglas and Jack, 2008).

## **5. Review of Literature**

### **5.1 National Studies**

In his study, "*the influence of service environments on customer's excitement and the outcomes of services*", Pourashraf (1394) investigates the influence of service environments on customer's excitement and the outcomes of services. The main target of the present study is exploring the influence of physical and social environments on customer's excitement, satisfaction and customers' behavioral inclination and eventually the outcomes of services. Results have found a significant relationship between employees' excitement and customer's positive excitement and satisfaction. Houdzadeh et al. surveyed customers' satisfaction with electronic banking services using EUCS model.

Results illustrate that the content of electronic banking services, services accuracy and precision in electronic banking, and also the format of services, easy access to services and time saving when utilizing the services, all have a positive and direct impact on customers' satisfaction with electronic banking services. Employing QFD model in enhancing the quality of electronic banking modern services of Saderat Bank of Iran under the supervision of west of Tehran, Ranjbar concludes that in terms of modern services of banks, the presence of expert staff and secure systems play a significant role for unobtrusive services and also the continual connection of internet and electronic systems highly affect customer satisfaction.

Zand Vakil (1392) has studied the relationship between utilizing information and communication technology and improving the quality of banking services based on SERVQUAL model. Result maintained from deductive statistics demonstrate that sympathy dimension has the highest rank among other dimensions of SERVQUAL. In exploring the comparison of the components of information and communication technology and communications of computer components and ATM in point of response, point of sale terminal is important in response, sympathy and confidence.

In their article entitled "*attracting and retaining customer as a step towards the development and success of the bank*", Rahmani and Varedi (1391) show that profitability is the main goal of banking. By providing their customers with various services, banks attempt to increase their deposits in terms of physical, financial investments and lends. Through this investment process and credits, banks should meet their customers' requirements by means of world quality standards.

## 5.2. Foreign Studies

Jie YU et al. have investigated the impact of hardware and software infrastructures on banking customers' satisfaction with the mediative role of flexibility and have concluded that hardware infrastructures has a considerable impact on customer satisfaction and also flexibility acts as a mediator in the relationship between infrastructures and customer satisfaction. Wioai (2013) have done a research entitled "*customer satisfaction records and their relationship with complaints in online shopping and exploring the effect of relations among fairness, technology and confidence on customer satisfaction*". Results derived from investigating a structural equation model represent that distributive and interactional justice considerably influences customer satisfaction but procedural justice does not have such an effect. Web-based features and confidence are important in determining two target variables. In a study on acceptance and usage of modern methods of telecommunication company such as internet telecommunication company in Oman, Emtiaz (2010) concludes that people's traditional habits, government's lack of support, weakness of communicative systems and low speed networks are the main obstacles to developing new methods of telecommunication company in Oman. Krishnan Gero (2008) in studying the evaluation of modern methods to offer the telecommunication company done by some professors, claims that development of information and telecommunication technologies causes a major

change in telecommunication company of Malaysia. Vast usage of modern methods in providing services of the telecommunication company is the result of this change.

### 5.3 Methodology

The present study is practical in terms of target; for its results can be taken in solving the problem of organizations. In terms of nature and method, it is a descriptive, survey and correlative research; because it attempts to obtain information about the status quo of the statistical sample by using questionnaire. In survey method, the researcher collects information at the location of research (Sarmad, 1384). Results generalizability is one of the advantages of this method.

In terms of time, it is cross-sectional and in terms of the type of data, it is a quantitative research. In this research, the scholar employs survey and library methodology and note-taking tools to collect information related to the questionnaire and the test of research hypothesis. The Likert score has also been used to answer the questionnaire.

The questionnaire assesses customer satisfaction through 24 questions from which the first five questions evaluate the dimension of physical condition, the second five questions check the dimension of confidence, number 11 to 14 assess the dimension of response, the next five questions check the dimension of assurance and the last five questions evaluate the dimension of sympathy. So, this SRRVQUAL-based questionnaire possesses five dimensions. SPSS software is employed for data analysis.

- Research variables are as follows:
- Flexibility: includes the first 12 questions of the questionnaire.
- Customer satisfaction: dependent variable of the research and includes 12 to 30 questions based on SERVQUAL standard questionnaire (2014)
- Software: includes the first 18 questions based on J et al. standard questionnaire
- Hardware: includes the first 18 questions based on J et al. standard questionnaire

### 5.4 Regression Test

In this part, in order to test the research hypothesis, the information are analyzed by means of regression test.

First hypothesis: regarding the mediative role of flexibility, hardware infrastructures influence customer satisfaction positively.

**Table 1:** Structural pattern: paths and standard coefficients to indirect affects among variables

$t$	$\beta$	Path
21/08	0/099	Software infrastructure flexibility customer satisfaction
26/56	0/127	Hardware infrastructure flexibility customer satisfaction

**Source:** scholar's calculations.

According to the results of table (1), the indirect path coefficient related to the mediative role of flexibility is significant in software infrastructures and customer satisfaction shown in the suggested model.

**Table 2:** Structural Pattern: paths and standard coefficients to indirect affects among variables

3	2	1	Correlation between variables	
0/43	0/23	-	Software infrastructures	1
0/17	-	--	Flexibility	2
-	-	-	Customer satisfaction	3
Level of significance	The upper limit of confidence interval	The bottom line of confidence interval		
0/011	-0/003	-0/04		

**Source:** scholar's calculations.

Table (2) represents the significance of bipartite correlation of variables in 0/05 of confidence interval and Bootstrap results for this hypothesis are evaluated as -0/04 bottom line of confidence interval and -0/003 the upper limit of confidence interval. Given that it is included in confidence interval, indirect affect is important and the first hypothesis is approved.

Second hypothesis: hardware infrastructures has a positive effect on customer satisfaction, regarding the mediative role of flexibility.

**Table 3:** Structural pattern: paths and standard coefficients to indirect effects among variables

3	2	1	Correlation between variables	
0/23	0/54	-	Hardware infrastructures	1
0/06	-	-	Flexibility	2
-	--	-	Customer satisfaction	3
Level of significance	The upper limit of confidence interval	The bottom line of confidence interval		
0/009	-0/001	-0/09		

**Source:** scholar's calculations

Results of table (3) demonstrate the significance of bipartite correlation of variables in 0/05 of confidence interval and Bootstrap results for this hypothesis are evaluated as -0/09 bottom line of confidence interval and -0/001 upper limit of confidence interval. The resulted significance equals 0/009 and the number of renewed sampling of Bootstrap is 4000. Given that it is not included in confidence interval, the indirect affect is important and it is approved in the second hypothesis of the research.

**Table 4:** First hypotheses regression

Explanatory variable	Correlative variable: innovative function		
	Coefficient	Statistic	P-value
Width	0/299	1/819	0/070
Speed	0/422	11/898	0/00
Facility (ease)	0/131	5/174	0/00
Access	0/603	44/170	0/00
Instruction	0/190	6/550	0/00

Assurance	0/337	10/891	0/00
P- value	0/000		
F-Value	803/718		
R <sup>2</sup>	0/914		
Adjusted R <sup>2</sup>	0/913		

**Source:** scholar's calculations

Based on the table above, the significance level of first minor hypothesis (0.000) in which the simple regression is 0.05, the significant effect of speed on customer satisfaction can be confirmed. Therefore, according to the variable coefficient it can be claimed that customer satisfaction increases to 0.454 by one unit increase in this variable.

According to the significance level of hypothesis (0.00) in which the simple regression is lower than 0.05, the significance of ease on customer satisfaction can be approved. Therefore, given the variable of ease variable it can be claimed that one unit growth in this variable increases customer satisfaction to 0.137.

According to significance level of the third minor hypothesis (0.00) in which the simple regression is lower than 0.05, the significance of access in customer satisfaction can be approved. Therefore, given the variable coefficient it can be asserted that one unit increase in this variable increase customer satisfaction to 0.677 units.

Regarding the significance level of the fourth minor hypothesis (0.00) in which the simple regression is lower than 0.05, the significant effect on customer satisfaction can be affirmed. Therefore, given the variable coefficient of safety, it can be claimed that one unit growth in this variable increases customer satisfaction to 0.378 units.

Regarding the significance level of the five minor hypothesis (0.00) in which the simple regression is lower than 0.05, the significant effect of instruction on customer satisfaction can be perceived. Therefore, given the variable coefficient of instruction, it can be asserted that one unit increase in this variable increases customer satisfaction variable to 0.199 unit.

**Table 5:** Second hypotheses regression

Explanatory variable	Correlative variable: innovative function		
	Coefficient	Statistics t	P-value
Width	1/004	8/342	0/00
Environment	0/275	6/805	0/00
Facilities	0/180	2/865	0/004
Adornment	0/292	6/839	0/00
Equipment	0/411	7/320	0/001
P-value	0/000		
F-value	167/577		
R <sup>2</sup>	0/635		
Adjusted R <sup>2</sup>	0/635		

**Source:** SPSS software output.

According to the table above, the significance level of sixth minor hypothesis (0.00) in which the simple regression is lower than 0.05, the significant effect of bank environment on customer satisfaction can be approved. Therefore, given the variable coefficient of bank environment, it can be represented that by increasing one unit of this variable, customer satisfaction increases to 0.324 unit.

According to the table above, the significance level of seventh minor hypothesis (0.009) in which the simple regression is lower than 0.05, the significant effect of facilities on customer satisfaction can be approved. Therefore, given the variable coefficient of facilities, it can be claimed that one unit increase in this variable, increases customer satisfaction to 0.203 unit.

According to the table above, the significance level of eighth minor hypothesis (0.00) in which the simple regression is lower than 0.05, the significant effect of adornment on customer satisfaction can be approved. Therefore, given the variable coefficient of adornment, it can be claimed that one unit increase in this variable, increases customer satisfaction to 0.345 unit.

According to the table above, the significance level of ninth minor hypothesis (0.00) in which the simple regression is lower than 0.05, the significant effect of equipment on customer satisfaction can be approved. Therefore, given the variable coefficient of equipment, it can be claimed that one unit increase in this variable, increases customer satisfaction to 0.462 unit.

### 5.5 Path Analysis

In this part, fit indices will be evaluated:

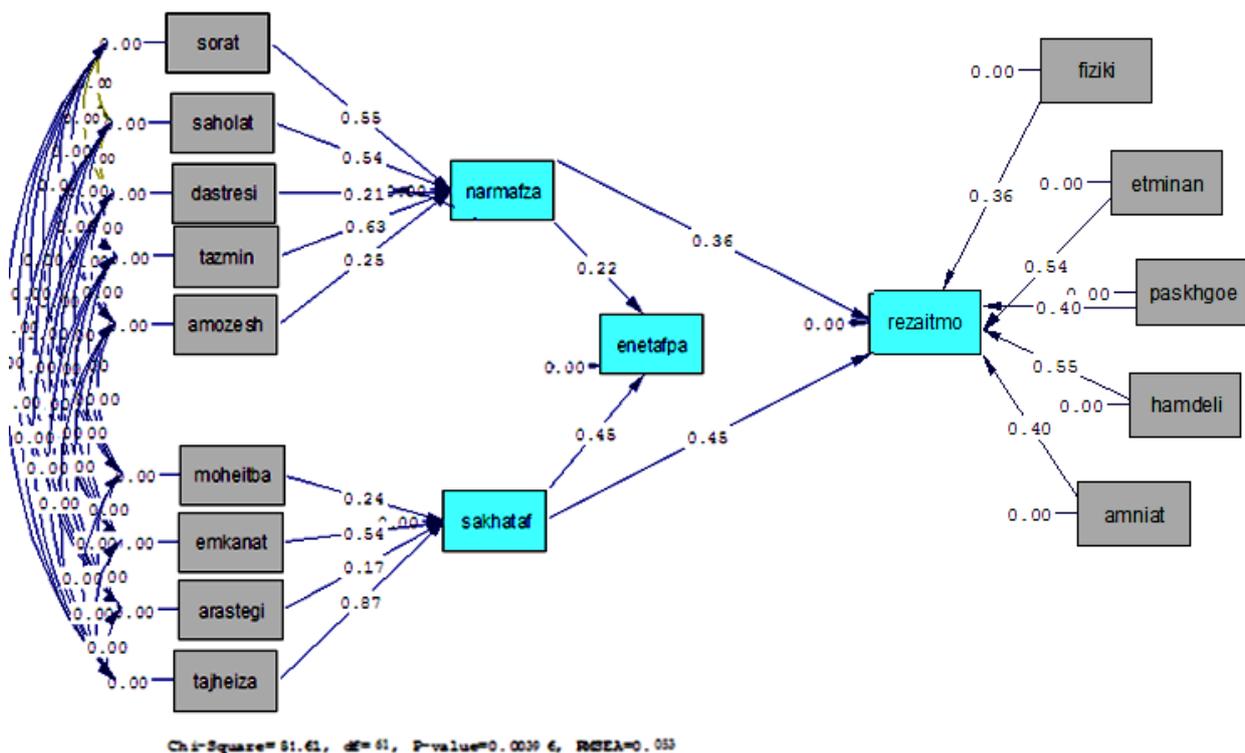


Figure 1: Path analysis and path coefficients of a model derived from LISERL software

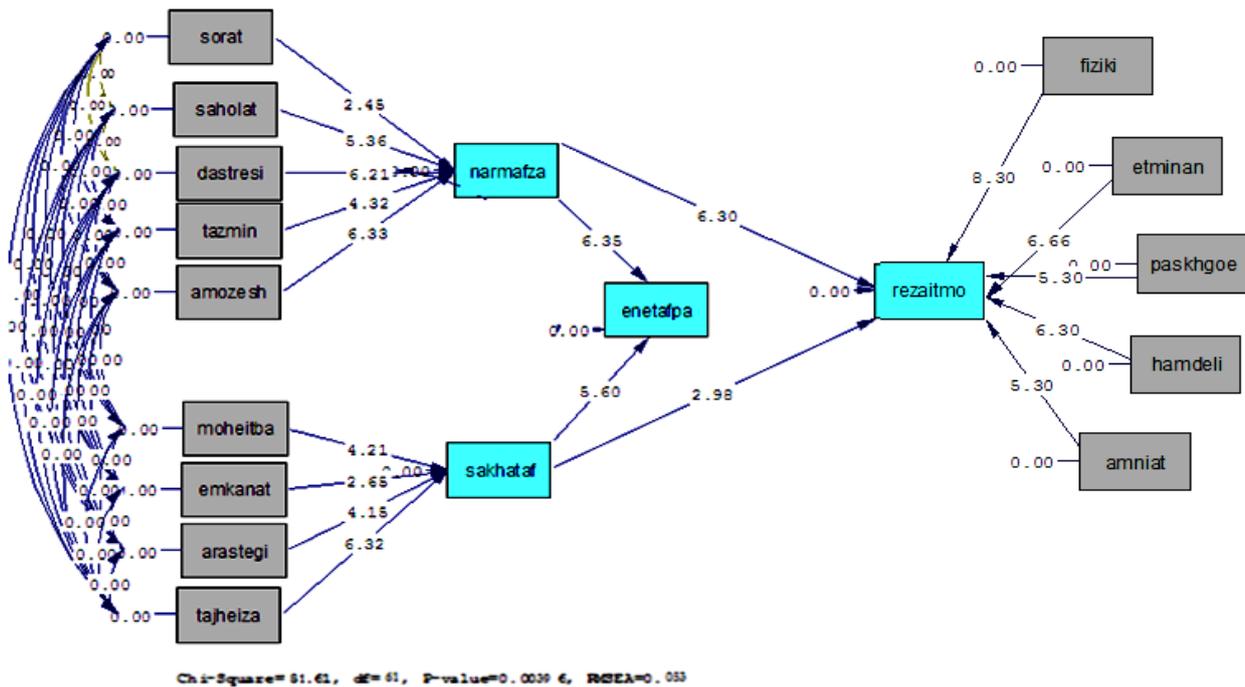


Figure 2: Path analysis and path coefficients of a model derived from LISERL t Test

The root mean square error of approximation (RMSEA) in the selected model equals 0.053 which represent the fit and significant correlation of the model. We continue to analyze the path of sub-variables.

Table 6: Model fit indices based on the main components

P- value	t-value	Coefficient	Overall fit indices
0/24	4/21	Bank environment and flexibility	$\chi^2= 22.07$ DF= 2 p-value I<005 RMSEA=053
0/63	4/32	Assurance and flexibility	
0/17	4/16	Adornment and flexibility	
0/87	6/22	Equipment and flexibility	
0/66	2/46	Speed and flexibility	
0/54	5/36	Ease and flexibility	
0/21	6/21	Access and flexibility	
0/54	2/66	Safety and flexibility	
0/26	6/33	Instruction and flexibility	

## 6. Conclusion and suggestions

Regarding the reliability test of variables, results demonstrate the validity and reliability of the research variables. Correlation between variables is significant at the confidence level of 0/05 and in Bootstrap test for this hypothesis, the bottom line of confidence interval and the upper limit of confidence are evaluated as -0/04 and 0/003 respectively. The resulted significance level is 0/011 and given that it is not included in confidence interval, the effect is significant and the first hypothesis is approved. The

results are consistent with results suggested by Joudzadeh et al. (1393), Ranjbar 91392), Pronsa et al (2011).

Jie Yu et al. (2015) investigated the impact of software and hardware infrastructures on satisfaction of banking customers and concluded that software infrastructures have a significant effect on customer satisfaction and also the flexibility has a mediating role in the relationship between infrastructure and customer satisfaction. Using Bootstrap test, the mediative role of flexibility is significant in hardware infrastructure and customer satisfaction in the proposed model. The correlation between variables is significant at confidence level of 0/05 and Bootstrap score for this hypothesis was calculated as -0/09 and -0/001 for the bottom line of confidence interval and the upper limit respectively. The resulted significance level equals 0/009. Given that is not included in confidence interval, the indirect effect is significant and the second hypothesis of the research is confirmed. The results of this hypothesis are consistent with results suggested by Joudzadeh et al. (1393), Ranjbar (1392), Pronsa et al. (2011). Due to the test of structural equations out of LISERL software, there is a significant relationship between software agents (transaction speed, easy accessibility, and safety and instruction method) and hardware agents (environment, facilities, adornment and equipment) in satisfying customers and all the hypotheses are confirmed.

In line with the results of the research, the following suggested can be suggested: First of all, it is suggested to deal with issues scientifically and to avoid dispersion and incoherency. Issues should be considered by plans, coherence and integrity and also other factors such as factors affecting customer expectations of service quality and factors affecting customer satisfaction should be studied.

1. In future studies, researchers can investigate the influence of several factors such as leadership style, teaching and employee participation, motivation of employees etc., on customer satisfaction in telecommunications.
2. Compliance of services with customer demands and expectations.
3. Enhancing high-quality services at a minimum time and cost.
4. Developing necessary facilities for serving customers.
5. Reduce technical dependency to foreign countries.
6. Reduce leisure time and unemployment.
7. Development and upgrading of telecommunication equipment.

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