

Technology Based Ability and its Relationship with Organizational Innovation

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Abstract

This research deals with studying effect of technology based abilities and its aspect on organizational innovation and evaluates the relationship between these 2 variables for better compatibility of service organizations with environment and society. In order to collect data upon determining validity and reliability, it was applied from technology ability questionnaire of Lal 2001 and organizational innovation questionnaire of Choupani et al 2012. Statistical universe of this research is all employees of water and sewage system organization, regional water organization and regional electricity company of Sistan and Balouchestan. The sampling method is based on classification i.e. employees with certificate of Associate Degree and higher were selected that upon distributing questionnaire, total number of 149 questionnaires were completed. Upon analyzing information and by using SPSS 19 and Lisrel software and regression statistical method and Spearman correlation coefficient method, it was determined that there is positive significant relationship between technology based ability and organizational innovation. In addition, there is positive significant relationship between technology based ability (investment ability, productive ability and communication ability) with organizational innovation.

Key Words: Technology Based Ability, Investment, Productive Ability, Communication Ability, Organizational Ability

Introduction:

Quick changes of environmental factors lead to increasing complexity and ambiguity in our surround organization and in fact management of organizations is facing with serious challenges. Under this condition, we shall inevitably use from old controlling paradigm that

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insists on specialty and efficiency that leads to creation of a multi section organization (Beizadeh et al 2010). One of the most important advantages of each company or any organization is benefiting from abilities of technology. In fact, developing qualifications of technology enables organization to benefit from privileges of obtaining new technologies, which requires organization to apply innovation; since, without such qualification the organization is not able to quickly respond to the innovations and technological changes (Ahuja 2000). Due to complexity of different analysis for theory of organization, it is necessary that while dealing with technology to determine the issue that should receive the highest attention. There are several methods for describing technology. There is a type of technology that directly prepares and produces the required goods and services of organization. Other technologies indirectly maintain the production process and other technologies are applied to adapt with their environment. In order to discriminate technology level of organization and other type of technologies that are applied for producing and offering goods and services to the environment, the organization theoreticians benefit from the term Basic Technology (Johich 2007, 212). All organizations require new ideas for their survival. New ideas are regarded as motivation that saves organization from liquidation. In the present age, for survival, advancement and even maintaining the present condition it is required for new movement and innovation in organization to prevent from depression (Alvani 229, 2010). By having some exceptions the term innovation deals with studying new products and developing production process. Recently, researchers criticized the exclusive application of this concept at technology. This criticize paves the way to direct comments toward non-technology based forms of innovation especially organizational innovation and management. OECD organization and statistics of Europe have offered a similar framework for innovation. Such organization defines innovation as applying a new organizational method for business process of company, work atmosphere of organization and foreign relationships of organization and consequently is regarded as a strategic decision making taken by management (Ganter and Hecker 2013). The concept of innovation has received attention of many researchers. Although innovation is result of attempts of people and organization, the domain of its influence is very broad. Economists, researchers and managers believe that the required condition for success of each society is having innovation; since, innovation is a criterion for discriminating societies and creation of competition among them (Elmir and Moris 2004, 17). Organizational innovation refers to processes, policies and different new organizational forms and consists of changes that influence policies, allocating resources and other related factors to social structure of organization (Choupani et al 2012)

Statement of Problem:

Quality of service is regarded as determining factor success of service organizations within today's competitive environment and any reduction in customer's satisfaction leads to reducing validity of organization and consequently reducing public trust to that organization. As the environment is very different and diverse, the organizations pay specific attention to permanent development and qualification of their employees. On this basis, with managerial topics it is focused on improving knowledge and skills of employees for obtaining competitive advantage and believes that role of human resources is very important due to its value and non-imitation property. Having effective human workforce evolves the available condition and meets the requirements of increasing demand for new service instead of traditional service. It is to be noted that human workforce that benefit from innovation and creativity requires to suitably recognizing creative persons. Innovation based organization may be

operating as up-to-dated and useful organization to offer service. On the other hand, evolving and diverse environment of organizations in the present age makes managers to apply more from abilities of technology in order to cope with rivals and maintaining and even increasing their position. In fact, mixing technology abilities and organizational innovation in addition to other organizational factors meets the requirements of customers. Water and sewage system companies, regional water company, electricity distribution company and telecommunication company are among service companies that offer service to numerous number of their customer and according to the aforesaid issues this question is raised that, what is the role of technology ability on organizational innovation

Review on Research Background and Theoretical Framework

Technology Based Ability

Basic technology of organization consists of type of technology that leads to offering original product to the customers, which forms the main process of producing goods and offering service. This type of technology that is studied from organizational point of view is generally performed by one of the sectors of organization and is created for showing general technology of organization and preventing from ambiguities due to different levels that is called as main technology or basic technology. For example in a steel company the steel is produced by using technology or in a automobile production company the automobile is manufactured and offered to market by using technology, such technology is regarded as basic technology (Ansari et al 2011). The main duty of technology manager of organization is cooperating with senior management and consultants of organization for preparing technology strategy of organization in the way of macro strategic program of organization. Such technology has the following strategies including:

- 1) Anticipating processes of technology
- 2) Preparing practical program and benefiting from the best current technologies of company
- 3) Preparing program of integrating current technologies of company with new technologies
- 4) Integrating technology programs of company with main purposes of organization (Heidari 2007)

There are 2 fundamental approaches including: technological abilities and its assessment. Some aspects of technology process focuses on ability of technology that is set of organizational routines and processes in the way of technological changes. Some other technologies including: technology based knowledge, secrets of business and technical knowledge that are created and developed by researcher refer to intellectual ownership of technology (Naghizadeh et al 2003). In continuation the table 1 offers the result of some important researches in the field of improving technology abilities with other approaches accepted in the field of technology abilities.

Research Background:

This is a modern research that in spite of studying different scientific and research resources, no researcher has still deal with the original topic either inside or outside of Iran. Therefore, we study the already performed similar researches in order to become more familiar with this topic:

* In research of Hosseini 2001 with title of studying the relationship between technologic innovation of middle managers with strategic opportunity, the outer structure and environment of middle managers on technologic innovation is regarded as basics for discriminating companies with respect to innovation. The statistical universe of this research

was 57 medium and large size enterprises. Results of research showed that there are important differences between highly innovative based companies and less innovative based companies with respect to strategic situation, structure and outer environment of organization

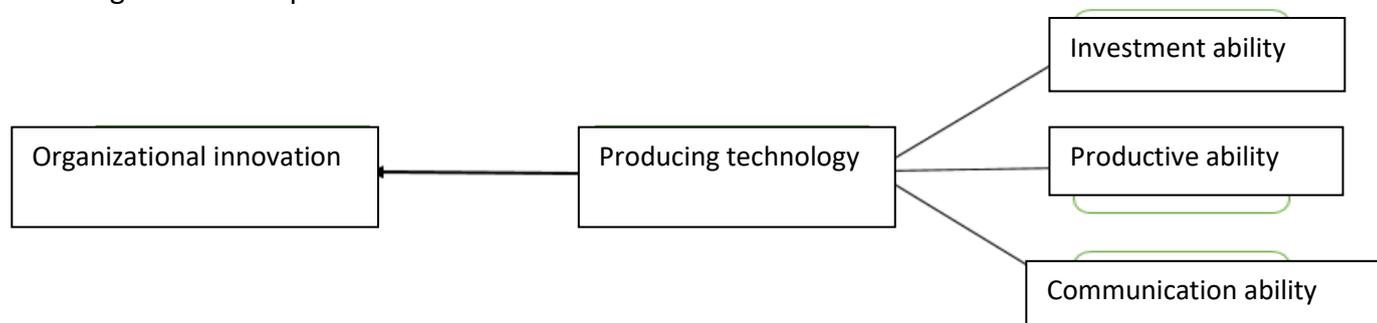
* In PhD thesis of Szogs 2010 with title of transferring technology and structure of enabling technology in unofficial companies of Tanzania showed that transferring technology to other innovative organizations leads to increasing abilities of technology in organization. In addition, transferring technology to unofficial organizations is more complicated than official organizations

* Inauen and Wichi 2012 in their research with title of “educating basic innovation by using open technology” studied the concept of open and closed innovation among organization. The term open innovation refers to a pattern that imagines companies should benefit from domestic and foreign ideas. On the other hand, the term closed innovation insists on domestic ideas of companies. In this research it is concluded that companies benefiting from open innovation may create basic innovation in their companies and sell new products or offer new services; meanwhile, companies benefiting from closed technology may successfully manufacture products with higher performance; however, they are not able to obtain new products

Conceptual Research Model:

Upon referring to theoretical basics and research background the conceptual research model is offered by considering aspects of abilities of companies in compliance with attitude of Lal process 2001

Figure 1: Conceptual research model



Principal Hypothesis:

* Ability of technology has significant relationship with organizational innovation

Subsidiary Hypothesis:

* Investment ability has significant relationship with organizational innovation

* Productive ability has significant relationship with organizational innovation

* Communication ability has significant relationship with organizational innovation

Research Methodology:

This is descriptive and correlation research and in order to collect data it was benefit from theoretical basics and literature review and library method through studying books, journals, domestic and foreign articles extracted from valid Internet websites related to technology ability and organizational innovation. Statistical universe means a set of persons or units having minimum one common property (Sarmad and et al 177, 1999; therefore, statistical

universe of this research is all employees of regional electricity company, regional water company and water and sewage system company of Sistan and Balouchestan province. Statistical sample refers to set of signs and marks that is selected from a larger part, group or society, so that this set introduces set of qualities and properties that are part of large part, group or society (Khaki 250, 2008). In this research it was benefit from class sampling method i.e. employees are classified into 2 groups including: persons with Associate Degree certificate and higher and persons with Associate Degree certificate and lower and the questionnaire was distributed among employees with Associate Degree and higher. Table 2 shows employees with Associate Degree and higher at regional water company, regional electricity company, water and sewage system company.

Table 2: No of employees with Associate Degree and higher certificate for companies under this study

| Regional water | Regional electricity | Water and sewage system |
|----------------|----------------------|-------------------------|
| 65 | 55 | 70 |

Upon distributing questionnaire among all employees with Associate Degree and higher certificate, the questionnaires were collected that is shown in table 3

Table 3: No of correct completed collected questionnaire from aforesaid companies

| Regional water | Regional electricity | Water and sewage system |
|----------------|----------------------|-------------------------|
| 46 | 51 | 52 |

The researcher should collect, measure or describe data. The tool for collecting information of this research is questionnaire. It is to be noted that questionnaire is the most common research tool that is mainly applied at behavioral sciences researches. Questionnaire with respect to form of questions are classified into 2 classes including: closed response and open response (Pasha Sharifi and Sharifi 183-165, 2001) that this research has closed response. Therefore, the method of collecting information at this research is including:

- * Library study consisting of studying books, domestic and foreign journals, searching at Internet for obtaining to theoretical basics and benefiting experience of other researchers
- * Benefiting questionnaire as main research tool for collecting information to obtain desired data

In this research, it is applied from 19 questions and 2 questionnaires for assessing technology ability and organizational innovation. In addition, 4 questions are offered for assessing demographical variables including:

1) Technology ability questionnaire: In order to assess technology ability it was benefit from Lal questionnaire 2001. In this questionnaire that consists of 19 questions it is benefit from Likert 5 item spectrum and 3 ability aspects including: investment ability, production ability and communication ability. With respect to application of this questionnaire at productive companies; whereas, the society of this research is among service organizations and benefiting comment of respected university professors; we eliminated some questions. Upon amending questionnaire some questions were changed and the number of questions was reduced from 19 questions to 15 questions. Finally the components and related questions for each item was offered in table 4

Table 4: Adapting questions of the questionnaire for technology ability and its components

| Index | Questions related to each index | Micro-index | Questions related to each micro-index |
|-------|---------------------------------|-------------|---------------------------------------|
|-------|---------------------------------|-------------|---------------------------------------|

| | | | |
|--------------------|-------------------|-----------------------|-----------------|
| Technology ability | Questions 1 to 15 | Investment ability | 1,2,3,4,5,12,15 |
| | | Production ability | 6,7,9,10 |
| | | Communication ability | 8,11,13,14 |

2) Organizational innovation questionnaire: This questionnaire is designed in compliance with these 3 items by having 4 questions that consists of questionnaire of James et al 2008, Pendiaz 2006, Perajgo and Sohel 2006 (Choupani and et al 2011). While designing questionnaire it was benefit from Likert 5 choice spectrum that is regarded as most common index for measurement

3) Demography property questionnaire: This questionnaire is applied for obtaining information about individual and demographical properties of society. In this questionnaire the variables of age, sex, education and experience of service records is measured

Research Validity:

In this research it was benefit from validity method; since, when empirical validity is impossible or there is problem to obtain validity through empirical and practical method, it is benefit from conceptual validity; in fact, through evidences the researcher intends to show that whether research has validity or not (Khaki 291, 2008). Researcher with respect to standard questionnaire, in addition to referring to comment of specialists and professors, benefits from factor analysis in order to confirm the validity of research. In this method, it is attempted to show that whether data are arranged with factor structure or not. Figure 2 and 3 studies this issue. The following figures show number for obvious variables (questions) and hidden variables (structures) with factor load or factor weight that show level of correlation and level of load that an obvious variable has on hidden variable; which, should basically be more than 3. The first figure shows validity of technology ability and evaluates its aspects and it is observed that all of the factor loads are more than 3. Thus, this questionnaire has good validity. The second figure evaluates validity of organizational innovation and it is concluded that factor load of question 19 is less than 3; therefore, it is eliminated from model

Figure 2:

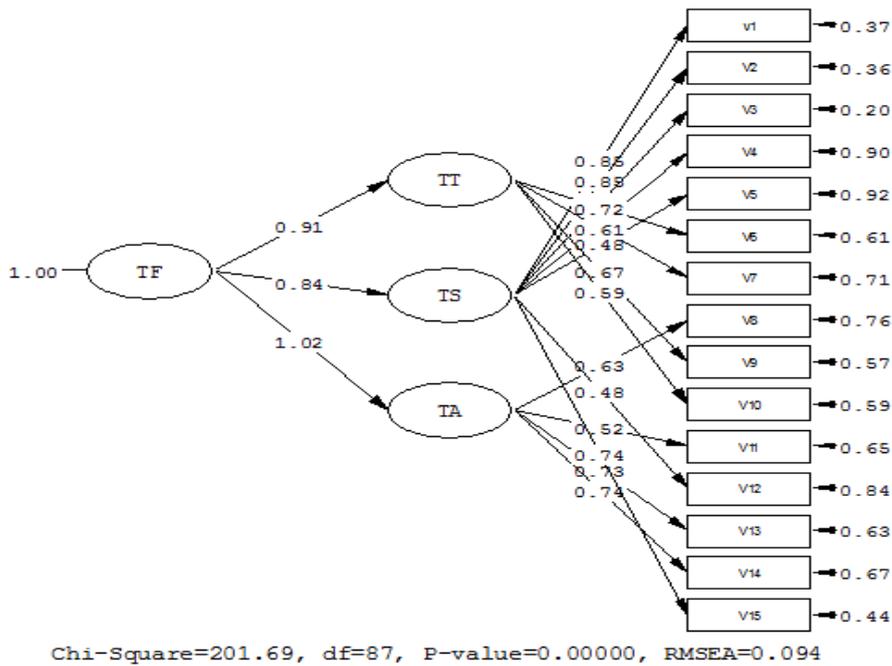
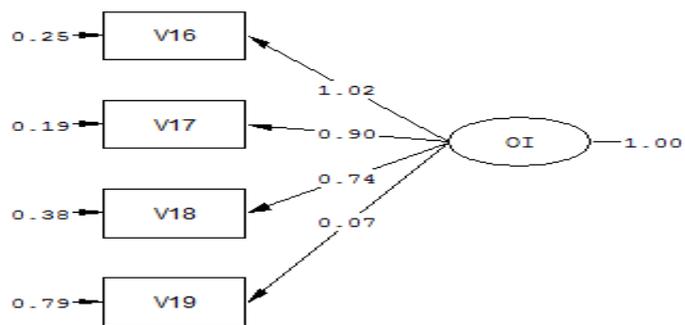


Figure factor

3: Approval analysis for

organizational innovation



Reliability:

A test is reliable if the observed grades and real grades have high level of correlation. Several factors are effective on validity and reliability including: 1) Not defining amendments 2) Not paying attention to person asking question 3) Incompatibility of respondents 4) Changing condition and grounds of asking question 5) Appearance of tools 6) Incompatibility of different stages of research (Ranji Jifroudi 2010). In order to determine reliability it is benefit from Alpha Cronbach method and finally the Alpha Cronbach coefficient is obtained for questionnaire of technology ability and organizational innovation as /909 and /889 and whereas Alpha Cronbach coefficient for both questionnaire is more than 0/7, both questionnaires have required reliability

Data Analysis:

According to the received questionnaire fro 149 statistical sample, the following demographical information was obtained:

| Demographical Variable | Sub-Group | No | Frequency | Frequency Percentage | Cumulative Frequency Percentage |
|------------------------|----------------------|-----|-----------|----------------------|---------------------------------|
| Age | Younger 30 years | 148 | 32 | 21.5 | 21.6 |
| | 30 to 40 years | | 78 | 52.3 | 74.3 |
| | 40 to 50 years | | 29 | 19.5 | 93.9 |
| | 50 years and over | | 9 | 6 | 100 |
| Sex | Male | 147 | 86 | 57.7 | 58.5 |
| | Female | | 61 | 40.9 | 100 |
| Education | Associate Degree | 148 | 23 | 15.4 | 15.5 |
| | Bachelor's Degree | | 92 | 61.7 | 77.7 |
| | Master's Degree | | 33 | 22.1 | 100 |
| | PhD Degree | | 0 | . | |
| Service Record | Younger than 5 years | 148 | 21 | 14.1 | 14.2 |
| | 5 to 10 years | | 42 | 28.2 | 42.6 |
| | 10 to 15 years | | 34 | 22.8 | 65.5 |
| | 15 to 20 years | | 29 | 19.5 | 85.1 |
| | 20 years and over | | 22 | 14.8 | 100 |

Whereas data are rank based, in order to obtain correlation between data, it is benefit from Spearman correlation

Principal Hypothesis: Technology ability has significant relationship with organizational innovation

Zero Hypothesis (H0): There is no significant relationship between technology ability and organizational innovation

Opponent Hypothesis (H1): There is no significant relationship between technology ability and organizational innovation

$$\begin{cases} H_0 : \mu \leq 3 \\ H_1 : \mu > 3 \end{cases}$$

Table 6: Summary of Spearman correlation test about relationship of technology ability and organizational innovation

| First Variable | Second Variable | Correlation Coefficient | Sig Level | Result of Test |
|--------------------|---------------------------|-------------------------|-----------|-----------------------|
| Technology ability | Organizational innovation | 0.632 | 0/000 | There is relationship |

According to the information of table, it is concluded that at sig level of sig=0/000 the level of Spearman correlation coefficient for technology ability and organizational innovation at

companies of this study is 0/632; therefore, there is positive significant correlation between 2 aforesaid variables. Thus, by more than 0/99% the zero hypothesis is rejected and the research hypothesis is confirmed. It is also concluded that there is direct significant relationship between technology ability and organizational innovation at 3 aforesaid companies

First Subsidiary Hypothesis: There is significant relationship between investment ability and organizational innovation

Zero Hypothesis (H0): There is no significant relationship between investment ability and organizational innovation

Opponent Hypothesis (H1): There is significant relationship between investment ability and organizational innovation

$$\begin{cases} H_0 : \mu \leq 3 \\ H_1 : \mu > 3 \end{cases}$$

Table 7: Summary of Spearman correlation test about relationship of investment ability and organizational innovation

| First Variable | Second Variable | Correlation Coefficient | Sig Level | Result of Test |
|--------------------|---------------------------|-------------------------|-----------|-----------------------|
| Investment ability | Organizational innovation | 0.599 | 0/000 | There is relationship |

According to the information of table, it is concluded that at sig level of sig=0/000 the level of Spearman correlation coefficient for investment ability and organizational innovation at companies of this study is 0/599; therefore, there is positive significant correlation between 2 aforesaid variables. Thus, by more than 0/99% the zero hypothesis is rejected and the research hypothesis is confirmed. It is also concluded that there is direct significant relationship between investment ability and organizational innovation at 3 aforesaid companies

Second Subsidiary Hypothesis: There is significant relationship between production ability and organizational innovation

Zero Hypothesis (H0): There is no significant relationship between production ability and organizational innovation

Opponent Hypothesis (H1): There is significant relationship between production ability and organizational innovation

$$\begin{cases} H_0 : \mu \leq 3 \\ H_1 : \mu > 3 \end{cases}$$

Table 8: Summary of Spearman correlation test about relationship of production ability and organizational innovation

| First Variable | Second Variable | Correlation Coefficient | Sig Level | Result of Test |
|--------------------|---------------------------|-------------------------|-----------|-----------------------|
| Production ability | Organizational innovation | 0./481 | 0/000 | There is relationship |

According to the information of table, it is concluded that at sig level of sig=0/000 the level of Spearman correlation coefficient for production ability and organizational innovation at companies of this study is 0/481; therefore, there is positive significant correlation between 2 aforesaid variables. Thus, by more than 0/99% the zero hypothesis is rejected and the research hypothesis is confirmed. It is also concluded that there is direct significant relationship between production ability and organizational innovation at 3 aforesaid companies

Third Subsidiary Hypothesis: There is significant relationship between communication ability and organizational innovation

Zero Hypothesis (H0): There is no significant relationship between communication ability and organizational innovation

Opponent Hypothesis (H1): There is significant relationship between communication ability and organizational innovation

$$\begin{cases} H_0 : \mu \leq 3 \\ H_1 : \mu > 3 \end{cases}$$

Table 9: Summary of Spearman correlation test about relationship of communication ability and organizational innovation

| First Variable | Second Variable | Correlation Coefficient | Sig Level | Result of Test |
|-----------------------|---------------------------|-------------------------|-----------|-----------------------|
| Communication ability | Organizational innovation | 0./523 | 0/000 | There is relationship |

According to the information of table, it is concluded that at sig level of sig=0/000 the level of Spearman correlation coefficient for production ability and communication innovation at companies of this study is 0/523; therefore, there is positive significant correlation between 2 aforesaid variables. Thus, by more than 0/99% the zero hypothesis is rejected and the research hypothesis is confirmed. It is also concluded that there is direct significant relationship between communication ability and organizational innovation at 3 aforesaid companies

In the aforesaid table R is equivalent to correlation coefficient; of course the difference of R with correlation coefficient is that R is available between zero and +1 i.e. it is never negative. R Square or R^2 is square correlation coefficient and coefficient of changing name. Adjusted R Square or R^2 is coefficient for determining adjusted amount. The determining coefficient shows level of variance for dependant variable that is described by variance or independent variable. Here R^2 equals to 0/374 i.e. technology ability only describes 37/4% variance of

changes for organizational innovation. If T is large and sig level is smaller i.e. independent variable (anticipation) has strong influence on dependant variable; in which, the level of T is 9.147. In order to describe role of technology ability on organizational innovation it is benefit from multi linear regression and step by step method. Here it is benefit from technology ability as anticipation variable and organizational innovation as criterion variable. It is to be noted that within step by step regression, entrance of variables is based on correlation coefficient. Results of test is offered at table 11

Table 11: Step by step regression related to share of technology ability on organizational innovation

| Step | Variables | R | R ² | F | Sig Level |
|------|-----------------------|-------|----------------|--------|-----------|
| 1 | Investment ability | ./582 | ./339 | 71.772 | ./000 |
| 2 | Communication ability | ./598 | ./358 | 38.720 | ./000 |
| 3 | Production ability | ./614 | ./377 | 27.840 | ./000 |

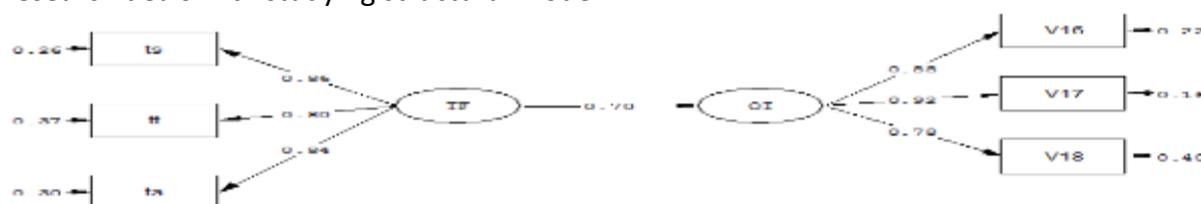
As it is concluded from table 11, in the first step the variable of investment ability due to having highest correlation coefficient is entered into regression equation by dependant variable and describes 33.9% for organizational innovation. Whereas F equals to 71.772 this level of variance describes the first stage at sig level of Sig=./000

In the second step the variable of communication ability due to having highest correlation coefficient is entered into regression equation and reaches R2 to 35.8 and describes 1.9% for organizational innovation. Whereas F equals to 38.720 this level of variance describes the first stage at sig level of Sig=./000

Finally in the third step of production ability due to having highest correlation coefficient is entered into regression equation and reaches R2 to 37.7 and describes 1.9% for organizational innovation. Whereas F equals to 27.840 this level of variance describes the first stage at sig level of Sig=./000

Evaluating Structural Model:

After hypothesis test, it is time for studying structural model that shows relationship between available variables. In this section the relationship between hidden inner and outer variable is considered. The purpose is determining whether theoretical relationships between variables that are among conceptual research framework are confirmed by data or not. This research deals with studying structural model



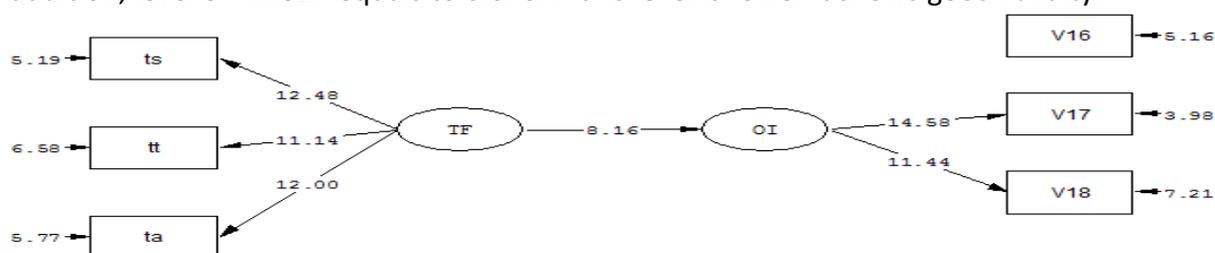
Chi-Square=22.59, df=13, P-value=0.00686, RMSEA=0.070

According to the results of table 12 it is concluded that this model has suitable validity

Table 12: Results of validity for structural research model

| X2 | DF | P-Value | RMSEA |
|-------|----|---------|-------|
| 22.59 | 13 | 0.00686 | 0.070 |

Table 12 shows structural model between technology ability and dependant variable of organizational innovation under standard estimation and influence of each variables on describing variance for grade or main factor. For the aforesaid structural model it is possible to compare variables with factor load and evaluate its influence on dependant variable, so that variable having large factor load has the highest influence on dependant variable. Results of estimation show that this model is appropriate. According to Lisrol output level of X^2/df is less than 3 that shows little difference between conceptual model with research data. In addition, level of RMSEA equals to 0.070. If this level is fewer it shows good validity.



Chi-Square=22.59, df=13, P-value=0.00686, RMSEA=0.070

Diagram 5 shows that significant number for structural research model. It is concluded that all relationships are significant. Therefore, the research model is regarded as suitable pattern for inner relationship between aspects and variables.

Conclusion:

The service sector is regarded as strategic sector that has received specific attention by policy makers recently. In this way, developing technological abilities of active companies in this sector is among necessary preliminaries of advancement of service sector of Iran. This research is step for studying the relationship between technology ability and organizational innovation among water and sewage system company, regional electricity company, regional water company of Sistan and Balouchestan province which is attempt to obtain research variables. This research studies the influence of technology abilities and its aspects on organizational innovation through linear regression test, step by step test, Spearman test and also structural equations by using Lisrol software that results of test were significant at certainty of 99% i.e. there is positive significant correlation between technology ability and organizational innovation. This issue means that if technology ability in organization increases, the innovation of employees that creates organizational innovation also increases. In addition, 3 aspects of technology including: investment ability, productive ability and communication ability has significant relationship with organizational innovation by certainty of 99%. Upon determining correlation, by using regression statistical tool, it is determined that the aspects of investment ability and communication ability have the highest influence and determining coefficient for organizational innovation. Thus, it seems to have service organizations to focus on the following fields: investment ability, recognition, preparation, acquiring technology, preparing, equipping and employees in order to increase level of innovation. Finally according to the results of research, it is concluded that service sector organizations feel that their employees have little amount of innovation. In addition, in compliance with findings of this research, the following recommendations are offered for improving technology ability and organizational innovation:

* Those companies may have permanent development that attempt to increase their technology ability continuously and offer new service or product to market in order to obtain competitive advantage

* Organizations should encourage their employees to have innovation and creativity and prepare grounds of showing their hidden talents

* Today's organizations should have more attention to knowledge based researches and attempt to acquire modern knowledge

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