IDENTIFYING AND PRIORITIZING EFFECTIVE FACTORS IN GOVERNMENTAL AND SEMI-GOVERNMENTAL ORGANIZATIONS' ELECTRONIC READINESS FOR ACCEPTING AND UTILIZING TELE-WORKING BY FUZZY AHP TECHNIQUE IN TABRIZ CITY-IRAN

Rahmani Kamaleddin[a], Shokrzadeh Morteza[b] and Samir Rahmani[c]

[a] *Assistant Professor, Department of Management, Islamic Azad University Tabriz, Branch, Iran*
kr13452000@yahoo.com
[b] *Faculty Member of Higher Education Non-governmental Azarabadegan University of Urmia, Iran*
[c] *Master Student, Department of Commerce, Islamic Azad University Azarbayijan East Branch, Iran*

Abstract

Nowadays, moving toward globalization, removing physical borders and living in global village have made societies to accept information technology as an un-separable part of their lives. Tele-working is an important innovation embeded in the context of information technology, and internet. But, before any widespread use of every new technology, necessary basis should be provided for it to be welcomed by the users. Or else, obligation in its exertion will lead the society to the blind usage of them. This paper first investigated the effective factors in-electronic readiness of governmental and semi-governmental organizations of Tabriz city ; Then , effective factors in accepting information technologies and tele-working were recognized using research theories and exploratory factor analysis and KMO test . To identify different aspects of electronic readiness of the organizations considering their types and dimensions, 34 factors were regarded from which 7 factors were extracted expressing 66.74% of total changes. To identify different aspects of information technology and tele-working, 19 variables were used from which 7 variables were extracted, eliminating 2 questions (11 and 19) from the questionnaire, expressing 75.27% of total changes. Using One-Sample T-Test, effectiveness of each variable on electronic readiness of organizations was tested through research hypotheses. Exerting Fuzzy AHP (Chang method), factors were ranked. The results showed that electronic readiness variables have higher priority than technology acceptance variables.

Keywords: E-Readiness; Fuzzy AHP; Information Communication Technology; Tele-working

1. Introduction

Many economists, experts, and predictors believe that during last years a revolution like industrial revolution has occurred, leading the world to information technology arena that has changed many economic, social, and cultural aspects of human life. Economic revolution is of this type (Golmohammadi 2009,1). If developing countries don't keep up with this trend, as it occurred during industrial revolution, they will have to be only the followers and consumers of developed countries in this field rather than the pioneers. Movement or even acceleration toward using IT for more efficiency in the economic and service

fields is not an unknown fact for anybody. No manager denies this necesity for the organizational, managerial, and economic revolutions in the industries and service corporations (Zargar 2005, 17).

Considering the great role of Information Communication Technology (ICT) in improving business efficiency, many countries have tried to exert it in their industries. But, despite huge investments on it, its spread and penetration is slow (Modern Technologies/Studies Office 2008, 5). The reason for this can be low electronic readiness level for accepting ICT inside and among businesses for which Iran can be exemplified where low efficiency of ICT is for the lack of proper context despite enormous investments on it (Modern Technologies/Studies Office 2008, 6) . Investigating the readiness level of different organizations is the first step. Then, providing the essential contextes for it leads organizations to using teleworking (Abtahi 2010, 16). Since accepting teleworking processes needs organizational and staff ' s behavioral changes, managers evaluate organizational readiness for accepting teleworking processses or changes to identify a proper starting point for it, or else they will have to bear excessive costs rather than benefits. Rediness is a prerequisite for the successful confrontation of a person or organization with the organizational changes. Then, true readiness estimation seems necessary for the true direction of the attempts and strategies. Other prerequisites for the successful implementation of teleworking should also be carefully considered. The time and place in which people accept a new technology and adopt with it are imprtant. Finding effective variables in accepting and using IT has been of great interest for the researchers without which no efficiency can be achieved.

2. Tele-working

In the industrial arena, trade centers were organized in definite locations for more conformation. Work instruments were concentrated and unmovable and the physical presence of the staff was necessary at work. In the informatic arena, production and supply of tools are electronic. With the advent of cheap computers, networks and Internet are accessible for every one without a physical presence at work. Along with great technological advances, work hour, environment, and time are losing their importance. Instead, job quality is gaining more significance. Then, liquid work or tele-working is growing fast in every place and time. Despite traditional employees, a tele-worker is away from formal organizational area and is connected to the employer by the electronic media. According to Niles tele-work is any IT replacement for work trips or the work movement toward employees rather than employees' movement toward work, one or some-day work in the office or at home or tele-centers, stressing reduction or elimination of daily commutation to work. In another definition, Morgan states that tele-working is a method for doing flexible work. In this way, employees can do their job in another place instead of their formal place by IT tools.

Considering above-mentioned points, this paper follows the following scientific and applied goals:

1.Identifying effective factors in electronic readiness of governmental and semi- governmental organizations for exerting tele-working.

2. Identifying effective factors in accepting and applying tele-working by governmental and semi-governmental users.

3. Prioritizing effective factors in governmental and semi- governmental organizations' readiness for accepting and using tele-work by AHP technique.

4. Representing a model including the indices and effective factors in governmental and semi-governmental organizations' readiness for accepting and using tele-work.

3.   Research Questions

The questions that were going to be examined in this paper are as follows:

1.What factors do contribute to the governmental and semi- governmental organizations' readiness for using tele-work in Tabriz?

2. What factors do contribute to the governmental and semi- governmental organizations' acceptance of telework in Tabriz?

3. Which effective factor is of higher priority in governmental and semi- governmental organizations' readiness for accepting and using tele-work in Tabriz?

4.   Study Design and Methods

This study is a survey with applied goals using descriptive methods. Exerting the theoretical bases and existing models, first, the indices of electronic readiness of the organizations and tele-work/IT acceptance were identified by the users. Then, 2 separate questionnaires were given to the employees of governmental and semi- governmental organizations. Recording respondents' answers to the questions, standardization operations and ideas' comparison were done using factorial analysis, KMO test, and SPSS software. Effective factors were identified and explained. To use experts' ideas on the issues, Delphi technique was used. The questionnaire of fuzzy comparison pair was given to the experts of governmental and semi- governmental organizations to weigh and prioritize effective factors in their electronic readiness. Using Fuzzy Analytical Hierarchy Process (Fuzzy AHP), Excel and Expert Choice software, the factors were prioritized and electronic readiness for tele-working was identified according which a model was represented.

Statistical population of this study included all software managers, assistants, experts and programmers in governmental and semi- governmental organizations in 2011 including 120 people. Using simple random sampling and Cochran formula, a sample size with 92 people was achieved.

Library and field data gathering methods were exerted. 2 researcher-made questionnaires, one about the electronic readiness of the organizations with 34 questions and the other, examining the acceptance of IT from the view of informatic employees of governmental organizations using a 5-item Likert scale (very low, low, average, high, very high) were exerted. The number of the questions matched with the number of criteria and sub-criteria. A questionnaire including fuzzy pair comparison was used to weigh these factors.

5.   Data Analysis

After gathering the questionnaires, they were codified. To analyze questionnaires' data, they were given to SPSS software to be investigated. To identify effective factors, factorial analysis and KMO test were used. To test the results' significance, a One-Sample T- Test, and to prioritize factors, fuzzy AHP was used.

5.1   Effective indices and factors resulted from existing theoretical principals and models

The indices and measurement criteria of electronic readiness and tele-work/IT acceptance for each index have been identified (Table 1 and2).

Table 1: Tele-work/IT Acceptance Indices

Measurement Criteria	Indices & References
Productivity promotion and job performance improvement A faster and easier relation Economization in time and money Telework usefulness	1. Perceived benefitability (TAM model)
Transparency and understandability Accessibility	2. Ease of use (TAM model)
Being wise Being fine Being lovely and pleasant Having better feeling Personal willingness Using tele-work in future	3. IT use purpose (TAM model)
Conformity with personal lifestyle Job-related variables	4. Job relation and conformity (IDT model)
Important people' s impression (family, friends, co-workers, relatives) Social status	5. Mental norms and images (model of TRA)
Capability of being tested before deciding to use it or not Being voluntary to use	6. Testability (IDT model)
Task performance quality in system output Results' observability	7. Output quality and provability (acceptance ' s secondary model)

Table 2: Electronic Readiness

Model	Measurement Criteria	Indices	
CSPP	Technologies for connection to Internet, Speed and quality of access to network	Basis	1
CSPP	Network-related places which provides access	Access to network	2
CSPP	It makes more qualitative hman life, more meaningful jobs, smarter people, stronger and safer communication.	Network application and services	3
CSPP	Discovery and innovation, Trained human source, Aware users	Network economy	4
CSPP	Learning, Safety, Privacy, Policy-making	Network fortifiers and assistants	5

CID	Informatic bases: the ratio of fixed or mobile telephone lines to the whole population Access rate to Internet: the ratio of Internet service providers to the whole population Proper price for Internet access: paid money for accessing Internet Internet access speed and quality: auditory communication quality, unsuccessful communication mean, lost information package rate	Access to network	6
CID	School access to IT and communication, Using IT and communication for education promotion, Developing workforce, IT, and communication	Education via network	7
CID	On-line people and organizations' number, Existing local electronic content IT usage amount in daily life, IT usage amount at work	Network-based society	8
CID	IT-related job opportunities rate, e-trade type B2C rate, e-trade type B2B rate	Network-based economy	9
CID	Telecommunication and communicative rules' status, IT-related economic policies' status	Network-based politics	10
APEC	Speed, price, access, market competition, industries standards, foreign investment	Basic technologies	11
APEC	Band length, industry variation, export control, credit card rules	Access to Network services	12
APEC	Usage in business, government, and houses	Using Internet	13
APEC	Industry direction' s standards	Facilitating and advertisement activities	14
APEC	IT education, work force	Human resources and skills	15
APEC	Taxes, tariffs, industrial self-regulation, public rules, consumer trust	Establishing digital economy situation	16
Mc Connel	Bases, network connection and access prices	Connectability(communication)	17
Mc Connel	Public rules and policies	Electronic leadership	18
Mc Connel	Spiritual ownership, privacy maintenance, e-signature	Information security	19
Mc Connel	IT training, skilled and accessible work force	Human capital	20
Mc Connel	Competition, financial and political stability, foreign investment, financial basis	Electronic business cost	21
Mosaic	Internet use per capita	Internet learning rate	22
Mosaic	Internet use geographical dispersion	Geographical dispersion Internet usage	23
Mosaic	Internet use in financial sections	Sectional absorption	24
Mosaic	Regarded bases for connection	Communicative basis	25
Mosaic	Service market 's status, Technical Internet use	Organizational basis	26
Mosaic	Technical and professional internet usage	Application complexity	27

WITSA	IT barriers	Barriers of IT	28
WITSA	Customer trust role	The role of customer trust	29
WITSA	E-trade problems	IT problems	30
WITSA	Domestic activities supporting e-trade	Internal activities supporting e-trade	31
WITSA	Work force problems	Work force problems	32
WITSA	Taxes	Taxes	33
WITSA	Public policies aspect	Aspects of public policies	34
WITSA	Customer resistance	Customer resistance	35
CIDCM	Structural content(economic, educational, and other existing bases), culture and political straucture(government, policy-making methods), cultural norms.	Background and history	36
CIDCM	Players goals and duties in government, local businesses, research groups and etc	Main players in Internet development	37
CIDCM	Every aspect of IT and Internet development	Negotiations among players in Internet Development	38

The results of exploratory factorial analysis

Before doing factorial analysis, KMO test was used for different factors like electronic readiness of the organizations. The results of this test showed the acceptability of the variables whose results are shown in Table 3.

Factorial analysis of the variables using Varimax Rotation was orthogonal Generally, factorial analysis of the variables was done by main factor analysis in which 7 factors of managerial indices, informatic and communicative bases indices, human resource indices, accessibility of IT, network-based economy, security indices, and network-based policies were extracted, expressing 66.74% of the whole changes. Table 3 shows the results of factorial analysis on the organizational electronic readiness in which Scree Plot method was used. Using Cronbach α, the variability of each factor and its variables were examined whose smaller than 0.05% values confirmed their validity.

Table 3.The components and results of factorial analysis and validity for the variables of electronic readiness

Topics	Questions	Factoriel load	Special values	Expressed variance	Validity coefficients	Total validity coefficients
Managerial indices	How much do managers' agreement with electronic readiness impact exerting telework?	0.634	5.38	16.3%	0.88	0.78
	How much does managers trust to employees impact electronic readiness for exerting telework?	0.631				
	How much does managers clear working goal identification for employees impact electronic readiness for exerting telework?	0.617				
		0.548				
	How much do managers work planning abilities impact electronic readiness for exerting telework?	0.54				
	How much do managers motivating creation in employees impact electronic readiness for exerting telework?	0.48				
	How much do feedback and performance assessment mechanisms impact electronic readiness for exerting telework?	0.43				
	How much does goal-based rather than process-based managerial approach impact electronic readiness for exerting telework?					
ICT bases indices	How much does website designing for organization impact exerting telework?	0.73	4.68	14.6%	0.58	0.78
	How much do telecommunication and communicative contexts impact exerting telework?	0.56				
	How much does WAN network for inter-office and telework communications impact exerting telework?	0.53				
	How much does LAN network for supporting accounting system ,benefited from IT advantages , impact exerting telework?	0.65				
	How much does backup and emergency recovery system impact exerting telework?	0.63				
	How much do informatic software like MIS,DSS,EIS , including comprehensive organizational information impact exerting telework?	0.52				
	How much does electronic data interaction system impact electronic readiness for exerting telework?	0.51				
	How much do activity performance capability and solving work problems without any supervisor impact exerting telework?	0.43				
	How much does organizational compatibility for being electronic impact electronic readiness for exerting telework?	0.36				
	How much does clients ability for paying via credit cards impact exerting telework?	0.68				
Human resource indices	How much do staff training for getting IT readiness and enough budget for it impact exerting telework?	0.45	3.42	10.69%	0.61	0.78
	How much do accessibility of IT experts inside and outside organization impact exerting telework?	0.52				
	How much do activity doing and problem-solving capabilities without need to supervisor impact exerting telework?	0.43				
	How much does time management of the staff impact electronic readiness for exerting telework?	0.54				
	How much does staff job satisfaction impact electronic readiness for exerting telework?	0.51				
	How much does a proper work place at home impact electronic readiness for exerting telework?	0.38				
IT accessibility	How much does net-related places with an access to it impact electronic readiness for exerting telework?	0.94	2.4	7.5%	0.65	0.78
	How much does Internet usage and access rate impact electronic readiness for exerting telework?	0.93				
	How much does Internet 's reasonable price impact electronic readiness for exerting telework?	0.78				
	How much do Internet access's speed and quality impact electronic readiness for exerting telework?	0.65				
Network-based	How much do IT-related job opportunities impact exerting telework?	0.78	1.94	6.07%	0.72	0.78
	How much do e-trade from type B2B and B2C impact exerting telework?	0.77				

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Securioty indices	How much does security site creation impact exerting telework?	0.96	1.9	5.96%	0.61	0.78
	How much do data and privacy protection and setting rules and penalties for Internet crime impact exerting telework?	0.84				
	How much does protection from spiritual and digital ownership rights impact exerting telework?	0.63				
Network-based policies	How much does the status of telecommunication and communicative rules impact electronic readiness for exerting telework?	0.542	1.61	5.05%	0.72	0.78
	How much does the status of IT-related commercial policies impact electronic readiness for exerting telework?	0.659				

Kazer Mayer Statistics: 0.871

significance level: 000   Bartlet Statistics:996.63   Expressed Variance Sum: 66.74%

KMO test was also done for different variables of telework/IT acceptance showing acceptable results whose results are shown in Table 4, Factoriel analysis of the variables using Varimax Rotation was orthogonal. Generally, factorial analysis of the variables was done by main factor analysis in which 7 factors of perceived profitability, ease of use, technology using purpose, job relation and conformity, mental norms and mental image, testability, and provability were examined. Eliminating 2 questions (11,19) from the questionnaire that were without factorial load , those 7 factors represented 75.27% of all changes. Internal validity analysis of existing variables of IT/tele-working was done using Cronbach α results are shown in Table 4.

5.3   Hypotheses Testing

H1.What factors do contribute to IT/telework acceptance in governmental and semi- governmental organizations in Tabriz?

To answer this question, IT/telework acceptance factor was investigated with 7 variables and 19 questions in the questionnaire. To test values significance, a group t-taq test was used.the result showed that percieved benefit with the mean of 6.38, ease of use with the mean of 8.2,technology use purpose with the mean of 8.8, job relation and conformity with the mean of 4.3, mental norms with the mean of 5.9, testability with the mean of 8.1, provability with the mean of 3.2, and in general technology /IT acceptance with the mean of 88.9 contribute to telework exertionbecause significance level of One-SampleT-Test is smaller than 0.05.

H2. What factors do contribute to the electronic readiness of governmental-semi- governmental organizations for exerting telework in Tabriz?

To answer this question, electronic readiness factor was investigated with 7 variables and 34 questions in the questionnaire. To test values' significance, One-SampleT-Test was used. The results showed that managerial indices with the mean of 6.38, basis indices with the mean of 22.91, human resource indices with the mean of 11.96, network-related policies with the mean of 5.2, network-related economy with the mean of 8.1, security indices with the mean of 11.06, IT accessibility with the mean of 10.5, and in general electronic readiness with the mean of 45.2 contribute to telework exertionbecause significance level of One-SampleT-Test is smaller than 0.05.

H3. Which one of the effective factors in the electronic readiness of governmental and a semi governmental organization is of higher priority for exerting telework in Tabriz?

To calculate criteria weights and effective factors as well as prioritizing them by fuzzy AHP and fuzzy pair comparison questionnaire,7 questionnaires were distributed among experts using Delphi method. Hang fuzzy AHP method and excel and expert choice software were used to weigh and prioritize each criterion. After analyzing all questionnaires, they should be incorporated.

Table 4: The components and results of factorial analysis and validity of IT /telework acceptance variables

Topics	Questions	Factorial load	Special value	Expressed value	Validity coefficient	total validity coefficient
Percieved profitability	How much do productivity promotion and job performance improvement resulting from telework impact IT/ telework acceptance?	0.81		o		0.78
	How much does creating a faster and easier relation with clients impact IT/ telework acceptance?	0.8				
	How much do time and money economizations for the lack of physical presence at home impact IT/ telework acceptance?	0.78	6.05	14.8%	0.72	
Ease of use	How much do transparency and understandability of telework impact IT/ telework acceptance?	0.87				0.78
	How much does telework usefulness in user' s view impact IT/ telework acceptance?	0.86	2.24	14%	0.68	
	How much does telework simplicity in user' s view impact IT/ telework acceptance?	0.66				
IT use purpose	How much does telework 's reasonability in user' s view impact IT/ telework acceptance?	0.79				0.78
	How much do telework 's loveliness and being pleasant in user' s view impact IT/ telework acceptance?	0.75	1.56	12.4%	0.78	
	How much does a better feeling to telework in user impact IT/ telework acceptance?	0.69				
	How much does a person' s tendency to telework impact IT/ telework acceptance?	0.27				
	How much does telework use by the majority og the organizations impact IT/ telework acceptance?	-----				
Mental use and image	How much do a person' s affecting relatives,friends, or coworkers' ideas about telework impact IT/ telework acceptance?	0.78	1.32	9.6%	0.82	
	How much does (social) status resulting from telework impact IT/ telework acceptance?	0.81				
Job relation and conformity	How much does telework conformity with a person' s lifestyle impact IT/ telework acceptance?	0.78	1.16	8.3%	0.78	0.78
	How much do job-related variables (activity type, important job characteristics, and job performance process) impact IT/ telework acceptance?	0.81				
Results output quality and provability	How much does investigating faverability of performance output in the systemimpact IT/ telework acceptance?	0.83	1.07	8.2%	0.77	0.78
	How much do results' observability and tangibility coming from teleworking impact IT/ telework acceptance?	0.72				
ty and being voluntar	How much does volunteer usage of teleworking impact IT/ telework acceptance?	0.9	0.85	7.8%	0.89	0.78
	How much does testability of teleworking before using it impact IT/ telework acceptance?	----				

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To prioritize the criteria and effective factors, first the final weights of all criteria were put in a table (Table 5) and then geometric mean of each row was calculated. First row belonged to the respondents.

Table 5: Final weights of electronic readiness criteria and IT/ telework

IT accessibility	Human resource indices	Managerial indices	IT and informatic bases	Mental norms and picture	Job relation and conformity	IT use purpose	Ease of use	Percieved benefit
0.131	0.141	.158	0.171	0.065	0.072	0.1	0.078	0.083
0.127	0.134	0.173	0.169	.058	0.075	0.097	0.074	0.093
0.125	0.132	0.166	0.166	0.061	0.078	0.105	0.076	0.091
0.127	0.136	0.162	0.173	0.069	0.07	0.103	0.075	0.085
0.132	0.148	0.149	0.173	0.063	0.069	0.107	0.081	0.078
0.135	0.146	0.154	0.170	0.072	0.066	0.095	0.082	0.080
0.139	0.150	0.143	0.175	0.067	0.074	0.093	0.080	0.079

Thus, the priorities of effective factors in electronic readiness and IT/ telework are shown in Table 6.

Table 6. the priorities of effective factors in electronic readiness and IT/ telework

Priorities	Geometric mean	Criteria
6	0.084	Percieved benefit
7	0.078	Ease of use
5	0.1	Technology use purpose
8	0.072	Job relation and conformity with personal life style
9	0.065	Mental norms and picture
1	0.171	Informatic and communicative bases
2	0.157	Managerial indices
3	0.141	Human resource indices
4	0.131	IT accessibility

6. Conclusion

These priorities show that electronic readiness criteria are of higher importance than IT acceptance . In other words, to exert tele-working in governmental and semi- governmental organizations first electronic readiness criteria including informatic and communicative bases , managerial indices, human resource indices, IT accessibility should be provided and then IT acceptance criteria like IT use acceptance, perceived benefit, ease of use, job relation and conformity with personal lifestyle, mental norms and picture should be met. These points are reflected in Figure 5.

According to research results, the following suggestions can be represented:

For informatic and communicative bases,

- Telecommunication bases should be provided for the users to enable them use teleworking.
- The organizations should conform themselves electronically to provide proper contextes for teleworking.
- WAN network should be provided in the organizations to connect the offices and teleworking system.
- LAN network should be provided in the organizations tosupport new accounting system, benefiting from IT advantages.
- Informatic software like EIS, DSS, MIS should be provided to include comprehensive information of the organizations.

- Organizations should use electronic data interactions.

Figure 5: Research model
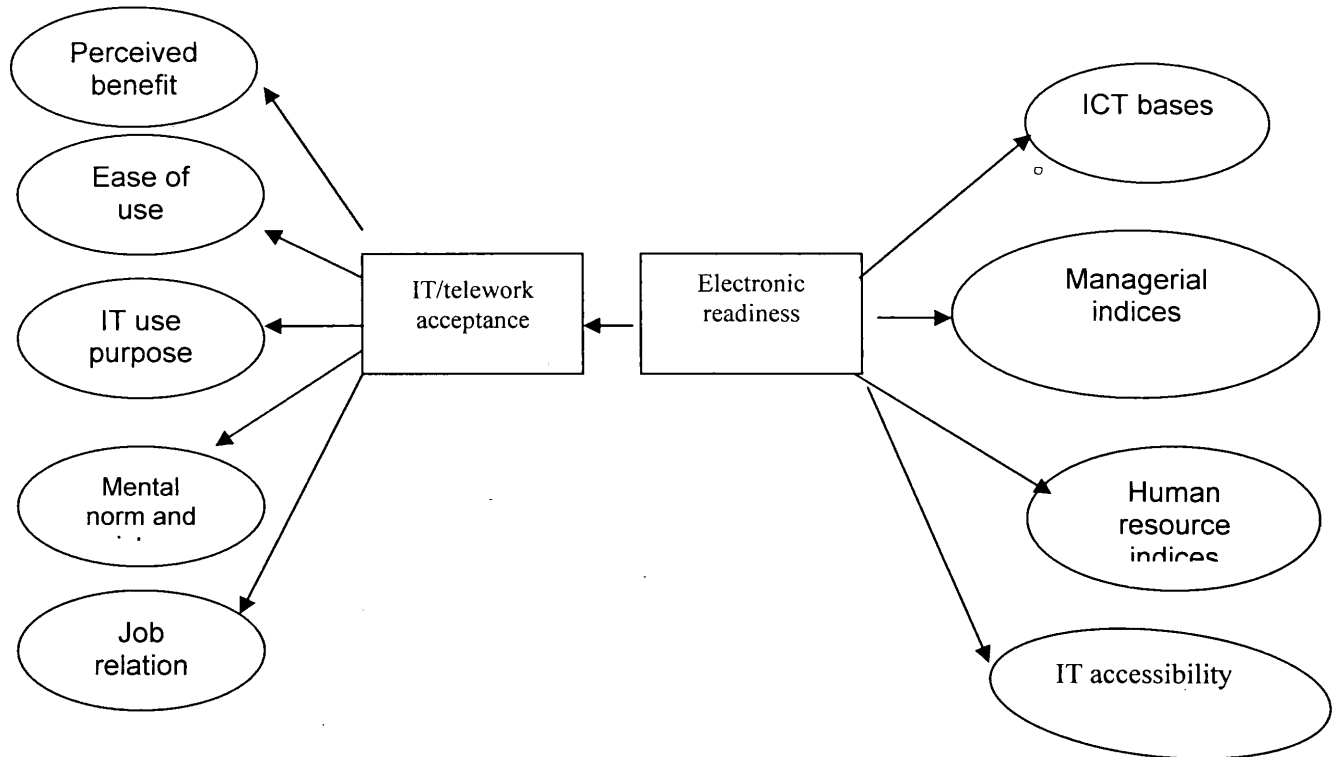
For managerial indices,

- Trust should be created in the managers to the employees for teleworking.
- Managers should agree with using electronic communications.
- Managers should clearly determine vocational goals for the employees.
- Managers should be skilled enough to plan and time the work.
- Managers should focus on goal-based managerial approach rather than process-based approach.
- Managers should exert a mechanism for feedback and evaluation of employees' performance.

For human resource indices,

- Employees should be trained in IT and enough budget should be allocated for this purpose.
- Employees should have access to IT experts inside and outside the organization to support organizational activities.
- Employees should have time management capability for doing their tasks.
- Proper work conditions should be created at home to make teleworing possible.
- Creating new job opportunities in IT like B2B, B2C should be practiced.
- Holding security sites to protect data,privacy of users, and set penalties for Internet criminals should be regarded.

For accessibility to informatic and communicative technologies,

- Network-connected places should be provided for employees.
- Internet speed and quality should increase and its price should decrease.
- Teleworking should be voluntary rather than compulsory.
- The results of teleworking should be made observable and tangible.
- The capability of trying teleworking should be available before deciding to use it or not.

Suggestions for further researches

- Managers should evaluate organizational capabilities and prioritize organizations according to electronic readiness and IT acceptance using fuzzy AHP or the model of this research.
- All 14 criteria, identified by factorial analysis, should be weighed by fuzzy AHP.
- The relation between effective factors in electronic readiness and IT acceptance for teleworking should be determined.

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