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Impact of Empowering Communication Technology Practices on Service Performance in Information Technology Sector

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***Abstract*—The technological advancement has tremendously evolved over the last two decades with continuing changes throughout their system and communication practices. The association between the elements of communication technology and service performance, however, has yet to be explored with special focus on employee empowerment from an organizational behavior point of view. This research's main aim is examine the impact of communication technology practices on service performance in the Information Technology (IT) sector. Therefore the mixed method research approach has been selected for the purposes of this study. 20 interviews have been conducted with experts in the field from the Iran Telecommunication Research Centre. 254 data samples were collected from IT sector employees in Iran. Data was used to test the conceptually developed model via the structural equation modeling-partial least square (SEM-PLS) approach. Based on the qualitative data, communication technology practices can be grouped into six areas including technology application, technology of equal opportunity, individual ability in technology, individual knowledge and attitudes towards technology, technological infrastructure, and security. The results show that among other factors, those variables related to technology application, individual knowledge and attitudes towards technology, organizational infrastructure for technology, and technology security have a positive impact on employees' empowerment; whereas technology application has a reverse effect. Moreover, the present study's results show that employee empowerment has a significant relationship to service performance in the ITsector.**

Keywords-Employee's Empowerment; Communication technology; Information Technology; Performance-based metrics

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I. INTRODUCTION

One of the most important challenges that managers encounter in the current era is failure to utilize intellectual resources of mental power and potentials of available employee empowerment. In many organizations, managers cannot employ the existing potentials in an efficient manner as skills aren't efficiently utilized. Researchers in the area of organization development management have introduced employee empowerment as an effective policy for the performance and development of human resources, and they believe that employee empowerment is a new and critical attitude that should be utilized by organizations. In fact, it's considered to be the best response to the critical need for management in responsiveness toward the need for transformation and change[1].

As a new approach for internal motivation, employee empowerment refers to releasing employees' internal powers, providing the required infrastructures and creating opportunities for their flourishing talents, abilities and capabilities -including the individual's perceptions toward his or her role regarding the job and the organization [2]. IT is needed to support firms' rapid product development and the collection and dissemination of market, product and process information in order to respond effectively to unanticipated changes in the business environment. Recent studies posit that IT capabilities (e.g., IT management and IT competencies) help firms to exploit opportunities and reconfigure IT resources to avoid disadvantageous outcomes, demonstrating Information Technology's key role in attaining and deploying strategic flexibility.[1] Extant conceptual frameworks propose several relationships involving IT capabilities, flexibility and firm performance; and recent papers have examined the proposed relationships empirically. They consider relations between the combination of customer, partnering and operational flexibility, and organizational performance to be moderated by environmental volatility[3]. Information is a primary and valuable resource for every organization. Just like how human resources, raw materials, and machineries have important roles in the process of producing and servicing, information also has a special place[4]. In the past, information referred to documents only accessible for certain people as opposed to in the present where information is gathered, processed and preserved by organizations using IT processes. On the other hand, communication and information technology have caused a potential mutation in the development of communication methods and cooperation of people in an organization. Communication and information technology include some elements and aspects that facilitate business processes and lead to the simplification of information flows and team working, increasing supervision of processes, promoting customer relationships, promoting design processes, utilizing preventive maintenance and repair systems, implementing quality systems and so on. In technological organizations, communication and information networks are utilized for developing communications, quick access to information, increasing ease and analysis of information, ensuring information security and finally, communication with the outside world[5]. Therefore, due to the significant effect of communication technology on organizational performance, utilizing it in the organization is considered a necessity. Many studies have also been conducted in the fields of communication and information technology on the effect of information technology for different organizational aspects including organizational structure, information circulation, lack of increasing concentration in decision making, decreasing working time, and increasing speed and accuracy. All of these affect enhancement of technological skills. However, regarding the various dimensions of information technology in nature and its structural and practical elements, no study exists regarding the direct effects of such aspects on individual performance and attitude as well as organizational enhancement of technical skills. The present study aims to fill this gap in a number of ways. In other words, the present research's main aim is to study communication technology in relation to employee empowerment and providing a desirable model towards performance at the Iran Telecommunications Research Center. The Iran Telecommunications Research Center is one of the oldest research centers in the field of IT with the main mission of institutionalizing the development and promotion of knowledge, technology and innovation in the country with wise infrastructure and programming according to defined priorities in the articles of the country's associations, documents and high level security documents. It is evident that advancing the main mission of this research center and achieving its great objectives depends on efficient employee empowerment. One of the most logical, proper and effective ways to achieve such an objective is the proper implementation of different agents and empowering variables among employees.

The present research's main aim is to study the technological factors related to employee empowerment and provide a desirable model in line with the performance of the Iran Telecommunications Research Center. For this purpose, the following research questions are considered:

- What are the technological factors related to employee empowerment at the Communication and Information Technology Research Center?
- Is there any relationship between communication technology and employee empowerment at the Communication and Information Technology Research Center?
- Is there any relationship between empowerment and performance at the Communication and Information Technology Research Center?

II. LITERATURE REVIEW

Several research works have been carried out in the field of Communication Technology Practices on Service Performance in the IT sector. In this section, a brief review of some relevant ones is provided.

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Employee Empowerment

Empowerment in management was introduced during the mid-20th century and the formation of humanistic relationships towards increasing the humanistic conditions of labor [6]. They introduced empowerment as the participation of front line staff of organizations in the four key areas of information, knowledge, reward, and power[7]. Consider empowerment as encouraging people to participate in decisions that are effective for their activities[8]. Empowerment may be considered to include all the methods and measures that can affect the attitude and behavior of staff and help them to make the best decisions regarding organizational conditions and leading the organization toward productivity through creativity in the form of team working [9]. As can be perceived from the definition of empowerment, that competency describes a potential that all people should possess in order to leverage performance development. Moreover, in this definition, leverage introduces competency in practice [10]. There are two approaches, structural-social and psychological, in classic empowerment. The basis for the structural-social approach towards empowerment is based on the idea of sharing power amongst the higher and lower levels with the aim of involving all organizational levels in related decisions, whilst the psychological approach refers to a set of psychological statuses required by employees in order to provide them more responsibility and control. This approach describes how staff experience their tasks and what their perceptions are regarding their related roles in the organization[11]. The feeling of effectiveness refers to the degree to which an individual can influence strategies and managerial policies at work [12] and provide an opportunity for the individual to be effective [13]. Empowered staff believe that they can be effective through affecting the environment in which they work or the outcomes obtained. They don't believe that outside environmental factors control their activities, but think they can control the obstacles. In fact, they have a feeling of active control [14]. Employee empowerment is facilitated when people take self-determining actions. Self-determination depends on active involvement in their job and believing the statement that the individual performance of employees can lead to their success [15]. Having choice causes organizational goals, human resources and priorities to become connected and related through participation of people in different programs and helping people in different areas [16].

Communication Technology and Empowerment

Information technology includes a wide range of media and new methods that connect people and informatics systems together such as voicemail, email, voice and video conferences, internet, intranet and local networks of organizations, phones, fax devices and so on [17]. Organizations consider information technology as a tool that helps them develop their employees' performance or adjust them to changes. However, these organizations should encourage and persuade their employees to use the technology in line with the speed of technology change and transformation so that their employees' performance becomes more effective and efficient in relation to education and profession level[18]. On the other hand, information technology leads to facilitation of the roles and duties of managers. Obtaining the required information for decision making, more control and supervision in an organization and its processes, and the possibility of analyzing conditions in planning and simulating the decisions can have considerable effects on information technology within an organization[19]. He believes that the primary aim of using information technology (innovation or efficiency) or a method to establish information technology (the time for implementation of information technology, the trainings required for supporting them and other trainings) is effective in relation to organizational performance[20]. Information systems provide the possibility of accessing information for the lower levels of an organization and cause more information sharing within it. Therefore, the sharing and free circulation of information leads to individuals' empowerment within an organization. Moreover, states that utilizing information systems provides context for the lack of focus in decision making and authority and helps employees to access the required information for quick decision making [21]. Through this lack of focus, employees engage in organizational decisions and feel more empowered. Regarding the freedom resulting from the routing and disturbing duties of the employees that is a consequence of information technology's emergence, it was found that employees will concentrate on strategic measures due to this freedom and spend their energy and time on such actions[22].

Performance-based metrics

Performance is widely used to evaluate organizational performance [23]. Within this scope, Performance Management Systems (PMS) are a set of metrics used to formulate strategic plans and monitor the achievement of organizational goals [24] and help management to identify areas requiring attention and improvement, monitor project progress, improve staff communication, convey management expectations, enhance accountability, and motivate employees with rewards based on individual performance [25]. The diagnostic and interactive uses of PMS are management tools that balance this tension within an organization to help attain established organizational objectives [27]. PMS assists in identifying areas that strengthen accountability, improve communication, motivate employees through performance-based rewards, monitor progress, and communicate expectations or areas requiring attention [28].

Communication Technology and the Related Types of Performance

There have been various studies regarding the effective factors for creating the feeling of empowerment among employees. They studied the works of some researchers and found that tendency towards development, having critical thinking skills, accepting changes, high self-confidence, coordination, dynamic structure, performance evaluation, feedback, support, training, relationships, the extent to which authority is provided

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to the employee, encouragement and motivation from management, a culture of cooperation, shared outlook, emphasis on compatibility and independency in the vote, information sharing and trust of management in employees; all of these are effective in empowering employees [29]. This paper has suggested four main factors for empowering employees: 1) participation of employees in decision-making processes, 2) participation of employees in programming processes, 3) appreciating employees, 4) providing continuous training and support to employees[30]. This paper introduces two main factors affecting the empowerment of employees: information resources for performance (customer centered instead of supervisor centered) and reward system (result orientation instead of behavior orientation)[31]. We believe that possessing information resources about performance creates more ability on behalf of customers in comparison to supervisors. Also, a reward system based more on the process in comparison to the result is more effective in empowering employees. The researchers [32] showed that IT infrastructures have great effects on increasing speed and accuracy, decreasing the physical size of information resources, removing redundant administrative formalities, providing remote cooperation possibilities, and decreasing costs of police administration. Information technology has a great effect on occupational development, optimum decision making, delegation of authority, change in job content, employee's skill, control, and the role of employees [33]. Many areas are affected by information technology such as occupational development, employees' skill, adoption of changes and innovation, development of decision making skills, self-supervision reinforcement, and balanced and multilateral humanistic development. The application of communication technology on employees' occupational empowerment at the Social Security Organization in Qom city shows that utilizing information technologies and applying information technology caused empowerment of employees in the organization [34].

III. RESERCH METHODOLOGY

The main aim of the present study is to identify the technology factors related to the empowerment of human resources and performance at the Iran Communication and Information Technology Research Center. Therefore, the present study is an applied research regarding the aim of the study and its data gathering method is descriptive-correlation. In order to achieve the study's main aim, a mixed exploratory research method was utilized. Therefore, a qualitative method was used to study the technology factors related to empowerment and a quantitative method was used to validate the data obtained from the qualitative stage. The statistical population of the present study in the quantitative stage includes all the human resources (the employees and the managers) of the Communication and Information Technology Research Center and includes the experts (the managers of the center and academic scientific experts) in the qualitative stage. In the present study, due to a mixed research strategy a compound of qualitative and quantitative sampling methods was used; mainly the mixed consecutive sampling method. Therefore, a purposeful sampling method (Snowball Sampling) was used in order to implement the qualitative research, and a simple random sampling method was used in order to implement the quantitative research. The sample size was defined as 15 individuals in the qualitative research stage, among which, 5 included the academic and scientific experts and 10 included the managers and consultants at the Iran Telecommunications Research Center. The sample size was calculated using the Cochran Formula (sampling from a limited population) in the quantitative stage as follows:

$$n=\frac{\frac{z^2pq}{d^2}}{1+\frac{1}{N}\left(\frac{z^2pq}{d^2}-1\right)}=\frac{\frac{1.96^2*.5*.5}{.05^2}}{1+\frac{1}{532}\left(\frac{1.96^2*.5*.5}{.05^2}-1\right)}\approx 224$$

In the above formula, as the amount for p was not available, it was defined as 0.5 because if p=0.5, then n will reach to its maximum amount. This causes the sample to be as big as possible [35]. According to the available statistics and information, the number of employees at the Iran Telecommunications Research Center was 532 at the time of conducting the research and the sample size was calculated as 224 in the Cochran formula by placing the mentioned amount in the formula.

The data for the qualitative stage of the study was gathered by using the semi-structured interview method and a questionnaire was used as a separate tool to gather the data for the quantitative stage. The research questionnaire included four main parts including the demographic specifications of the respondents, empowerment-related questions, technology-related questions, and performance-related questions. A five point Likert scale was used to measure the questions related to the study's main variables. The content validity method was used to define the questionnaire's validity and reliability. For this aim, the primary concepts extracted from the questionnaire stage were firstly sent to some experts in order to define the accuracy of categorization and naming different items and some corrections were made based on their comments. Then, the primary questionnaire's questions were designed based on the concepts of each item and, after applying the comments by the experts, the final questionnaire was compiled. The Cronbach's Alpha method was used to calculate the questionnaire's reliability. The type of variables, number of questions, and Cronbach's Alpha as related to the questionnaire variables are introduced in Table 1.

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Table 1: Type of variables, number of questions and Cronbach's Alpha related to the variables in second questionnaire.

Variable	Subsidiary Aspects	Number of Questions	Average	Standard Deviation	Cronbach's Alpha
Employee Empowerment	Meaning	4	4.329	0.533	0.73
	Competency	4	4.310	0.540	0.78
	Effectiveness	4	3.456	0.853	0.88
	Autonomy	4	3.499	0.824	0.89
	Trust	4	3.124	0.766	0.82
Communication Technology	Technology Application Range	6	3.305	0.628	0.78
	Technology Equal Opportunity	2	3.027	0.845	0.85
	Individual Ability in Technology	4	4.190	0.564	0.88
	Individual Knowledge and Attitude Toward Technology	4	4.076	0.508	0.76
	Organizational Infrastructure for Technology	5	3.585	0.484	0.77
	Technology Security	3	4.336	0.475	0.78
productivity Performance Metric	Cost Reduction	6	3.170	0.464	0.74
	Time Reduction	6	3.803	0.483	0.79
	Quantity Increase	6	3.346	0.664	0.84
	Quality Development	8	3.516	0.494	0.75
Total	-----	70	3.153	0.715	0.89

IV. RESULTS

We followed the guidelines to report with the PLS-SEM approach[36]. Since PLSSEM is a non-parametric approach, it does not require the data to be normally distributed. However, it is important to verify that data is not too far from a normal distribution. Skewness and kurtosis were used prior to data analysis to evaluate the extent to which a variable's' distribution was symmetrical[36]. The skewness and kurtosis values of most items were ranged between -1 and +1, which are well below the levels suggested for transformation of variables[37]. Thereby, non-normality of data was not an issue for this study. Common method bias was assessed by conducting Harman's single factor. Harman's single factor accounted for the majority of variance explained (18.6% only). This suggests that common method bias is not a major issue in this paper. For the results obtained from the exploratory stage of the study that was conducted through semi-structured interview, a total of 15 individuals attended including academic and organizational experts (5 professors from the human resources management departments of universities, and 10 experienced counselors and managers of the research center). Among the experts, 2 women and 13 men attended. 5 experts were educated in the field of management (business and administrative), 6 experts in the field of technical and engineering (electrical engineering, computer and mechanic, each 2 individuals) and 4 experts in other fields (economic, statistics, mathematics and education management) Among them, 1 individual graduated with a bachelor's degree, 8 with a master's degree and 6 with a doctorate degree. Generally, the experts' demographic characteristics are shown in Table 2.

Table 2: Experts' Demographic Characteristics (Exploratory Stage)

		University Experts		Organizational Experts	
		Percent	Number	Percent	Number
Total Number		33	5	67	10
Gender	Male	100	5	80	8
	Female	0	0	20	2
Education	Bachelor	100	5	10	1
	Master	0	0	80	8
	Doctorate	0	0	10	1
AGE	year 45-37	80	4	60	6
	year 60-45		1	40	4
Experience/ Teaching	Less than 10	60	3	0	0
	year 20-10	40	2	50	5
	More than 20	0	0	50	5

After conducting some interview and writing down the experts' responses and comments, interpretative analysis was utilized to determine the hidden messages in the written document. Moreover, the previous theory's approach was utilized for interpretive analysis and to make the texts meaningful. According to this approach, the researcher creates some ideas regarding the subjects and concepts that should be selected for coding through studying the available literature about the subject of the study and then considers a theory based on the effect of the extracted concepts on the employee's empowerment. The first stage in the interviews' interpretation process is open coding and extracting the concepts. For this aim, after gathering the responses from each interview, the main content of each was studied and the considered primary concepts were then identified and extracted. The concepts extracted from the first stage of the interview interpretation process are shown in Table 3.

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Table 3: Extracted concepts related to technology in the first stage of interpretation

Expert's Consensus Opinions	Concepts
More than 75%	Easy access to internet at the organization, providing a proper infrastructure based on technology to do assignments, working with automation and automatic programs, computer general skills, internet communication, internet using, using electronic services same as banking, internet sale and purchase, working with electronic equipment same as scanner, fax, copy, working with administrative software like Office
50 to 75%	Technology-based processing in organization, adjustment with technology news, updating, electronic learning and training, related education, social networks application, cellphone and smart phones application, electronic commerce development, observing the ethical issues in virtual environment, digital control and observation
25 to 50%	Cooperation with related international organizations, technology based research and attitude, modernized and ICT based attitude, internet sharing, standardization, digital opportunity development and patterning, preserving the privacy, proficiency in the rules related to technology.
Less than 25%	Observing the organizational disciplines and instructions, preserving the organizational secrets, technology related research abilities, cloud environment related achievements, internet of things development, augmented reality development

The second stage of the interview interpretation process is axial coding; categorization and naming all these categories in the form of a higher level as "Categories". For this aim, the similarities and differences between the concepts extracted from the last stage were identified and the concepts with more similarities put into one specific category and one general content attributed to them (Categories). Table 4 shows the categories and naming.

Table 4: Extracted concepts related to technology in the second stage of the interview interpretation process

Categories	Concepts
Technology Application Range	Technology based studies, social networks applications, internet content building and sharing, electronic services same as banking, internet sale and purchase, cell phone applications and smart phones related programs, cloud related achievements, internet of things development, augmented reality, electronic commerce
Technology of Equal Opportunity	Standardization, patterning and providing digital opportunities
Individual Ability in Technology	Computer general skills, working with electronic equipment same as scanner, fax, copy and …, working with administrative software same as Office, internet communications, Internet using
Individual Knowledge & Attitude of Technology	Related educations, attitude and search based on technology, modernized attitude based on ICT, familiarity with the news of technology, upgrading and updating, electronic training and learning
Organizational Infrastructure for Technology	Cooperation with related international organizations, easy access to internet in the organization, providing a proper infrastructure based on technology to conduct the assignments, processing based on technology in the organization, observing the organizational disciplines and instructions, working with automation and automation programs of the processes, preserving organizational secrets
Technology Security	Privacy, ethic in virtual environment, proficiency in technology related rules, digital control

Results Obtained from the Quantitative Stage

Analysis of the data obtained from the interviews was conducted until the categorization stage and the identified categories were defined as the effective factors (technology) in empowerment. In the following, the questionnaire for the next stage of the work was written via the concepts related to the categories and distributed among the employees of communication and information research center. Regarding the available responses in the questionnaires, it was defined that among 224 respondents, 75.9 percent were male and 24.1 percent were female, 8 percent were single and 92 percent were married. The age range of 5.4 percent of the respondents was less than 30, 30.8 percent between 31 to 40, 38.8 percent between 41 to 50, 23.2 percent between 51 to 60, and 1.8 percent older than 60. The information related to the respondents' education status showed that 6.7 percent graduated with diplomas, 31.7 percent with bachelor's degrees, 56.3 percent with master's degrees, and 5.3 percent with doctorate degrees.

Table 5: Number and percentage of the respondents based on different demographic variable

Variable	Number	Percent	Variable	Number	Percent
Gender			Experience		
Male	170	7/9	Less than 5 years	21	9/4
Female	54	24/1	5 to 10 yeas	20	8/9
Marital Status			11 to 15 years	29	18/3
Single	18	8	16 to 20 years	43	19/2
Married	206	92	More than 20 years	99	44/2
Age			Education		

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Less than 30	12	5/4	Diploma	0	0
31to40	69	30/8	Associate	15	6/7
41to50	87	38/8	Bachelor	71	31/7
51to60	52	23/2	Master	126	56/3
More than 60	4	1/8	Doctorate	12	5/3
Less than 30	12	5/4	Diploma	0	0
Employment Status			Organizational Position		
Official	115	51/3	Employee/expert	172	76/8
Contractual	39	17/4	Faculty member	21	9/4
Limited-Time Contract	62	27/7	Department Head/ manager/ center deputy	19	8/5
Project Partner	8	3/6	Manager/deputy/ center principal	12	5/4
Official	115	51/3	Employee/expert	172	76/8
Total				224	100

The desired model of "the relationship between technology factors with empowerment towards performance" was prepared through theoretical hypothesizing of the relation between each technological factor with empowerment as well as the relation of empowerment with performance. In order to study the significance of the relations in the aforementioned model, the structural equations modeling method combined with the Partial Least Squares method in PLS software was used. Composite reliability tests and variance average were evaluated in order to achieve convergent validity and correlation. The results obtained from these two tests are shown in Table 6.

Table 6: The results obtained from composite reliability and variance average of the model

Structure	Composite Reliability	Variance Average
Individual Knowledge and Attitudes towards Technology	0.85	0.58
Individual Ability in Technology	0.90	0.69
Organizational Infrastructure for Technology	0.80	0.50
Technology of Equal Opportunity	0.82	0.71
Technology Security	0.83	0.61
Technology Application Range	0.80	0.58
Employee Empowerment	0.91	0.53
Performance metrics	0.85	0.41

According to the above table's information, the composite reliability obtained for all the structures was higher than 0.7. In addition, the coefficient obtained for variance average of all structures (except than one structure) was more than 0.5, so it could be said that the structure of the present research model has proper composite reliability and convergent validity.

After studying the internal structure and the status of the research structure via the confirmative factor analysis method, the accuracy of the written hypothesizes was then analyzed in terms of a structural model. Regarding the interpretative pattern in modelling the structural equations, if the figure for t-statistic related to one path was higher than 1.96, then it could be stated that the mentioned path is significant at a 95% confidence level and so the hypothesis related to the mentioned path is confirmed. In the following, the significance of each research model path was studied separately according to the information obtained from the model test (mentioned table). The amounts for the path coefficient and t-statistics of the model paths are shown in Table 7.

Table 7: Path coefficient and t-statistic amounts for model paths

path	Relationship			Relationship	t-statistic	Result
1	Technology Application Range	→	Empowerment	2.590	-0.222	Path Confirmed
2	Technology Equal Opportunity	→	Empowerment	1.225	0.144	Path not Confirmed
3	Individual Ability in Technology	→	Empowerment	0.890	-0.109	Path not Confirmed
4	Individual Knowledge and Attitude of	→	Empowerment	2.609	0.238	Path Confirmed
5	Organizational Infrastructure for Technology	→	Empowerment	3.408	0.229	Path Confirmed
6	Technology Security	→	Empowerment	2.594	0.160	Path Confirmed
7	Empowerment	→	Performance	10.255	0.467	Path Confirmed

The results obtained from the model testing method showed that the figure for t-statistic related to the 2nd and 3rd paths of the model are lower than 1.96.

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Therefore, the mentioned paths are not significant at a confidence level of 95 percent. In other words, the relation between technology of equal opportunity and individual ability in technology with empowerment isn't confirmed. On the other hand, according to the information obtained from the model testing, it could be stated that the figure for t-statistic related to the 1st, 4th, 5th and 6th paths of the model are higher than 1.96. Therefore, the mentioned paths are significant at a confidence level of 95 percent. In other words, the relation between technology application range, individual knowledge and attitudes towards technology, organizational infrastructure for technology and technology security with empowerment is confirmed. Regarding the path coefficient obtained for the mentioned paths, it could be stated that the amount of effectiveness of empowerment demonstrated by different indicators are as follows: technology application 0.222, individual knowledge and attitudes towards technology 0.238, organizational infrastructure for technology 0.229, and technology security 0.160. Moreover, the results showed that the figure for t-statistic related to the sixth path is higher than 1.96. Therefore, the mentioned path is at a confidence level of 95 percent and the relation between empowerment and performance is confirmed. Regarding the path coefficient obtained for this path, it could be stated that the figure for effect of empowerment on performance equals 0.467. In order to study the research model fitting, three criteria were used: validity study (redundancy and communality), coefficient of determination, and Goodness of Fit (GOF) amount. In the PLS approach, three figures were obtained for the weak, average and strong GOF respectively as 0.01, 0.25 and 0.36. Positive figures were obtained for redundancy and communality, and three figures of 0.19, 0.33 and 0.67 were introduced as the weak, average and strong coefficients of determination respectively. The figures for the model fitting criteria are shown in Table 8.

Table 8: Amounts for Fitting Indicators of Model Variables

Structure	Coefficient of Determination	Communality	Redundancy
Technology Application Range	0	0.193	0.193
Technology of Equal Opportunity	0	0.052	0.052
Individual Ability in Technology	0	0.367	0.367
Individual Knowledge and Attitude of Technology	0	0.321	0.321
Organizational Infrastructure for Technology	0	0.179	0.179
Technology Security	0	0.225	0.225
Empowerment	0.213	0.386	0.065
Performance	0.218	0.234	0.067

According to the items mentioned in the table, the amounts obtained for redundancy and communality are positive whilst the amounts for coefficients of determination for the endogenous variables of the model are at an average range. On the other hand, the GOF figure obtained for the research model is seen to equal 0.31, which falls within the average range. Therefore, considering these amounts, it can be claimed that the model of research functions well. Fig 2 shows this fact.

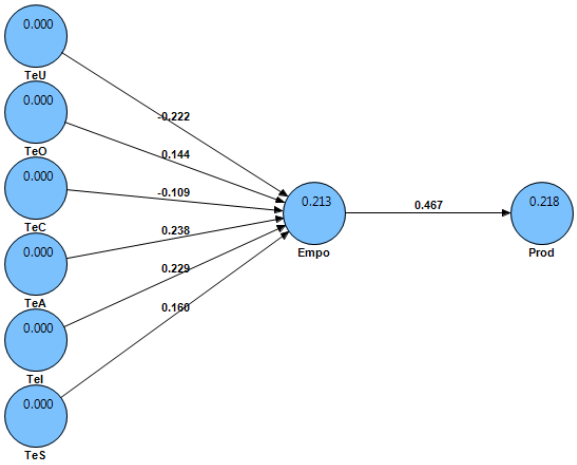


Figure 2: Tested Model of the Research

V. A Technical Scenario

As it was discussed in section 4, "technology application range", "technology of equal opportunity", "individual ability in technology", "individual knowledge and attitude of technology", "organizational infrastructure for technology", "technology security", "empowerment and performance" all have been shown to be significant with regard to realizing employees' empowerment in an organization. Out of these structures, "individual knowledge and attitude of technology" holds the highest score, while "technology application range" has the lowest score. Now suppose that there is an organization working on different applications of Internet of Things (IoT) as an advanced technology in the area of information and communications technology. Here we try to show that how these structures can help empower employees in this technology based organization. With regard to "technology application range", some aspects like "decreasing maintenance cost", "enhancing products/services", as well as "facilitating communications" can be mentioned for which issues like, "self-learning", "self-repairing networks", "connecting the staff to their organization", "collaboration between the employees", and "cognitive processing" are of particular significance. In addition, with regard to "individual knowledge and attitude of technology", operatory and programming knowledge helps employees understand computer in a better way and gain necessary skill for performing their tasks in a satisfactory manners. Coming to a vertical like "intelligent irrigation", its main focus is on an "automated irrigation system" to ensure lower cost and higher power efficiency. Wireless Sensing Unit (WSU) is also something, which is built with humidity sensor and soil temperature sensor to guarantee necessary amount of humidity in the soil. Within the scope of

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"intelligent irrigation", aspect of "security with regard to infrastructure of technology" is also important in the sense of managing security in the network structure. This complies with significance of "self-repairing network" discussed above. Here the management structure is to be motivated by the existing successful approaches in P2P network for checking the amount of humidity in soil.

Table 9 illustrates how the structures already discussed in Table 8, may practically mean in this scenario.

Table 9: Manifestations of structures in case of IoT application

1	Technology application	Self-learning, self-repairing networks, easy-to-deploy IoT software things-to-humans collaboration, cognitive processing and optimization of the activities.
2	Individual knowledge	The more operatory and programming knowledge and skill essential to realizing the items addressed for technology application
3	Attitude toward technology	Monitoring the activities, saving the energy essential to performing the activities, reducing the time necessary for the activities.
4	Organization infrastructure of technology and technology security	Computing facilities, security management, network infrastructure security, application security, users' access control.

We can clearly observe that, through empowering employees with regard to the items discussed in Table 9, one can expect high organizational performance in the area of IoT and its applications.

VI. Conclusion and Discussion

Information technology is one of the extra organizational factors that have a significant and increasing role in applying changes inside organizations. Achieving the information as an effective and critical tool and also attaining axial and political information are some of the suitable utilities of every organization because higher, faster, more suitable and more efficient production will be achieved by utilizing information and its desired circulation. This is the important concept that many organizations nowadays define as their priority in their working structures. On the other hand, when managers equip their employees with more information, they feel more powerful and are more likely to work with increased productivity and success and in line with the management's objectives and demands. However, considering the applications of this technology including tasks such as data gathering and its transformation into information within organizations; providing proper and on-time information with proper quality and cost; of effective communication between members; distribution of decision making processes; and providing new tools for increasing the ability, skill, creativity and performance of the employees in the organization; it can be concluded that this technology is the main grounds for employee empowerment. There are fast environmental changes and increasing competition with similar research centers in different countries around the world on the one hand, as well as the dynamic activities of research centers and considerable changes occurring in this field. In Iran and the world, on the other hand, it becomes clear that every organization requires flexible employees and that employees are expected to have creativity and accept responsibility for administrating their working areas. This aim will be achieved only through empowering them for getting affairs done in a better way.

The present research was conducted with the aim of identifying the technological factors related to empowerment of human resources at the communication and information technology research center in two specific stages. In the first stage, some technology-related concepts were identified by using the exploratory interview method on scientific and experimental experts and the mentioned concepts were then categorized in six categories as the effective technological factors for empowerment including technology application range, technology of equal opportunity, individual ability in technology, individual knowledge and attitude in technology, organizational infrastructure for technology, and technology security. In the following, the relationships between the identified technology factors and employee empowerment toward the mentioned manifestations were studied by compiling a theoretical model and conducting a quantitative study. The results showed that among the other factors, the variables related to technology application range, individual knowledge and attitudes towards technology, organizational infrastructure for technology and technology security are effective for employees' empowerment whereas technology application has the reverse effect. On the other hand, individual ability in technology and technology of equal opportunity have no effect on employee empowerment. Technological changes are occurring continuously and increasingly; the fast growth rate of technology has affected all aspects of organizations. Such changes cause some changes in the nature of affairs as computers, robots and automatic devices have replaced some routine jobs. These tools resulted in great changes in the kind of skills required from people and an organization's members (Robins, 2008). It is evident that in order to confront such challenges, employees should adjust themselves to these changes continuously by learning the required knowledge and skills. The results of the study showed that employee empowerment has a significant relationship with performance.

Regarding confirmation of the inverse relation of technological application and empowerment, it seems that when the range of technology's effects and uses in life and organizational affairs become higher and faster,

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people feel inability and weakness due to their limited abilities and skills and so it has negative effects on their self-esteem and internal domination. Therefore, encouragement of employees through training programs as well as non-training affairs to increase their range of dominance in applying technology may lead them to overcoming this weakness. In addition, organizational managers should provide context for promoting the knowledge and attitude of employees regarding technology and more seriously consider concepts such as technology-based attitudes and searching, familiarity and adjustment to new technology, and upgrading systems in line with technology for organizational affairs. The confirmation of a positive relationship for organizational infrastructure between technology and employees' empowerment reinforces the issue that managers should plan and implement measures inside and outside the organization in line with increasing the possibility to access the internet and other communication and information technologies, providing a proper infrastructure to fulfill assignments based on communication and information technology, providing application disciplines, and pursuing development of international cooperation in the field of communication and information technology. Regarding the confirmation of a positive relationship between technology security and employees' empowerment, it is suggested that the center's managers predict and implement training promotional programs alongside general culture building to preserve privacy in the virtual environment, observe security principles and ethical issues in the virtual environment, and observe the rules related to this field while providing administrative standards and system frameworks toward increasing security related to communication and information technology for employees. As defined in the results of this study, psychological empowerment is effective on the performance of employees. Therefore, the managers of the center should pay attention to empowering their employees in the field of human resources and make their human resources strategy based on promoting the ability level of their employees. For this purpose, they should apply changes or review all the activities related to human resource management. Similar to many scientific studies, the present study also has some shortcomings that may be considered in further studies. First, it should be suggested that the extraction factors related to technology in this research should be studied in other contexts for other organizations, other administrative areas or statistical populations, and also from the viewpoint of experts in the field of information technology so that a general consensus may be achieved regarding categorization method and naming. The results should also be generalizable. Second, studying the relation of each identified factor for the technology in a separate way along with the subsidiary factors of empowerment can provide a better and deeper insight regarding information technology's effect on employee empowerment.

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