

The Effect of Applying Information Technology on Efficiency of Parks and Green Space Organization: A Case Study

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Abstract: Since we live in the era of information and communication, what has attracted the attention of all companies and organizations is investment in information technology and efficiency resulting from it. Nowadays, great amount of saving in resources and reduction in costs of organizations have occurred by using information technology which has increased the efficiency of organizations. A main hypothesis and two sub-hypotheses were developed to investigate significance of the difference between the efficiency of Parks and Green Space Organization of Mashhad Municipality before and after application of information technology. Based on research findings, the main hypothesis and the sub-hypotheses were confirmed and it was shown that application of information technology in Parks and Green Space Organization of Mashhad Municipality has respectively increased optimum use of human resources and information resources and, therefore, increased efficiency of that organization. At the end of the article, practical suggestions are presented based on research findings for effective and efficient application of information technology to increase the efficiency of organizations.

Key words: Information Technology (IT) • Performance Improvement • Efficiency • State Organizations

INTRODUCTION

In today's world, "Technology" has a vital role in creating added value, creating wealth and increase in productivity in all aspects and levels and is considered propellant of achievement and development in any society. Organizations as sub-system of the system of society are also forced to use variety of technologies and technological innovations as a way to modernize production capacity and increase their competitiveness and flexibility [1]. Nowadays, in the era of communication and information when virtual network and non-border organizations and citizen-centered e-government are gaining importance, it is necessary and inevitable to use "Information Technology" for all organizations, because with the expansion of commercial activities, globalization and rapid technological changes, organizations need to have the required flexibility to comply with environmental changes which cannot be achieved except through "information technology" [2]. In fact, involvement in and

taking advantage of opportunities created by information technology are among the important issues for successful and modern organizations [3]. During recent years, the use of modern information and communication technologies (ICT) in state sector, which aim to establish efficient organizations and offer services in a fast, easy and convenient way, has been considered by the public sector agencies in most countries throughout the world. Understanding the importance of IT application in state sector to increase organizational productivity (efficiency and effectiveness) and customer and citizens' satisfaction, have made policy-makers in different communities apply institutional and administrative infrastructures of information technology to state sector by considering it as guideline and enacting related policies [4]. Since the wide application of information technology in governmental organizations of Iran has been emphasized from the beginning of the third Five-year Development Project in the form of the project of applied development of IT and establishment of electronic

government and plan to develop administrative system to improve the performance of those organizations, so the authors hope this research will provide appropriate practical recommendations for effective application of IT in government organizations in the country which can cause performance and efficiency improvement in those organizations.

Statement of Problem: Nowadays, one of the main necessities and objectives of using information technology in government organizations is to create e-government, increase productivity (efficiency and effectiveness) and promote service in those organizations. Electronic government has been defined as technological application of information and communication in governmental organizations to increase efficiency, effectiveness and transparency [5]. In Iran, ever since 2002 and in the framework of national development program, including the project of applied development of IT and comprehensive administrative system development plan, state officials and managers have seriously been trying to direct the administrative system of the country from the traditional space towards the information society-based environment and "information management based system" using information technology capabilities, so that the application of information technology in governmental organizations to increase the efficiency is one of the most challenging tasks of modern managers in our country. But as evidence shows, according to the following reasons, it seems that application of IT in state organizations of Iran has not been that efficient.

- Insufficient knowledge of some organization managers about information technology and benefits and requirements arising from it.
- Managers' lack of trust in documents created through information technology.
- Weakness of specialized software used in different units of organizations in terms of inability to respond to users' demands.
- Lack of required foundation before applying information technology in organizations.

One of the organizations that have seriously attempted to apply information technology since 2002 to improve its performance quality and increase its efficiency is Parks and Green Space Organization of Mashhad Municipality. Considering what went above, the issue which the current research is trying to study is that:

"Whether organizations' application of information technology in Parks and Green Space Organization of Mashhad Municipality has increased the efficiency. Or in other words, if there is substantial and significant difference between Parks and Green Space Organization of Mashhad Municipality before and after application of information technology."

Research Background: Ever since, various fundamental and applied studies and research have been conducted regarding information technology throughout the world, the main part of which we mention here:

Burn *et al.* [6] Investigation and Research: A research entitled "Managing IT Professionals in Hong Kong: Review of Career Expectations and Progression" has been conducted by Burn in Hong Kong. In this study, the structure of Hong Kong organizations was studied based on five structural pattern of Ginsberg [7]. According to the research findings, there is consistency between state of computer-based information systems and organizational structure. For example, there is consistency between decentralized computerized information system and adhocracy structure as well as between centralized computerized information system and automated bureaucracy structure. Finally, in this study, a suitable structural pattern is presented for the organizations in Hong Kong.

Research by Pfeffer and Leblebice [8]: Another study has been performed by Pfeffer and Leblebice "Study of the relationship between IT and organizational structure". They considered structural aspects such as concentration, formality and complexity in their investigation. The results of this study include:

- The relationship between information technology and concentration is negative. In this study, correlation coefficient between information technology and lack of concentration is about 68%.
- Information technology has an also negative relationship with recognition. Because lack of concentration removes the organization's need to apply documents and formal methods extensively and reduces verbal communications.
- The relationship between information technology with expertise orientation and task grouping is positive.
- Research by Dewett *et al.* [9, 10].

Another study has been conducted by Dewett *et al.*, "Study of the effect of information technology on organizational characteristics". According to the results of their study, information technology, with two features of information efficiency and data attenuation influences characteristics of the organization (structure, size of learning, culture and inter-organizational relationships), leads to five organizational outcomes which are empowerment of human resources, knowledge-based encryption, expansion of monitoring domain of organization, increase of efficiency, creativity and innovation.

Research by Nault [11, 12]: In other research conducted by Barrie R. Nault entitled "Study of the effect of information technology on organizational performance", it has been concluded that application of information technology leads to better decision-making and organizational performance improvement.

Research by Leavite and Whisler [13]: According to the studies conducted by these two experts, information technology provides high levels of organization with more access to the data of low levels of organization. Also, the information which reaches to higher levels through information technology will be less likely to get distorted and manipulated, which increases power of decision-making, supervision and control of higher level managers. According to these experts, application of information technology will have the most effect on reduction of the number of middle managers and shape of the organizational pyramid will be thinner in the middle.

Research by Daft [14]: According to the studies carried out by Daft, information technology is the most important factor affecting organizational performance and competitive advantage. According to Daft, correct application of information technology in organizations can respond to the needs and demands of customers and citizens more accurately and faster and make them more satisfied.

Theoretical Foundations of Study: Theoretical foundations of this study is a brief review on the issue of "information technology", "efficiency" and the role of information technology in efficiency of organizations which will be further discussed.

The Necessity and Importance of Applying Information Technology in Modern Organizations: During the last half century, modern and successful organizations have

increased investment on information technology, because they believe that information technology is one of the most important factors affecting changes and upheavals in organizational structure and function [15]. Application of information technology, including the Internet, email as well as pervasion of using computers and computer networks, has caused new organizational forms to be developed whose nature is completely different from that of large traditional and bureaucrat organizations. Of the common characteristics of these organizations, utilization of information and communication networks, knowledge-based employees, customer-orientation and high productivity can be pointed out. Nowadays, with environment having got complicated and rapidly changing, using information technology to increase efficiency and effectiveness and providing goods and services to customers and citizens quickly and with high quality is very important in organization. Existence of information technology causes filing type (from paper records to electronic records) to change and improves response, receiving complaints, informing customers, etc. Nowadays, information technology as one of the modern human technologies is rapidly influencing various fields of human life, including the field of organization and management. IT makes even the smallest companies and organizations acquire some concessions of large companies. They gain access to customers quickly and offer service to them wherever they are; they can gain access to the large international markets via the internet through cheapest way ever.

Definition and Concept of Information Technology: Some of the definitions provided for "information technology" by various authors are as follows:

- "Information technology" is a set of physical and mental equipment and tools which are used in planning, analyzing and applying the information in decision-making and management. Electronic devices (like computers) are of physical and planning equipment and tools and their application conditions is of mental tools [16].
- Information Technology can be defined as Computational and telecommunication technology which provide automatic facilities for using information [17].
- "Information Technology" is set of hardware and software, communication and information, human, management, system resources which are used for processing production, distributing and using information. Information technology is actually

technology, information and communication services. Often the emphasis is on the aspect of technology and it is considered more than services, but most of users do not care for mere technology, but they take into consideration information services through different ways - from media to satellite and the Internet [18].

According to scholars, information technology is more of a strategy, reflection, thought and tools in the field of human beings along with innovation. Generally, information technology systems in organizations include mainly administrative automation, management information systems and various communication networks.

Definition and Concept of Efficiency: "Efficiency" is one of the main components of management and the most long-standing criteria of improvement of organizations' performance. Today, "efficiency" along with other modern criteria, including effectiveness, administrative health and client satisfaction is also considered as the main criteria and indicators of administrative system development and evaluation and improvement of the performance of governmental organizations. Concepts of "efficiency", "effectiveness" and "productivity" in the organizational culture are often used interchangeably, while they have completely different concepts. Productivity is sum of effectiveness and efficiency. "Effectiveness" means performing the right things through which the organization would have access to their targets; in fact, effectiveness has a qualitative concept. But "efficiency" refers to comparing the obtained output with the inputs used by organizational system. In efficiency, individuals and organizations are trying to do things correctly; in fact, efficiency has a more quantitative sense. In other words, efficiency is the optimum use of resources or, in other words, it is the ratio of production of final goods or services (output) to the resources used in production (data). Organizational resources mainly

include human resources, information resources, material resources and financial resources. Measurement indicators of concepts of effectiveness and efficiency are compared in Table 1.

Effects of Applying Information Technology on Efficiency of Organizations: Information technology reduces operational expenses and increases efficiency of organizations from several aspects. Firstly, introduction of information technology reduces organizations' need for manpower so that use of automatic machines and robots in some cases obliterates the necessity for manpower completely. Secondly, information technology by providing rapid access to accurate information about issues such as inventory levels reduces operational expenses. And thirdly, it causes the waste level and time needed for production and, consequently, related costs to reduce as well [19]. Pervasion of use of information technology in organizations helps human resources management perform their tasks such as planning human resources, performance control, recruitment, presence and absence of employees, etc. Also, it will improve quality and confidence level of goods and services through reduction of human resource involvement in production. Moreover, common applications of information technology in production, including product planning, control and processes modeling are major management information systems and support affairs. Information technology expands people's view to organization and what they do through job development, thus it can cause employees' satisfaction [20]. Information technology can help increase individual and organizational productivity through creating and developing new capabilities in human resources. Applying information technology in aspects of vocational and skill development of employees, enhancement of perceptual skills, enhancement of decision-making skills, formation of standard-oriented thinking and strengthening self-control lead to human resource

Table 1: Comparison of indicators of measuring effectiveness and efficiency in organization

Effectiveness	Efficiency
-Accessing to intended targets by assessing them	-Saving organization costs
-Determining the right position and proportionate to the goals	-Saving time and resources in organization
-The level of solving the processing problems creatively	-The amount of removal and integration of Redundant work processes
-The amount of performed ideas in the organization	-The amount of presented ideas
-The amount of performed Suggestions	-The amount of presented Suggestions
-The amount of improving the quality and content of goals	-Correct and reasonable standard processing
-The level of competitiveness and satisfaction of customers	-Optimal use of existing resources in organization
-Intensity coefficient of organizational incidents	-Repetition coefficient of organizational incidents
-Expected efficiency to the real efficiency in the organization	-Expected data to the real data in the organization

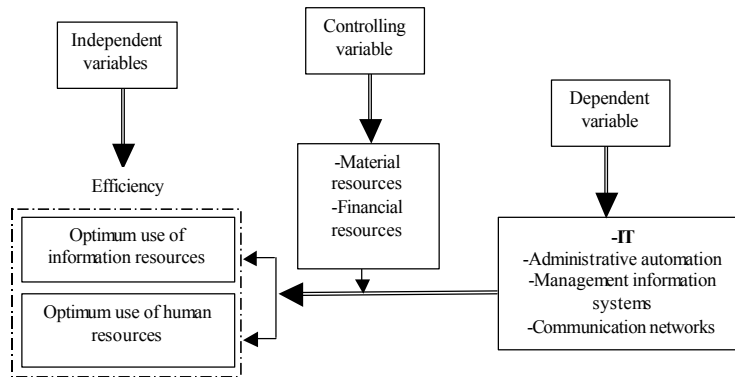


Fig. 1: Research Analysis Model

development. In another way, application of information technology through the following method could lead to increase of organizational efficiency:

- Strengthens people’s power of identification and understanding of organizational issues;
- Minimizes the time for decision-making;
- Reduces human error in processing network of organizational data;
- Creates tendency towards rational decision-making assumptions;
- Improves decision-making skills through rapid feedbacks;
- Strengthens using information empowerment in people;
- Enhances the speed of access to information.

Analytical Model and Research Variables: Relationships between variables of the current study are presented in Figure 1 entitled "analytical model of research".

Given the fact that according to experts the impact of information technology is more on tangible and significant intelligence and human resources, from the four resources of organizational systems, material and financial resources are considered as controlling variables in the study.

Research Hypotheses: According to the analytical model, to investigate and respond to the issue of research, research hypotheses are presented in two forms of main hypotheses and sub-hypotheses as follows:

The Main Hypothesis: Applying information technology in Parks and Green Space Organization of Mashhad Municipality has increased efficiency of this organization.

Sub-Hypotheses:

- Applying information technology in Parks and Green Space Organization of Mashhad Municipality has led to optimal use of *Information Resources* of that organization.
- Applying information technology in Parks and Green Space Organization of Mashhad Municipality has led to optimal use of *Human Resources* of that organization.

MATERIALS AND METHODS

Methodology: The current study is practical in aim and in terms of the nature and methodology is "field study" and "descriptive-surveying" type.

Spatial Scope and Research Community: Spatial scope of the current study is Parks and Green Space Organization of Mashhad Municipality and statistical population of this research includes all managers and employees of the mentioned organization who have been working in that organization during the period before and after application of information technology (From 2001 on). Total number of managers and employees who have been engaged in activities in the mentioned organization at each period before and after application of information technology is 47.

Sampling and Sample Size Determination Method: Given that in this research those staff who have attended Parks and Green Space Organization of Mashhad Municipality before and after application of information technology (prior to 2001) should be selected as sample and since the total number of these people was only 47, all that 47

Table 2: Operational definition of research independent variables

Concept	Dimensions	Components and indicators
Information Technology	1 - Management Information System (MIS)	1 - Financial System
		2 - Business and Storage Systems
		3 - Design and Development System
		4 - Public Relations System
		5 - Human Resource System
		6 - Planning and Research System
		7 - Distribution Monitoring system
	2 - Office Automation System (OAS)	1 - PC
		2 - Fax
3 - Communication Networks (CN)	3 - IVR	
	4 - E-mail	
	5 - Data Electronic Exchange	
	6 - Electronic Dashboards	
	7 - Electronic filing	
	8 - Video Conference	
		1 - Internet
		2 - Extranet
		3 - Intranet

Table 3: Operational definitions and indication of research dependent variable

Concept	Dimensions	Components and indicators	Questions related to questionnaire
Efficiency	1-Information Resources	1-Speed of data transmission between various departments of organization.	Questions 1 to 14 of questionnaire
		2- Rapid access of staff to new directives and rules.	
		3 - Informing employees of the affairs in their units.	
		4- Software used in the organization being updated.	
		5 - Connection to network from home by managers and expedition of performing things	
		6 - Simple and fast access to information to perform tasks.	
		7 - Easy classification of information and rapid preparation of comprehensive reports.	
		8 - Reduction of duplications.	
		9 - Reduction of paper works and bureaucratic excessive formalities.	
		10 - Increase of information security.	
		11 - Increase of accuracy in tasks.	
		12 - Performing tasks and organizational activities more effectively.	
		13 - Easy classification of information and accurate preparation of comprehensive reports.	
		14 - Speed of transmission customers' demands to the organization.	
2- Human Resources	2- Human Resources	15 -More emphasis on employees' training and empowerment.	Questions 15 to 28 of questionnaire
		16 - Employees' better knowledge of general decisions of the organization.	
		17 - Reduction of the distance between managers and employees.	
		18 - Increase of the supervisory ability of managers on personnel's work.	
		19 - Increase of staff's trust in managers.	
		20 - Reduction of the number of required personnel to perform organizational tasks.	
		21- Increase of manager's trust in staff.	
		22 - Employees' access to information proportionate to their organizational level.	
		23 - Increase of staff's knowledge and information.	
		24 - Increase of opportunities for employees' growth and career advancement.	
		25 - Increase of employees' satisfaction with work activities.	
		26 - Better work division between staff.	
		27 - Increase of staff's responsibility spirit.	
		28 - Increase of staff's participation in decision-makings.	

individuals were selected as sample. Therefore, it can be said that sampling method in this study is targeted (judicable) non-random sampling.

Tools of Data Assessment and Data Collection: In this study, data has been collected using questionnaire tools. Questionnaire of this study includes 29 questions in which 28 questions have been in closed format and one question has been in open format. 28 closed questions have been designed based on the five-degree Likert range on the ranking (sequential) scale and have been used for research hypothesis test. The study subjects have responded to any question in the questionnaire in two positions of before and after application of information technology. From 28 regulatory packages of questions, the first 14 questions are related to the first hypothesis test and the next 14 questions are related to the second hypothesis test. 47 questionnaires were collected from 47 subjects and were analyzed completely and perfectly in order to test the hypotheses.

Operational Definition of Research Variables: Information Technology which is independent variable in this study, is observed in Table 2 in its operational form.

Operational definitions of research dependent variable (that is organizational performance) are shown in Table 3 in two dimensions of information resources and human resources. It should be noted that the questions of questionnaire have been designed and arranged based on the indicators (indices) of this table to test the hypotheses.

Data Analysis Methods: In this study, descriptive statistics have been used to analyze and summarize descriptive data (in the form of tables of frequency distribution, mean) and analytical and inferential statistics have been used to analyze the collected data and testing hypotheses. Considering the fact that variables of this study are qualitative and their measurement criterion is ranking and normality of community is unknown and that we are also trying to compare two correlated samples or two groups, "sign test"- which is more resistant than Wilcoxon test - has been used for testing hypotheses in the context of nonparametric statistics.

RESULTS

The results of testing the hypotheses of the current research which has been conducted using sign test and by the thirteenth edition of SPSS statistic software is as follows:

Result from Testing Sub-Hypothesis Number 1: Considering that significance level obtained from sign test is equal to Asymp. sig. = 0 / 000 and is smaller than fallibility level of $\alpha = 0/05$ and also because the modulus of quantity of statistic of test calculated in this hypothesis ($z = -7 / 235$) is larger than Z value in the table at the fallibility level ($Z_{(0.050)} = 1/645$), according to the decision-making rule, H_0 hypothesis is rejected and H_1 hypothesis (the researcher's claim) is approved. Thus, the first sub-hypothesis of the research is confirmed and therefore it can be acknowledged with 95 percent of confidence that there is a significant difference between the level of optimum use of information resources before and after application of information technology in Parks and Green Space Organization of Mashhad Municipality and, in other words, it can be said that application of information technology in Parks and Green Space Organization of Mashhad Municipality has caused optimal use of information resources.

Result from Testing Sub-Hypothesis Number 2: Considering that significance level obtained from sign test is equal to Asymp. sig. = 0 / 000 and is smaller than fallibility level of $\alpha = 0/05$; and also because the modulus of quantity of statistic of test calculated in this hypothesis ($z = -7/841$) is larger than Z value in the table at the fallibility level ($Z_{(0.050)} = 1/645$) $\alpha = 0/05$, according to the decision-making rule, H_0 hypothesis is rejected and H_1 hypothesis (the researcher's claim) is approved. Thus, the second sub-hypothesis of the research is also confirmed and therefore it can be claimed with 95 percent of confidence that there is a significant difference between the level of optimum use of human resources before and after application of information technology in Parks and Green Space Organization of Mashhad Municipality and, in other words, it can be said that application of information technology in Parks and Green Space Organization of Mashhad Municipality has caused optimal use of human resources.

Result from Main Hypothesis of the Research: Considering that the first and second sub-hypotheses were confirmed, which means it was shown with 95 percent of confidence that there is a significant difference between the level of optimum use of information resources and human resources before and after application of information technology in Parks and Green Space Organization of Mashhad Municipality, it can be claimed with 95 percent of confidence that there is a significant difference between efficiency of Parks and Green Space Organization of Mashhad Municipality

Table 4: The mean of total scores and results of testing hypotheses

Items	Variables		
	Information resources	Human resources	Efficiency
Mean of scores before applying IT	08/37	94/38	02/76
Mean of scores after applying IT	52/56	12/58	64/114
Z Value (calculated)	235/7	841/7	436/7
Z Value at the fallibility level $\alpha = 0/05$	645/1	645/1	645/1
Approving or rejecting H_0	Rejecting H_0	Rejecting H_0	Rejecting H_0

before and after application of information technology. Meanwhile, since the modulus of quantity of statistic of test calculated in main hypothesis ($Z=-7/436$) is larger than Z value in the table at the fallibility level ($Z_{(0.050)} = 1/645$) $\alpha = 0/05$, according to the decision-making rule, H_0 hypothesis is rejected and H_1 hypothesis (the researcher's claim) is approved. Thus the main hypothesis of this research is also confirmed and therefore it can be said with 95 percent of confidence that application of information technology in Parks and Green Space Organization of Mashhad Municipality has increased the efficiency of that organization. Summary of results obtained from testing research hypotheses is shown in Table 4.

CONCLUSION

Based on the results of research hypothesis test, it is concluded that using information technology (IT) in Mashhad Municipality Department of Parks has increased the best use of human and informational resources. In fact, we can say that using IT has decreased the expenses and increased efficiency in organization under study.

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