Impact of Information Technology on Iran Distribution Company Performance in View of Organizational Infrastructures

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Abstract

The relationship between information technology investments and firm value as an area of inquiry has sustained interest among IS researchers over the past decade. Based on literature review of published work at corporate level productivity, researchers have developed three different approaches in assessing the correlation between IT implementation and productivity measures. Broadly speaking, the first two approaches focus on the effects of IT investment on direct, intermediary, financial and non-financial measures of productivity. None of these two approaches could positively prove either a direct correlation or lack of such a relation. The third approach, "complementary" approach, considers the IT implementation but emphasizes the role of complementary investments that enhance and complement the IT implementation. Recently, some studies focus on process approach, which emphasized on evaluation of impact of information technologies from process to process capabilities, and from capabilities to performance.

However, there has been no well-founded empirical research on process-oriented evaluation of impact of IT simultaneously with considering complementary investment. The current paper aims to evaluate the level of impact of IT on organization process and the effect of these processes on capabilities. Finally, the impact of capability improvement on performance will be assessed. Results show significant relation between process influence, capability improvement and performance upgrading. On the other hand, this research assesses the

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impact of interaction between IT and organizational infrastructure. Data from 109 distribution companies was gathered in a field survey. The empirical work indicated constructed measures reliability and validity. The findings prove the moderating effect of organizational infrastructure as one of information technology complementary. In addition, by considering process oriented approach, the result of analysis shows the significant influence of IT on operational and managerial processes of organizations while these processes' impression improve capabilities of organizations significantly.

Keywords: Information technology, Process framework, Performance, IT complementary Inter-organizational infrastructure

Introduction

The measureable impact of information technology investment on performance of firms remains a topic of discussion among managers and researchers. While developed organizations continue to invest heavily in advanced communications and computing technologies, researches report contradictory findings on impact of these investments on organizational performance. Over the past decades, we have witnessed an increasingly convergent set of communications and computing technologies that are being recognized as facilitators of fundamental business change. Considering intervening variables such as total quality management, reengineering of processes and organizational infrastructures is suggested way to explain productivity paradox. (Albadvi, Keramati, & Razmi, 2006).We can consider intervening variables to understand the indirect relationship between IT and organizational performance, which leads us to better explanation of impact of IT. Some researches have mentioned these intervening variables as complementary of information technology, which can strengthen IT effectiveness (Keramati & Albadvi, 2006). Although IT provide significant new facilities and capabilities for firms, these capabilities can be fully realized when companies also invest in organizational infrastructure such as empowering workers, decentralization, team working and process management.

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Recently there are few researchers have argued that unlike much of previous research on IT impacts, we should evaluate IT at the level it has the major impact: the process level. Such process level assessment can offer considerable insight how and in what manner IT interact with organizational processes to create process capabilities, which in turn can help firms in deriving differential business value from IT investments. In addition to all approaches used for measuring and explaining the impact of IT on performance, few recent literatures have argued about assessing the impact of information technology on business process and how it changes the processes to capabilities and the impact of these capabilities on organizational performance which is called process oriented approach (Radhakrishnan, Zu, & Grover, 2006). They indicate that relationship between IT investment and financial performance is mediated by processes performance which is called process-model.

Over the past decade, information technology has had a deep effect on Iran's economy. This fact, however, has also produced what may be labeled as paradox of productivity. While percentage of a firm's budget spent on IT continues to increase, there is increasingly evidence that firms fail to obtain the benefits of these expenditures within expected period. Companies and organizations without mentioning demand and performance of IT and impact of it on organizational structure and effectiveness of this systems on cost, time, human resource management and business processes, are going to spend a lot of time and money on implementation of such an automated system. Organizations expect more efficiency, effectiveness in their process by using IT tools in their cycles, and process; however, they reach to opposite results. They invested more money in adopting information technology than improving their organizational infrastructure, which is the base floor for information technologies. Therefore, the research problem is formulated to gain a better performance from implementation and using information technologies in firms and identifying complementary that investment on them would lead companies to

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solve their problem of productivity paradox such as investment on organizational infrastructure. The research aims at assessing the impact of information technologies on distribution processes and performance and evaluating the relation between investigation on organizational infrastructure, information technology usage and firm performance. Specifically, the main objectives of this study are to finding the power of investment on organizational infrastructure to increase the effectiveness of information technology impact on distribution company performance besides proofing the idea that using the level of investigation on information technologies has positive effects on organizations processes efficiency which lead to more performance.

Literature review

Some researches tried to take into custody the explanations of IT and Productivity Paradox. Brynjolfsson, Hitt, and Yang (1996) measured and empirically tested the possibility of the productivity paradox as an object of miss-measurement. They used the neoclassical production theory in order to determine the contribution of such inputs as computer capital and information systems staff labor to output. They measured output in inflation-adjusted dollar terms because, this partially accounts for changes in product quality and introduction of new products. They concluded that that IT had made a substantial and statistically significant contribution to firm output. A research by Stratopoulos and Dehning (2000) mentioned the probability that a portion of the productivity paradox is resulted from mismanagement in firms. Empirical findings of Strassmann (1990) indicate that the lack of significant correlation between the investment in IT and performance points to potential illogical behavior of the management. Productivity paradox is still a research area on IT and productivity. One of the most important explanations of productivity paradox is the amount of organizational complementary investments, which should be emphasized on in order to achieve more productivity (Boyer, Leong, Ward, &

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Krajewski, 1997). There have been many studies on the relevancy between the application of information technology (IT) and organizational efficiency or firm performance. The results have shown a significant and positive correlation between IT and firm performance (Mukhopadhyay et al., 1995, as cited in Albadvi et al., 2006). Meanwhile the other researchers have not been able to find such a relationship (Davern & Kaffman, 2000, as cited in Albadvi et al., 2006). This is called productivity paradox in the literature of IT and productivity.

During the last three decades, many studies have been conducted on the impact of Information Technology (IT) on productivity at various levels and by scanning the published work at corporate level productivity. Researchers have developed three different approaches in assessing the correlation between IT implementation and productivity measures (Keramati & Albadvi, 2006). The first two approaches focus on the effects of IT investment on direct, intermediary, financial and non-financial measures of productivity. The third approach, "complementary" approach, focuses on IT accomplishment and effects considering the role of complementary investments that improve and complement the IT implementation or complementary which can improve the impact of information technologies on firms' performance.

The 'Direct Measures' approach mainly focused on various direct measures of productivity such as a number of partial productivity measures (including workforce and capital productivity (Rai et al., 1997, as cited in Keramati & Albadvi, 2006) and total factor productivity (Alpar & Kim, 1990, as cited in Keramati & Albadvi, 2006) as well as profitability and cost reduction. In an attempt to explicate the cause of productivity paradox, data set and measurement methods selections have been pointed which leads to a new nonspecific type of IT productivity measures, called Intermediary Measures. These measures are commonly related to insubstantial costs and benefits, managerial

behavior and utilization of capacities (Brynjolfsson & Yang, 1996, as cited in Keramati & Albadvi, 2006; Brynjolfsson et al., 1996). Although the intermediary measures approach reveals many important facts about IT affecting performance of organizations via non-financial data, but there are problems related to this approach. The most important problem is the productivity paradox that remains on some of the research results of this approach. While there are, still a number of researchers adhering to the first two approaches, which were mentioned in previously, third `complementary' approach, have evolved. In this approach, researchers believe that "IT investment will confidently affect the productivity if complementary investments are made". Instead of measuring the traditional measures of productivity that are related to industrial age, they focus on IT ability to create the new shape of values (Berndt & Morrison, 1995, as cited in Keramati & Albadvi, 2006). Albadvi et al. (2006) mentioned and summarized both researches focusing on intervening variables and complementary investment and researches showing positive or negative effects of information technologies on productivity. Lau, Wong, Chan, and Law (2001) pointed out the fact that IT complementary investments need consideration of decentralization and investment on human capital.

Process oriented approach

In the past decade, several researches focused on impact of information technology on firm performance from process-oriented perspectives. The main purpose of those studies is to find the effects of information technologies on processes and in return the impact of these effects on creating business value and capabilities and improving these capabilities (Radhakrishnan et al., 2006). Their research suggests that effectual operations and use of IT in organizations can result in differential value to organizations by formation of organizational capabilities. Process oriented approach can be explained as impact of IT influences on business processes on capabilities and the degree, which these capabilities will be improved. These capabilities directly affect organizational

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performance and productivity. Operational processes include inbound logistics process (supplier relations), production and operation process, product and service development process, sales and marketing process, customer relationship process (outbound logistics) (Tallon et al., 2000, as cited in Radhakrishnan et al., 2006). Management process refers to processes carried out at different management levels of an organization associated with administration, allocation of resources, resources utilization, communication, coordination and control. Management processes can help improve decision making related to resources allocation, resources utilization, strategic planning on mergers and acquisitions, new product planning, new market entry planning, R&D planning, budgetary control, etc. (Mooney, Gurbaxani, & Kraemer, 1996). They are not directly related to the primary (core) activities of the value chain and they help in carrying out the support functions of an organization. Process capabilities refer to the firm's capacity to apply IT to operational and management processes, to affect desired firm's performance. When the firms understand and effectively set up standard IT into their operational and management processes, they create differentiated operational and management process capabilities. Since these capabilities are valuable, rare, appropriable, inimitable, immobile and non-substitutable, firm which use information technologies extensively enjoy better performance than their counterparts.

Figure 1 shows process oriented model of impact of information technologies on firms' performance which presented by Radhakrishnan et al. (2006). This model explains the relationship between influence of IT on processes and the impact of this change and impression on building capabilities.
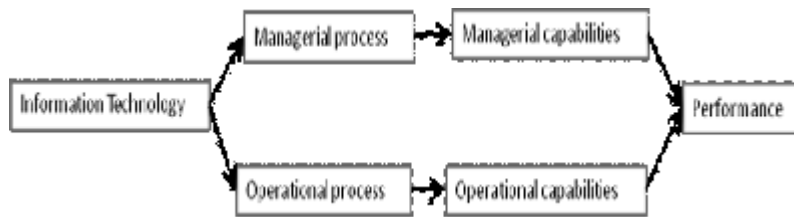
**Figure 1.Process base view on deferential business value creation
by IT, Source: (Radhakrishnan et al., 2006)**

Theoretical framework

We can see process oriented approach in some ways was supported by complementary approach. Keramati and Albadvi (2006) mentioned that Complementary approach shows that the strategic stress is changed from "IT to improve and support ongoing operations "to "IT as a capability builder". Considering information technology as creator of organizational capabilities is similar goal, which process oriented approach emphasizes on. Consequently this research is going to evaluate the impact of information technologies on firm performance from process oriented view and besides by considering complementary investment and emphasize to evaluate the impact of interaction and integration between information technologies IT complementary investment on firms performance. Figure 2 shows combinational model. This is supposed to be the combination of complementary and process approach which according to are artifact discussion in this research may removed the problem associated with two other approaches, direct and intermediary approach. This model is an integrated model resulted from three previous models. The first one is Radhakrishnan et al. (2006) process model for measure the impact of information technologies on firm performance by evaluating the effect of information technologies on process and the power of IT to create and improve process capabilities. The second one is Keramati and Albadvi (2006) model, which mentioned IT and complementary investment interaction as stimuli

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to improve firms' performance. Finally Albadvi et al. (2006) model, which tried to explain the impact of information technologies on firm performance by assessing the influence of IT on business processes while considering role of interaction between organizational infrastructure and information technologies on upgrading organization performance.
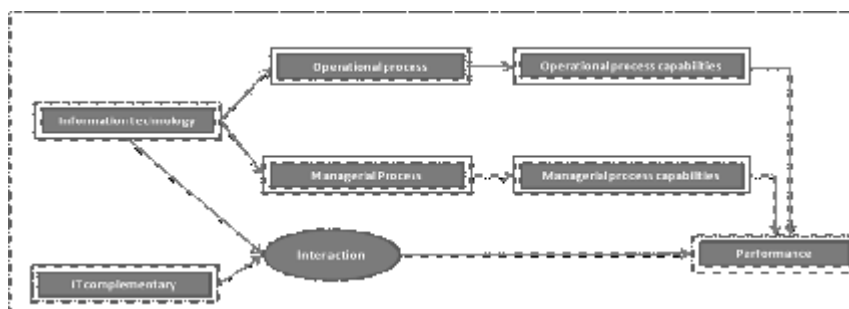

Figure 2. Combination of complementary and process oriented approach

Although IT provides powerful new capabilities for firms, these capabilities can only be fully realized when companies also invest in organizational infrastructures, such as providing quality leadership, empowering workers, decentralization, team working and process management provide one of the keys for unlocking the enormous potential of IT. The theoretical frame work which is demonstrated by Albadvi et al. (2006). shows how organizational infrastructure interaction effected company's performance.

Based on above stated research problem and research purpose, the following research questions have been developed as How organizational infrastructure and information technologies interaction affect firm performance and how improvements of capabilities from information technology's processes influencing and changing improve the organization performance.

There are different hypo researches, which should be tested in order to show the proposed relations among latent variables. These hypotheses are: (H1).The greater operational process capabilities

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improved the lower improvement in performance, (H2) .The greater managerial process capabilities improved, the lower improvement in performance, (H3). Interaction between information technologies and investment on organizational infrastructure has no positive effect on performance, (H4). Level of IT use in organization has no positive influence or impact on operational process of organization, (H5). Level of IT use in organization has no positive influence or impact on managerial process of organization, (H6). Influence of IT on operational processes has no effect on create and improve operational process capabilities and (H7). Influence of IT on managerial processes has no effect on create and improve managerial process capabilities.
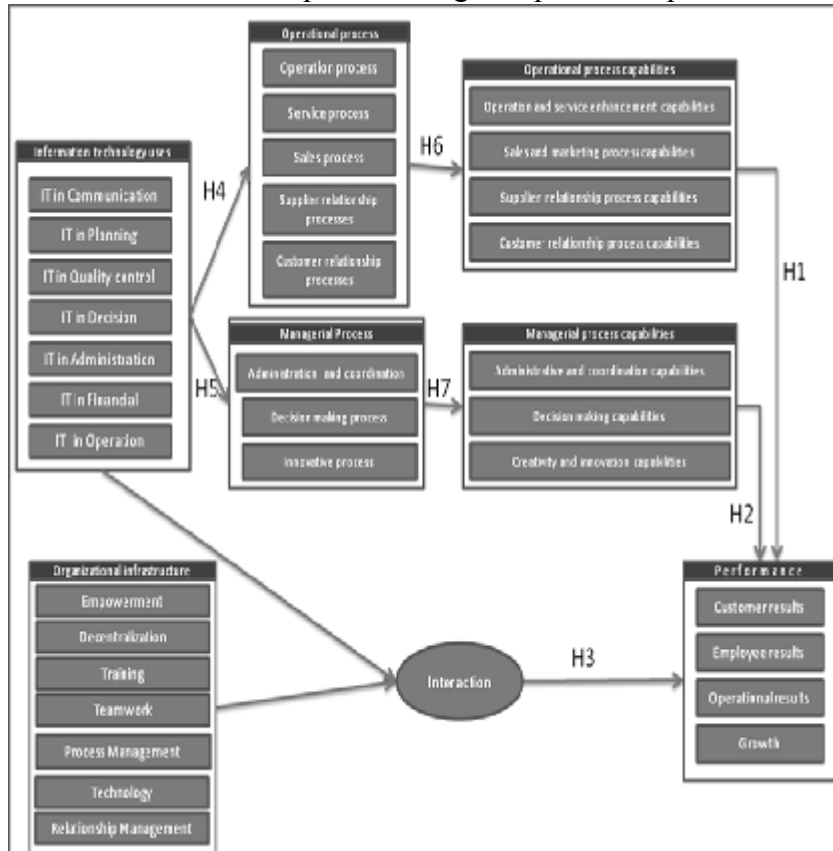

Figure 3.Conceptual framework

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Methodology
Data collection and sampling

In this study, survey is used as a data collection method. As we mentioned before the main goal of this study is to found the degree of impact of information technologies on firm performance. Data collection was conducted in 135 distribution companies and their branches in Iran, from the middle of November 2007 to the middle of February 2008. Total number of distributed questionnaire was equal to 286 (IT and sales manager) from 135 distribution companies, from which 91 were incomplete from 26 companies so the sample size of this study was 109.

In this paper, we used non-probability sampling. Sampling was unrestricted and different methods of non-probability sampling were used in sample selection phase. Considering using convenient sampling in pilot test, we used judgmental, quota and snowball sampling technique.

In fact, the focus of this research is on distribution companies because they are one of the greatest classes of IT users in close direction with their processes. In addition, some distribution companies are the greater investors on information technologies while some other distribution companies have not invested a lot on information technologies application such as information management system, so this was a great opportunity to evaluate the comparison between companies of industry, which the degree of using information technologies in them is different.

Due to lack of a comprehensive database of Iranian distribution companies, finding category of distribution companies were difficult. Based on meetings with managers of Iran distribution association, attending in different exhibitions, study databases of Iran distribution companies and other sources, category of FMCG, pharmaceutics, detergents and cosmetics distribution companies were chosen. By using purposive non-probability sampling, we could select sample members to conform to some criterion and at the same time, we used snowball method and asked respondents to locate the companies who possess similar characteristics and core

processes. Table of appendix 2 show the demographic variables of samples and respondents.

Pilot Testing

An indispensable part of questionnaire development is 'field testing'. According to Dornyei, field-testing "is piloting the questionnaire at various stages of its development on a sample of people who are similar to the target sample the instrument has been designed for. To this end, once the semifinal version of the questionnaire was prepared, the pilot study was carried out in two phases.

In the first phase of the pilot study, the final version of the questionnaire was reviewed by two university professors lecturing at the industrial engineering and management Department of Tarbiat Modares University and Tehran Azad University to check for different aspects of the questionnaire including wording of the items and design and format of the questionnaire. They provided the researchers with useful and constructive comments and feedbacks regarding the wording of some of the items. After applying their feedbacks, the 'near-final' questionnaire was prepared for the second phase of the pilot study.

Then the near-final questionnaire was administered among 18 participants who were working at 9 different distribution companies in Tehran. Results of the pilot study were fed into SPSS to check the reliability of the instruments using Cronbach's Alpha reliability.

Questionnaire

After extended literature review questionnaire was developed. The questionnaire was translated to Farsi language. After translating, pilot study was conducted in order to identify and eliminate potential problem. They were asked to critique the questions and to mention any vague point in the questions. Based on feed back the questionnaire was refined for clarity.

Data analysis framework

The figure, the data analysis consists of two separate phases; first, exploratory data analysis which prepares proper input for the second phase, and second, confirmatory analysis, which in this study consists of structural equation modeling with latent interaction effects.

EDA is an approach to data analysis that employs a variety of techniques to maximize insight into a data set, uncover underlying structure, extract important latent factors, and detect outliers and anomalies.

In the primal data set, the data for some respondents and indicators had some missing values. It is usually good practice not to use respondents/indicators containing a great amount missing values. This is done in the data cleaning task. Descriptive statistics can give useful information about univariate/multivariate properties of variables. This statistics include mean, variance, covariance, correlation, skewness, kurtosis, and normality indexes. In clustering, the data set (respondents) will be clustered into homogenous clusters based on their responses to the questionnaires items. If a cluster is rather far from the other clusters, or has very specific characters, or is an outlier cluster, it will be discarded in this phase because the presence of outliers can affect the model significantly and decrease the accuracy of the confirmatory models (Johnson & Wichern, 2007).

The outputs of EDA phase include cleaned and preprocessed data, clusters of respondents and outlier cases. Outlier cases must be removed from the dataset. Cleaned data are the main output of phase 1 and are directly fed to the next phase.

According to the research question, we are facing with several variables. On the other hand, multivariate analysis consists of a collection of methods that can be used when several measurements are made on each individual or object in one or more samples (Rencher, 2002).

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In this paper, different multivariate methods can be used, but according to our research questions and our model, which is based on the literature, there will be some limitations. First, we have complicated indirect relations between our variables, which results in inefficiency of simpler methods like multiple regression analysis. Second, measuring some of the variables of interest of this research is not easy and straight forward, and finally our needs in this research could not be satisfied by using only a simple analysis method like factor analysis or multiple regressions.

According to the above limitations, and the power of structural equation models (SEMs) in the analysis of complex relations we will use this method of analysis in our research. As Klein and Moosbrugger state, SEM integrates various statistical concepts like confirmatory factor analysis, path analysis, multiple regressions, ANOVA and simultaneous equation models (Klein & Moosbrugger, 2000). But SEM can not completely satisfy our needs in this research as one of the research questions is about the interaction between some latent variables (Organizational Infrastructure and IT Usage). This interaction between latent variables cause a non-linear effect in our equations and so, the model can not be solved as a simple linear model, because the normality assumption of the interaction term will be violated.

Therefore, we shall use Latent Moderated Structural Equations approach (LMS) to develop the statistical model and estimate its coefficients. To develop such a model we simply followed the steps indicated in Figure 6 (Hair, Anderson, & Tatham, 1995).

1- Developing a theoretically based model; As in the SEM, a good model based on strong theory is of great importance, the model is developed based on the extant literature and can finally lead to the answers of the questions of the research.

2- Construct a path diagram; Defining exogenous and endogenous variables and linking them based on the theoretical model, path diagram was constructed.

3- Converting path diagram; As Mplus software can take crude input data and calculate covariance matrix and develop needed equations, suitable code for the software was developed

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4- Solve the model and evaluate estimates; Solving the model using M-plus software, estimates were evaluated to be sure that there is no identification problems (e.g. huge variances).

5- Evaluate goodness-of-fit; Goodness-of-fit of the model was evaluated and if there was any problem, the cause of the problem was detected. In this case, although a complete set of indices for evaluating of the goodness-of-fit of LMS models is mot developed yet, the overall goodness-of-fit was suitable and there was not any serious problem.

6- and 7- Model interpretation and modification; Interpretation of the final model will be presented in the discussion section.

Analysis and results

Based on the framework that was explained in the previous section, data analysis was performed. In this section we will present the results of analysis. As there is not enough space to report the results of all different explanatory data analysis performed on the data, we just report the results of reliability and validity controls of the data, and then we present the results of running the structural model with more details.

If nothing changes in the population between two investigations in the same purpose, it is reliable. In order to prevent error of interviewer and interviewee and bias responses, this test has been done. It helps to find a common factor behind the related indicators. There are two groups of Cronbach's α, one α for each group of indicators and their factor, and the other α for all indicators of the research. Based on (Cronbach & Meehl, 1995) reliability testing has been done with help of Cronbach's alpha in order to investigate the validity of each construct. Values of constructs greater than 0.7 were accepted and the rest were rejected. Detail analysis of reliability tests show that reliability of all model constructs were accepted according to Cronbach alpha greater than 0.7. As an example for better clarification table 2 demonstrate reliability of ITU.

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Validity

Content validity of this research was broadly discussed in literature review and measurement of instrument. All categorize of models and constructs are based on literature and adopted from previous models. Three key article strongly support the model and the idea of this research (Albadvi et al., 2006; Keramati & Albadvi, 2006; Radhakrishnan et al., 2006).

According to LMS method, the structural validity of structure will be tested and confirmed in confirmatory phases simultaneously with confirmation of models relations and constructs.

Guided by results generated from EDA, experts' opinions as well as the domain knowledge, a primary measurement model was obtained. This model should be hypothetically validated in order to have the potential of being used as a valid measurement instrument. Therefore, a CDA phase has been developed. According to the steps explained in the previous section, statistical model of the research was developed.Primary results of solving the structural model are shown in figure 8.
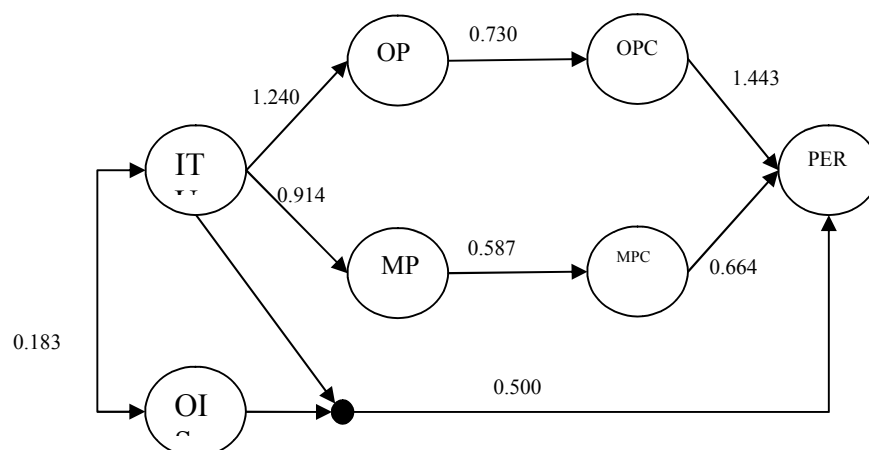

Figure 4. Structural model with results

Table 1 illustrates the estimated coefficients of the model and their corresponding standard error and calculated statistic.

Table 1.summary of main relations

Relation	Estimate	Standard Error	Statistic
ITU → OP	1.240	0.163	7.603
ITU → MP	0.914	0.125	7.292
OP → OPC	0.739	0.046	15.998
MP → MPC	0.587	0.082	7.173
ITUxOI → PER	0.500	0.148	3.383
OPC → PER	1.443	0.167	8.616
MPC → PER	0.664	0.193	3.433

Measurement model

Figure 5 shows the full model including coefficients of measurement model as well. Using LMS method, we can test the validity of indicators and their construct in this phase.

IT use in operation, Investment and emphasizing on improving teamwork, influenced operational process related to customer, improving decision making quality, improving relation with suppliers and finally upgrading performance from customer view have the greatest impact on their constructs among other indicators.
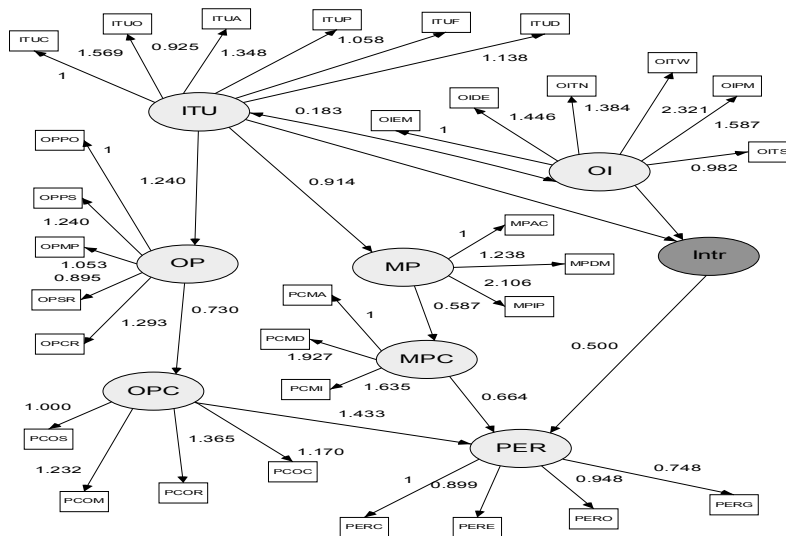

Figure 5.The full model (including coefficients of measurement model)

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As it is clear from following table, their indicators significantly support all constructs. All relations are significant at level of 5%, and it can show the validity of the instrument.

Table 2 coefficients and statistics of measurement model.

CONSTRUCT	RELATION	ESTIMATE	STANDARD EROR	STATISTIC
IT use **(ITU)**	ITUC→IT	1.000	0.000	0.000
	ITUP→IT	1.348	0.093	14.551
	ITUO→IT	1.569	0.106	14.802
	ITUD→IT	1.138	0.062	18.289
	ITUA→IT	0.925	0.092	10.005
	ITUF→IT	1.058	0.106	10.007
Operational processes **(OP)**	OPPO→OP	1.000	0.000	0.000
	OPPS→OP	1.240	0.126	9.875
	OPMP→OP	1.053	0.107	9.865
	OPSR→OP	0.895	0.068	13.203
	OPCR→OP	1.293	0.149	8.688
Managerial processes **(MP)**	MPAC→MP	1.000	0.000	0.000
	MPDM→MP	1.238	0.137	9.016
	MPIP→MP	2.106	0.274	7.687
Operational process capabilities **(OPC)**	PCOS→OPC	1.000	0.000	0.000
	PCOM→OPC	1.232	0.095	12.989
	PCOR→OPC	1.365	0.086	15.912
	PCOC→OPC	1.170	0.088	13.285
Managerial process capabilities **(MPC)**	PCMA→MPC	1.000	0.000	0.000
	PCMD→MPC	1.927	0.175	11.041
	PCMI→MPC	1.635	0.205	7.995
Organizational infrastructure investment **(OI)**	OIEM→OI	1.000	0.000	0.000
	OIDE→OI	1.446	0.192	7.531
	OITN→OI	1.384	0.228	6.077
	OITW→OI	2.321	0.381	6.092

	OIPM→OI	1.587	0.264	6.000
	OITS→OI	0.982	0.169	5.822
Performance measures **(PER)**	PERC→PER	1.000	0.000	0.000
	PERE→PER	0.899	0.072	12.481
	PERO→PER	0.948	0.045	20.962
	PERG→PER	0.748	0.060	12.553

Conclusion

In fact, seven main hypotheses tested in this research. From these seven, all of the hypotheses were rejected at the significant level 5% and just H_1 were accepted. These proposed relations that were extracted from reviewing the literatures. Furthermore hypo research confirms all two main questions and two minor research questions of this research.

In this study, measurement instruments of the impact of IT on the performance of distribution companies regarding the role of intervening variable including organizational infrastructures have been developed and their reliability and validity, based on a survey in 109 distribution companies in Iran, have been assessed. On the other hand, by using process-oriented approach, we developed a process framework with their suitable capabilities. These processes and their capabilities are the map for researchers on distribution companies in Iran in researches that would focus on process-oriented approach.

In order to achieve this, four variables have been examined: the application of IT as independent variable, firm performance as dependent variable, the impact of IT on Processes (operational and managerial) as mediator, impact of influenced process on capabilities (operational and managerial) and finally organizational infrastructures as the moderator variable. We have defined and mentioned all measurement criteria and their applications in the literature. Their validity and reliability have been tested and modified accordingly. Ultimately, we have introduced valid and

reliable criteria (six for ITU variable, four for firm performance, five for the impact of IT on operational process, three for impact of IT application of managerial process, four for impact of operational process changes on improvement of their capabilities, three for managerial process impact on their capabilities upgrading and, finally six for organizational infrastructures). Some criteria were initially defined to be used in measuring the application of IT in companies. The defined criteria are IT in communications, operation, IT in administration and office work, IT in financial, IT in planning and IT in decision-making. The criteria used in other studies have been proven valid and reliable, using confirmatory factor analysis (CFA) with regard to latent structure among these criteria.

Results of this study prove the moderating effect of organizational infrastructures as information technology complementary in the relationship between IT and firm performance. In fact, this study shows that practical diligence for organizational infrastructures including work empowerment, decentralization, training; teamwork and process management and customer relationship strengthen the relationship between IT and firm performance. These results are consistent with the study of Boyer et al. (1997) and Albadvi et al. (2006): the only difference is that Boyer et al. (1997) did not consider the role of process management and customer relationship, changes in supplier relationship in their study and both of these studies did not mentioned the impact of information technology from process oriented view.

Result prove the complementary model and approach which have mentioned in Keramati and Albadvi (2006) in literature review. Investment and emphasize on organizational infrastructures such as training the supervisor and visitors in distribution companies, empowerment and decentralization by giving more authority to middle manager and workers are significantly improve and upgrade the impact of information technology on performance.

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Companies can enjoy from better performance of IT solution by putting more emphasizes on their organizational infrastructure like training, empowerment, decentralization and using new technologies. On the other hand, IT applications can be more effective if companies provide good infrastructures for IT before implementation and before adoption of information technologies.

Results of data analysis show that according to information technologies application used in distribution companies, these applications change operational and managerial processes and the output of these changes will create managerial and operational capabilities that these capabilities improve performance significantly.

Information technologies use in operation (ITUO) has the biggest impact on information technologies use (ITU) among all other applications and use of IT. In return IT have the biggest influence operational process and again in return the operational process capabilities improvement which related to stimuli of information technology change and influence on process, have the biggest impact on performance of organizational. These results show us how the value chain of information technology in organization will be shaped and the effect of each element of this chain of final impact on performance.

Impact of information technologies on process and improvement in capabilities clearly shows the use of IT as differential business value creation among distribution companies. It is observable from results that in companies like distribution companies that core process of organization is involved with use of information technologies, IT shows its highest business value creation and improvement in performance through process and process capabilities.

This is the first time that such study focused on distribution companies in Iran is conducted. On the other hand, the primary contribution of this research to the main model and articles are that this research mix the process oriented approach and complementary

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approach in one model to measure the impact of information technology on firm performance. As it was discussed in literature review, Albadvi et al. (2006) evaluated the impact of organizational infrastructures interaction with IT on firm performance in car manufacturing industry. Although the industries of these two studies are completely different, they did not measure the impact of information technologies on processes but this research did.

Radhakrishnan et al. (2006) assessed the impact of information technologies from process-oriented view. They designed the framework for conducting studies to evaluate that how much IT changes and influences the processes and how much these processes changing improve performance. Radhakrishnan et al. (2006) did not mention any of information technologies complementary but this research did. Putting complementary in model and assessing the impact of them simultaneously considering process and from process oriented prospective will lead us to better understanding of impact of information technology on performance and the attitude, infrastructure and complementary which are needed to upgrade this affection.

Finally, no other previous studies conducted on assessing the impact of information technology on the core process of distribution while considering organizational infrastructures. This research creates the map of process and capabilities for future researchers who call for the study of the impact of information technologies on distribution from process oriented prospective.

The most important limitation of this study lies in the study's sample size. The study's sample size is 109 plants (out of 195 plants). This size is considered small for our statistical analysis. On the other hand, this size is generally used at individual respondent level of analysis, where measures' instability is high. In the present study, each measure used, has high internal consistency. In other words, the answers are highly correlated, and this consistency increases the stability of measure. Hofstede stated that a lower

sample size is acceptable when this kind of stable data with high internal consistency is used.

The second potential limitation lies in the process of making the research variable of performance. We used four separate subjective measures to assess the company performance. Researchers, conducting similar studies, have reported that the number of people willing to answer objective questions on the company performance is more than those who want to answer the subjective questions (Ang et al., 2001, as cited in Albadvi et al., 2006; Boyer et al., 1997). This is most likely that the result of being reluctant to divulge the companies' confidential performance information somehow undermine the findings, so we used objective, Likert scale questions to assess performance. Radhakrishnan et al. (2006) used subjective data from data base that he use. They carefully designed the indicators and measurement for they capabilities and process and absolutely they conduct subjective measurement for performance too. We do not have access to such database about Iranian distribution companies and using objective measure for evaluating performance and capabilities is one of limitation in this research.

The third limitation of this research is about Lag effect and Halo effect. As Radhakrishnan et al. (2006) mentioned, deployment of IT does not make immediate impacts on the firm performance. There is usually a time lag between the time of IT deployment and the time when IT impacts are felt at the firm level. Lag effect arises in organizations because of "technology assimilation and interaction" between the IT and organizational processes which takes time to affect financial indicators. We could not mention lag effect due to the lack of information and time limitation for this research. Finally, another concern of limitation is that of possible influence of firms' previous year performance, i.e. a "halo effect" on current year's firm performance. Radhakrishnan in a similar study, tried to evaluate the impact of IT on processes before conducting the t-test for matched group comparison; they adjusted

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for the "halo effect" of prior firm performance and they used two regression models consistent with prior research (Radhakrishnan et al., 2006).

According to our discussion and introduction in chapter one, both core operational and managerial process of distribution companies in Iran are involved extensively with information technologies applications. According to the results of this research, it can be suggested to the managers of distribution companies to investigate more on organizational infrastructure especially on team work (OITM: Estimate 2.3), decentralization (OIDE, Estimate: 1.44) and process management (OIPM, Estimate: 1.58). In addition, it can be suggested that distribution companies' investments focus more on information technologies in planning (ITUP, Estimate: 1.34), decision making (ITUD, Estimate: 1.13) and operation (ITUO, Estimate: 1.569), since these have the major impact on process and in return on capabilities.

By investment on proper information technology application, also investment on suitable infrastructure, managers can optimize the impact and effect of IT on process and performance of their firms. By assigning more authority to middle managers, training labor and educate them how to work as a team and create the team work personality in them and by continues evaluating and improving the process in company, distribution companies can achieve more output in their performance from investment on information technologies.

The strong role of intervening variables such as OIS to realize IT potential is outlined in this study. Also, we have evaluated process and process capabilities according to each category of process. This research assess the impact of IT on performance separately from process prospective and by process capabilities and from interaction between organizational infrastructure and IT use in organization. By attention to this interaction, further research can be conducted on evaluating the impact of information technologies

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and organizational infrastructure interaction directly on process and process capabilities improvement and finally from capabilities to upgrade performance.

In addition, the research measure instrument developed here is useful for further IT and performance studies. The second future research direction lies in developing and creating process and process capabilities framework to enhance studies and researches in process-oriented approach. Creating such a framework for process and the respected process capabilities for any industry can facilitate the researches focus on impact of IT in such industries and portions.

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APPENDIX A: ACRONYNMS

CAD: Computer aided design

CAM: Computer aided manufacturing

CDA: Confirmatory data analysis

CIM: Computer integrated manufacturing

DSS: Decision support system

EIS: Executive information system

EDI: Electronic data interchange

OIS: Organizational infrastructure

EDA: Exploratory factor analysis

ERP: Enterprise resource planning

FMS: Flexible manufacturing system

IS: Information system

IT: Information technology

ITU: Information technology use

PER: Performance

OPC: Operational process capability

JIT: Just in time

MP: Managerial process

MPC: Managerial process capability

MRP: Material requirement planning

MRPII: Manufacturing resource planning

OI: Organizational infrastructure

OP: Operational process

APPENDIX B: Demographic variables

Number of staff	<100	10~200	200~500	500~1000	1000~2000	>2000	Total
	7%	17%	33%	28%	10%	6%	100%
Distribution field	FMCG		Drug and Pharmaceutical product		Detergents	Cosmetics	Total
	61%		10%		21%	8%	100%
Position of respondents	Director	Commercial manager		IT manager	Sales manager	Other	Total
	8%	1%		41%	46%	3%	100%
Age of company	<5	5~10	10~20		20~40	>40	Total
	12%	32%	25%		23%	8%	100%
Age of IT in company	<1	1~5	5~10		10~20	>20	Total
	14%	32%	28%		15%	11%	100%

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