



THE EFFECT OF BUSINESS PROCESS RE-ENGINEERING FACTORS ON ORGANIZATIONAL AGILITY USING PATH ANALYSIS: CASE STUDY OF PORTS & MARITIME ORGANIZATION IN IRAN

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ABSTRACT

Ports and Maritime organization that is in charge of handling the highest volume of container operations in Iran plays a very important role in economy and trade of that country. This organization is also trying to maintain a high level of responsiveness to achieve agility and to remain competitive in the global marketplace, and so it needs to consider Business Process Re-engineering (BPR). Application of business process re-engineering is the way for successful re-engineering of processes. The present study is aimed at investigating the effect of business process re-engineering factors on organizational agility using path analysis in Ports and Maritime Organization of Iran. BPR factors are operationalized by cultural factors, communications, methodology, project management, strategic alignment, information technology, leadership, empowerment, and performance management.

Initially the theoretical principles were discussed. The data gathered in this stage provided us with the possibility to present a conceptual framework for the study. Subsequently, through interviewing with experts, some indices for evaluating the variables in the model were identified. On the following stage, a questionnaire was developed. The questionnaire included 55 items, based on a 5-point Likert scale. 120 questionnaires were distributed to marine, training, assessment, financial, and information technology (IT) divisions of Ports & Maritime Organization. Using path analysis, with partial standardized regression coefficient, the priority and grade of every independent variable could be defined based on affecting the depended variable. The results of the research revealed that leadership and empowerment variables had the most effect on organizational agility than other variables.

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Keywords: Business process re-engineering, CSF for BPR, Agility, Agile organization, Path analysis method, Ports, Maritime organization.

Contribution/ Originality

This study contributes in the existing literature by using Path Analysis method to describe the effect of BPR factors on organizational agility. It is the first which have been prioritized leadership, empowerment, IT, cultural factors, project management, methodology, performance management, communications, and strategic alignment variables as effective variables on organizational agility.

1. INTRODUCTION

Business process re-engineering (BPR) is a popular management tool for dealing with rapid technological and business changes (Ranganathan and Dhaliwal, 2001). It was first introduced by Hammer (1990) as a radical redesign of processes in order to gain significant improvements in cost, quality, and services (Ozcelik, 2010). BPR creates changes in people (behavior and culture), processes and technology (Al-Mashari and Zairi, 2000). It does not seek to alter or fix existing processes; yet, it forces companies to ask, whether or not a process is necessary, and then seeks to find a better way to do it (Siha and Saad, 2008). BPR integrates all departments into a complete process which have been designed to fulfill a specific business goal (Cheng *et al.*, 2006). Successful implementation of BPR enables organizations to achieve dramatic gains in business performance (Shin and Jemella, 2002). And on the other hand, Organizations in today's world face great environmental turbulence due to ever-evolving competition, changing technology, fluctuating demand, disruption in the supply chain caused by manmade or natural disasters, etc. High levels of environmental turbulence can paralyze an organization's operations. Turbulence is comprised of uncertainty and risks faced by an organization. Consequently, managing uncertainty and reducing risk should be the focus of organizations. Building organizational agility in organizations is a way to manage unforeseen changes and risks faced by organizations. Agility has been defined as the capability of surviving and prospering in the competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by custom designed products and service (Gunasekaran, 1999).

Also, this paradigm primarily is related to organization's ability for dealing with unexpected changes, eliminating unprecedented threats of work environment and using changes as opportunities (Goldman *et al.*, 1995). But it should be noted that agility and achieving agility is not a purpose but according to Jackson and Johansson (2003), it is an essential tool for maintaining competition in the market through uncertainty and changes.

Therefore, the problem that has occupied the minds of managers of each organization, especially in private sectors is how agility can be achieved in organizations. In order to answer this question, managers should have adequate knowledge about the ability level of their organization and tools which creates these abilities. In this research, with purpose of helping managers of Ports

and Maritime organization, we assessed organizational agility in order to provide a better guideline for managers in solving organization problems.

Supporting with this background, this study tries to find a new relationship between BPR factors and organizational agility. The main objective of the paper includes:

- (a) to identify BPR factors in Ports and Maritime organization;
- (b) to find out the relationships between BPR factors and organizational agility;

2. LITERATURE REVIEW

2.1. Business Process Re-Engineering

In BPR large-scale "radical redesign" is considered to gain "dramatic improvements" (Ranganathan and Dhaliwal, 2001). Therefore, BPR is defined as:

... total transformation of a business, an unconstrained reshaping of all business processes, technologies and management systems, as well as organizational structure and values, to achieve quantum leaps in performance throughout the business (Crowe *et al.*, 2002).

A BPR project is successful if it meets predetermined goals within the project scope and over a longer period of time. There are many reviews reporting as many as 70% of BPR projects have not been successful (Shin and Jemella, 2002). It is therefore not surprising that many organizations are not convinced that the implementation of BPR could bring significant and measurable benefits (Vergidis *et al.*, 2008). In fact, the risky nature of BPR has motivated a detailed investigation of its critical success and failure factors (Abdolvand *et al.*, 2008) and many researchers (Bandara *et al.*, 2005; Ariyachandra and Frolick, 2008) have tried to identify critical success factors (CSF) of BPR. In the present study we also identified the key BPR factors in the organization under study, through interviewing and data analysis using Shannon's entropy technique. Ultimately 9 factors were identified as CSF for BPR including:

A. Culture

Culture has been recognized as a CSF for BPR implementation in the literature (Crowe *et al.*, 2002; Maull *et al.*, 2003; Reijers and Mansar, 2005; Abdolvand *et al.*, 2008; Salimifard *et al.*, 2010). Coordination, employees' involvement and friendly interactions are the standard feature of an innovative organizational culture. Effective utilization of employees' ideas enables organizations to achieve their expected results.

B. Leadership

Existing literature specifically recognized the vital role of leadership in BPR efforts (Ahadi, 2004) the role of leadership in driving, monitoring and controlling the activities related to the change is very important. Hammer and Champy (1993) mentioned obstacles in leadership as reason for most of the failures in business process changes. Elimination of the political issues between organizational frontiers, providing a suitable structure for compensations, solving the conflicts

between managers and leading IT in organizations only will take place with senior management effort. High power of senior management can make an effective start and lead implementation.

C. Communication

Communication refers to the interaction between different people in different levels and different functional departments, which can be conducted by activities such as providing an environment for exchanging ideas; holding open meetings, and using different media to collect and distribute information. Suitable communication in organizations, not only provides a suitable environment for implementing the project but it also facilitate the deployment of the project. In addition, by effective communication, the fears and insecurities of employees (which is often the reason of their resistance and unwillingness to change), will be cleared (Sockalingam and Doswell, 1996).

D. Information Technology

To achieve the expected results in BPR implementation, appropriate IT infrastructure is needed. In most projects, BPR starts from IT department. IT is a natural partner of BPR and plays a critical and central role in BPR projects (Crowe *et al.*, 2002; Salimifard *et al.*, 2010). IT not only speeds up the process to be carried out but also integrate processes and reduces errors, hence improves productivity (Guimaraes, 1999; Reijers and Mansar, 2005).

E. Methodology

Methodology is an organized collection of the procedures, techniques and tools which has been developed for addressing the life cycle of one project to lead to its objective and decrease the problems and difficulties (Valiris and Glykas, 1999; Al-Mashari and Zairi, 2000). Different methodologies for supporting the business process projects have been developed (Mansar *et al.*, 2003).

F. Project Management

Lack of suitable project management is one of the important problems that organizations are faced during the project implementation. Project should include a detailed scheduling with clear milestones (Sarker and Lee, 1999). Resource management is another essential part of the project. Resources include financial resources, technical resources, human resources (Wells, 2000). Role of the different stakeholders in the project should be identified. Risk management also is an integrated part of the managing the project (Shin and Jemella, 2002; Khong and Richardson, 2003).

G. Strategic Alignment

Strategic alignment of BPR is defined as "the continual tight linkage of organizational priorities and enterprise processes enabling the achievement of business goals" (De Bruin and Rosemann, 2006). If business process re-engineering goals are established based on the strategic

direction, it would help organizations to achieve long-term benefits (O'Neill and Sohal, 1998). In fact, BPR in this way can be seen as a tool for execution the strategy (De Bruin and Rosemann, 2006).

H. People

People are one of the most important elements in the business process change since processes should be conducted by people in organization. If people were not encouraged and would not agree with the change, then resistance would emerge (Paper and Chang, 2005). Change resistance can influence the failure of the BPR project. Based on the process-oriented concept, peoples' attitudes in organization should change and they should learn how to work across functional boundaries and accept the responsibilities. In addition, people should learn to integrate their work to other efforts to achieve process outcomes (Jeston and Nelis, 2008). All of these softer human attitude/ behavior changes are essential, in addition to trainings in new tools and procedures in new processes (Riley and Brown, 2001).

I. Performance Measurement

BPR projects need some metrics to monitor the progress and ensure that the goals are achieved (McAdam and Donaghy, 1999). BPR related literatures emphasize the necessity of adequate performance measurement systems for employees, which should include incentives and rewards which are compatible with process oriented concepts in the organization (Al-Mashari and Zairi, 1999; Wells, 2000; Paper and Chang, 2005).

2.2. Agility

The term "Agility" was first introduced officially to the public in 1991 by Iacocca Research Institute in Lehigh University in a report called "the strategy of manufacturing firms in 21st century: the viewpoint of industrial specialists". Thereafter, Peter Drucker presented the concept of agile institute to the business world to explain the necessity of increasing flexibility and responsibility of current organization (Vokurka and Fliedner, 1998).

Given the importance of agility, several definitions have emerged since the Iacocca Institute first associated agility with organizational abilities in manufacturing. Sharifi and Zhang (1999) define agility as:

... the ability to cope with unexpected challenges, to survive unprecedented threats of business environment, and to take advantage of changes as opportunities.

While Kidd (2000) provides one of the most comprehensive definitions of organizational agility.

An agile enterprise is a fast moving, adaptable and robust business. It is capable of rapid adaptation in response to unexpected and unpredicted changes and events, market opportunities, and customer requirements. Such a business is founded on processes and structures that facilitate speed, adaptation and robustness and that deliver a coordinated enterprise that is capable of

achieving competitive performance in a highly dynamic and unpredictable business environment that is unsuited to current enterprise practices. These definitions depict organizational agility as dynamic, context-specific, change-embracing, and growth-oriented (Goldman *et al.*, 1995).

Following the review of several works (Goldman *et al.*, 1995; Montgomery and Levine, 1996; Goranson, 1999; Gunasekaran, 1999; Meade and Sarkis, 1999; Sharifi and Zhang, 1999; Gunasekaran *et al.*, 2001), three key elements in the implementation and development of agile organization have been identified: drivers (or motivators), enablers (facilitators, providers or pillars) and capabilities.

The business environment, as a source of change and generator of uncertainty, has been considered the main drivers. In fact, agile organization describes "a comprehensive response to a new competitive environment shaped by forces that have undermined the dominance of the mass-production system" (Gunasekaran *et al.*, 2001). So, agility is reflected in the "capability to survive and prosper by reacting quickly and effectively to a continuously and unpredictably changing, customer-driven and competitive environment" (Jain and Jain, 2001). Agile organization can be considered a model that integrates technology, human resources through an information and communication infrastructure. It provides flexibility, speed, quality, service and efficiency and enables firms to react deliberately, effectively and in a coordinated manner to change in the environment.

3. CONCEPTUAL MODEL OF RESEARCH

First a conceptual model was derived from literature. The model is shown in Fig. 1. In this study, the initial model was considered as the independent variable based on the dimensions of process re-engineering (including cultural factors, communications, methodology, project management, strategic alignment, information technology, leadership, empowerment, and performance management) and organizational agility as dependent variable.

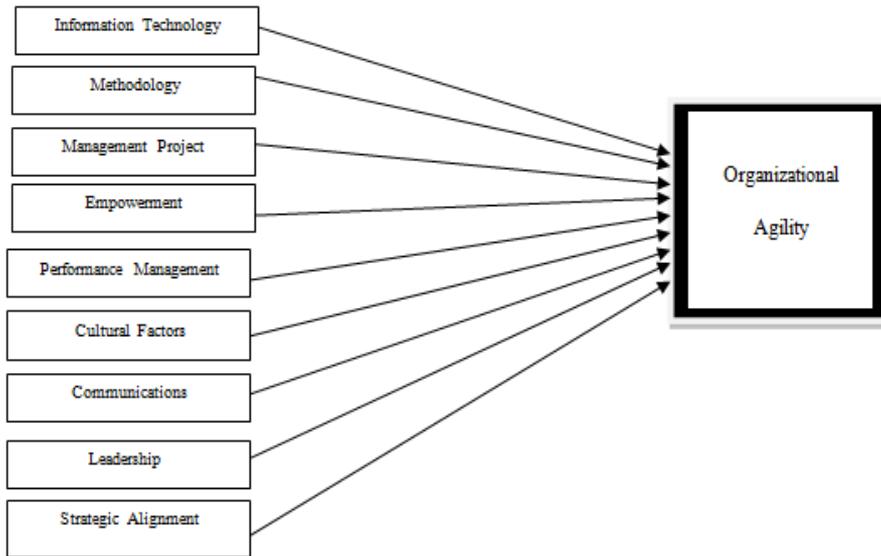


Figure-1. Conceptual Framework based on Literature

4. RESEARCH HYPOTHESES

Based on the presented framework, we derived at nine hypotheses, which are stated in null form.

4.1. Main Hypotheses

H1: There is no statistically significant impact of business process re-engineering (information technology, methodology, project management, empowerment, performance management, cultural factors, communications, leadership, and strategic alignment) on organizational agility.

4.2. Sub-Hypotheses

According to the Independent variables indicated on conceptual model.

Hypothesis 1:

H10: there is no statistically significant impact of Information Technology on organizational agility.

Hypothesis 2:

H20: there is no statistically significant impact of Methodology on organizational agility.

Hypothesis 3:

H30: there is no statistically significant impact of Project Management on organizational agility.

Hypothesis 4:

H40: there is no statistically significant impact of Empowerment on organizational agility.

Hypothesis 5:

H50: there is no statistically significant impact of Performance Management on organizational agility.

Hypothesis 6:

H60: there is no statistically significant impact of Cultural Factors on organizational agility.

Hypothesis 7:

H70: there is no statistically significant impact of Communications on organizational agility.

Hypothesis 8:

H80: there is no statistically significant impact of Leadership on organizational agility.

Hypothesis 9:

H90: there is no statistically significant impact of Strategic Alignment on organizational agility.

5. RESEARCH METHODOLOGY

The present study is a descriptive-correlational research in terms of method. First, the correlation between each of the pairs of variables was evaluated using regression model, then ESQ statistical software was used to explain the model and to calculate direct and indirect effects of independent variables on the dependent variable.

5.1. Statistical Population and Sample Size

The statistical population of the present research consists of the managers and experts of Ports and Maritime Organization of Tehran Province. Since all the population has been available in this study, all members have been asked to answer the questions. In this case, since all members have the same chance for being sampled, and also as the population and the sample are of the same size, thus the results obtained from the questionnaires are quite reliable and valid. Hence, 120 questionnaires were distributed among respondents which 104 usable ones were collected from marine, training, assessment, financial and IT divisions of Ports and Maritime Organization.

5.2. Reliability & Validity of Instrument

5.2.1. Validity

In this study, content validity is used to investigate the validity of research instrument. For this purpose, 10 questionnaires of different formats were sent to the professors and theoreticians of this field. Then, required modifications were made to the questionnaire based on their comments.

5.2.2. Reliability

The internal consistency is usually calculated using an alpha coefficient, which measures the interrelationship between items in the questionnaire (Cortina, 1993). Nunally (1978) argued that a reliability of 0.70 or higher is acceptable. The Cronbach alphas all ranked higher than 0.70 (actual scores were 0.79). This analysis indicates that the scales used in the study are reliable. The results for calculating the reliability index of the questionnaire is illustrated in Table 1.

Table-1. Reliability of Research Variables

Variable	Chronbach's Alpha
Business re-engineering process factors (independent variable)	0.78
Organizational agility factors (dependent variable)	0.94
Overall	0.91

As it can be observed, all indices are acceptable (>0.7) and this indicates the reliability of the questionnaire.

6. DATA ANALYSIS

In the last decade, -many attempts have been made to investigate the causal relationship among variables. One of the promising methods for this purpose is structural equations modeling (SEM) or multivariate analysis with latent variables which is also applied in this study. Structural equations modeling is a comprehensive statistical approach to test the hypotheses about relations among observed and latent variables which is known by several names including covariance structure analysis, causal modeling, and linear Structural relationships (LISREL). However, its most common term is structural equation modeling (Houman, 2005). The results of structural equation modeling are presented via path analysis chart. In the present research, this method is used for analyzing the statistical data according to the features and advantages of path analysis. Path chart is a graphical representation of structural equation modeling. The three main components are as follows: rectangles, ovals and arrows. In addition, the most significant indices of model fit are Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI) and Root Mean Square Residuals (RMSR) (Hoyle, 1995). The main question for the investigation of every model is whether the model is appropriate and useful. To answer the above-mentioned question, the chi-square statistic (χ^2) or chi-square goodness-of-fit and also other goodness-of-fit indices have to be studied.

A model is fit if it meets the following optimal statuses:

- χ^2/df should be less than 3.

-GFI and AGFI tests should be higher than 90%.

-RMSEA test should be lower than 0.8. The lesser RMSR, the better the result because this test is an index for mean difference between observable data and model data (Joreskog and Sorbom, 1984).

7. FINDINGS & PATH MODEL

To analyze the data, first multiple regression model was specified using correlation analysis method, then the variables that had no significant relationship with dependent variable were omitted. Afterwards, direct, indirect, and overall effects on the responding (dependent) variable were analyzed using path analysis method for each variable. In this research, the dependent (endogenous) variable is organizational agility and independent (exogenous) variables include

cultural factors, communications, empowerment, methodology, project management, strategic alignment, IT, leadership, and performance management. The results of research hypotheses testing performed based on Pearson's Correlation test are listed in Table 2:

Table-2. Findings of the statistical research hypotheses testing using Pearson Correlation Coefficient; test error=5%

Hypothesis Number	Correlation Coefficient	N Value	T Value for Test Statistic	Sig. level	Result
Hypothesis 1	0.74	103	3.91	0.00	Reject the null hypothesis
Hypothesis 2	0.46	104	3.02	0.01	Reject the null hypothesis
Hypothesis 3	0.55	102	3.36	0.01	Reject the null hypothesis
Hypothesis 4	0.78	104	4.12	0.00	Reject the null hypothesis
Hypothesis 5	0.62	104	2.98	0.02	Reject the null hypothesis
Hypothesis 6	0.49	98	3.48	0.01	Reject the null hypothesis
Hypothesis 7	0.35	100	2.54	0.01	Reject the null hypothesis
Hypothesis 8	0.81	104	4.47	0.00	Reject the null hypothesis
Hypothesis 9	0.21	102	1.90	0.15	Accept the null hypothesis

Table-3. Analysis of variance for the study model

	Sum of Squares	df	Mean Square	F	Sig.	Result
Between Groups	.760	8	0.481	5.585	.035	Reject the null hypothesis
Within Groups	3.737	23	.162			
Total	4.498	31				

As it can be observed in table2, the maximum correlation coefficient between the independent variables with the dependent variable (organizational agility) belongs to the variable of eighth hypothesis (leadership) as $r=0.81$ and then belongs to the variables of first and fourth hypotheses (empowerment and IT) as $r=0.78$ and $r=0.74$, respectively. On the other hand, the minimum relationship belongs to the variable of ninth hypothesis (strategic alignment) as $r=0.21$ and then belongs to the variable of seventh hypothesis (communications) as $r=0.35$

The relationship of independent variable between dependent variable can be surveyed according to t-value coefficients. In this case, because the obtained t-value is less than 2 (strategic alignment criteria) for t, there is no significant relationship between independent variable (strategic alignment) and dependent variable (organizational agility).

- Hypotheses 1 to 8

The decision rule is to reject the null hypothesis if the significance level is less than 0.05. Thus, these null hypotheses 1 to 8 will be rejected and the alternative hypothesis are substantiated, which means that there is a statistically significant effect of BPR factors (information technology, cultural factors, communications, empowerment, methodology, project management, leadership and performance management) on organizational agility.

- Hypothesis 9

The null hypothesis 9 (strategic alignment) will be accepted and the alternative hypothesis is rejected because its significance level is more than 0.05. This indicates that there is no statistically significant effect of Strategic Alignment on organizational agility.

Table 3 shows hypothesis test of nihilism statistically using the analysis of variance (ANOVA) main hypothesis was rejected based on the value (F) as it was (5.585), and the level of significance (.000) is less than the significance level ($\alpha \leq 0.05$). We conclude that there is a statistically significant effect of the possible factors on organizational agility. Therefore, the hypothesis of nihilism has been rejected and the alternative hypothesis has been accepted.

To determine the direct and indirect effects of the research variables on the dependent variable (organizational agility), which is based on the schematic model designed in this research, their standardized coefficients were calculated using EQS software. The summary of findings as well as direct and indirect effects of the research independent variables are illustrated in Table 4.

Table-4. Direct and Indirect effects of different variables on organizational agility using standardized coefficients

Research Variables	Direct Effect	Indirect Effect	Overall Effect
Information Technology	0.35	0.12	0.47
Methodology	0.24	0.09	0.33
Project Management	0.21	0.18	0.39
Empowerment	0.40	0.11	0.51
Performance Management	0.18	-	0.18
Cultural Factors	0.27	0.12	0.39
Communications	0.02	0.06	0.08
Leadership	0.39	0.21	0.60
Strategic Alignment	-	0.02	0.02

According to the findings and also considering the related standardized coefficients of path equations, the research path model can be represented as Fig. 2. In this chart the degree of effect is shown on the related vectors. As it can be observed, among independent variables of the research, the highest degree of effect on organizational agility belongs to leadership and empowerment with standardized coefficients of 0.60 and 0.51, respectively. Moreover, the lowest degree of effect on organizational agility belongs to strategic alignment with standardized coefficient of 0.02.

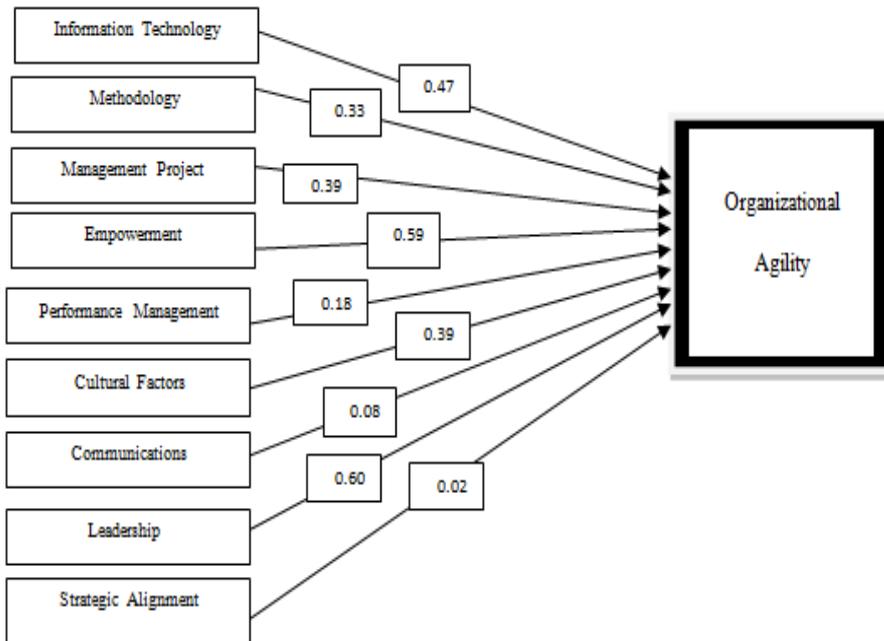


Figure-2. Path analysis model for the factors affecting organizational agility, considering standardized coefficients (overall effects)

Therefore, the factors related to process re-engineering, degree of their effects on organizational agility, and their prioritizations are presented in Table 5.

Table-5. Process re-engineering factors in Ports and Maritime Organization and their prioritization

Factor	Overall effect	Priority
Leadership	0.60	1
Empowerment	0.51	2
IT	0.47	3
Cultural Factors	0.39	4
Project Management	0.39	5
Methodology	0.33	6
Performance Management	0.18	7
Communications	0.08	8
Strategic Alignment	0.02	9

According to Table 5, the leadership variable with highest overall effect has the most important impact on organizational agility so it takes the first priority. Therefore, the prioritizations of factors obtained from the model based on their importance are as follows: leadership, empowerment, IT, cultural factors, project management, methodology, performance management, communications, and strategic alignment.

Considering the output of EQS, the value of χ^2/df is equal to 2.79 which is less than 3, and is desirable. The low value of this index shows the insignificant difference between the research

conceptual model and its findings. Moreover, the output of RMSEA index for the model is equal to 0.087. The lesser RMSEA index the more appropriate the model's goodness-of-fit is. This applies to this model. Moreover, in Table 6, other goodness-of-fit indices of confirmatory factor analysis model are shown which are a confirmation for this model is

Table-6. Goodness-of-fit indices for research conceptual model

Index	Criteria	Current Situation
df (degree of freedom)	>0	4734
χ^2 /df	<3	2.79
p-value (significance level)	-	0.000
RMSEA (Squared Error)	<0.1	0.087
GFI (Goodness-of-Fit Index)	>0.9	0.936
AGFI (Adjusted Goodness-of-Fit Index)	>0.9	0.903

8. CONCLUSION & FURTHER SUGGESTIONS

In this study, the effects of independent variables on dependent variable of the research were investigated using correlation analysis method. As a result, a significant relationship was observed among them. Considering the statistic of t-test, null hypothesis 9 was confirmed and other ones were rejected. On the other hand, path analysis was used to investigate direct and indirect effects of independent variables on dependent variable. As it is understood from standardized coefficients, totally, the effects of leadership and empowerment on organizational agility with standardized coefficients of 0.60 and 0.51, respectively, are higher than other variables and the variables of strategic alignment and communications with coefficients of 0.02 and 0.08, respectively, have the lowest effect on organizational agility. And the highest direct effect of research variables based on path model is related to empowerment, leadership and IT, with standardized coefficients of 0.40, 0.39 and 0.35, respectively.

The suggestions offered by the researchers are as follows:

- This study is carried out in Ports and Maritime Organization. To apply the research conceptual model in other organizations, the questionnaire of this research needs to be filled by the experts of those organizations and the findings should be compared to the model extracted in this study and then analyzed.
- Organizational affairs should be carried out simultaneously by complying homogeneous working teams, as much as possible. This leads to reduction of performance time and accelerates performance.
- Senior managers of organizations should effectively develop incentives, and also encourage and train the personnel. These factors build the criteria for organizational agility.
- Leadership team should consist of talented elites from different departments which have executive power. Board of directors should play a significant role in directing the project.

- Related managers and experts should take advantage of IT during the processes designing as well as their implementing.

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