International Journal of Business and Management Invention
ISSN (Online): 2319 – 8028, ISSN (Print): 2319 – 801X
www.ijbmi.org || Volume 5 Issue 4 || April. 2016 || PP—65-73

Prioritizing the Effecting Factors in Organisational Structure of the Iranian Ports at Khuzestan State by Using Grey Relational Analysis

Dr.Homayoun Yousefi

Abstract: *The purpose of this paper is to identify and investigate the relevant factors in organisational structure of the Iranian southern ports which are located at Khuzestan state such as Abadan, Khorramshahr and Imam Khomeini port. It should be noted that two stages have been carried out in terms of the required infrastructure for implementation of knowledge management. In the first stage by analyzing the research data from the questionnaire and by using the single-sample t-test the situation of the above mentioned ports in terms of the required infrastructure of knowledge management has been reviewed and the hypotheses were tested. To capitalize on knowledge management, an organization must be swift in balancing its knowledge management activities.*

The results of these research shows that the condition of the ports is not suitable in respect of the infrastructure to implement the knowledge management. In the second stage, by using the grey relational analysis the ports have been evaluated by considering the five effecting factors such as information technology, organisational culture, organisational structure, human resources and change management. By referring to the port grey relational factors the following ranking in organisational structure of knowledge management has been achieved for the ports: Imam Khomeini port as first rank, Khorramshahr port as second rank and finally Abadan port as third rank in this research.

Key Words: *Grey Relational Analysis, Knowledge Management, Survey, the Ports,*

I. Introduction

The main factors for increasing growth and prosperity of the ports which is achieved through utilizing information technology, has made the organizations change their present economical approaches from the one which is based on sources such as lands, machines, factories, raw material and work force to a new one based on knowledge and economical value creation through knowledge utilization. Today, knowledge is known as a key property and a valuable asset that is the base of constant development and the key of permanent competitive advantage of an organization. In the current climate of increasing global competition, there is no doubt about the value of knowledge and learning in improving organization competence (Preto et al, 2004). Organizations need to consider adaptive and intelligent strategies of knowledge management processes to succeed in today's competitive environments. (Kangas, 2005). Knowledge is a difficult concept to define. Knowledge management is exciting, both as an area of academic study and for application in maritime business. Organization scholars still argue that knowledge is a multifaceted concept with multi-layers meaning for different circumstances and for different people. Nonaka et al (1995) define knowledge as the justified true beliefs. The Present study attempts to identify organizational, relational, and technological and knowledge factors which impact on technology transfer effectiveness in several Iranian southern ports.

II. Research Paradigm

The researcher operates within a hybrid post-positivist/non-positivist paradigm believing that knowledge is primarily socially constructed; all knowledge is fallible; there is no real truth. As a result, the approach is mostly descriptive and interpretive. The researcher believes knowledge constitutes ideas and claims that have been subjected to validation from others and us. Those evaluations are subjective themselves. While the data is mostly qualitative, the flexibility of a case study approach afforded the researcher the opportunity to make use of both quantitative and qualitative methods.

III. Hypotheses of Research

1) Information technology systems at the mentioned ports have appropriate conditions in order to establish the knowledge management.

2) Organizational structure at the mentioned ports has appropriate conditions in order to establish the knowledge management.

3) Organizational culture at the mentioned ports has appropriate conditions in order to establish the knowledge management.

4) Human Resources at the mentioned ports have appropriate conditions in order to establish the knowledge management.

5) Change in the attractiveness of the mentioned ports has appropriate conditions in order to establish the knowledge management.

IV. Literature Review and Scientific Background

Jones (2005) stated that knowledge management is a systematic, integrated approach to the diagnosis, management and division of intellectual assets including databases, documentation, procedures, and policies and experiences in the minds of individuals. O Dell (2000), knowledge management is a systematic approach to finding, understanding and using knowledge to create value. Most of their activities. Choo (2005), a framework for applying the structures and processes at individual, group, organization in the direction that the organization can learn from what he knows and if necessary, acquire new knowledge to create value for customers and stakeholders. Such a framework to manage people, processes and technology for sustainable development in the performance of a fabric. Beckman (2004) (2004), a mechanism for expertise, knowledge and experience that provide new functionality, better performance leads, encourages innovation and optimal stakeholder value increases (Ansari Renani and Qasemi Namghi, 1388).

The model includes 25 components; these components have been classified in five dimensions (index) such as Culture, Organizational Structure, Information Technology (IT infrastructure), Human resources (human resources capability) and the attractiveness of change management. The following briefly as they have been discussed.

A). Information Technology: Information Technology supports all processes of knowledge management (Hasanzadeh et al., 2009). Knowledge of information technologies and their proper selection and operation of one of the major issues to be considered for implementing knowledge management in organizations. There are various tools and techniques for implementing knowledge management that are supported by information technology (Mohammadi, 1385). Knowledge Management uses the information technology as a powerful tool in own processes. Information technology scattered throughout the organization as one unit in the shortest possible time and do most activities on transferring information. This perspective includes indicators of access to network infrastructure and hardware, access to operational software, flexibility and quality of information (Mousakhani et al., 1389).

B). Organizational Structure, organizational structure is an important factor to establish the knowledge management in organizations. Helping various aspects of knowledge management in achieving organizational structure can be implemented to accomplish its objectives. Organizational structure affects organizational leadership knowledge management processes (Aujirapongpan and et al., 2010) and the ability to communicate between individuals, as well as the underlying facilitate to transfer the knowledge and the culture of the organization in order to offer knowledge (Sun, 2011). Internal organizational structure may encourage or hinder knowledge of organization in order to be successful of using knowledge management (Hussain, 1390). For the effective establishment of knowledge management, organizations must have an appropriate structure. These indicators include elements of centralization, the formalization, channels of communication and teamwork (Mousakhani et al., 1389).

C). Organizational Culture: Organizational culture is a factor to implement the knowledge management as another significant underlying organizational culture. It is set of values, beliefs, norms, understand that people have the common organization, an effective organizational culture play an important role in creating knowledge and support for the exchange of knowledge activities in organization. Organizational learning capability, memory expansion and departmental knowledge sharing culture depend on them (Mills and Smith, 2011). In other words, culture is a combination of the company background, expectations, unwritten rules, common beliefs and social etiquette which effect on behaviour and has following components such as trust, empathy, cooperation, and learning from mistakes (Mousakhani, et al., 1389).

G). Human resources in the knowledge era, most organizations have understood that their success is not due to physical assets, but also because of the experience and skills of employees. The ratio organizations realize their knowledge on how to do things which should be considered as important value assets of organization in order to manage these assets. The importance of the role of human resources for the success of organizations in knowledge management has been confirmed for a lot of researchers. Human resources and organizational learning are key issues for knowledge management and most of available literature for knowledge management designated for these two issues (Hussain, 1390). This index consists of components of expert in business, verbal skills, creativity and skills in information technology (Hussain, 1390).

D). The attractiveness of change: This index consists of individual change was attractive, fit, top management commitment, training, rewards and participation change management of employees is changed strategy (Mousakhani, et al., 1389).

V. Research methodology

The study is an applied method. Due to the nature and objectives of the research descriptive survey method was used. The study population included all experts of the ports that are up to 800 people. Sampling method in this study because of the different ports in the study population was stratified random sampling. Cochran formula is used to determine sample size calculation that the sample size was 150. Source data collection in this study is a questionnaire that was designed based on the conceptual model. It is noteworthy that the study questionnaire included 25 questions (as items) in five areas of information technology (includes 3 questions), culture (5 items) and organizational structure (4 items) and human resources (including 4 questions) and the attractiveness of change or change management.

Since the present study is after finding the existence of relations between enablers and processes, it is of correlative type. The research is of field type from statistical point of view, since the sample is used to generalize the society. The knowledge management enablers are considered as independent variables. Enablers are technology, structure and organizational culture. Knowledge management processes are dependent variables and enabling factors' effect is analysed. Knowledge management processes are creation, capture, organization, storage, dissemination and application. In order to quantitatively analyse the information and get to know the Isfahan Refinery Company personnel and managers points of view about enablers and knowledge management processes, questionnaires are used. The questionnaire of this research has 3 parts. Statistical variables are in the first part. The second part deals with questions about knowledge management processes' evaluation. The third part includes questions about enabling factors measurement. Lawson questionnaire (2003) is used knowledge management processes' evaluation. Enabling factors are measured in the third part through Lee and Choi scale (2003). This scale is comprised of technology, structure and organizational culture dimensions. The questionnaire validity, its content validity, was approved by experts and critics. The Cronbach alpha method that is one of the most important and most common methods was used to measure the reliability of the test. Using SPSS software and Cronbach alpha method, the reliability of knowledge management processes questionnaire and enabler's questionnaire turned out to be 0.852 and 0.863 respectively. Since it was more than 0.7, the questionnaires were highly reliable. The statistical population of this research was 977 of personnel and 33 managers of Isfahan Refinery Company in Iran. Since the variance was not available, it was calculated according to the primary sample. To do this, the questionnaire was distributed among 30 personnel of the organization. The obtained variance from the primary sample was 0.347 and 0.32 for knowledge management processes questionnaire and enablers questionnaire respectively. According to the above formula and obtained variances, the least sample volume was calculated 156 people for the processes questionnaire and 136 people for enabling factors with the precision of 0/05 and at the safety level of 95 percent. As a result, the bigger sample, 156, was chosen as the sample volume. The multiple regression test was used to predict the effect of independent variable on dependent variable. In this research, three enabling factors of technology, structure and culture are considered as independent and knowledge management processes as dependent variables. In the following equation, x_1 technology, x_2 structure and x_3 is culture. We determine which independent variable has the greatest effect on dependent variables using standard coefficients.

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3$$

The test significant statistical hypotheses of the regression model are as the following. If the significant is less than 5 percent, the linear relation of the two variables is confirmed.

H_0: There is not a linear relation between enabling factors and knowledge management processes variables.

H_1: There is a linear relation between enabling factors and knowledge management processes variables.

Data
analysis

In this section, we want to determine the relations between enabling and knowledge management processes, too. As $0.00=P<0.05$ in the knowledge creation process, H_0 is rejected and H_1 accepted and therefore the linear relation of the two variables is confirmed. The knowledge creation process and enabling factors' equation is calculated according to the following formula.

$$Y=2.401+0.264\ x_1+0.19\ x_3$$

As 0.00=P<0.05 in the knowledge capture process, H_0 is rejected and H_1 accepted and therefore the linear relation of the two variables is confirmed.

$Y=2.695-0.36\ x_2+0.396\ x_3$

As 0.00=P<0.05 in the knowledge organization process, H_0 is rejected and H_1 accepted and therefore the linear relation of the two variables is confirmed.

$Y=1.119+0.343\ x_1+0.29\ x_3$

As 0.00=P<0.05 in the knowledge storage process, H_0 is rejected and H_1 accepted and therefore the linear relation of the two variables is confirmed.

$Y=0.594\ x_1+0.282\ x_2+0.25\ x_3$

As 0.00=P<0.05 in the knowledge dissemination process, H_0 is rejected and H_1 accepted and therefore the linear relation of the two variables is confirmed.

$Y=1.557+0.655\ x_1$
As 0.00=P<0.05 in the knowledge application process, H_0 is rejected and H_1 accepted and therefore the linear relation of the two variables is confirmed.

$Y=0.441\ x_1+0354\ x_3$
The results of the research major hypothesis show that 0.00=P<0.05, H_0 is rejected and H_1 accepted, in other words, the linear relation of the two variables is confirmed. Based on the obtained data from the major hypothesis, the test fixed amount of significant, zero regression coefficient of technology and culture variables that is less than 5 percent, the equality hypothesis of these variables coefficients with zero is rejected. As significant is more than 5 percent for structure variable coefficient, it is not inserted into the equation. The table shows in the standardize coefficient columns (Beta) that among the three variables effects on knowledge management processes dependent variable, technology and culture have the greatest effects respectively. The regression equation is as the following. $Y=1.351+0.392\ x_1+0.234\ x_3$

VI. BASICS OF GREY SYSTEMS

Many systems in studies are named after the features of the research objects, while grey systems are labelled using the colour of the concerned systems. For instance, Ashby referred objects with unknown internal information as black boxes. We use "black" to indicate the unknown information, "white" for the completely known information, and "grey" for the partially known and partially unknown information. Accordingly, systems with completely known information are regarded as white, those with completely unknown information as black, and those with partially known and partially unknown information as grey. Here, the term "system" is used to indicate the studies of the structure and function of the concerned object through analysing the existing organic connections among the object, the relevant factors, the environment, and the related change laws.

VII. GREY SYSTEMS THEORY

7.1 Grey theory steps

The information that is either incomplete or undetermined is called Grey. The Grey system provides multidisciplinary approaches for analysis and abstract modelling of systems for which the information is limited, incomplete and characterized by random uncertainty Wei (2011).
The 1st order one variable Grey model denoted as GM (1, 1) is especially applicable for forecasting. GM (1, 1) model uses the variation within the system to find out the relations between sequential data and then establish the prediction model Ping et al (2004).
The three terms that are typical symbols and features for Grey System are stated by Kue et al (2008):

a) The Grey number in Grey system is a number with incomplete information.
b) The Grey element represents an element within complete information.
c) The Grey relation is the relation with incomplete information.

There are several steps of the theory of Grey system Wei (2011):

1. Grey generation: This is data processing to supplement information. It is aimed to process those complicate and tedious data to gain a clear rule, which is called the whitening of a sequence of numbers. The expected goal for each influence factor is determined based on the principle of data processing.

2. Grey modelling: The modelling is performed in order to establish a set of Grey variation equations and Grey differential equations, which is called the whitening of the model. The Grey model is denoted as GM (*n, h*), which is a*n*-th order differential equation of *h* variables. This Grey differential equitation is used for infinite information. Most of the previous researchers have focused on GM (1, 1) models because of its computational efficiency. GM (1, 1) model have time – varying coefficients. It means that the model is renewed as the new data become available to the prediction model. A Grey differential equation having *N* variables is called GM (1, N).
3. Grey prediction: Uses the Grey model to conduct a qualitative prediction, which is called the whitening of development. Grey models predict the future values of a time series based on a set of the most recent data.
4. Grey decision: A decision is made under imperfect countermeasure and unclear situation, which is called the whitening of status. It is primarily concerned with the Grey strategy of situation, Grey group decision making and Grey programming. Grey strategy of situation deals with the strategy making based on multi objects which are contradictory in the ordinary way. It is important to make a satisfactory strategy by means of effect measure maps, which transfer the disconformities samples resulting from different objects into identical scales.
5. Grey relational analysis: Quantifies all influences of various factors and their relation, which is called the whitening of factor relation. It uses information from the Grey system to dynamically compare each factor quantitatively, based on the level of similarity and variability among factors to establish their relation. GRA analyses the relational grade for discrete sequences.
6. Grey control: Work on the data of system behaviour and look for any rules of behaviour development to predict future behaviour. The predicted value can be fed back into the system in order to enable system control.

This study will adopt the above mentioned research steps to develop an influence factors evaluation model based on GRA, and apply to influence factors evaluation and selection. The Grey relational analysis uses information from the Grey system to dynamically compare each factor quantitatively.

7.2 Grey relational analysis

The generation of Grey relation for software projects and the process is elaborated here. Let the number of the listed software projects be *m*, and the number of the influence factors be *n.* Then a*m* x *n* value matrix (called Eigen value matrix) is set up by Kue et al (2008):

$$X = \begin{bmatrix} x_1(1),\ x_1(2),\ldots.\ x_1(n) \\ x_2(1),\ x_2(2),\ldots.\ x_2(n) \\ \ldots. \\ \ldots. \\ x_m(1),\ x_m(2),\ldots.\ x_m(n) \end{bmatrix}$$

Where $x_i(k)$ is the value of the number *i* listed project and the number *k* influence factors. Usually, three kinds of influence factors are included, they are:

1. Benefit – type factor (the bigger the better),
2. Defect – type (the smaller the better)
3. Medium – type, or nominal-the-best (the nearer to a certain standard value the better).

It is difficult to compare between the different kinds of factors because they exert a different influence. Therefore, the standardized transformation of these factors must be done. Three formulas can be used for this purpose.

$$x_i(k) = \frac{x_i(k) - \min\ x_i(k)}{\max\ x_i(k) - \min\ x_i(k)} \qquad (1).$$

The first standardized formula is suitable for the benefit – type factor.

$$x_i(k) = \frac{\max\ x_i(k) - x_i(k)}{\max\ x_i(k) - \min\ x_i(k)} \qquad (2).$$

The second standardized formula is suitable for defect – type factor.

$$x_i(k) = \frac{\left|x_i(k) - x_0(k)\right|}{\max\ x_i(k) - x_0(k)} \qquad (3).$$

The third standardized formula is suitable for the medium – type factor.

The grey relation degree can be calculated by steps as follows:

a) The absolute difference of the compared series and the referential series should be obtained by using the following formula:

$$\Delta x_i(k) = \left|x_0(k) - x_i(k)\right| \qquad (4).$$

and the maximum and the minimum difference should be found.

b) The distinguishing coefficient *p* is between 0 and 1. Generally, the distinguishing coefficient *p* is set to 0.5.

c) Calculation of the relational coefficient and relational degree by (5) as follows.

In Grey relational analysis, Grey relational coefficient ξ can be expressed as follows:

$$\xi_i(k) = \frac{\Delta\min + p\Delta\max}{\Delta x_i(k) + p\Delta\max} \qquad (5).$$

and then the relational degree follows as:

$$r_i = \sum\left[w(k)\xi(k)\right] \qquad (6).$$

In equation (6), ξ is the Grey relational coefficient, *w (k)* is the proportion of the number *k* influence factor to the total influence indicators. The sum of *w(k)* is 100%. The result obtained when using (5) can be applied to measure the quality of the listed software projects.

VIII. Extended Entropies for this Research

8.1 Generalized Shannon entropy

One method of extraction criteria importance weights of multiple criteria decision making is Shannon entropy. (Asgharpour, 1377, Mohammad et al, 1389). In theory, the amount of uncertainty information available, expect the content of a message. In other words, entropy is a measure uncertainty expressed by a P, so if the broadcast distribution, frequency distribution sharper known, is higher than in controls. The uncertainty in a multi-criteria decision is described as follows. Decision-making Matrix related to a decision making model attribute contains information that entropy can be used to assess. The decision matrix A and different options, x have different criteria and(X, j ∈ J = (1, 2, ⋯, n), i ∈ I = (1, 2, ⋯, m values are Matrix system. Then, using the following formula content on this matrix for normalized P calculate (Asgharpour, 1377, Mohammad and Molaee, 1389).

$$Pij = \frac{x_{ij}}{\sum^{m} x}, \quad \forall i,j \qquad (7)$$

For E of sets for each characteristic p, we have

$$E = -K \sum_{i=1}^{m} [P \,.\, LnPij] \qquad \forall ij \qquad (8)$$

$$K = 1/Ln(m) \qquad (9)$$

So that K is a positive constant to satisfy $0 \leq E \leq 1$ apply. Receive created uncertainty or degree of deviation d and the weight W of each index j is as follows (Mohammadi , 1389) :

$$d = 1 - E_J \ , \forall_j \quad (10)$$

$$Wj = \frac{d_j}{\sum^n d} \ \forall_j \quad (11)$$

Since the natural logarithm function a monotonic function defined as operators and according to the grey numbers is used to calculate E of this property (Mohammadi , 1389).

IX. Analysis and Interpretation

9-1. The results of the first stage

In the first stage using a questionnaire based on the basis of this study were tested as assumptions points. In order to test the hypothesis one sample t-test was used. To run these assessments how to follow the normal distribution of variables test using Kolmogorov - Smirnov test was carried out. The results of the Kolmogorov - Smirnov showed that higher levels of 0.05. Therefore, assuming normality of the data is confirmed. One-sample t test made it possible to calculate the mean values and the difference with the average value (assessed value) 3 significant level (a=5%), was reviewed. For this purpose, in this study, SPSS statistical software was used and the difference was calculated, it provides significance level too. The result of the T test is presented in Table 1 as follows:

Hypothesizes	Statistics	dp	Sig	The Average difference	Confidence interval 95%		result
					Upper bound	lower bound	
No.1 hyp	4.787	41	0.000	0.76190	1.0833	0.4405	Rejected
No.2 hyp	3.873	41	0.000	0.71429	1.0867	0.3418	Rejected
No.3 hyp	2.892	41	0.006	0.52381	1.8895	0.1581	Rejected
No.4 hyp	3.344	41	0.002	0.57143	0.9165	0.9165	Rejected
No.5 hyp	3.344	41	0.002	0.57143	0.9165	0.9165	Rejected

Table 1 : Results of one-sample t test hypotheses

The results of the one-sample t-test (Table 1) indicated that sig value for all the hypothesis is less than the standard significance level of 0.05, therefore the author concluded that the average community (all hypothesises) with amount of three have a significant difference. Also, due to the lower and upper limits of confidence interval 95% (all hypothesises) is both positive and there is no zero in that limit and also null hypothesis (for all hypothesises) is rejected and the alternative hypothesis is confirmed. It means that the Ports from the perspective of IT, organizational culture, organizational structure, human resources and change management are not in a suitable condition in order to establish knowledge management.

9-2. The results of the second stage

In the second stage using a questionnaire -based on the designed scale (verbal phrases and numbers corresponding grey distance With it (Dong et al., 2006) (Table 2) condition of the ports from the perspective of information technology, organizational culture, organizational structure, human resources and change management was assessed.

Verbal phrases	**Numbers corresponding grey distance**
Very weak	[1,0]
Weak	[3,1]
Weak rather	[4,3]
Average	[5,4]
Fair	[6,5]
Good	[9,6]
Very good	[10,9]

Table.2: verbal phrases and numbers corresponding grey distance

Then, by using the mean of each of the components, the final scores of indexes which were calculated (by using the plus operators and division grey numbers) and based on the merits of the decision matrix the grey relational analysis was formed (Table 3) .

Factors /ports	IT		culture		Org structure		Human resources		Change Manag	
	U	L	U	L	U	L	U	L	U	L
Abadan Port	3.41	2.12	4.18	2.78	3.63	2.77	3.50	2.41	3.33	2.45
Imam Khomeini port	4.31	3.12	4.34	3.12	4.58	3.47	4.84	3.94	4.14	3.10
Khoramshahr Port	4.00	3.01	4.39	3.21	4.39	3.24	4.49	3.51	4.02	2.99

U= Upper, L= Lower

Table 3: Analysis of gray relational decision matrix

X. Conclusion

This study aimed to evaluate the readiness of southern Khuzestan state ports (ports of Abadan, Khorramshahr, and Imam Khomeini Khomeini) which is done in terms of infrastructure needed to implement the knowledge management in two stages. In the first stage using one-sample T-test of the ports necessary infrastructure factors (information technology, organizational culture, organizational structure, human resources and attraction of change) in order to implement the knowledge management which was evaluated. The results of the hypotheses test showed that the ports form information technology, culture, organizational structure; change management are not in suitable conditions to establish knowledge management.

Among the infrastructure of knowledge management, two items such as change management and information technology in comparison to the other infrastructure are not in good condition. In general, the ports of the Khuzestan state for the purpose of implementing knowledge management in terms of the required infrastructure are evaluated in moderate downward. Then at the second stage, using grey relational analysis for the ports based on the five indexes which have been used to rank the ports. According to the results of the grey relational analysis of the above mentioned ports, concluded that Imam Khomeini port ranked first, Khoramshahr port ranked second, and Abadan port ranked as third.

The findings of this research revealed a significant relation between enabling factors and knowledge management processes. The correlation coefficient between them was positive and this proves the direct relation between them. The multiple correlation coefficient of 0.649 shows that 42.2 percent of changes in dependent variable has been due to the effect of enabling factors' independent variable. Among technology, structure and culture, technology and culture have significant effects on knowledge management processes. Technology coefficient was 0.392 that shows an effect of 40 percent of this variable on the dependent variable. Culture coefficient was 0.234 that shows an effect of 23 percent of this variable on the dependent variable. The structure coefficient was 0.057, which means it has little or any effect on knowledge management processes. The six minor hypothesis of this research which go about the relation between 6 processes and enabling factors were all approved at the safety level. These relations confirm the effect of enabling factors variable as the independent variable on knowledge management processes variable as the dependent variable and also considers it significant. In fact, improving enabling factors status in the organization can be followed by the knowledge management processes improvement.

XI. Acknowledgment

"We would like to thank Khorramshahr University of Marine Science and Technology for supporting this work under research grant contract No.101".

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