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**FORECASTING THE DOMESTIC SUPPLY OF MANPOWER USING MARCOV
CHAIN MODEL (CASE STUDY: FARS PROVINCE'S SADERATBANK)**

**MASHAALLAH VALIKHANIDEHAGHANI^{1*}, ZOHREH
AGHABABAEIDEHAGHANI² AND ABDOLRAHIM NAZARI³**

1: Young Reserchers & Elite Club, Dehaghan Branch, Islamic Azad University, Dehaghan,
Iran

2: Young Reserchers & Elite Club, Dehaghan Branch, Islamic Azad University, Dehaghan,
Iran

3: Islamic Azad University, Dehaghan Branch, Iran

***Corresponding Author: E Mail: valikhani_ma@yahoo.com; Babaii@iran.ir;
Rnazari1357@yahoo.com**

ABSTRACT

The present research tends to investigate firstly the amount of Marcov chain model usage, and secondly this model's capabilities in manpower planning, in Fars province's Saderat Bank, while evaluating the amount of relation between them, and ultimately try to improve human planning in this organization by stating found results. Library method and sampling are used in data collection. For data analysis, SPSS software is used. The results of studying Fars province's Saderat Bank human resources predict, by using Marcov chain model showed this model can be used to predict input and output manpower, manpower increased or decreased, and also required manpower in an organization.

Keywords: Manpower planning, Marcov chain, human resources management

INTRODUCTION

In the present era, manpower is raised as a resource that investing in which is posed as a competitive advantage. No organization can grow without innovation, and any innovation and growth depend on skillful manpower [1]. Thus, it can be said that

manpower is considered as a strategic resource for the organization. Since manpower is raised as the most important asset of organization, planning for these valuable resources is one of the most important duties of every organization.

Every organization's success and progress depends directly on its manpower. Hence, for providing, maintaining, and educating every organization's required manpower, one must plan. By planning manpower, in addition to predicting personnel future requirements, optimized usage of existing manpower, and choosing the employee correctly, will be the future infrastructure of a well-planned organization. Manpower planning in its every aspect has an effective share in founding this, and using the employee correctly is of special attention [2].

Human Resources Management

Human Resources Management is focused on policies, proceedings and systems that affect the employee's behavior, mentality and performance. Human Resources Management is a strategic approach to recruitment, development, management, creating motivation and approaching commitment to the organization key resources; it means the people who work in it or for it [3].

By human resources management we mean the policies and proceedings required to perform a part of the management's duty that depends on some aspects of the employee's activities, especially for recruitment educating the employee, evaluating performance, rewarding, and

creating a healthy and fair environment for the employee.

Manpower Planning

Manpower planning includes regular predicts about the amount of human resources required in the future and the way to provide it; so that the organization estimates the number of its required manpower input to predicts, and provides the required employee through domestic or foreign supply in order to answer the demand, and by using the available manpower optimally, and choosing future employees correctly, they make the fundamentalsof a successful organization [4].

In human resources' management the basis for all activities is human resources planning, while there are different definitions of manpower planning. If we want to present a definition of manpower planning we should say manpower planning is, "to choose the most appropriate person, for the most appropriate job, in the most appropriate time".

Manpower planning is to recognize and provide the required employeeinput to the organization's changes in the future, which is done in two stages,includingmanpower requirement's planning, and human resources providing planning [5].

Marcov Chain

Marcov chain named after Andrei Marcov, the Russian mathematician, is a mathematics system in which transference happens from one state to another, yet the number of these states is accountable. Marcov chain is an accidental, no memory process, meaning that state's conditional possibility distribution depends only on the current state, and doesn't depend on its previous happenings. This no memory type is named Marcov property. Marcov chain has lots of applications in real world modeling [6].

Application of Marcov Chain

Marcov analysis or Marcov chain like a descriptive tool, its major objective is to predict the future behavior of managing systems. This system can be a person, an organization, a demand for a product, a machine or cases like this. Marcov chain is a procedure that can be used to describe every system's behavior in dynamic situation. This method evokes a dynamic planning, and is even applied to dynamic planning problem solving [7].

Marcov method is an analytical method that makes it possible to predict future by applying the possible states and transference possibilities matrix. If we want to study Marcov method accurately and define its place in predicting human resources' supply, we should say that this method is a practical approach to predicting manpower

supply. In this method job transference past models are drawn, and they are used for planning future models [8].

The present research's purpose is to use Marcov chain model firstly and secondly investigate this model's capability in manpower planning in Fars province Saderat Bank, and evaluates the amount of relationship between them. The main objective of the research is to ultimately present new and innovative aspects by explaining found results and by using management opinions in addition to presenting a model, it presents new and innovative aspects, tries to improve planning in this organization by presenting scientific offers.

Nowadays using science in management replaces the traditional methods, thus, the old methods are not used in management at all. One of the important discussions in management is manpower planning. Since manpower is the most important and expensive belonging of an organization, the more a research helps planning in this part, the more importance it gains. Marcov chain model is known and tested as a model, in management science it is specifically the concepts and tools that can be used for planning in different organizational aspects, specially manpower [9].

The importance of the present research is due to enabling the organization to estimate

the number of its required manpower, and realize the deficiencies of manpower in each level, and do the consequent proceedings to replace and make appropriate decisions way to increase in human resources in a predictable future.

The necessity of using Marcov model as one of the domestic supply predicting methods that studies the personnel's transference state, and internal displacement inside the organization is hereby cleared, since its scientific and authentic techniques are appropriate guides for keeping balance in human capital during the change and development. Therefore the present research is done by the objective of predicting the domestic supply of manpower, predicting the entry and exit of manpower in organizational units, and ultimately studying the way of estimating the surpluses and shortages in organizations according to Marcov chain model, and to answer the research questions.

Among other aspects of present research's importance and necessity is the lack of fundamental and practical research with the present research's subject. This research in its kind is done for the first time in the country and in Iran Saderat Bank within this domain.

In this paper a new method is done for Human Activities Recognition (HAR) by using the common specialties of a D3 model

of human body. Contrary to customary methods in which the common aspects of analyzing reverse movement from light indicator position taken with several cameras is calculated, our approach is achieved by using body joints' angles directly from the pictures of time series' activities, with a high registry stereo camera, a D3 object with the model estimate in stereo information. The specialties of estimate angel are common, and then each activity is specified to mapping code words and separate symbols for a Hidden Marcov Model (HMM). By using these symbols, each activity is educated through HMM, and after that all HMMs are educated and used to recognize the activities.

The Research Background

[10] did a research titled, "Recruitment Modeling Education in Manpower Mathematics Planning". Specifically, its results show a new model for a manpower planning system.

All in all, this study expresses K categorized hierarchical system, in which demand for manpower in every period is expressed through domestic mobility and appropriate recruitment. The inclination for doing this was according to Europe Union different inclinations, it is for propagating the programs of helping the local governments, which the company can use not only for employing and educating the newcomers,

but also for improving the skills and knowledge of its available personnel. In this relation, in our Added Mobility model it uses new education/class ready to work, that in existing conditions as manpower acts for a potential recruitment. This category, external or internal, is placed in non-homogeneous Markov chain model framework. Additionally, the goals of expenditure are applied by using programming goal approach, under different suppositions for minimizing operational expenses despite limitations and system regulations [10].

[11] performed a research titled, "Vital Mission for Collective Deciding: Solving the Problem of Changing Deciding Priorities in Deciding Group by Using Markov Chain Model". This article considered to offer Markov Chain Model to approach to the subject of research. Moreover, the new approach's deciding group offered weight allocation, too.

In Iran, few researches address the subject of manpower planning by using Markov model.

[12] performed a research titled, "Application of Markov chains in human resources planning (in Esfahan Steel Company). Hereby we try to express the application of Markov chains in manpower planning and its prediction as far as possible. Markov chains have multiple

applications that were used in repair and maintenance, stocks, sale forecast, etc. fields. The information is taken from recruitment officers and personnel files. Information resources are responsible for all mentioned information, and this chapter presents only a model for application without paying attention to information correctness and accuracy. Only information and transference in central laboratory range is considered, and transference from other parts to this part like recruitment and transference from central laboratory like desertion are considered [12].

[13] in a research titled, "Predicting the Domestic Supply of Organization's Manpower Using Markov Chain Model (National Iranian Oil Refining and Distribution Company case study)" examined this subject. A research by using descriptive method and based on Markov model is done, in order to study the way of manpower domestic supply predicting in organizations.

The achieved results, proved the model's capability in predicting the amount of available manpower in units and different organizational posts. Also the process of manpower entry and exit in units was shown well, and the findings indicate that the amounts of personnel surpluses and shortcomings in all organizational posts are predictable with an acceptable accuracy by

using Markov properties, for a five years period [13].

[14] performed a research titled Marcov chain application in manpower planning (a practical approach for human resource's managers in social organizations). In the research abstract it reads:

“We know different methods and approaches to predict manpower in organizations, usable for human resources' managers. The computational and statistical methods and approaches specially benefit from more strength. Human resources' managers can predict the supply and demand of their organization's manpower by applying these methods. Marcov chain is among the methods applied to predicting manpower supply [14]”.

[15] in their research titled, “the methods of manpower planning in empowering manpower”. In this research's abstract it reads:

“Nowadays, manpower planning is considered one of the most important manpower management's duties, which have a deep impact on management's other activities. If we can employ the qualified individuals through functional planning, lots of managing problems in organizations will be resolved for using the scientific method and systematic view existing in manpower planning. Reduction in expenses, continued education of employee, and following

environmental changes and technology are among the advantages of using effective functional manpower planning [15]”.

[16] wrote an article titled, “Manpower Planning with Marcov Chain Method, case study: Mazandaran District Sepah Bank”. The results of the research show the present data and appropriate prediction of manpower in the future.

METHODOLOGY

This research is sectional in terms of time, practical according to its objective and deep in terms of research depth. It is categorized as a descriptive (non-experimental) research in terms of the quality of achieving required data, and it is among attributive researches, and in terms of research nature is among surveying researches. The research's statistical population includes all employees in staff management posts (the office of managing director, finance manager, commerce, planning, operations, administration, engineering, plans, providing and distributing) and staff offices (legal affairs, technical inspection, research and development, guarding, and public relations), also the whole line manpower (all employees in all parts in located and active branches) of Fars province Saderat Bank from 2006 to 2012. Since in this research, the researcher studies manpower planning in a six years period, and intends to use Marcov model, the study way which

requires all available data in the statistical population, thus in this research the sampling method is not used. In this research library information collection method is used to collect data. The descriptive statistical methods are used. For this purpose, statistics of abundance, average, percent, standard deviation, and variance for describing the achieved information are used in the research. Also to show the achieved results, one-dimensional and multi-dimensional circle, column, and histogram graphs are used. In order to analyze the information after collecting data, these data are encoded and entered into SPSS computer program version 19, and excel 2010.

RESULTS

As the information available in **Table 3** shows, the input rate of Fars province Saderat Bank in the year 2011 was equal to zero and the output rate was equal to 00450. Examining the results indicates that manpower input rate is to the bank was less than its output rate.

According to **Table 4** the result is cleared:

$$\bar{X}_i = \frac{\sum A}{N} = \frac{0.09724}{7} = 0.013891$$

So Fars province Saderat Bank input average rate between the years 2006 to 2012 is equal to 0.013891.

According to **Table 6** the result is cleared:

$$\bar{X}_i = 0.013891$$

Prediction of the input rate in the year 2008 was in the highest level equal to 21.66, and in the lowest level for the year 2012 equal to 18.5. It means in the year 2008, 21.66 people and in the year 2012 18.5 people were employed by the bank.

According to the above **Table 7** the result is cleared:

$$\bar{X}_0 = 0.02607$$

Prediction of manpower output rate in the highest level is equal to 41.01, and in the lowest level for the year 2012 is 34.73. It means in the year 2009, 41.01 people and in the year 2012, 34.73 people were discharged by the bank.

According to the above **Table 8** the result is cleared:

From the years 2006 to 2012 the bank was always confronting manpower decrease, and every year discharged more manpower from its human resource system. But the most manpower decrease in the bank occurred in the year 2007, equal to -19.93 people, and the least manpower decrease occurred in the year 2012 equal to -16.23 people.

Table1: Saderat Bank Manpower Condition

Organizational Post	The number of line manpower				The number of staff manpower			
	Woman		Man		Woman		Man	
	First year	Last year	First year	Last year	First year	Last year	First year	Last year
Presidency	2	2	169	172	0	0	23	25
Deputy	6	6	155	158	0	0	19	21
Employee	280	270	421	395	36	41	39	43
Guarding	0	0	0	0	0	0	20	20
Services	0	0	163	169	0	0	11	10
Total	36	41	112	119	288	278	908	894

Table 2: The Manpower in and Out Status in Saderat Bank in Year 2012

Discharged Employees	Woman	Man	Input Employees	Woman	Man
Leaving Service	0	0	Employed	0	0
Retired	1	10	Permanently Relocated to the Province	0	0
Fired	0	0	Temporarily Relocated to the Province	0	0
Permanently Relocated from the Province	1	0			
Temporarily Relocated from the Province	0	0			
Died	0	0			

Table 3: The Indexes for the Input and Output Rate of Manpower in Saderat Bank in Year 2012

Title	Label	Rate
Attended to the Saderat Bank	A	0
Discharged from the Saderat Bank	B	0.0045

Table 4: The indexes for the input rate of manpower in SaderatBank in years 2006-2012

The Values of A	Year
0.01271	2006
0.03143	2007
0.04355	2008
0.00855	2009
0.00100	2010
0	2011
0	2012
0.09724	total

Table 5: The Indexes for the Output Rate of Manpower in Saderat Bank in years 2006-2012

The Values of B	Year
0.03478	2006
0.01026	2007
0.04100	2008

0.02696	2009
0.00733	2010
0.05766	2011
0.0450	2012
0.18249	total

Table 6: The Index for the Prediction of Number of Input Manpower in Saderat Bank

Year	The Values of h	P'
2006	1495	20.77
2007	1559	20.71
2008	1573	21.66
2009	1521	21.13
2010	1501	20.85
2011	1344	18.67
2012	1332	18.5

Table 7: The Index for the Prediction of Number of Output Manpower in Saderat Bank

Year	The Values of h	q'
2006	1495	38.97
2007	1559	40.64
2008	1573	41.01
2009	1521	39.65
2010	1501	39.13
2011	1344	35.04
2012	1332	34.73

Table 8: The Increased/Decreased Manpower in Saderat Bank in Years 2006-2012

Year	P'	q'	M
2006	20.77	38.97	18.2
2007	20.71	40.64	19.93
2008	21.66	41.01	19.35
2009	21.13	39.65	18.52
2010	20.85	39.13	18.28
2011	18.67	35.04	16.37
2012	18.5	34.73	16.32

DISCUSSION

In previous researches the results of the research was also exactly in line with the present research. For instance, in the research [13] performed titled Predicting Organization's Manpower Domestic Supply by Using Markov Chain Model in National Iranian Oil Products Distribution Company, they resulted in the mentioned model predicted manpower domestic supply by a practical approach. It plans the future models by drawing the past models, and determines the possibility of employee's

relocation within different positions during a period of time. This model can also determine promotion, degradation, relocation, employment and employee's desertion. This research's findings indicate that by using Markov properties, the amount of manpower surplus and shortage can be predicted in a distinctive way for a definite time period and acceptable precision.

In the research [17] used to increase production veracity and product quality through predicting compensatory control. The researcher also concluded that Markov

internal chain model is highly enabled to predict and supply manpower. This model even in organization's minor parts has the same total ability [17].

[18] also used Markov chain to predict manpower internal supply in organizations. He introduced it for manpower evaluation and predicting in definite successful periods.

[14] did also use Markov chain to study manpower and required manpower predicting in Tavanir Company. He has concluded that Markov chain is a powerful tool and appropriate for predicting manpower in all aspects, it means manpower input and output, surplus, and decrease or increase.

[19] in another research used Markov chain to plan appropriate model for human resources and studying the conditions of recruitment and deployment in Tehran Province Water And Wastewater Company. It indicates the point that this model is an appropriate tool of high power and effectiveness for evaluating and predicting the required manpower.

[20] also used Markov model for two-variable manpower planning. He promulgated that transference possibilities matrix for the upcoming years can be easily predicted by using Markov chain. So this tool makes it well possible to plan for a definite period.

CONCLUSION

The results of the present research by using Markov chain has shown that Fars province Saderat Bank about manpower entry and exit, and also manpower increase or decrease in relation to the previous similar year is frequently lowering manpower, and had manpower input only in the two years of 2007 and 2008, while in the other years it always planned for manpower increase. The results of Fars province Saderat Bank manpower prediction by using Markov chain showed this model can be used for predicting input and output manpower, decreased or increased manpower, and also required manpower in the organization. The results of the study indicated that in all studied years the available manpower in the bank was more than the required manpower.

OFFERS

According to the results achieved from the research hypotheses, the following offers are presented:

1. Evaluation is a process in which human resources management is linked to organizational performance by using data analysis and interpretation. Effects of manpower activities evaluation and economic performance are well-defined in the field of human relations, so we offer that managers and planners evaluate the subject scientifically, before any proceedings. It is especially

important about manpower, which is among the investments of an organization, and in case of the lack of correct evaluation, it can cause the organization to fail.

2. One of the common mistakes of human resources managers is that they pay attention to short-term replacement requirements instead of considering the organization's manpower requirements. Such a view causes the managers to ignore the changes in manpower existence, quality, and quantity, and this causes a series of ambiguities and uncertainty in short terms. This view is completely inefficient, and features the method of managing on the basis of crisis. If enough skillful and eligible employees are not available, it is not possible for an organization to meet their commercial objectives. Therefore we offer that the managers predict their required manpower in long terms by using the appropriate scientific model and benefit from strategic management in this way.

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