ANALYSIS OF THE FACTORS AFFECTING THE PRODUCTIVITY OF THE TILE INDUSTRY USING INTERPRETIVE STRUCTURAL MODELING (ISM) AND MIC MAC ANALYSIS

Ensiyeh Taki¹, Habib Allah Mirghafouri², Ali Morovvati Sharifabadi³

¹Master of Science in industrial management, Faculty of Economics, Management and accounting, Yazd University,
²Associate Professor, Faculty of Economics, Management and accounting, Yazd University (IRAN)
³Corresponding author: mirghafouri@yazduni.ac.ir

DOI: 10.7813/jee.2015/6-2/11
Received: 16 Dec, 2014
Accepted: 18 Jan, 2015

ABSTRACT

The current paper initially identifies the most important key factors affecting productivity in the tile industry and then examines the relationships between the factors using structural modeling approach (ISM), and then depicts the productivity promotion map in the tile industry. In the next stage, by using MIC MAC analysis, the factors are divided into four groups with regard to the conduct and independence forces including independent variables, dependent variables, linking variables and key variables. The results show that the factors including manpower, technology, and suppliers have the highest priority, and also dependent variables and environment are placed at the final level of prioritization, which all of these are the key variables affecting productivity in the tile industry in the tile industry.

Key words: Productivity; Tile Industry, Interpretive Structural Modeling; MIC MAC Analysis

1. INTRODUCTION

Due to the acceleration of economic and social changes in different social and economic areas and increase the competitiveness of industrial and service organizations, today productivity has become a decisive factor, because the survival of any organization is dependent upon its ability to achieve productivity. In addition, productivity is one of the most basic foundations of competition and the countries that do not pay attention to this important matter, have encountered some problems in relation to the global markets. This is because lack of productivity leads to a difference in resource utilization and these countries are forced to put a wall around their economy and removal of these walls results in a severe imbalance in their economy (Taheri, 2008). Despite the importance and scope of productivity, the concept of the term is not clearly defined for many managers and they often restrict it to their subjective views. As Bernolak claims, "most of managers do not know the meaning of true productivity and also its critical role in in organizations. Also, they do not know how they can improve, evaluate and analyze it, and identify the influential factors in this context (Alvani & Ahmadi, 2001). Productivity is an overall and comprehensive concept that its promotion as a necessity to improve the standard of living and to achieve greater prosperity and comfort is a goal for all countries of the world (Mirghafoury & Saiadi, 2004).

In the area of management, productivity determines a system’s success in the use of resources to achieve the stated objectives. In fact, productivity means both efficiency and effectiveness (Richard, 1992). By understanding the significance of productivity, it should be noted that productivity improvement cannot be achieved except through identification and analysis. Thus, the factors influencing productivity should be identified in order to know where to search the opportunities to promote productivity (Khaiti & Ma’eshoughi, 2006).

In recent years, several studies have been conducted in the area of productivity because increased productivity in organizations is one of the concerns of executives, and it is clear that productivity at a large scale level can be accomplished when it is at the top agenda of all levels including organizations, public and private institutions. The findings from the study by Rau (2006) suggest that motivational programs can improve performance and lead to improved productivity. Ellis & Dick (2003) in their investigation concluded that in the organizations that work as a team and managers employ participative style of management, productivity improves. Mahmoud Zadeh and Asadi (2007) and Ghlami et al. (2004) evaluated the effectiveness of communications on increase in productivity as positive and significant. Jamshidian and Shahshany (2001) examined the productivity of country’s textile industry and regarded software factors as the main cause of fluctuations in the relevant industry. Chandrasekar and Sidharan (1993) analyzed productivity and capital in Indian industry, and using Cobb-Douglas function in a linear and logarithmic fashion and assuming the fixed productivity compared to the scale, they estimated elasticity of inputs and concluded that manpower productivity has increased more than capital productivity in the promotion of productivity in the period studied results from manpower adjustment, and also low capital productivity is due to management factors.

And using a study of the research literature and interview with the experts, eight aspects were identified as the main aspects of influencing productivity which each of them include several factors.

These factors are presented in Table 1:
Table 1.

<table>
<thead>
<tr>
<th>Row</th>
<th>Dimension</th>
<th>Factors</th>
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| 1   | Equipment | 1: The accuracy of the equipment alignment  
2: Remove or reduce the toll caused by materials, machinery, etc. |
| 1   | Manpower  | 1: Manpower training  
2: Increase the salaries of employees according to their performance  
3: Delegating more authority to do things  
4: The lack of discrimination between employees  
5: Trust in the work space  
6: Appropriate and reasonable distribution of human resources in different sections  
7: The design and implementation of appropriate mechanisms of rewards and punishments |
| 3   | Technology| 1: Enhance technological power |
| 4   | Competitors| 1: The use of experiences of other tiles companies  
2: The ability to respond to threats and overtaking rivals  
3: Competition of tile price in the domestic and global markets |
| 5   | Research & Development| 1: Determine the purpose of research and development and more attention to this  
2: Allocate more funds to research and development |
| 6   | Suppliers | 1: Close cooperation between suppliers, manufacturers and distributors  
2: The quality of raw materials |
| 7   | Customer  | 1: Identification and production based on customer preference  
2: Clarification and documentation of procedures for customers |
| 8   | Environment| 1: Subsidy targeting and optimal use of energy  
2: The ability to respond to environmental change |

2. METHODOLOGY

The present paper is applied in terms of objective and it is surveyed in terms of method to perform. The statistical population is composed of all tile companies in Yazd Province. To achieve the maximum accuracy coefficient in obtaining the samples that have a high degree of the characteristics of the study population and their results is generalizable to the whole population, random sampling is utilized. Here, using Cochran Formula at 90% confidence and error level of 0.1 with the p=0.5 and q=0.5, the sample size is estimated. Therefore, in the current study, we have:

\[ N = \frac{P \times q + z^2}{d^2} \times 0.5 + 0.5 \times (1.64)^2 = 67 \]

To calculate the validity, Cronbach alpha method using SPSS is used, which whatever α in this method gets closer to 100%, the accuracy of the questionnaire higher will be. The Cronbach alpha coefficient of this questionnaire is 0.87, which shows the questionnaire validity.

Then, for data analysis, MIC MAC and ISM techniques are used.

Interpretive Structural Modeling (ISM)

Interpretive structural modeling is an interactive learning process that was developed in 1973 by Varflid (Magliocca and Christakis, 2001; Vivek, Banwet & Shankar, 2007). This model is used to identify and summarize the relationship between variables (Mandal and Deshmukh, 1994; Agarwal, Shankar & Tiwari, 2007). This method has the steps as follows:

1. The formation of the structural self-interaction matrix (SSIM): This matrix is used to analyze the relationship between the components, and to show their relations four following symbols are used:
   - V: one-way relation from i to j
   - A: one-way relation from j to i
   - X: two-way relation from i to j
   - O: in case of relation between i and j, and vice versa.

2. The matrix RM (Reachability matrix): at this stage, SSIM matrix turns into a 0-1 matrix using placement law (Ravi, Shankar & Tiwari, 2005). It should be noted that if element i and j lead to the attainment of k, the element i should also lead to the element k (Agarwal, Ankar & Tiwari, 2007).

3. Classification of elements: different elements are divided into four categories: independent, dependent, linking and conducting (independent). This division is based on the strength to be conductive.

4. Determine the level of elements: at this stage, attainable and unattainable sets and common set for each element are calculated using matrix RM. Attainable sets are a set of elements that the element (element whose level is calculated) affects them. Unattainable set is a set that impacts the relevant element. The shared set is sharing of two above mentioned sets. An element lies at the highest level that its achievable and common set is the same. Then these elements are removed from the list and the trend will continue to determine the level of any particular element.

5. Matrix CM: (conical matrix): this matrix is actually the same RM matrix that its elements are arranged in its row and column in order of the levels attained from the last stage.

6. Draw the graph: according to the CM matrix relations and levels of the stage 4, a drawing is presented.
MIC MAC Analysis

The main aim of MIC MAC is to analyze conducting forces and dependent variables force (productivity factors). In this analysis, the variables are divided into four categories. The first category includes key variables. These set of the variables have a weak dependent force and also weak driving force. The variables in this category act almost independently of the system. Such variables have little effect on other variables. In fact, their relations with other variables are very limited. The second category includes those variables that have a driving force. However, they have a higher independent force compared to other obstacles. The third category includes those variables that have a strong driving force and also a robust dependent force. These variables are the obstacles that are unstable. This means that taking any action on these obstacles not only directly affects other obstacles; it can affect the obstacle itself in the form of feedback taken from other obstacles as well. The fourth category consists of those independent variables that have a strong driving force, while with a weak dependent force.

3. RESULTS

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Table 2. SSIM Matrix

Table 3. Attained Matrix

Table 4. Final Attainment Matrix
4. CONCLUSION

As it could be seen from ISM model outputs and Micmac analysis, the dimensions including research and development and environment as the key variables are placed in the basic levels of ISM Model and tile company managers should pay special attention to these dimensions. This is because addressing these dimensions and planning to manage them can lead to the promotion of other dimensions. In fact, dimensions including equipment, competitors and customers as linking factors can contribute to the improvement of the dimensions including improvement of manpower, technology and suppliers. The results of the model indicate that the managers of tile industry should pay special attention to the research and development, and also do great efforts in the sphere of the establishment of R & D department and funding and manpower. Also, due to the competitive environment and its significant impacts on industry, managers of this industry should consider environmental factors as one of their priority programs.

REFERENCES