

PERFORMANCE MEASUREMENT PRACTICES IN MANUFACTURING FIRMS: THE CASE OF IRANIAN MANUFACTURING SECTOR

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ABSTRACT

Using a cross-sectional sample of medium to large size manufacturing organizations in Iran, this study utilized cluster and regression analyses to study the relationships among extent of use, predictive values and information availability for sixty three (63) performance measures. Based on the results, it appears that these organizations do not overemphasize financial measures at the expense of other important performance measures related to competitive environment, operational efficiency, and human resources.

INTRODUCTION

Today's manufacturing organizations have evolved into dynamic and open operational systems with strategic focus. The systematic interactions between soft organizational know-how (human resources and procedures) and hard know-how (technology) are tracked, monitored and managed in order to achieve a sustainable competitive performance. In this context, organizational culture and technology are important aspects of organizational effective performance.

Due to recent economic and competitive environmental changes and challenges, manufacturing organizations across the globe are being forced to pay closer attention to organizational performance. In this context, manufacturing organizations operating in tradition-based culture are facing even more performance related challenges. On the one hand, these organizations are attempting to join the ranks of global organizations. On the other hand, they have to adhere to cultural elements which may restrict their abilities to perform globally. Therefore, such organizations must find the right balance between the desire to change and cultural realities. This elusive balance is essential toward the effective management of the different aspects of organizational performance. In this context, a broader perspective on organizational performance becomes a necessity rather than a luxury.

Like their counterparts in different parts of the world, Iranian manufacturing organizations are being forced to pay a closer attention to their competitive performance. However, these organizations are operating under unique cultural and economic realities.

The executives of these organizations must view organizational performance from a broad perspective than their counterparts in western countries due to the cultural constraints and realities in which they are operating. Therefore, understanding the scope, frequency and relevance of different performance measures available to executives is essential to the process of integrating the different dimensions of organizational performance. Such understanding, on the part of manufacturing executives, tends to strengthen the linkages between the selected business model, targeted competitive strategy, and the operational performance required to sustain the competitive market position. The art of performance management is an evolving dynamic process. Such process is always in search of innovative approaches to the management of organizational resources in order to better track, monitor and improve the different aspects of organizational performance.

This process is even more challenging in traditional rather the pure market-based business cultures. Insights gained through the systematic investigation of the different facets of organizational performance bring executives from different cultures closer as they interact globally. Furthermore, such investigations should enhance the developments of theoretical frameworks needed to foster the study of organizational performance.

While several studies have attempted to empirically shed some light on the different aspects of performance measures and measurement in a manufacturing operational environments (Gomes et al 2004a; Pun and White, 2005; Neely, 2005; Shepherd and Gunter, 2006), studies examining changes in the perspectives of manufacturing organizations with regard to practices related to the utilization of different performance measures have not been forthcoming. Since such organizations are considered dynamic systems, which are operating in an ever changing operational and competitive environment, it is important to assess their changing perspectives on performance measurement and measures practices. The insights gained from this line of research should contribute to improving our practical and theoretical understanding of the organizational role and impact of performance measurement practices. Such understanding is an evolving process, where change is the norm rather than the exception. This research focuses on performance measures as a first step toward a more effective performance management (Neely, 2005). The specific purpose of this study is twofold. First, using a sample of fifty (50) Iranian manufacturing executives, the extent of utilization, predictive value, and availability of information for sixty-three (63) financial and non-financial performance measures are examined. In the process, the current perspectives and practices of these executives, in relation to these measures, are investigated.

BACKGROUND

The tradition-rich Iranian manufacturing sector represents the setting for this investigation. This sector consists of well-established manufacturing organizations operation in different lines of business. The presence of modern Iranian industrial sector goes back at least to the beginning of the 20th century with the discovery of oil and establishment of the oil related industry. The textile industry history goes back to the end of 19th century. According to the Iranian Central Bank statistics, the Iranian industrial sector today contributes to more than fifty percent (50%) of the annual GDP. The petrochemical industry and Automobile industry are among the strongest industries in today's economy.

Iranian manufacturing organizations are facing many challenges which tend to have direct impact on their performance. These challenges stem from economics, operational, technological, and unique cultural realities. Economically, Iran has been under varying degrees of economic embargo by the western countries, particularly the United States since the Islamic Revolution in 1979. Operationally, Iranian manufacturing organizations must manage raw materials, parts, components very effectively as the flow such materials are often interrupted. The lack of availability of the latest operational technology and machinery also presents efficiency and operational problems. In this context, effective maintenance of existing technology and in-house improvements has been an important part of their operation.

At the cultural front, Iranian manufacturing organizations must operate under a culture which does not often equate effective performance with merely financial results. In this context, reputation and loyalty to employees and community are important indicators of organizational performance.

RELEVANT LITERATURE

During the 1980s, scholars and practitioners advocated drastic changes in the way that organizational performance was measured and managed. Due to mounting of criticism of financial indicators, as promoters of short-term thinking and barriers to strategic innovations (Banks and Wheelwright, 1979; Hayes and Garvin, 1982; Kaplan, 1983), the literature begun to stress the utility of non-financial measures, as well as the need to balance and integrate the different performance dimensions (Johnson and Kaplan, 1987; McNair and Mosconi, 1987, Santori and Anderson, 1987). The decade of the 1980s ended with the appearance of the first two performance measurement systems (PMS), namely the SMART (Cross and Lynch, 1988-1989; Lynch and Cross, 1991), and the Performance Measurement Matrix (Keegan *et al.*, 1989).

During the 1990s, several PMS, universal models and approaches were proposed to promote general frameworks, which can be extended to different organizations and operating environments. Among the most widely cited of these frameworks are: the Performance Measurement Questionnaire (Dixon *et al.*, 1990), the Performance Measurement Model in Service Business (Brignall *et al.* 1991), the Balanced Scorecard (Kaplan and Norton, 1992) and the Integrated Dynamic Performance Measurement System (Ghalayini *et al.*, 1997). During this period, some authors focused more on the intrinsic characteristic of each organization. Thus, they tended to stress the design and implementation aspects of a PMS, rather than the general utility of a given PMS, across different organizations (Dixon *et al.*, 1990; Eccles and Pyburn, 1992; Neely *et al.*, 1996; Flapper *et al.*, 1996; Beamon, 1999; Waggoner *et al.*, 1999). Reflecting this case-by-case approach to PMS, the Performance Prism was presented with a prevalent focus on both stakeholder satisfaction and contribution (Neely, *et al.* 2001; Adams and Neely 2002).

During the last two decades, the performance measurement literature underscored some relevant features and characteristics of performance measures and measurement systems, which are highlighted below:

- Must reflect relevant non-financial information, based on key success factors of each organization (Clarke, 1995);

- Should be implemented as means of articulating strategy and monitoring organization results (Grady, 1991);
- Should be based on organisational objectives, critical success factors, and customer needs and monitoring both financial and non-financial aspects (Manoochehri, 1999);
- Must accordingly change dynamically with the strategy (Bhimani, 1993);
- Must meet the needs of specific situations in relevant manufacturing operations, and should be long-term oriented, as well as simple to understand and implement (Santori and Anderson, 1987);
- Must make a link to the reward systems (Tsang *et al.*, 1999);
- Financial and non-financial measures must be aligned, and used within a strategic framework (McNair and Mosconi, 1987; Drucker, 1990);
- Should stimulate the continuous improvement processes (Kaplan and Norton 1992, 1993; Flapper *et al.*, 1996; Neely *et al.*, 1997; Medori and Steeple, 2000);
- Must be easy to understand and to use (Kaplan and Norton 1996; Ghalayini *et al.*, 1997);
- Must be clearly defined, and have a very explicit purpose (Flapper *et al.*, 1996; Neely *et al.*, 1997);
- Should allow a fast and rigorous response to changes in the organizational environment (Bititici *et al.*, 1997; Medori and Steeple, 2000).

Recent dramatic environmental and market changes have left their unmistakable marks on the performance measurement literature. Due to these changes, the recent literature tended to emphasize the need to approach the management of performance from a more open systems perspective. Such perspective has a clear market/customer focus. Some of the relevant issues raised in the literature recently are highlighted below:

- Should capture the dynamic nature of the market and environment and include it in the performance measurement systems (Pun and White, 2005; Neely, 2005; Shepherd and Gunter, 2006);
- The organizational focus should be redirected from performance measurement to performance management (Neely, 2005).
- Should be changed from an internal/closed to an external/open perspective, measuring across supply chain and networks (Folan and Browne, 2005; Neely, 2005; Shepherd and Gunter, 2006).
- Information systems and technology should be facilitators of the performance measurement and management process (Gunasekaram *et al* 2001; Gomes *et al* 2007; Marchand and Raymond, 2008).
- New processes, initially developed for large organizations, should be found to implement PMSs in SMEs (Garengo *et al*, 2005).
- A stakeholder oriented approach should be created, balanced in its perspective (Sinclair and Zairi, 2000).
- Performance Measurement Systems should take in consideration the human factor, including new and innovative incentive/reward systems, and their links to performance measurement in order to involve employees in the performance

measurement process (Gomes et al., 2004a; Chenhall and Langfield-Smith 2007; Berry et al., 2009).

When examining the literature, certain key themes emerge. The first theme tends to emphasize the dynamic nature of performance measurement and measures. The second theme underscores the importance of information and related systems to the measurement process. The third theme focuses on the need for a strategic approach to the measurement effort. The importance of the human factor to the effectiveness of the measurement process is also stressed in the literature. Finally, linking performance measurement and measures to continuous improvement efforts appear to be gaining more importance.

Against this backdrop, the objective of this study is to examine the current views of manufacturing executives in Iran on key aspects of performance measures and measurement. In the process, the nature of the measures used by executives is classified. The extent of availability of information on these measures is also explored.

METHODOLOGY

Instrument, Sample, and Data Collection

The research instrument used in this study was utilized in analyzing performance measurement in Portugal, by Gomes *et al.* (2004b, 2006, 2011). The research instrument is composed of sixty-three (63) financial and non-financial performance measures. These measures are organized in eight categories. For each of the measures included in the instrument, manufacturing executives were asked to classify the nature and characteristics of the measure used on a 1 to 5 Likert-type scale.

To collect the data for this a study, a sample of medium to large size manufacturing firms, which was obtained from the Ministry of Industry and Mines were contacted by phone. After a brief explanation of the objective of the survey, executives from these firms were asked if they were willing to participate in the study. An appointment was scheduled with the executives who showed willingness in participating in this study. The Personal interviews were conducted by one of the authors with the help of several graduate students from a local university. As a result of these contacts and interviews, a cross-sectional sample of fifty (50) manufacturing organizations responded to the research instrument. Although this sample is relatively small, it is representative of the population of medium to large manufacturing organizations. The most relevant manufacturing sectors in Iran are represented in this sample.

MODELS, VARIABLES, AND DATA ANALYSIS

The data obtained from the participants was analyzed using cluster analysis and regression analysis. The objective of the data analysis was to obtain a profile of the participating executives in terms of their extent of utilization of financial and non-financial measures in assessing the different aspects of their organizational performance. In the first phase of the data analysis, clusters analysis was used to evaluate responses. The frequency of use that executives associated with each of the 63 performance measures, their perceptions of the measure predictive value, and ease of acquiring information for each on the studied measures were evaluated. The number of clusters was set to 5 in order to be consistent with the scale used on the research instrument (Dempsey et al., 1998; Gomes et al., 2004b; Gomes et al., 2006).

The second phase of the data analysis utilized multiple regression analysis. For this purpose, the frequency of use of a given performance measures (FU) was assumed to be a function of its predictive value (PV), and ease with which information for the measure could be Acquired (EA). Thus, the model tested was:

$$FU = f(PV, EA)$$

The linear function to be estimated is:

$$\overline{FU}_i = \alpha_0 + \alpha_1 \overline{PV}_i + \alpha_2 \overline{EA}_i + e_i$$

\overline{FU}_i - The mean frequency of use score on the i^{th} measure,

\overline{PV}_i - The mean predictive value score on the i^{th} measure,

\overline{EA}_i - The mean ease of acquisition score on the i^{th} measure,

e_i - Variable that represents the residual,

α_0, α_1 e α_2 - Linear parameters.

The observation unit for this model is the average of the responses of all executives for each measure. The use of regression analysis in this manner is consistent with Hair *et al.* (2009). After analyzing the data to verify the assumptions relevant to this model, the model was used to evaluate the profile of the executives in relation to the relative use of financial and non-financial measures.

RESULTS

Cluster Analysis Results

This study focuses on eight categories of performance measure. These include, Financial (A), Product Quality and Customer Satisfaction (B), Process Efficiency (C), Product and Process Innovation (D), Competitive Environment (E), Quality/independence of Management (F), Human Resource Management (G) and Social Responsibility (H). The results of the cluster analysis for each measure frequency of use, Predictive value and ease of acquiring information are reported in Tables 1, 2 and 3. The first column in these tables presents the cluster number. The second column designates the measure. The third column designates the category to which the measure belongs. In the fourth column, the average of the executives' responses is reported. The fifth column reports the standard deviation. Finally, the last column reports the coefficient of variation.

The frequency of use results (Table 2) for the different measures are interesting. Only six out of the twenty measures most used by the executives (clusters 1 and 2) are financial in nature. One of these ten measures are Product Quality and Customer Satisfaction related, three are Process Efficiency related, three are Competitive Environment related, two are Quality/Independence of Management related, and five are Human Resource Management related. The remaining financial measures are found in the third cluster, mixed with non-financial measures. These organizations appear to be putting more emphasis on the non-financial aspects of performance.

Based on the results in Table 2, cluster 5, which includes the least used measures, consists of one measure from category D (Product and Process Innovation), and one measure from category E (Competitive Environment).

The cluster analysis results related to the executives' perceptions of the predictive value of each of the 63 measures are presented in Table 3. The first two clusters include all the nine measures of the financial category. The other measures, with the highest predictive values, are focused on Human Resource Management (9), Process Efficiency (7), Competitive Environment (6), Quality/Independence of Management (4), and Product Quality and Customer Satisfaction (3). The absence of measures related to category D (Product and Process Innovation), and category H (Social Responsibility) is noted.

Based on the results in Table 3, cluster 5, which includes the least used measures, consists of one measure from category E (Competitive Environment).

The cluster analysis results related to ease of acquisition of information are presented in Table 4. As expected, the first two clusters include all the nine measures from the financial category. Twenty-eight of the thirty-seven measures in these two clusters are from the non-financial categories. These measures are from categories B, C, E, F and G. Based on the results in Table 4, cluster 5, which includes the least used measures, consists of two measures from category D (Product and Process Innovation), and one measure from category E (Competitive Environment).

Table 5 presents the average of responses for each category, as well as the ranking of these values for the three variables (FU, PV and EA). Based on the results in Table 5, measures of the financial category are found in first place for three variables. This finding is not surprising. The frequent use of financial measures in the evaluation of performance of manufacturing organizations may be attributed to the fact that information on these measures is the most readily available. The frequent use of these measures may also be attributed to the fact that executives perceive these measures as having high predictive values. Among the non-financial categories, the Human Resource Management (G), Process Efficiency (C) and Quality/Independence of Management (F) categories appear to be the highest in rank. On the other hand, Social Responsibility (H) appear to be the lowest in rank.

REGRESSION ANALYSIS RESULTS

In the second phase of the data analysis, the model initially proposed in the methodology section was used. Thus, the linear function to be estimated was:

$$\overline{FU}_i = \alpha_0 + \alpha_1 \overline{PV}_i + \alpha_2 \overline{EA}_i + e_i$$

The observation unit used in this model was the average of the responses of the executives surveyed for each measure. After verifying the assumptions relevant for linear regression, a stepwise procedure was used to select variables to include in the model. This procedure resulted in the inclusion of the two independent variables (PV and EA).

The regression results shown in Table 6 point to a high R^2 of 0.890. Thus, revealing that almost ninety percent of the total variability in the frequency of use has been explained

by the predictive value and ease of information acquisition. The estimated regression coefficients were found to be significant ($\alpha=0.01$).

$$FU = -0.339 + 0.790PV + 0.222EA$$

CONCLUSION

Using a cross-sectional sample of Iranian manufacturing organizations, this study examined the views of the executives of these organizations on performance measures utilization, predictive value, and availability of information. Based on the results of this study, the following conclusions are drawn. First, Iranian executives appear to not over emphasize financial measures. This is despite their high predictive value and readily available information on these measures. Based on the most used clusters of measures, only six out of twenty measures were financial in nature. Human resource related measure and process efficiency as well as competitive environment related measures were also used. Process innovation related measures were not used as frequently. Overall, it appears that the bottom line is not the sole determinant of Iranian executives practice in relation to gauging organizational performance. Perhaps this is due to the influence of the traditional rather than the pure market culture.

Second, financial measure tended to be assigned high predictive value by Iranian executives. However, human resource management measures tended to also high predictive value. Process efficiency and competitive environment related measures were also among the measures with high predictive values. The absence of product and process innovations measures from the high predictive value category is noted. Iranian executives need to pay close attention to these measures as they are important if the manufacturing organizations are to be considered a serious player in the global competitive environment.

Third, the financial measures were characterized as having the most readily available information. It appears that Iranian manufacturing organizations information systems are designed to track information related to financial measures. These systems are also tracking employee related and competitive environment related measures relatively well. However, they are not tracking information related to product and process innovation related measures. This represents an area for improvement in terms of the nature and scope of the information systems of these organizations. This finding may also signify some technological gap in terms of the availability of technology needed for such systems.

Overall, the frequency of use of the performance measures studied appears to be a function of their predictive values and information availability. In this context, having more information readily available may facilitate the use of measures such as product and process innovation.

REFERENCES

(References are available upon request from any of the authors)

TABLES

(Tables are available upon request from any of the authors)