A MULTIPLE CRITERIA METHODOLOGY FOR ASSIGNING FIRMS TO PERFORMANCE CATEGORIES: THE PORTUGUESE CONSTRUCTION INDUSTRY

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ABSTRACT

A multiple criteria approach to evaluate the financial performance of Portuguese construction firms is utilized. In the process, the research methodology which utilizes the PROMETHEE TRI method is illustrated using actual data. The results obtained from this study can be used to assess the competitive position of a given firm. Such an assessment is useful towards developing a set of performance benchmarks in the context of continuous improvement of performance.

INTRODUCTION

Since the admission of Portugal to the European Community in 1986, Portuguese industries are dealing with new challenges and opportunities brought about by the new markets and customers. The resulting increased competition requires Portuguese firms to have consistently high performance to survive in this broad market, where fierce competition is the rule rather than the exception. Therefore, Portuguese investors, managers and entrepreneurs (Decision-Makers) must be able to assess and track the performance of firms in different industries. In turn, they should be able to make better tactical and strategic decisions to improve the competitive standing of these firms.

The relative performance of firms within a given economy or industry can be assessed through different types of methodologies. In this context, however, it is important to select a methodology which is reliable, easy to understand and implement. Such a methodology should be multiple criteria in nature due to the multiple aspects to be considered when analyzing the operational, financial, and strategic performance facets of a given firm. Also, the selected methodology should lend itself to meaningful comparisons and benchmarking implementations.

This study offers such a methodology. The process used to assign constructions firms to pre-defined performance categories is useful, yet not overwhelming to Decision-Makers. In this context, the definition of a high performance class, using multiple criteria can contribute to the development of a set of indicators which can be used by firms in designing their strategies in pursuit of competitiveness.

BACKGROUND

Multiple criteria approaches have been successfully utilized in many situations – namely in finance and energy planning (see Figueira *et al.*, 2004). The theoretical rigor and reliability of the multiple criteria methodologies, and their advantages over one-dimensional procedures are well-documented in the literature (see Vincke; 1992; Roy, 1996; Doumpos *et al.*, 2001; Brans and Mareschal, 2002; Figueira and Roy, 2002).

This study uses a multiple criteria approach for the purpose of sorting the Portuguese construction firms into five different categories. In the process, it provides a set of financial and economical indicators that can be used as benchmarking criteria. The methodology utilized in this study is simple. In addition, it has the capacity to deal with the imperfect knowledge of data (i.e., uncertainty, imprecision, ...). It takes into consideration the different opinions available, when weighting the contribution of the different propose measures to determine the segmentation categories. Also, under this methodology, the performance criteria associated whit reference firms are derived directly from the sample data.

PROBLEM DEFINITION

The multiple criteria approach makes use of an outranking method to assign firms to performance categories (see Figueira *et al.*, 2004, chapters 4, 5, and 6). In this study, the authors defined based on the criteria used for performance analysis, and for each the five class categories (very bad, bad, sufficient, good, and very good), a firm type or reference action that represents the characteristics of each class. Once the categories are defined, the proposed methodology allows for the sorting of the construction firms in accordance with the standard performance criteria for each category. Therefore, the approach used in this methodology can be easily extended to other economic sectors in order to provide classification schemes, and to establish appropriate performance benchmarks for different industries.

The sample used in this study was obtained from the data supplied by the Portuguese magazine EXAME in the collaboration with the Dun & Bradstreet. This database contains data related to the highest performing 500 large Portuguese firms in 2003. Banks and insurance firms are not part of this database. To be included in this database, a firm has to respond to an inquiry submitted by Dun & Bradstreet. In the process, it must provide its balance and income statements for the year 2003. A weighted average of seven financial measures which include added-value-per-sale, return on equity, return on assets, profitability of sales, sales growth, liquidity, and solvency is used to determine the 500 highest perform large firms. Since this study is interested in classifying the firms within the construction sector, forty-seven firms were selected from the database to be included in the sample to be studded.

The criteria used to sort out the firms in different categories in this study is mainly financial in nature. The measures used in the criteria are designed to capture the multifaceted nature of financial performance of the studied firms. Thus, the performance criteria is the following: growth (sales growth); profit growth; return on equity and profitability of sales; structure of assets; efficiency of material usage (assets turnover); productivity of the human factor (productivity of workers), and capacity to meet commitments in the short-term, medium-term, and long-term (liquidity and solvency). All these criteria are to be maximized.

Table 1 reports the values associated with the criteria for each firm. The minimum and maximum for each measure, as well as the average and standard deviation are reported in this table. The results in Table 1 underscore the differences existing among the studied firms based on the different measures of the criteria used.

Table 2 reports the values for the indifference and preference thresholds of the criteria according to the PROMETHE TRI method (see Figueira *et al.*, 2003). These thresholds are established by the analyst and the Decision-Makers based on their experience. In this study, the authors acted as the analyst and Decision-Makers.

The weights were determined through a parameter elicitation procedure which elicit this information by asking indirectly the Decision-Maker about the weights to be assigned to each measure of the criteria. The method used to accomplish this task is described in Figueira and Roy (2002).

The utilized methodology requires the definition of a reference or central firm for each category. These firms can be obtained by selecting from the sample data a firm which financial indicators, as a whole, represents a particular category. However, due to the difficulty of finding a firm with a set of indicators that match the requirements for the reference firm in each category, the authors utilized a technique that takes into consideration the singularity of the sample. As such, the following steps were used to define the reference firm for each class category:

1. the 10th, 30th, 70th and 90th percentis for each measure of the criteria were calculated;

2. the reference firm indicators of the class "very bad" were determined by calculating the average of each criteria indicators inferior or equal to the correspondent 10th percentile. The reference firm for the class classified as "bad" was determined by averaging the criteria indicators between the 10th percentile and the 30th percentile. The same procedure was used for the determination of the reference firm for the classes classified as "sufficient" and "good". For the category classified as "very good", the reference firm indicators were calculated by averaging the criteria indicators above the 90th percentile. Table 4 reports the values associated with criteria indicators for the five reference firms, one for each category. Exhibit 1 presents the resulting firms' profiles.

RESULTS AND DISCUSSION

Table 5 presents the classification of firms in the Portuguese construction sector. Based on these results, the following observations are noted:

- 1. In the "very good" category, two firms were found. A more detailed analysis of the performance indicators of these firms revealed a few negative deviations from the reference firm's indicators (example: profit growth and assets turn over). However, such deviations were offset by other indicators such as the return on equity. In fact, these two firms, as a whole, exhibited strong overall financial performance.
- 2. In the opposite category, two firms were also found. These are the ones with very poor performance indicators.
- 3. Between these two extremes categories, twelve firms within the "good" category were found. Also, twenty-one firms within the "sufficient" category were found, while ten were found in the "bad" category. The distribution of the number of firms by category was found to be normal.
- 4. Based on the results of this study, the resulting classification provides a framework which allows for benchmarking the construction firms classified in the "very good" category.

In this research, a multiple criteria approach is used to sort the performance of Portuguese construction firms. Five categories were used to classify forty-seven construction firms, using nine performance measures. The distribution representing the number of firms in each category appears to be normal in nature. The performance indicators of the reference firm associated with the "very good" category may used by others firms for benchmarking purposes.