# Estimation of the Manufacturing Competitiveness of Honduran Apparel Assembly Factories

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***Abstract*– The manufacturing competitiveness of Honduran apparel assembly factories can be calculated using their comparative performance in manufacturing capabilities demanded by the market. A proposed integrated methodology can produce an indicator that will allow apparel assembly companies to focus their attention in those practices that will help them achieve a higher manufacturing competitiveness.**

***Keywords*—Manufacturing competitiveness, Competitive priorities, Manufacturing capabilities, Apparel assembly.**

## I. Introduction

An important problem faced by different industries is that there is not a clear way to estimate or measure manufacturing competitiveness that administrators can use to help them direct their improvement efforts. The purpose of this extended abstract is to present the advances made in the creation of an integrated methodology for the estimation of manufacturing competitiveness of the apparel assembly industry in Honduras. This methodology uses expert analysis through Delphi method, empirical data collection through a survey and factor analysis. The apparel assembly industry has been targeted because of its importance to the gross domestic product (GDP) and to the labor market of developing countries such as Honduras.

## II. Background

Although there is not a universally accepted definition of competitiveness, a company that perform better than their competitors in specific dimensions such as sales, efficiency, and quality is considered more competitive [1]. From the analysis of two theories: the resource-based view (RBV) and the dynamics capability view (DCV), it is proposed that a good way to measure a company's manufacturing competitiveness is by measuring its manufacturing capabilities, meaning its ability to achieve high performance in its manufacturing goals [2][3]. These goals are known in the literature as competitive priorities, and are strategic choices about which capabilities are important to achieve certain expected outcome. Since some authors have found a positive correlation between high levels of competitive capabilities and the achievement of high levels of performance [4], it is expected that the performance of a company in its competitive capabilities can describe its manufacturing competitiveness.

From the literature review four competitive priorities emerge as fundamental: cost or efficiency, flexibility, quality and delivery time [5]. However other authors have added to these priorities innovation, customer service, environmental protection, among others [6] [7]. These priorities are multidimensional in nature, which means that there is a group of components or dimensions that explain each priority. These components and dimensions vary depending on the industry or market under study and can be used to establish a competitiveness model.

## III. Methodology

The methodology proposed to determine manufacturing competitiveness in the apparel assembly industry follows the method proposed by [8] as shown in Fig. 1:

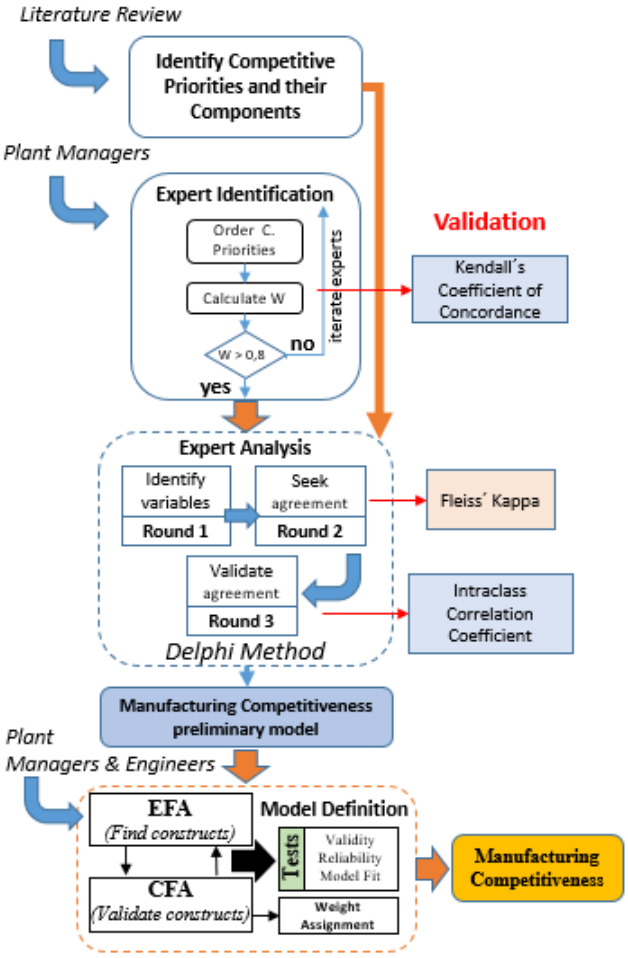


Fig. 1 Methodology for determining manufacturing competitiveness

Competitive priorities and its components which are applicable to the apparel assembly industry need to be obtained from a literature review. The most important factors and corresponding components from the original list need to be found using a Delphi study with previously selected domain experts. Using these variables a 5-point Likert survey that asks

companies about their comparative performance in the most important manufacturing capabilities is presented to define a model of manufacturing competitiveness. This definition is done through a factor analysis that uses exploratory factor analysis (EFA) using principal component analysis (PCA) with varimax rotation and confirmatory factory analysis (CFA) through the maximum likelihood method (ML). The total explained variance of each competitive priority (factor) along with the factor loadings of each component (variable) are used to find the relative weight of each variable.

The manufacturing competitiveness index value (MCI) can be calculated using the following formula:

$$MCI = \sum_{i=1}^{k} \left( \left( \frac{V_i}{\sum_{i=1}^{k} V_i} \right) \left( \frac{\sum_{i=1}^{j} P_i L_i}{\sum_{i=1}^{j} L_i} \right) \right) \quad (1)$$

Where $V$ is the variance of each factor, $L$ its corresponding factor loading and $P$ the comparative performance reported by each company being evaluated. This formula yields a value ranging between 1 and 5 which can then be standardizing to a value between 0 and 100.

## IV. Results and Analysis

The survey used for the analysis had an 18% response rate with 59 usable surveys and 66% of the answers coming from managers and engineers from multinational companies. The sample was confirmed adequate by a Kaiser-Meyer-Olkin (KMO) value of 0.69 and a significant Bartlett's test ($p$ = 0). The instrument was considered adequate by obtaining a Cronbach's alpha value of 0.88.

Using the methodology described, 177 components were reduced to 25 by a group of 10 experts through a Delphi study. These proposed constructs (25 components grouped into 7 factors) were analyzed using EFA and the model found tested using CFA. The results of this analysis yielded 4 significant factors (cost, environmental protection, delivery time and flexibility) disaggregated between 13 components with good convergent and discriminant validity and good model fit (Table 1). This model is able to explain 72% of all the variance, with 19.2% of the total variance being explained by the factor cost, 18.2% explained by environmental protection, 17.3% by delivery time and 17% by flexibility.

TABLE I
Validity, reliability and model fit for CFA

| | CR | AVE | MSV | ASV | F | DT | C | EP |
|---|---|---|---|---|---|---|---|---|
| **F** | 0,82 | 0,61 | 0,27 | 0,18 | 0,78 | | | |
| **DT** | 0,78 | 0,55 | 0,38 | 0,29 | 0,52 | 0,74 | | |
| **C** | 0,82 | 0,53 | 0,21 | 0,13 | 0,16 | 0,46 | 0,73 | |
| **EP** | 0,85 | 0,66 | 0,38 | 0,26 | 0,48 | 0,61 | 0,40 | 0,81 |
| $\chi 2/d.f. = 1.469$, *CFI = 0.915, RMSEA = 0.092 y SRMR = 0.0806* | | | | | | | | |

Using the factor structure, components, factor loadings and explained variance, a reference model can be proposed. Figure 2 shows this reference model which can be used to calculate the MCI for any company in this industry. This index will allow to use the responses to the survey questions regarding their comparative performance in those competitive capabilities considered strategic.

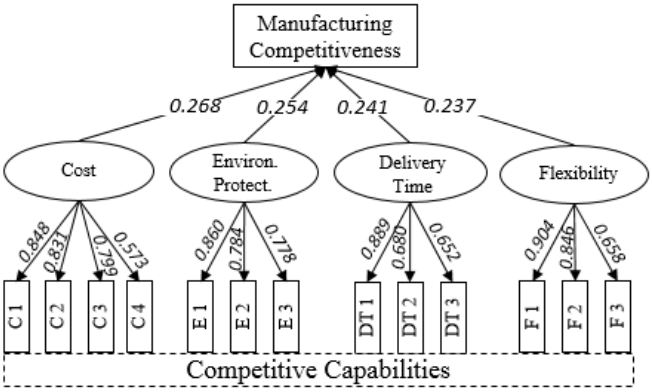


Fig. 2 Manufacturing competitiveness model for the Honduran apparel assembly industry

One of the most significant findings was that quality does not appear to be one of the competitive priorities for the Honduran apparel assembly industry. A possible reason for this is that this industry considers quality an "order qualifier" instead of an "order winner" [9]. It could be argued that since clients already expect products of high quality, textile assembly managers consider it an integral part of their operations and have assimilated it as a core competence and an order qualifier. Another interesting fact is that environmental protection appears as a competitive priority for this industry. One reason for this could be the emphasis that corporate clients place on the adoption of Lean practices, and its waste elimination philosophy. Another possibility is that since many consumers are making purchasing decisions based in their desire to protect the environment, apparel assembly companies could be trying to become socially responsible.

## V. Conclusions

This extended abstract presents a methodology that allows plant managers to estimate the manufacturing competitiveness of their plants and have an idea of how they are in terms of their corporate emphasis and where they should focus their improvement efforts. A model that can be used to estimate manufacturing competitiveness for an apparel assembly factory has been presented and is ready for use in industry.

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