Evaluation of Competitive Distance for Auto Parts Manufacturing Companies

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Abstract
The automotive industry has been in the forefront of the globalization process as a result of increasing global manufacturing. This has imposed the challenge of competitiveness for auto parts manufacturing companies. This paper aims to analyze the competitive distance for 3 of the main auto parts manufacturers operating in the Brazilian automotive market considering the 2008 to 2010 period by determining the competitive profile of each company. The results show that the competitive distance between the companies increased in the period, confirming that the choice of a competitive reference based on the "best in class" criterion is feasible.

Keywords – Competitive distance; Competitive variables; Competitiveness.

Introduction
Competitiveness is considered as a key strategic factor for the auto parts manufacturers in Brazil to remain in the First Tier of automotive industrial complex. (LUCATO et al., 2012).
Competitive environment of companies has significantly changed since the last decade of the twentieth century, mainly due to the process of economic globalization. Levitt (1983) has already pointed to the end of domestic territoriality, with companies constantly being threatened by global competitors, a process that has already reached its point of no return (LEE; WILHEM, 2010).
Such a scenario, according to Demeter (2003), has led companies to establish as its competitive priorities: price, quality of products, delivery times, product variety and flexibility, elements formerly considered goals for production systems (SLACK ET AL, 2002). Furthermore, additional services for products began to be offered as a way to create more value for customers (Nordin, 2008). Only companies that can achieve levels of excellence in terms of costs and services will be able to lead the market in which they operate.
These changes imposed to the auto parts sector in Brazil the challenge of competing among world-class companies. To assess how companies in this industry have responded to this challenge, this paper proposes to monitor the competitive profile of 3 major suppliers of auto

parts operating in the Brazilian market considering a period of three years (2008 to 2010). Also an analysis of the competitive distance between each two of these companies will be performed

Methodology
This paper is an exploratory research, with a theoretical basis for competitiveness, the review of the proposed Competitive Profile prepared by Lucato and Vieira Junior (2009). With the definition of the competitive variables which define the competitive profile of suppliers of auto parts in Brazil. In addition, the paper promotes the competitive distance calculation between the companies at issue, identifying how this parameter has evolved over the period studied.
The studied companies were chosen based on the following criteria: being a publicly held company to facilitate the access to their financial information, usually treated with confidentiality character in private companies; and have an outstanding performance among the suppliers in the auto parts sector in Brazil.

Competitiveness
There are various definitions of competitiveness proposed by different authors. Thus, in this study we adopted a definition that integrates a set of aspects, as indicated by Lucato and Vieira Junior (2009): marketing, strategy, production, finance, people, the environment, the integration to global markets and social responsibility.
Thus, competitiveness of a company can be stated as the ability to remain continually creating and renewing its competitive strategies (Prahalad & Hamel, 1995) in order to obtain a favorable position in the market (Kotler & Armstrong, 2002) . As a result of these actions it should achieve profitability above the average of the industry in which the company operates (Porter, 1989), working in a financially sustainable manner (Ross et al., 2002). The production must also be performed with quality, speed and flexibility (Slack et al., 2002). A competitive company should also be aligned with global markets (DANIELS & DANIELS, 1994), working in perfect harmony with its employees (Pfeffer, 1996), operating with environmental (Porter & Linde, 1995) and social responsibility (SIMFRONIO, 2007).

Competitive Profile
Each one of the aforesaid aspects used to define competitiveness could be measured by a set of indicators that will be called competitive variables that are shown in Table 1(LUCATO; VIEIRA JÚNIOR, 2009).

Based on those variables, it is possible to define the competitive profile of an enterprise as defined by Lucato and Vieira Junior (2009): the set of values assumed by the competitive variables in a specific point in time.

Based on Table 1, the Competitive Profile of a company will be given by:
- six quantitative variables:
    - Market share;
    - Sales growth;
    - Return on equity;
    - current liquidity index;
    - general liquidity index; and
    - general indebtedness index;

- eight qualitative variables, of dichotomous type:
    - Existence of an effective quality system certified by the automakers;
    - Use of Lean Manufacturing techniques;
    - Effective practice of at least 5 basic principles of modern management in human resources;
    - Existence of programs to encourage and investment for employee qualification;
    - Existence of employee qualification and retraining of periodic programs;
    - Existence of an effective environmental management system that meets the ISO 14001 requirements ;
    - Permanent and constantly evolving role in international trade, ; and
    - Maintaining at least one active program of social responsibility.

As an example, a company "X" could present competitive profile such as:

PCX = {20,5%; 10,2%; 22,0%; 1,25; 0,81; 0,79; 1; 0; 0; 1;1;1;1;0}

where each element of the set is represented by the value of the respective competitive variable, expressed in the order listed above. For dichotomous variables, the number (1) is associated with the presence of certain characteristic and (0) the non presence of the variable.

Table 1 - Variables that compose the Competitive Profile and means of measuring them (adapted from Lucato; Vieira Junior, 2009)

Focus	**Competitive Variable**	**How to Measure**	**Type of Variable**
Market	Position favorable in market, with sales growth	Market share Sales growth	Quantitative Quantitative
Strategic	Effective generation and renovation of its strategies	Profitability (ROE) Sales growth	Quantitative Quantitative
Production	Certified quality system *Lean Manufacturing*	Existence of a specific certification from automakers Adoption of Lean Manufacturing techniques	Dichotomous Dichotomous
Finance	Profitability above sector average Good short-term liquidity Good long-term liquidity Low indebtedness	Profitability (ROE) current liquidity index general liquidity index general indebtedness index	Quantitative Quantitative Quantitative Quantitative
Mobilizing People	Principles of human resources management Career path defined Development program	Practice of 5 principles of modern HR management Incentives and investment for employee qualification Conduct training activities	Dichotomous Dichotomous Dichotomous

	employees	and periodic retraining	
Environmental	Existence of an Environmental Management System (EMS)	EMS established according to ISO 14000	Dichotomous
Integration to the Global Markets	Growing presence in the global market	Active role in international commerce	Dichotomous
Social Responsibility	Complying with the SA 8000	Maintain at least one social responsibility program	Dichotomous

Competitive Distance

To measure the competitive distance between a company there is a need to compare its competitive profile with a competitive profile standard yet to be established. Thus, there is a need to define a framework of competitiveness (S corporation), which will become the competitive paradigm against which will it be compared the competitive profile of the company under assessment (company X) (LUCATO; JUNIOR VIEIRA, 2009).

Once established the standard competitive profile (or reference) among the companies under study, one must calculate the competitive distance (**d_c (S,X)**) as defined by Lucato; Vieira Junior (2009):

$$\mathbf{d_c\,(X,S)} = \frac{n_e \,.\, d_e\,(S,X) \;+\; n_b \,.\, d_b\,(S,X)}{n_e + n_b} \qquad \text{(Equation 1)}$$

where:

d_c (S,X) – combined coefficient of similarity of Ramesburg or competitive distance between company S (standard) and company X (company under study);

n_e – number of quantitative variables used on the calculation;

d_e (S,X) – Euclidean distance between company S (standard) and company X (company under study);

n_b – number of dichotomous variables used on the calculation;

d_b (S,X) – binary distance of Sokal among company S (standard) and company X (company under study).

The Euclidean distance among S and X can be calculated by:

$$d_e\,(S,X) = \{\textstyle\sum\ [(z_i\,(S) - z_i\,(X)]^{2}\ \}^{1/2} \qquad \text{(Equation 2)}$$

where:

z_i (S) ➔ quatitative variables of company S (standard);

z_i (X) ➔ quatitative variables of company X (company under study).

And the binary distance of Sokal among S and X can be calculated by:

$$d_b\,(S,X) = \frac{b + c}{a + b + c + d} \qquad \text{(Equation 3)}$$

where:
d_b (S,X) - binary distance of Sokal among companies S (standard) and X (under study).
a - number of instances in which companies X and S have an attribute.
b - number of instances in which company S does not have an attribute but company X has.
c - number of instances in which company X does not have an attribute but company S has.
d - number of instances in which companies X and S have none attribute.

From the calculation of the competitive distance between companies S and X, the grater is the value of **d_c (S,X)**, more distant from the standard of competitiveness S the company X is.

Assessment of Competitive Distance Between Suppliers of Auto Parts
Three companies from the auto parts sector with outstanding performance in the Brazilian market were chosen. They are identified as companies A, B and C.
In order to establish their respective competitive profiles, the data referring to the quantitative variables were obtained from the management reports and financial accounting reports released by firms. On de other hand, the qualitative variables were taken from the data presented in their respective websites and through interview by phone with managers responsible for production in the researched companies.
The competitive variables for the years 2008, 2009 and 2010 of each company are presented in Tables 2, 3 and 4, and the competitive profile of each firm for each year is presented after each table. The values of dichotomous variables for each company were considered constant during the 3 years due to the fact that there was no perception of fact to justify any change in this period.

Table 2 – Competitive variables for the years 2008, 2009 and 2010 of the Company A

DICHOTOMOUS		YES	NO
EXISTENCE OF A SPECIFIC CERTIFICATION BY AUTOMAKERS		x	
ADOPTION OF LEAN MANUFACTURING TECHNIQUES		x	
PRACTICE OF 5 PRINCIPLES OF MODERN HR MANAGEMENT			X
ENCOURAGEMENT AND INVESTMENT IN EMPLOYEE QUALIFICATION		x	
PERIODIC EMPLOYEE TRAINING AND RECYCLING		x	
EMS ACCORDING ISO 14000		x	
ACTIVITY IN INTERNATIONAL TRADE		x	
BE IN ACCORDANCE WITH SA 8000STANDARD		x	
QUANTITATIVES	**2008**	**2009**	**2010**
SALES (US$ MILLIONS)	**702,9**	**592,9**	**694**
MARKET SHARE	**1,71%**	**1,56%**	**1,40%**
SALES GROWTH	**-4,60%**	**-12,60%**	**16,00%**
PROFITABILITY (ROE)	**0,08%**	**-0,20%**	**-0,61%**
INDEX OF CURRENT LIQUIDITY	**1,40**	**0,90**	**0,90**
INDEX OF GENERAL LIQUIDITY	**1,00**	**0,70**	**0,60**
INDEX OF GENERAL INDEBTEDNESS	**62,90%**	**66,20%**	**81,70%**

PCA (2008) = {0,0171; -0,046; 0,0008; 1,40; 1,00; 0,6290; 1; 1; 0; 1; 1; 1; 1; 1}
PCA (2009) = {0,0156; -0,126; -0,002; 0,90; 0,70; 0,662; 1; 1; 0; 1; 1; 1; 1; 1}
PCA (2010) = {0,0140; 0,16; -0,0061; 0,90; 0,60; 0,817; 1; 1; 0; 1; 1; 1; 1; 1}

Table 3 – Competitive variables for the years 2008, 2009 and 2010 of the Company B

DICHOTOMOUS		YES	NO
EXISTENCE OF A SPECIFIC CERTIFICATION OF CARMAKERS		X	
ADOPTION OF LEAN MANUFACTURING TECHNIQUES		X	
PRACTICE of 5 PRINCIPLES OF MODERN HR MANAGEMENT		X	
ENCOURAGEMENT AND INVESTMENT IN EMPLOYEES THROUGH THE STUDY		X	
PERIODIC TRAINING AND RECYCLING		X	
EMS ACCORDING ISO 14000		X	
ACTIVITY IN INTERNATIONAL TRADE		X	
BE IN ACCORDANCE WITH STANDARD SA 8000			X
QUANTITATIVES	**2008**	**2009**	**2010**
SALES (US$ MILLIONS)	**1273,70**	**991,1**	**1190**
MARKET SHARE	**3,11%**	**2,61%**	**2,39%**
SALES GROWTH	**-6,20%**	**-21,90%**	**19,60%**
PROFITABILITY (ROE)	**14,00%**	**9,00%**	**6,00%**
INDEX OF CURRENT LIQUIDITY	**1,00**	**2,40**	**2,30**
INDEX OF GENERAL LIQUIDITY	**0,80**	**1,00**	**0,90**
INDEX OF GENERAL INDEBTEDNESS	**66,70%**	**52,50%**	**44,30%**

PCB (2008) = {0,0311; -0,062; 0,14; 1,00; 0,80; 0,667; 1; 1; 1; 1; 1; 1; 1; 0}
PCB (2009) = {0,0261; -0,219; 0,09; 2,40; 1,00; 0,525; 1; 1; 1; 1; 1; 1; 1; 0}
PCB (2010) = {0,0239; 0,196; 0,06; 2,30; 0,90; 0,443; 1; 1; 1; 1; 1; 1; 1; 0}

Table 4 – Competitive variables for the years 2008, 2009 and 2010 of the Company C

DICHOTOMOUS		YES	NO
EXISTENCE OF A SPECIFIC CERTIFICATION OF CARMAKERS		X	
ADOPTION OF LEAN MANUFACTURING TECHNIQUES		X	
PRACTICE of 5 PRINCIPLES OF MODERN HR MANAGEMENT		X	
ENCOURAGEMENT AND INVESTMENT IN EMPLOYEES THROUGH THE STUDY		X	
PERIODIC TRAINING AND RECYCLING		X	
EMS ACCORDING ISO 14000		X	
ACTIVITY IN INTERNATIONAL TRADE		X	
BE IN ACCORDANCE WITH STANDARD SA 8000		X	
QUANTITATIVES	**2008**	**2009**	**2010**
SALES (US$ MILLIONS)	**962,6**	**955,5**	**1245,8**
MARKET SHARE	**2,35%**	**2,52%**	**2,50%**
SALES GROWTH	**-6,9**	**-0,75**	**30,4**
PROFITABILITY (ROE)	**-0,04%**	**-1,00%**	**0,27%**
INDEX OF CURRENT LIQUIDITY	**0,80**	**0,50**	**0,90**
INDEX OF GENERAL LIQUIDITY	**0,80**	**0,70**	**0,80**
INDEX OF GENERAL INDEBTEDNESS	**79,60%**	**77,50%**	**75,40%**

PCC (2008) = {0,0235; -0,069; -0,004; 0,80; 0,80; 0,796; 1; 1; 1; 1; 1; 1; 1; 1}
PCC (2009) = {0,0252; -0,0075; -0,01; 0,50; 0,70; 0,775; 1; 1; 1; 1; 1; 1; 1; 1}
PCC (2010) = {0,00250; 0,304; 0,0027; 0,90; 0,80; 0,754; 1; 1; 1; 1; 1; 1; 1; 1}

For the calculation of competitive distance between the 3 companies, it was initially established that Company B would be the benchmark because it is the one that presents, on average, the best results in quantitative variables (except for the sales growth).
From the competitive variables displayed in Tables 2, 3 and 4, and with equations 1, 2 and 3, we calculated the competitive distance between B and A, and between B and C, for each year.

Table 5 – Values of d_e, d_b e d_c between the companies A:B and B:C for the years 2008, 2009 e 2010

Companies	Year	d_e	d_b	d_c
B;A	2008	0,4703996	0,25	2,411189
	2009	1,541425	0,25	5,624276
	2010	1,481768	0,25	5,445303
B;C	2008	0,278259	0,125	1,335077
	2009	1,953774	0,125	6,361322
	2010	1,442957	0,125	4,328872

From the values of Table 5 a graph was plotted in Figure 1 in which it is observed that d_c (B, A) and d_c (B, C) increases during the three year period considered. Moreover, it is clear that Company A had a worsening competitive behavior in relation to company B in the period, with a slight recovery in 2010. On the other hand, the company C has shown an increase in distance from B in 2009, but regained competitiveness in 2010 and reduced the distance, proving to be even more competitive than the company A in that year.
In a comparison among the competitive profiles of each company year after year, it is possible to identify the points that collaborated for the increase in the competitive distance between companies. In 2008 the company B already showed a best performance in market share and profitability:

PCA (2008) = {0,0171; -0,046; 0,0008; 1,40; 1,00; 0,6290; 1; 1; 0; 1; 1; 1; 1; 1}
PCB (2008) = {**0,0311**; -0,062; **0,14**; 1,00; 0,80; 0,667; 1; 1; 1; 1; 1; 1; 1; 0}
PCC (2008) = {0,0235; -0,069; -0,004; 0,80; 0,80; 0,796; 1; 1; 1; 1; 1; 1; 1; 1}

In 2009 this performance was repeated and added to the improved performance in the current liquidity index. The company had a reduction in sales growth and profitability, and company C remained at the same level as in the previous year:

PCA (2009) = {0,0156; **-0,126**; **-0,002**; 0,90; 0,70; 0,662; 1; 1; 0; 1; 1; 1; 1; 1}
PCB (2009) = {**0,0261**; -0,219; **0,09**; **2,40**; 1,00; 0,525; 1; 1; 1; 1; 1; 1; 1; 0}
PCC (2009) = {0,0252; -0,0075; -0,01; 0,50; 0,70; 0,775; 1; 1; 1; 1; 1; 1; 1; 1}

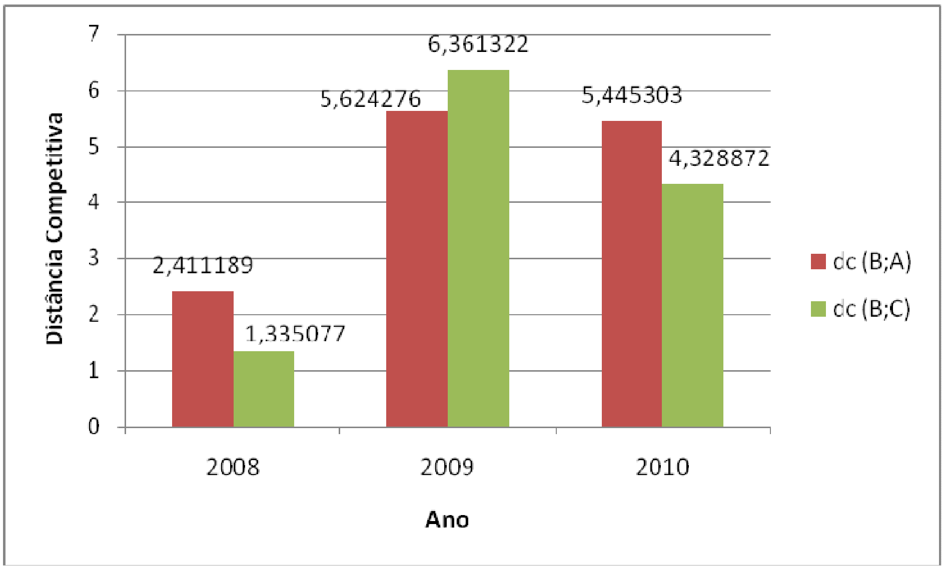

Figure 1 – Evolution of competitive distance between A and B and between B and C in the 2008 / 2010 period.

In 2010 company A had the reduction in its market share, despite the positive increase in sales. Company C had an improvement in sales growth, profitability and the current liquidity index. However, Company B besides maintaining the basic competitive conditions of previous years, showed positive growth in sales, reflecting its competitive ability in the period.

PCA (2010) = {**0,0140**; **0,16**; -0,0061; 0,90; 0,60; 0,817; 1; 1; 0; 1; 1; 1; 1; 1}
PCB (2010) = {0,0239; **0,196**; 0,06; 2,30; 0,90; 0,443; 1; 1; 1; 1; 1; 1; 1; 0}
PCC (2010) = {0,0250; **0,304**; **0,0027**; **0,90**; 0,80; 0,754; 1; 1; 1; 1; 1; 1; 1; 1}

By analyzing the competitive distance and their competitive profiles, one still observes the influence that the global crisis had on corporate results over time (negative sales growth and low profitability are key indicators).

Conclusions

The assessment of the competitive distance between the companies A, B and C during the period from 2008 to 2010 showed that the competitive profile of companies allows a more structured analysis of their competitive conditions.

Isolated assessments of quantitative competitive variables such as, for example, the "Sales Growth", can lead to confusing conclusions. In this case, Company B had no positive results in 2008 and 2009, and in 2010 had a worse performance compared to company C. The rating of the competitive variables consolidated by the competitive distance allows local mistakes are avoided.

In the cases studied, the company B showed the best competitive profiles throughout the analyzed period, reflecting the increase in the competitive distance when compared with the companies A and C in the 3 years, also confirming that the choice of the company by reference criterion (best in class) was correct.

Analysis of the behavior of the competitive distance between the companies in longer periods than can be deeper researched and reflects the correction of the mistake of management actions taken.

Acknowledgements
The authors acknowledge Universidade Nove de Julho – UNINOVE – and Coordenadoria de Aperfeiçoamento de Pessoal de Nível Superior – CAPES - for the support for the development and presentation of this work at POMS 2013.

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