MANUFACTURING AND MARKETING INTEGRATION FROM A CUMULATIVE CAPABILITIES PERSPECTIVE

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Abstract

A growing number of studies have analyzed the dynamics of integration among different functional areas in the last years. Manufacturing and marketing integration is a relevant topic in management research since the classic articles of Shapiro and Crittenden decades ago. This study aims to evaluate the relationship between manufacturing and marketing integration, managerial priorities and business performance. We used a survey methodology to collect the data. The sample includes ninety and nine (99) companies from food and machinery industries. These two industries are the main exporters in the Brazilian's economy. We used three scales in the proposed theoretical model: manufacturing and marketing integration, managerial priorities and business performance. The results suggest that manufacturing and marketing integration and managerial priorities influence positively business performance.

Introduction

Literature has discussed the need for more collaboration and integration among different functional areas. According to some seminal articles this aspect may enhance the business performance and the company's competitiveness (Shapiro 1978; Crittenden, 1992).

Anecdotic references also have shown that companies have been compelled for developing higher levels of integration between their functional areas in order to strengthen their capabilities and to improve business performance. In the Special Issue on manufacturing and marketing integration of the Journal and Operations Management in 2002, two articles analyzed the influence of manufacturing and marketing integration over performance. Even thus, articles exploring manufacturing and marketing integration and performance are still scarce.

We explore this issue from a perspective based on the cumulative capabilities approach. We follow a proposal of managerial priorities in multiple competitive criteria simultaneously. Thus, high performance in multiple competitive criteria is a manufacturing's objective. We included a firm's size variable in order to mediate manufacturing and marketing integration, managerial priorities and business performance in the proposed model.

The article presents the following structure. Firstly, we present the theoretical references. Secondly, the research methodology is discussed. Thirdly, we present the results. Finally, we present the conclusions.

Operations Performance: Trade-Offs or Synergetic perspective

Operations performance and competitive priorities several times are analyzed based on the logic of trade-offs. Trade-offs can be expressed through a function of two variables that are inversely correlated (Hayes and Pisano, 1996). This is one of the main debates in the early articles in manufacturing strategy stream.

The concept of trade-off should orient manufacturing decisions in the shop-floor and along the supply chain (Skinner, 1969, 1978; Wheelwright, 1984). Currently, other articles have identified the existence of trade-offs between competitive criteria such as flexibility, costs and

delivery (Boyer and Lewis, 2002). Nevertheless, Da Silveira and Slack (2001) state that sometimes managers have difficulty to understand and to identify trade-offs concept within a practical view.

An alternative model for trade-offs is expressed through a synergetic approach. The sand cone model is an example (Collins, Cordon and Julien, 1998; Corbett and Wassenhove, 1993; Ferdows and De Meyer, 1990). Therefore, the idea of cumulative capabilities instead of inversely correlated dimensions is the key aspect in the sand cone model (Ferdows and De Meyer, 1990). In this case a competitive criterion would be positively related to the other ones (Mapes et al., 1997; Noble 1995; Rosenzweig and Roth, 2004).

Even that there is not a concordance between the authors. Flynn and Flynn (2004) in a cross-country study did not identify a single pattern in the sequence of the capabilities as suggested by Ferdows and De Meyer. Diversely, the authors found that accordingly to the industry or country companies will arrange a group of capabilities in order to achieve their strategic objectives.

Within a similar view, the concept of world class manufacturing (Schonberger, 1986) also has an alternative approach to the trade-off approach. In this case, companies would seek to improve quality, cut their costs and reduce their lead times at the same time.

In this study we expect that managers from the most competitive companies would seek to achieve high performance in several competitive criteria simultaneously through cross-functional integration. Several studies have empirically suggested the existence of this approach in the last years (Ferdows and DeMeyer, 1990; Vickery et al., 1993; Ward et al., 1994; Flynn and Flynn, 2004).Thus, companies instead to focus in a narrow group of competitive criteria as trade-off approach argues would try to accomplish a high performance in multiple competitive criteria simultaneously.

Manufacturing and Marketing Integration

The link between performance and manufacturing's cross-functional integration is frequent in the literature (Skinner, 1969, Wheelwright, 1984, Ward et al. , 1994). Hayes (2002) stated that manufacturing needs to act beyond the functional silos in order to achieve a performance suited to the current competitive landscape.

Related to this approach, integration between manufacturing and marketing has been studied along the last decades (Abernathy, 1976; Shapiro, 1977; Hutt and Speh, 1984; Crittenden, 1992). Some classical articles like Shapiro (1977) and Crittenden (1992) highlighted the existing gap between manufacturing and marketing management identifying as a cause of this different points of view.

At the same time, research on manufacturing and marketing integration has followed a variety of focus. Parente (1998) listed different approaches in manufacturing-marketing integration research. One of these is related to the hierarchical level: strategic, tactical or operational. According to her, the contacts between the actors are more direct at the operational level, because short time adjustments are needed in this context. While in the tactical level individual characteristics are not at the center of the interaction, individual and functional integrations are the spotlight at the strategic level. Malhotra and Sharma (2002) also listed key-

decision areas, which are dependent of cross-functional integration between manufacturing and marketing. These areas include strategic planning integration, strategic or visionary forecasting, new product/process development, tactical forecasting, demand management and operational integration.

Nevertheless, despite the importance to the interactions among marketing and other functions in market orientation literature (Kohli and Jaworski, 1990, Narver and Slater, 1990, Slater and Narver, 1994, 1995), there is no much empirical evidence on how this integration influences company's performance. Thus, Parente (1998) and Malhotra and Shama (2002) suggest that performance evaluation in manufacturing marketing integration should be include from strategic to operational variables.

Integration Marketing and Operations and Performance

Operations performance is usually linked to the competitive criteria. The four competitive criteria (quality, costs, flexibility and delivery) with slight variations have been cited for many authors in the last decades, such as Skinner (1969), Wheelwright (1984), Miller and Roth (1994), Ward et al. (1998) and Boyer and Lewis (2002). Vickery (1993) linked production competence to company's strategy and identified also an influence of production competences over company's overall performance. Considering that some managerial practices have a direct influence in different functional areas, Kaynak (2003) showed that quality management leads to a higher business performance.

Shapiro (1977) and Crittenden (1992) analyzed barriers and they also identified possible performance improvements when higher level of cross-functional integration occurs. More recent literature has tried to identify the results related to this integration (Hausman et al., 2002). . Nevertheless, several articles have focused on product development performance. In this way, they have analyzed preferentially the flexibility competitive criterion. We may mention Song, Montoya-Weiss and Schmidt (1997), Olson et al. (2001) and Tatikonda and Montoya-Weiss (2001). Considering that marketing analyzes customer's satisfaction, Kahn and McDonough III (1997) explored the possible links between collaboration, performance and satisfaction. Other studies such as Leary-Kelly and Flores (2002) also explored the link between operations and business performance and manufacturing and marketing integration. Nevertheless, the authors have a wider analysis because they used the classic competitive criteria as the moderating variables.

Hypotheses

Different authors have stated that manufacturing and marketing leads to high performance (Shapiro, 1977; Crittenden, 1992). Based on the cumulative capabilities approach companies may have high performance in multiple competitive criteria simultaneously (Ferdows and De Meyer, 1990, Mapes et al., 1997; Noble 1995; Rosenzweig and Roth, 2004). Thus, we hypothesize that companies with high level of manufacturing and marketing integration will follow as objective high performance in multiple competitive criteria. Therefore, we may address the first hypothesis:

Hypothesis 1 – Manufacturing and marketing integration is positively related to a high performance orientation in multiple competitive criteria.

Manufacturing and marketing are key functional areas for company's performance (Shapiro, 1977; Crittenden, 1992; Parente, 1998). We should expect that companies with higher levels of manufacturing and marketing integration present a high performance at the business level (Leary-Kelly and Flores, 2002). Therefore, we may list the following hypothesis:

Hypothesis 2 – Manufacturing and marketing integration is positively related to business performance.

According to the synergetic performance approach, companies in the most competitive levels present higher performance in all the competitive criteria (Schonberger, 1986; Ferdows and De Meyer, 1990; Mapes et al., 1997; Rosenzweig and Roth, 2004). Therefore, we expect that companies that are seeking a high performance in multiple competitive criteria should present higher levels of business performance. In this way, we propose the third hypothesis:

Hypothesis 3 – High performance orientation in multiple competitive criteria is positively related to business performance.

Methodology

We have carried out the research in two steps. The first step was an exploratory analysis and the second, a survey, which is discussed in the next sections. In the first step we studied three companies following an exploratory approach.

The first company was a manufacturing automation specialist. The second company is a component manufacturer for agricultural machines and heavy transport equipment. They are a transnational companies' global supplier. The third company is a global competitor in the port loading equipment market. These three cases oriented the first version of the questionnaire. Additionally, a group of three scholars and three managers analyzed the questions and suggested some improvements.

We developed the variables based on the theoretical domains discussed in the literature review. The questions are at the end of the article. We used a survey methodology to collect the data in order to test our hypotheses. We mailed twice the questionnaires.

Shortly, the steps followed during the field research were: (a) framework validation with researchers and managers; (b) first mail of the definitive questionnaire to the chosen sample; and (c) second mail to no responder companies.

Sample

We sent the questionnaires to 366 companies located in the Southern region of Brazil from the food and machinery industries. These two industries are the main Brazilian exporters. These companies were chosen from Sebrae's (Brazilian Service for Companies' Support) database. All

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the companies have more than 100 employees. We received answers from CEOs, vice-presidents, manufacturing directors, and manufacturing managers.

The response rate was 27.2 % (99 companies). There was a response bias related to the industry.. This fact may be related to the more dynamic environment, which is a machinery industry characteristic. This aspect may lead to a higher integration with universities and a higher response rate. (Table 1)

Table 1 – Return rate for each industry

Industry	Number of Companies	Return rate (%)
Food	163	31 (19 %)
Machinery	203	68 (30.3 %)
TOTAL	366	99 (27 %)

Annual revenues measured the company size in the sample. Table 2 shows that there is a proportional distribution regarding this profile characteristic.

Table 2 - Company's profile – Annual   Revenues (US$1,000)

Function	Freq	Percent	Cumulative Percent
Less than 5,000	22	22.2	22.2
5,000 - 25,000	31	31.3	53.5
25,001 - 250,000	21	20.2	74.7
More than 250,0001	25	25.3	100
Total	99	100	

Variables

We used three scales: manufacturing and marketing integration, managerial priorities and business performance.

The manufacturing marketing integration scale measures how extent that these two functional areas are integrated in the three hierarchical levels, i.e., strategic, tactical and operational (Parente, 1998; Malhotra and Sharma, 2002). Variable I1 is related to the strategic level (product and service development). Variable I2 evaluate the tactical level (integrated coordination) and variable I3 focus on the operational issues (problem solving).

The managerial priorities scale is related to the cumulative capabilities approach (Ferdows and De Meyer, 1990). We measured how extent that manufacturing management seeks to improve performance in the four competitive criteria simultaneously (cost, flexibility, quality and delivery). Finally, business performance scales focus on three dimensions of the business unit.

One is related to the short time performance (profitability). The second evaluate medium and long time performance (sales increment) and the last evaluates international competitiveness through the rate between exports and total sales.

Validity and Reliability Analysis

As several authors have argued that traditional Exploratory Factor Analysis present clear limitations (Heck, 1998; Ahire et al., 2000; Jiang et al., 2000; Das et al., 2000), a Confirmatory Factor Analysis (CFA) was used in order to verify validity and reliability. The analysis was based on three dimensions: reliability, unidimensionality and convergent validity. We analyzed the constructs through a CFA. Figure 1 presents the variables related to Strategic Integration scale. GFI, CFI and NFI present recommendable values (above .90). The model presents chi-square equal to 16.74 and the probability level is not significant, as expected.

Table 3 – General statistics for goodness-of-fit

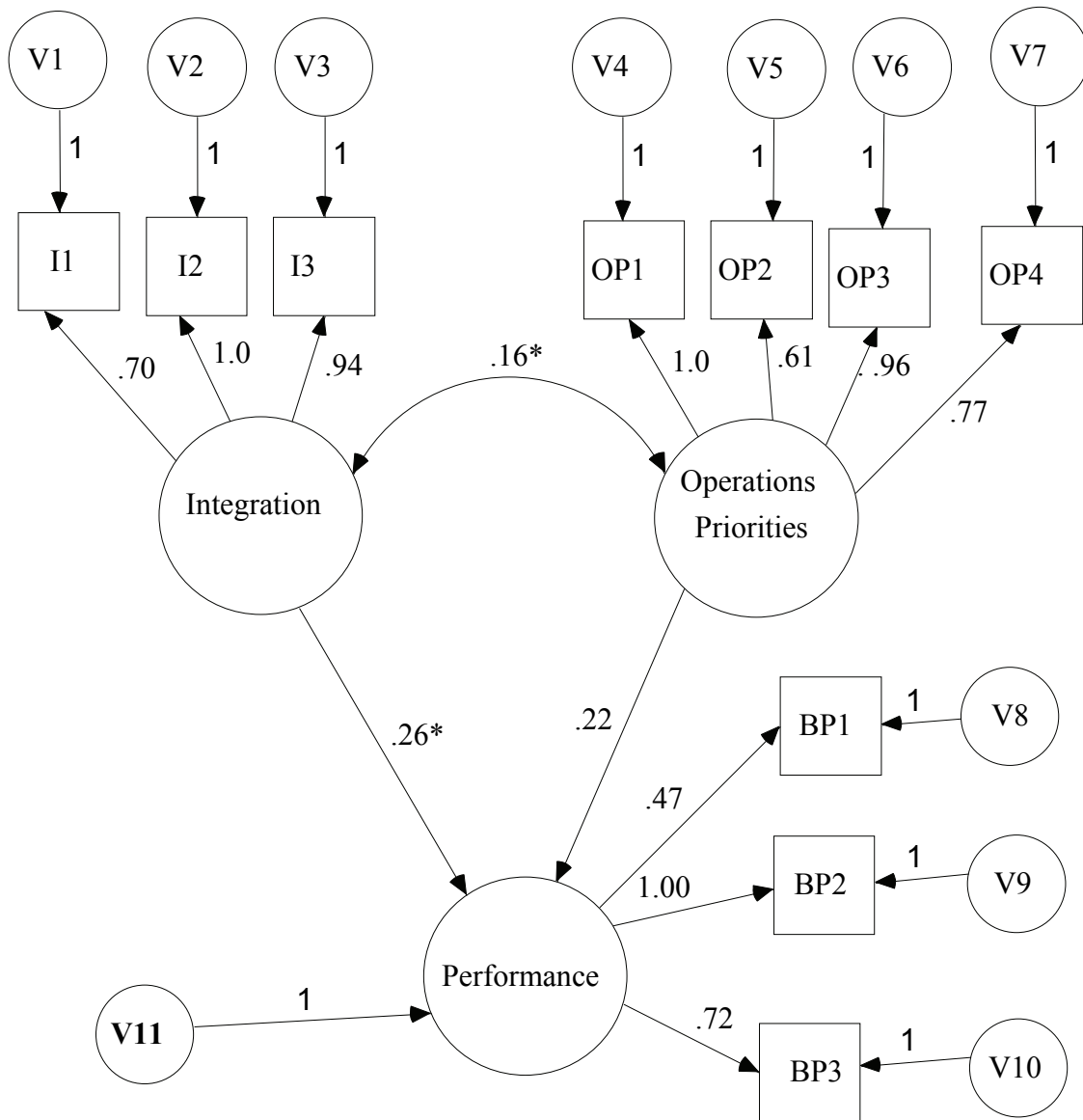| *Stand Alone Indices*	
Chi-Square	36.212
Degrees of Freedom (df)	32
Probability Level	.669
Goodness of Fit (GFI)	.932
Adjusted Goodness of Fit (AGFI)	.883
Standardized RMR	.063
RMSEA	.037
Incremental Indices	
Normed Fit Index (NFI)	.853
Incremental Fit Index (IFI)	.980
Comparative Fit Index (CFI)	.979
Tucker-Lewis Coefficient (TLI)	.971

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Figure 1 - Manufacturing and Marketing Integration, Managerial Priorities and Company's Performance model.
    *Significant at $p < .10$

The chi-square difference tested the discriminant validity between the scales (Anderson, 1987; Ahire et al., 1996; Stratman and Roth, 2002). Using the usual procedure of fixing the correlation for the three pairs of scales, the models showed statistically significant differences. Thus, the results suggest that the scales present acceptable levels of validity and reliability (Table 4)

Table 4. Results of confirmatory factor analysis test of measurement scale discriminant validity

Construct Scale Pairs		Unconstrained		Constrained		χ^2 Difference
		χ^2	DF	χ^2	DF	nce
Mkt Manufac. Integration	Operations Priorities	14.3	13	58.1	14	43.8*
Operations Priorities	Business Performance	11.0	13	59.3	14	48.3*
Mkt Manufac. Integration	Business Performance	13.0	8	45.0	9	32.0*

*Significant at $p < .01$

We tested the form invariance (H_{form}) between the two industries (calibration and hold-out samples). The calibration sample presented a Chi-square equal to 44.31 and p<.10. The fit measures such as GFI, IFI and CFI are in satisfactory values (around .90). Therefore, this result suggests that the both samples present the same form (i. e. the null hypothesis of same form can not be rejected). (Table 5)

Table 5 - Tests of invariance of path model across calibration and hold-out (baseline) samples.

	Hform
Chi-Square	44.31
Degrees of Freedom (df)	32
Probability Level	.10
Goodness of Fit (GFI)	.89
Adjusted Goodness of Fit (AGFI)	.80
Standardized RMR	.07
RMSEA	.08
Incremental Indices	
Normed Fit Index (NFI)	.73
Incremental Fit Index (IFI)	.90
Comparative Fit Index (CFI)	.90

Mediator Variable

According to MacKinnon et al. (2002, p. 100), "tests of intervening variables are useful because they examine processes by which variables are interrelated". An inclusion of a variable indicates that it may affect or not the proposed model. In this case, we include a variable related to the firm size. We expect that higher levels of cross-functional integration and multiple competitive criteria in managerial priorities are related to firm size.

We tested the model including the firm size variable and evaluated the effects of this inclusion. Thus firm size was the mediator variable. Therefore, we will test if manufacturing and marketing integration and managerial priorities in multiple criteria are influenced by the size of the firm. According to Baron and Kenny (1986) a mediator variable highlights the importance of a process that intervenes between the inputs and outputs. The model in the figure 2 still is robust if we consider the statistics for goodness-of-fit. (Table 6)

Table 6 – General statistics for goodness-of-fit for model with mediator variable

Stand Alone Indices	
Chi-Square	45.858
Degrees of Freedom (df)	39
Probability Level	.21
Goodness of Fit (GFI)	.92
Adjusted Goodness of Fit (AGFI)	.87
Standardized RMR	.06
RMSEA	.04
Incremental Indices	
Normed Fit Index (NFI)	.83
Incremental Fit Index (IFI)	.97
Comparative Fit Index (CFI)	.97
Tucker-Lewis Coefficient (TLI)	.96

We fixed the paths that link the exogenous variables (manufacturing and marketing integration and managerial priorities) to the endogenous variable (business performance) through the mediator variable (size). According to Kline (1998, p. 52) "indirect effects involve one or more intervening (or mediator) variables that "transmit" some of the causal effects of prior variables onto subsequent variables". Table 7 presents the direct and indirect effects in the model with the mediator variable (firm size).

According to Baron and Kenny (1986) a strong indication of mediation would present if the direct path is no longer significant when the indirect paths are controlled. In this case, the regression weights related to the endogenous and exogenous variables become non significant when all the paths are fixed with 1 value. Therefore, even that the first model (without the mediator variable) is statistically significant the second model allows a more complete view of the relationship between the exogenous and endogenous variables.   Thus, business performance was influenced by manufacturing and marketing integration and managerial priorities when we included the firm size as a mediator factor. In other words, we may state that according to the proposed model firm size influences the relation between manufacturing and marketing integration, managerial priorities and business performance.
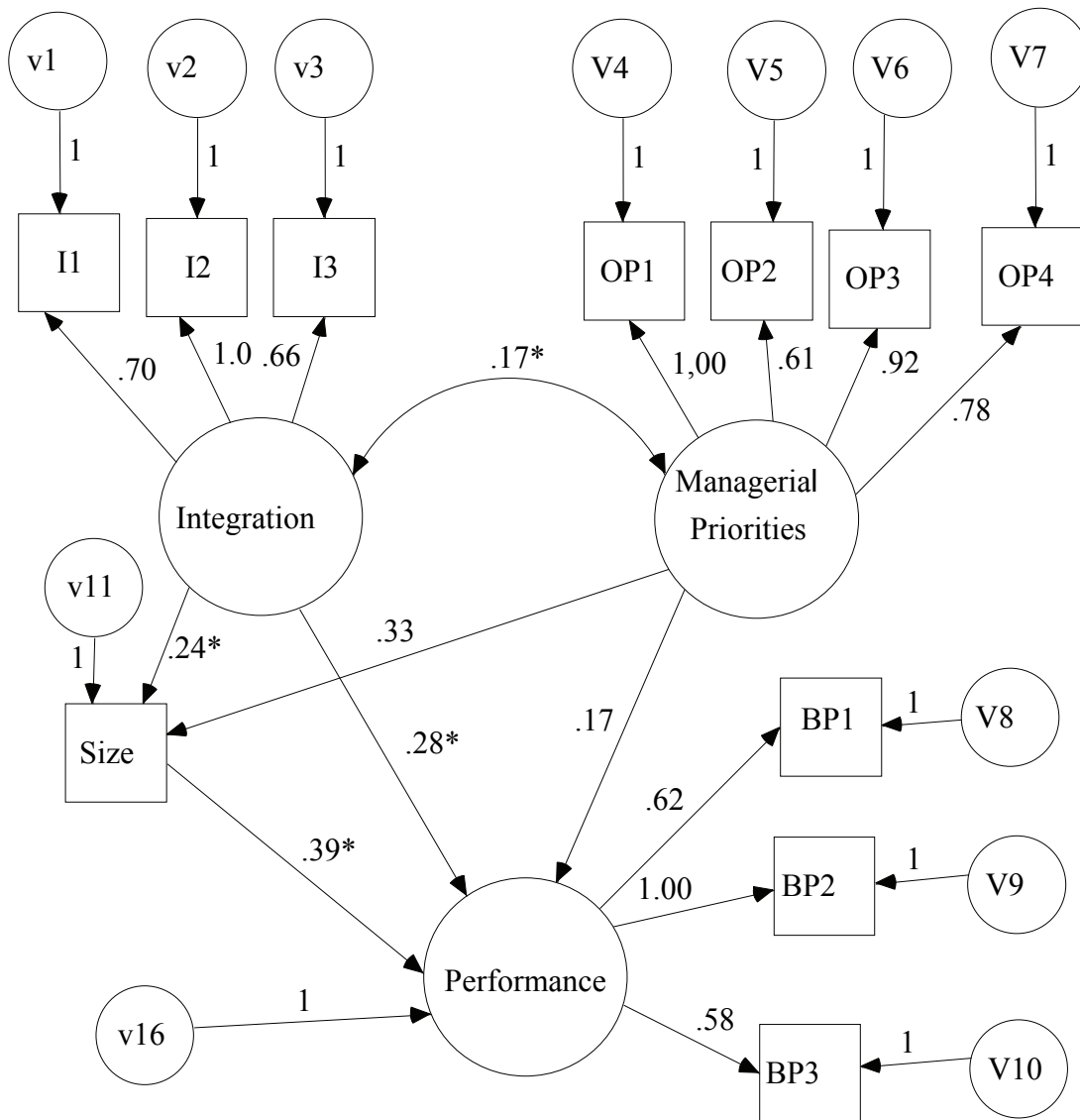
Figure 2 - Manufacturing and Marketing Integration, Managerial Priorities and Company's Performance model with a mediator variable.
*Significant at $p < .10$

Table 7. Effects of exogenous and prior endogenous variables on model constructs (n=99)

Variable	Managerial Priorities		Integration Manufacturing and Marketing		Firm Size	
	Direct	*Indirect*	*Direct*	*Indirect*	*Direct*	*Indirect*
Firm Size	.331	.000	.241	.000	.000	.000
Business Performance	.107	.130	.284	.095	.394	.000

Results

The results confirm the hypothesis 1. Manufacturing and marketing integration are positively correlated to the managerial orientation in multiple competitive criteria. In this case, this result shows a close relationship with the cumulative capabilities approach (Ferdows and Meyer, 1990). Therefore, the results suggest that higher performance in simultaneous competitive criteria is a goal for companies that seek to integrate their functional areas internally. In this specific case, manufacturing and marketing would be the key functions in order to accomplish high performance in the four basic competitive criteria.

On the other hand, manufacturing and marketing integration is positively related to business performance and presents statistically significant results. Thus, the hypothesis 2 is confirmed. This is an expected result as several studies have shown in the last decades. Hausman et al. (2002) also had identified empirically a positive relationship between the performance and manufacturing and marketing integration exploring cultural aspects. Possibly, companies in the sample with high performance are adopting Advanced Manufacturing Technologies in order to achieve new performance patterns. Lean systems or microelectronics based equipments are able to lead to high levels of performance in quality, cost and flexibility at the same time.

Hypothesis 3 is partially confirmed because the result found is not statistically significant. Companies that manufacturing managerial are seeking a high performance in the four competitive criteria presented a higher business performance in the sample. Even that other studies have explored diversely this relationship between competences and business performance like Flynn and Flynn (2004), this is an expected result based on the cumulative capabilities approach. Therefore, the results suggest that this managerial orientation is a possible characteristic of high performance companies.

Finally, it is worthy to discuss the role of the mediator variable. The results suggest that large companies are possible more capable to integrate manufacturing and marketing areas

and to achieve high performance in multiple competitive criteria. This finding agrees with the common sense regarding that usually large companies have more resources to invest in capabilities development based on cross-functional integration. Probably small companies do not need an especial effort to integrate their functional areas because the areas are physically closer than in a large company and they have a centralized decision process (Simon, 1996). Regarding the competitive criteria, Porter (1986) also emphasized that generic business strategy for small companies should be focused in specific niches. Thus a sharp focus in a specific or few competitive criteria is more coherent with a niche strategy.

Conclusions

The study showed empirically that manufacturing and marketing integration is directly related to managerial orientation. The results suggest that when manufacturing management is concerned to achieve high performance in multiple competitive criteria, manufacturing and marketing seeks more integration. The results are coherent to the cumulative capabilities approach. In this way, manufacturing and marketing will have shared goals in the most competitive companies within the cumulative capabilities approach.

The performance is positively related to manufacturing and marketing integration and managerial orientation. These results are also coherent to the literature on manufacturing and marketing integration. Along the last decades different authors have stated that this aspect is a key element for business performance. Therefore, the results suggest that companies achieves better results when manufacturing and marketing work together.

The inclusion of a mediator variable related to the firm size indicates suggested that larger companies are suitable to achieve high performance in multiple competitive criteria. That is an expected result according to the proposal of world class manufacturing (Schonberger, 1986) and cumulative capabilities (Ferdows and DeMeyer, 1990). It is worthy to mention that this two approaches present clear connections.

Finally we emphasize that all the results need caution considering the sample size and the focus in only two industries. Future research may explore other performance measures for business performance and manufacturing performance. Other industries also may be analyzed in order to test the results found.

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Questions

I1 – Indicate how often manufacturing develop conjoint activities with marketing in order to develop new products/services.

I2 – Indicate how often manufacturing develops activities in order to improve its coordination with marketing.

I3 - Indicate how often manufacturing develops cooperative activities for problem solving with the marketing.

P. Indicate which are the manufacturing managerial priorities.
        1. Manufacturing costs
        2. Product conformity to the project specification
        3. Capability for quick new production introduction
        4. Manufacturing lead time reduction

Scale

Unimportant	Modestly important	Sometimes	Important	Highly Important
1	**2**	**3**	**4**	**5**

BP1. Which is the company's profitability in the last year?

Negative	1
Equal to zero	2
Until 5%	3
5% to 10%	4
More than 10%	5

BP2. The sales improvement in the last three years was

More than -20%	Less than -20%	Stable	Less than + 20%	More than +20%
1	2	3	4	5

BP3- The rate between exports and total sales is

Equal to 0%	Less than 10%	11-30%	31 - 50%	More than 50%
1	2	3	4	5