



Revista Base (Administração e
Contabilidade) da UNISINOS

E-ISSN: 1984-8196

cd@unisinos.br

Universidade do Vale do Rio dos Sinos
Brasil

CUNHA CALLADO, ANTÔNIO ANDRÉ; CUNHA CALLADO, ALDO LEONARDO;
PORTO CHAVES, RENATA
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Revista Base (Administração e Contabilidade) da UNISINOS, vol. 12, núm. 3, julio-
septiembre, 2015, pp. 183-192
Universidade do Vale do Rio dos Sinos
São Leopoldo, Brasil

Available in: <http://www.redalyc.org/articulo.oa?id=337242231003>

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USE OF NON-FINANCIAL METRICS AND THE ROLE PLAYED BY AGRIBUSINESS COMPANIES WITHIN THE SUPPLY CHAIN STRUCTURE

*USO DE MÉTRICAS NÃO FINANCEIRAS E A FUNÇÃO DESEMPENHADA POR EMPRESAS
AGROINDUSTRIAIS DENTRO DA ESTRUTURA DE CADEIAS DE SUPRIMENTO*

**ANTÔNIO ANDRÉ CUNHA
CALLADO**

andrecallado@yahoo.com.br

**ALDO LEONARDO CUNHA
CALLADO**

aldocallado@yahoo.com.br

RENATA PORTO CHAVES

portorena@hotmail.com

ABSTRACT

Individual companies may play different roles within the structure of supply chains, as well as present different operational characteristics and skills relating to their respective roles. In this context, the identification of an appropriate set of metrics is not an easy task. The objective of this paper is to investigate the patterns of use of non-financial performance indicators among individual agribusiness companies that play different roles within the supply chain structure. A survey among input suppliers and producers was carried out to investigate a sample of 38 individual agribusiness companies, in which 33 non-financial performance indicators were considered. A structured questionnaire was used for data collection. Senior managers from these companies were asked to inform which non-financial performance indicators have been used. After performing the Fisher's exact and Mann-Whitney U tests, the results show that both the input suppliers and producers consider customer satisfaction and business partners' satisfaction as key supply chain performance drivers. Significant evidence relating to specific managerial concerns and significant percentages of use of non-financial metrics from input suppliers were also found, indicating that patterns of use of performance indicators may change along the supply chain structure.

Keywords: performance measurement, supply chain performance, agribusiness.

RESUMO

Empresas individuais podem assumir diferentes papéis dentro da estrutura de uma cadeia de suprimento, bem como apresentar distintas características operacionais e habilidades referentes às suas respectivas posições. Nesse contexto, a definição das métricas apropriadas não é uma tarefa fácil. O objetivo deste artigo é investigar padrões de uso de indicadores de desempenho não financeiro entre empresas agroindustriais individuais que possuem diferentes funções dentro da estrutura de cadeias agroindustriais de suprimento. Esta pesquisa foi operacionalizada através de um *survey* entre fornecedores e produtores que investigou uma amostra de 38 empresas individuais considerando 33 indicadores de desempenho não financeiros. Os procedimentos de coleta de dados foram operacionalizados através de um questionário estruturado, e os gestores dessas empresas foram solicitados a indicar quais indicadores têm sido utilizados. Foram utilizadas duas técnicas estatísticas distintas: Prova exata de Fisher e Teste U de Mann-Whitney. Os resultados demonstram que tanto fornecedores quanto produtores consideram satisfação do consumidor e satisfação dos parceiros de negócio como fatores-referência para o desempenho

da cadeia. Evidências significativas referentes a particularidades de uso, bem como diferenças na intensidade de uso entre fornecedores, foram encontradas, indicando que padrões de uso de indicadores de desempenho se alteram ao longo da estrutura da cadeia de suprimento.

Palavras-chave: mensuração de desempenho, desempenho de cadeia, agronegócio.

INTRODUCTION

The paradigm change regarding competitiveness, assuming that current competition takes place between supply chains instead of individual companies, has shifted the core of managerial concerns relating to performance beyond the physical boundaries of individual companies in the supply chain context. Traditionally, supply chain performance systems have been based on financial accounting, but these are no longer suitable for implementation in modern supply chain management (Bigliardi and Bottani, 2010). Supply chain performance measurement is very complex, and specific aspects relating to chain characteristics should be considered (Alcântara and Pigatto, 2006).

Agribusiness supply chains are formed by individual companies that work together to deliver agricultural products to end consumers (Christopher, 2005) and are considered one of the critical factors related to corporate business performance (Toigo *et al.*, 2015). The commercial and financial relations existing between several individual companies from upstream to downstream influence each other and affect one another's performance (Batalha and Silva, 2008; Bigliardi and Bottani, 2010). Moreover, individual agribusiness companies are more likely to keep their own identity or autonomy compared to individual companies from other economic sectors (Van der Vorst, 2006).

The structure of an agribusiness supply chain can be composed of several entities (Matopoulos *et al.*, 2007) that may play different roles, such as input suppliers, producers (breeders and growers), processors (manufacturers or processing companies), distributors (wholesalers) and retailers (supermarkets), where these entities have core processes relating to their specific typical functions within the supply chain, according to their respective up or downstream positions (Durski, 2003; Henson and Reardon, 2005; Chan *et al.*, 2007).

On the other hand, managers cannot easily determine how business practices within individual companies may drive supply chain performance (Lambert and Pohlen, 2001). Some performance metrics might be used at the multi-organizational level, while others might be used only for individual purposes (Cuthbertson and Piotrowski, 2008).

Not long ago, corporate performance measurement was based almost exclusively on financial information obtained

from accounting records. However, a broad range of non-financial indicators, such as customer satisfaction, product quality, market share, customer retention, customer loyalty and innovation have become relevant in the managerial decision-making process (Miranda *et al.*, 2001).

The increase in the use of non-financial indicators is related to the inability of financial measures to provide all the relevant information needed (Bernard, 1999). Moreover, non-financial measures are better predictors of future performance versus financial measures, since they help managers to focus their actions on long-term prospects (Banker *et al.*, 2000).

So far, the literature has not presented any study that specifically addresses the use of specific supply chain performance metrics among the various entities in the supply chain nor has it provided any typologies regarding non-financial performance indicators. To fill this gap, the objective of this paper is to investigate the patterns of use of non-financial performance indicators among individual agribusiness companies that play different roles within the agribusiness supply chain structure.

SUPPLY CHAIN PERFORMANCE MEASUREMENT

Performance measurement is an issue that has been receiving significant attention both in business and academic contexts. A precise definition of performance indicator should be able to illustrate its institutional significance, as well as indicate its range of use.

MacArthur (1996) defines a performance indicator as a quantification regarding certain activities designed to compare the actual results with a previously specified target. Neely *et al.* (1996) define it as a useful instrument for quantifying the efficiency and/or effectiveness of decisions made within the organization. Martins (2004) argues that the performance measurement process is the means by which an organization manages its performance in accordance with corporate and functional strategies and goals. Callado and Soares (2014) state that performance indicators allow managers to monitor both managerial decision and operational processes.

Additionally, a performance indicator can be defined as the process of quantifying actions, where performance indicating tools are used to quantify the outcome of these actions (Neely *et al.*, 1995).

According to Bond (2002), performance measurement can be defined generically as the activity of determining the performance measures in order to adapt, adjust and control any activity. It is worth noting that the performance analysis goals may vary according to the specific needs of each company. However, it can be stated that the main purpose of performance measurement is to identify whether companies will accomplish their strategically determined objectives.

It is also important to consider the influence of managerial perspectives attributed to the preparation, implementation and monitoring of performance indicators as a strategic framework for the decision-making process within an organization. Kaplan and Norton (1992) state that no single performance indicator is able to provide a clear representation of corporate performance, nor can it focus on all relevant areas at the same time.

There are several ways of classifying performance indicators in the literature. For instance, Paula and Ichikawa (2002) classify indicators by relating them to quality and productivity. The first one refers to issues related to customer satisfaction, while the latter refers to processes and resource allocations.

In the context of supply chains, performance measurement becomes more complex, as they are expected to measure the performance of a group of individual companies that form a cluster of interrelated processes and activities.

The literature highlights that it is difficult to identify any specific set of performance indicators that could be used to represent all key processes and activities performed by individual companies within the supply chain structure if the performance of the entire supply chain depends on the performance of individual companies.

Rafele (2004) states that performance measurement used to be focused on specific processes of the supply chain, but in the late nineties, the focus has shifted towards the entire supply chain. From this perspective, the understanding of measurement systems for supply chains is crucial, as managerial concerns have gone beyond the boundaries of individual companies and reached the system as a whole (Lucht, 2005).

The development of any supply chain measurement system must deal with the challenge of selecting the appropriate metrics. Thus far, the literature does not provide any clear statement about this issue and the debate among scholars is far from finished. The only consensus is that there is no pre-established set of performance measures that could be applicable to any supply chain, since each chain has its own characteristics which require performance indicators suitable for each of them individually (Beamon, 1999).

According to Holfman (2004), the concern in evaluating the performance of supply chains should be addressed to define indicators that really matter in the evaluation of the chain. The specificities of the supply chains should be taken into account, such as the number of individual companies involved, the business processes and established arrangements of relationships.

According to Beamon (1998), consistent performance indicators in the measurement of supply chain performance might be classified into two dimensions: qualitative and quantitative. Qualitative performance indicators are designed to observe certain subjective aspects, such as customer satisfaction and flexibility. The first illustrates the degree of satisfaction regarding products and/or services offered from the customer perspective. The second reflects the capacity in which a supply chain can respond to variations in specifications to meet customers' demands. Quantitative measures mainly related to financial issues are those that can be explicitly described numerically.

The classic criterion classifies performance indicators relating to their financial or non-financial characteristics. Morissette (1977) states that a financial indicator is a quantitative measure, expressed in monetary value, resulting from the actions taken by businesses, whereas a non-financial indicator is a quantitative measure that is not expressed through a monetary value. Financial performance measures are related to logistics and production costs (Gunasekaran *et al.*, 2004).

While financial measures have been criticized by scholars devoted to research regarding performance measurement, they should not be overlooked in the evaluation of results as they should be considered concrete evidence of the effects from all other measures.

Furthermore, the exclusive use of financial data is considered inadequate for guiding and evaluating the company's trajectory in a competitive environment because they are indicators of occurrence and tell part, but not the entire history, of past actions and do not provide adequate guidance for the actions that need to be implemented to create future financial value (Kaplan and Norton, 1997).

Banker *et al.* (2000) point out that non-financial measures are better indicators of future performance, compared with financial measures, because they allow managers to focus on long-term prospects.

Walter *et al.* (2000) state that the consideration of non-financial aspects when assessing performance is one of the greatest challenges of contemporary business management.

METHODOLOGY

Given both the objective and the nature of this research, it may be classified as exploratory. Exploratory research is defined by Gil (2002) as those that aim at addressing issues that haven't been studied previously. Netto (2008) adds to this definition by stating that exploratory research aims at finding things in need to be known better.

In order to achieve the objective proposed in this exploratory research, a survey was carried out among individual agribusiness companies located in the Metropolitan Region of Recife, in the state of Pernambuco, Brazil). This region consists of fourteen municipalities (Abreu e Lima, Aragoiaba, Cabo de

Santo Agostinho, Camaragibe, Igarassu Itamaracá Ipojuca Itapissuma, Jaboatão Guararapes, Moreno, Olinda, Paulista, Recife and São Lourenço da Mata (Governo do Estado de Pernambuco, 2012). The last official records available regarding Brazilian agribusiness is the Censo Agropecuário 2006, provided by the Instituto Brasileiro de Geografia e Estatística (2006). However, Castanheira (2008) points out that if the description and analysis of the characteristics from the whole universe is extremely difficult or impossible, it is feasible to take a portion of the population to obtain the desired data.

Given the limitations faced, as well as the exploratory nature of this research, an accessibility criterion for sampling was used. According to Gil (2002), in cases of exploratory studies, neither convenience nor accessibility can be used.

In this study, ninety individual input suppliers and producers from the Recife region were randomly selected based on accessibility. Input suppliers are responsible for the supply service of all kinds of inputs – not only relating to seeds, fertilizers, pesticides, vaccines, farm implements, tools and machinery –, but also to technology improvements and information systems. Producers, whether from agriculture or livestock farming activities, represent one of the most striking characteristics of Brazilian agribusiness, especially the complexity of its production arrangements, as well as the extensive diversity of economic activities explored. All of the companies were contacted in order to verify their willingness to get involved in the study. Thirty-eight individual agribusiness companies (fourteen input suppliers and twenty-four producers) accepted the invitation. The characteristics of these groups of individual companies are presented in Table 1.

The literature provides hundreds of performance indicators that could be considered (Elrod *et al.*, 2013). In this such case, variables selection can be performed by researcher's choice (Gil, 2002). In addition, Raupp and Beuren (2006) state that exploratory research allows the implementation of new dimensions. To address this issue, thirty-three non-financial performance indicators were chosen from previous studies

(Beamon, 1998; Gunasekaran *et al.*, 2001, 2004; Rafele, 2004; Conceição and Quintão, 2004; Callado *et al.*, 2008) and classified into seven categories presented in Figure 1.

Senior managers from each company were asked to inform the role played by their respective companies as well as to indicate which of the thirty-eight non-financial performance indicators listed have been used as data collection procedures (Chia *et al.*, 2009). The operationalization of data collection used in this study consisted in the following steps:

- Delivery of questionnaires to senior managers of each individual company that had agreed to provide the data;
- Collect the answered questionnaires.

Out of the thirty-eight individual companies from the sample, thirty-four delivered the printed questionnaire in person. The other four questionnaires were sent by email. All procedures related to data collection were performed from August 08, 2011 to October 31, 2011.

Table 1. Characteristics of individual companies investigated.

Characteristics	Input suppliers	Producers
Period of time in the market		
Up to 10 years	35,71	37,50
More than 10 years	64,29	62,50
Range of business		
Local	14,28	20,83
Regional	85,72	79,17
Size		
Small	28,57	41,67
Medium	14,29	16,66
Large	57,14	41,67

Categories	Performance indicators
Customers	Brand value, customer loyalty, customer satisfaction, new customers, number of complains and responsiveness.
Human resources	Employee capability, employee motivation, employee satisfaction and investment in training.
Inter-organizational	Business partners satisfaction, information and materials integration and suppliers.
Managerial practices	Innovation management, investment in information systems, investment in technology, managerial efficiency and risk management.
Marketing	After sales, growth in market share and maximizing sales.
Operations	Flexibility, new processes, new products, operational cycle, productivity by business unit, products turnover and waste.
Timing	Delay in delivery, delivery time, response time to customers, storage time and time response of suppliers.

Figure 1. Categories proposed to classify non-financial performance indicators.

As the sample size was adequate to provide the data needed to carry out the survey (Gunasekaran *et al.*, 2004), the following hypotheses were tested:

Hypothesis 1a. The use of non-financial performance indicators is not related to the role played by individual companies in supply chain structure.

Hypothesis 1b. The overall use percentage of non-financial performance indicators is not related to the role played by individual companies in supply chain structure.

As it would not be possible to apply any parametric statistical tests, given the characteristics of the sample, two non-parametric tests were used. Fisher's exact test was applied to analyze whether each non-financial performance indicator has been used accordingly in the position of individual companies in the supply chain structure. According to Levin (1987) and Levine *et al.* (1998), this statistical technique should be used when the amount of data is small enough not to allow the use of more sophisticated options. Mann-Whitney U test was applied to analyze the significance of the overall use percentages of non-financial performance indicators considering the position of individual companies in the supply chain structure. Bisquerra *et al.* (2004) and Martins (2006) state that this test is suitable for analyzing data coming from two independent and different groups.

RESULTS

Initially, data obtained from the individual companies investigated was used whether or not each non-financial performance indicator has been used accordingly in the position of individual companies in supply chain structure considering the categories on non-financial performance indicators identified. The results relating to the use of performance indicators from the customers category considering the position in the supply chain structure are presented in Table 2.

The data shows that none of the non-financial performance indicators relating to customers presented use patterns related to the position of individual companies in the supply chain structure. It can also be observed that both input suppliers and producers reported significant attention to measurement of customer satisfaction (highest use levels for both supply chain roles investigated), followed by customer loyalty. However, none of the thirty-eight individual companies investigated reported the use of performance indicators relating to number of complaints.

The second category of non-financial performance indicators analyzed was relating to Human Resources. The results are shown in Table 3.

Similarly to the results presented in Table 2, none of the non-financial performance indicators presented use patterns related to individual companies' position in the supply chain structure. Surprisingly, only investment in training presents significant managerial attention (use pattern of 64,29%) among

Table 2. Results relating to customers performance indicators.

Performance Indicators	Input suppliers		Producers		p
	Use	Non-use	Use	Non-use	
Brand value	50,00	50,00	25,00	75,00	0,11
Customer loyalty	64,29	35,71	62,50	37,50	0,59
Customer satisfaction	85,71	14,29	75,00	25,00	0,36
New customers	57,14	42,86	45,83	54,17	0,36
Number of complains	0,00	100,00	0,00	100,00	-
Responsiveness	28,57	71,43	20,83	79,17	0,43

Table 3. Results relating to human resources performance indicators.

Performance Indicators	Input suppliers		Producers		p
	Use	Non-use	Use	Non-use	
Employee capability	42,86	57,14	41,67	58,33	0,60
Employee motivation	35,71	64,29	45,83	54,17	0,39
Employee satisfaction	50,00	50,00	58,33	41,67	0,43
Investment in training	64,29	35,71	45,83	54,17	0,22

input suppliers. It appears that non-performance indicators from this category haven't been used on a large scale.

Inter-organizational aspects were the third category of non-financial performance indicators analyzed. Their results are presented in Table 4.

None of the performance indicators in Table 4 obtained significant results from Fisher's Exact Test indicating that input suppliers and producers share similar managerial concerns regarding this category. It can be observed that business partners' satisfaction received the highest amount of attention from both groups of individual agribusiness companies.

The fourth category of non-financial performance indicators analyzed was relating to managerial practices. The results are shown in Table 5.

It can be observed that one statistically significant difference relating to non-financial performance indicators use patterns was found. According to the results, input suppliers have been focusing on innovation management much more than producers and null hypothesis was rejected at 99% significance level. This result indicates that the economic activities performed by them have been reflected on managerial concerns

addressed to improvement on their products and/or services (such as fertilizers, pesticides, vaccines, farm implements, tools and machinery, technology and information systems) through innovation.

Following the same procedure, marketing non-financial performance indicators were analyzed. The results are shown in Table 6.

Another statistically significant difference was found. Results indicate that input suppliers have greater concerns about marketing performance relating to growth in market share in comparison to producers. The null hypothesis was rejected at 95% significance level. This result is due to the high level of competitiveness among input suppliers derived from their position in the supply chain.

The sixth category of non-financial performance indicators analyzed was relating to operations. The results obtained from these non-financial performance indicators are presented in Table 7.

Results indicate that use patterns relating to four non-financial performance indicators from this category presented statistically significant differences. They also indicate that

Table 4. Results relating to inter-organizational performance indicators.

Performance Indicators	Input suppliers		Producers		p
	Use	Non-use	Use	Non-use	
Business partners' satisfaction	85,71	14,29	66,67	33,33	0,18
Information and materials Integration	35,71	64,29	12,50	87,50	0,10
Suppliers	42,86	57,14	45,83	54,17	0,56

Table 5. Results relating to managerial practices performance indicators.

Performance Indicators	Input suppliers		Producers		p
	Use	Non-use	Use	Non-use	
Innovation management	57,14	42,86	8,33	91,67	0,00
Investment in information systems	64,29	35,71	45,83	54,17	0,22
Investment in technology	71,43	28,57	54,17	45,83	0,24
Managerial efficiency	57,14	42,86	33,33	66,67	0,13
Risk management	35,71	64,29	16,67	83,33	0,17

Table 6. Results relating to marketing performance indicators.

Performance Indicators	Input suppliers		Producers		p
	Use	Non-use	Use	Non-use	
After sales	57,14	42,86	33,33	66,67	0,13
Growth in market share	42,86	57,14	12,50	87,50	0,04
Maximizing sales	71,43	28,57	54,17	45,83	0,24

input suppliers have been using them more often than producers. Null hypothesis relating to use patterns differences regarding new processes and operational cycle performance measurement was rejected at 99% significance level. Null hypothesis relating to flexibility and productivity by business unit performance measurement was rejected at 90% significance level. These results suggest that use patterns of non-financial indicators relating to operations differ significantly from input suppliers to producers, indicating that the use of performance indicators has been strongly related to core activities performed.

At last, non-financial performance indicators from the timing category were analyzed. The results are shown in Table 8.

It can be observed that only using pattern differences relating to response time of suppliers was statistically significant. In addition, none of the thirty-eight individual companies investigated reported use of both delay in delivery and delivery time.

Secondly, data obtained from the individual companies investigated was used to analyze the statistical significance of relations between non-financial performance indicators use percentages and the position of individual companies in the supply chain structure. Descriptive statistics relating to non-financial performance indicators using percentages among input suppliers and producers are present in Table 9.

The data shows that non-financial performance indicators using percentages are higher among input suppliers. In order to analyze the statistical significance, Mann-Whitney U test was used. Results are shown in Figure 2.

It can be observed that the differences found are statistically significant, indicating that input suppliers have higher overall use percentage of non-financial performance indicators than producers. These results suggest that individual companies may possess different performance indicators use patterns according to their respective position in the supply chain structure. Therefore, supply chain performance measurement

Table 7. Results relating to operations performance indicators.

Performance Indicators	Input suppliers		Producers		p
	Use	Non-use	Use	Non-use	
Flexibility	64,29	35,71	33,33	66,67	0,06
New processes	71,43	28,57	29,17	70,83	0,01
New products	57,14	42,86	50,00	50,00	0,46
Operational cycle	50,00	50,00	8,33	91,67	0,00
Productivity by business unit	50,00	50,00	20,83	79,17	0,06
Products turnover	42,86	57,14	41,67	58,33	0,27
Waste	57,14	42,86	37,50	62,50	0,20

Table 8. Results relating to timing performance indicators.

Performance Indicators	Input suppliers		Producers		p
	Use	Non-use	Use	Non-use	
Delay in delivery	0,00	100,00	0,00	100,00	-
Delivery time	0,00	100,00	0,00	100,00	-
Response time to customers	0,00	100,00	0,00	100,00	-
Storage time	50,00	50,00	41,67	58,33	0,43
Time response of suppliers	64,29	35,71	20,83	79,17	0,00

Table 9. Use percentages descriptive statistics of non-financial performance indicators.

Supply chain position	Minimum value	Lower quartile	Median	Upper quartile	Maximum value
Input suppliers	0,00	42,85	50,00	64,28	85,71
Producers	0,00	16,66	33,33	45,83	75,00

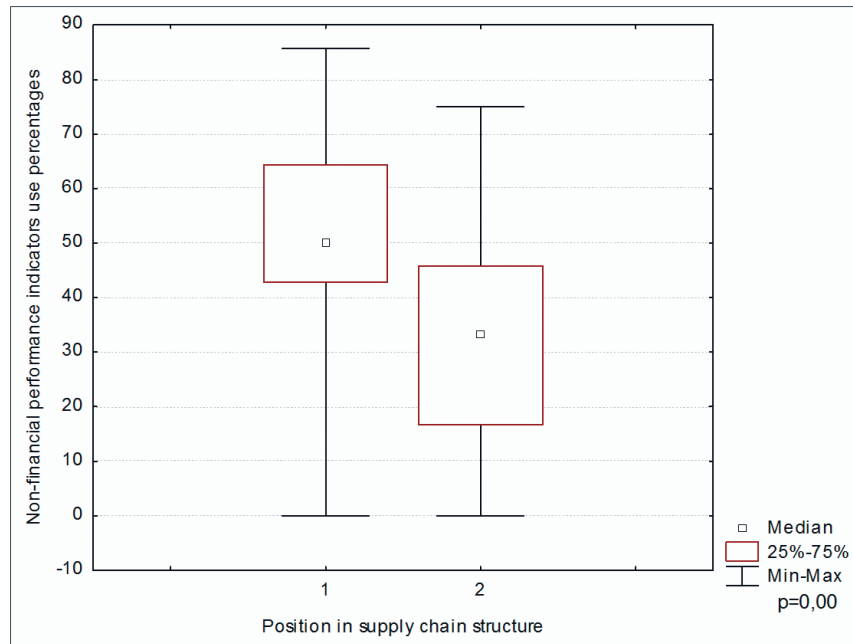


Figure 2. Results relating to overall use percentages of non-financial performance indicators considering the position of individual companies in supply chain structure.

Notes: (1) Input suppliers; (2) producers.

should not consider only common metrics for all participants but also consider managerial specificities derived from core processes from all stages of the supply chain structure.

CONCLUSIONS

The objective of this paper was to investigate the use patterns of non-financial performance indicators among individual agribusiness companies that play different roles within the agribusiness supply chain structure. In order to accomplish this objective, a survey of thirty-eight Brazilian individual agribusiness companies was carried out.

The results presented statistically significant evidence, which provides new theoretical insights from a dual perspective of the use of supply chain performance metrics. This dual perspective presents metrics used despite/beyond the supply chain role, as well as statistically significant use patterns differences between input suppliers and producers. Common performance metrics relate to both customers and business partners. These findings extend the meaning of satisfaction in supply chain performance measurement as a key driver not only to customers, pointed out in previous works as the single supply chain performance driver, but also considering market relations between supply chain participants.

The overall perspective of supply chain performance measurement remains a managerial challenge. The identification of common performance metrics to all supply chain participants isn't enough to assure that individual participants should not use specific metrics designed for their respective core processes.

Furthermore, the results show significant evidence supporting the presence of specific metrics used more intensively by input suppliers than by producers. More importantly, the results indicated that input suppliers have been using non-financial performance indicators more frequently than producers.

These findings indicate that the managerial relevance of individual performance indicators may not be the same for all supply chain participants as they should be related to their respective roles.

The contribution provided by these findings is based on the understanding of how supply chain participants occupying different roles should consider specific measures without focusing their importance on the overall performance of the supply chain. These findings also indicate to both academics and practitioners that any implementation of a supply chain performance measurement system should consider the use of performance indicators that are common to the role-type and specific to the constituent companies.

These results do not conflict with supply chain performance measurement conceptual perspective that considers supply chains as single entities. They indicate that singularities of individual companies should also be considered. Furthermore the lack of similar research in the literature does not allow the establishment of any kind of comparison with previously published results. Further studies should be performed in order to provide a better understanding about the nature of the relations between characteristics of supply chain participants and performance indicators use patterns.

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Submitted on September 9, 2013

Accepted on November 16, 2014

ANTÔNIO ANDRÉ CUNHA CALLADO

Universidade Federal Rural de Pernambuco
Av. D. Manoel de Medeiros, s/n, Bairro de Dois Irmãos,
52171-900, Recife, PE, Brasil

ALDO LEONARDO CUNHA CALLADO

Universidade Federal da Paraíba
Cidade Universitária, s/n, 58051-900, João Pessoa, PB, Brasil

RENATA PORTO CHAVES

Centro Universitário Maurício de Nassau
Rua Guilherme Pinto, 114, Bairro das Graças, 52010-210,
Recife, PE, Brasil