

RELATIONS BETWEEN THE USE OF PERFORMANCE INDICATORS AND THE ROLE OF INDIVIDUAL COMPANIES IN SUPPLY CHAIN COORDINATION PROCESS

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ABSTRACT

This paper aims to investigate the relations between the use of performance indicators and the role of individual companies within supply chain coordination process. A survey among 36 individual agribusiness companies was undertaken taking the role of each company in the coordination process of its supply chain into consideration. Senior managers were asked to declare the role of each company in the coordination process of its supply chain as well as to indicate which performance indicators they used through a questionnaire which presented a list composed by 49 performance indicators divided into the four traditional perspectives. Fisher's exact test and a logit model were used to analyze the relations between the usage of performance indicators and the role played in supply chain coordination process. The statistically significant results from Fisher's exact test were relating to inventory, operational costs, operational cycle, information and integration of materials, and risk management. The results from the logit model point out that inventory, and operational costs presented significant predictability levels regarding to the identification of individual supply chain participants, while operational cycle, information and integration of materials, and risk management presented significant predictability levels relating to individual supply chain coordinators. The research carried out in this paper is based on responses provided by senior managers regarding managerial practices and the sample size is limited. However, the results presents a new perspective about the relevance of the role of individual companies within the coordination process of supply chain regarding to performance indicators from which further research may be conducted. The implications relating to management control arising from the findings suggests that metrics selection criteria within in the context of supply chain can be based on both individual motivations and objectives.

Keywords: Performance measurement, Supply chain performance, Supply chain management.



1. INTRODUCTION

Supply chains (SC) are formed by several individual interrelated, not self-centered companies with the objective of delivering products and all members should be functionally coordinated in either an integrated or a disintegrated manner as an extended enterprise (Simatupang & Sridharan, 2002; Chan & Qi, 2003; Brewer & Speh, 2000). An integrated SC often has one controlling company that makes all relevant decisions about the management processes of the chain. Non-integrated SCs are formed by individual companies that act through a process of coordination.

Individual companies are legally independent entities (Kulmala, Paranko & Uuzi-Rauval, 2002) and as they become only a small part of a more complex network of interactions within the SC structure they are no longer in control of all aspects relating to their businesses (McAdam & McCormack, 2001).

The management of SC can be carried out by either a single entity through the presence of a dominant (controlling) member or through a system of partnerships that requires cooperation and coordination (Kuo & Smits, 2003). Coordinate activities in SC is difficult due to the complexity of related and independent activities (Holmberg, 2000) and the literature does not provide many examples of collaborative efforts from individual SC participants (Thakkar, kanda & Deshmukh, 2009).

Performance measurement of SC has been receiving significant attention from both academics and practitioners over the past decades (Ganga & Carpinetti, 2011) but there is very little discussion in the literature available that deals with measures selection (Beamon, 1998; Beamon, 1999; Chan & Qi, 2003).

Performance indicators selection procedures are, to a certain extent, both subjective (Folan & Browne, 2005) and uncertain (Lohman, Fortuin & Wouters, 2004). The literature does not provide further discussion whether the controlling company should make part or all coordinating decisions relating to SC management (Pfohl & Buse, 2001).

There is a lack in understanding the interrelationship between corporate and SC performance and the literature does not provide any holistic method designed to identify the set of metrics that should be used to measure SC performance (Lambert & Pohlen, 2001). Most of the inter-firm relationships analyzed take place in terms of dyadic or two-party context and scarce evidence of management across the supply system of businesses as a whole has been found (Kulmala et al., 2002). The role of the management accounting in supporting interorganizational decision making has been left largely unexplored (Nilsson, 2004).

An agri-food SC is a network of companies that work together to deliver agricultural products to final consumers (Christopher, 2005) and there is a greater tendency of keeping their own identity or autonomy than in of all the SCs (Van der Vorst, 2006) which indicates the absence of a specific controlling company as well as several challenges in implementation of coordination processes designed to align this network of business relations.

The aim of this paper is to investigate the relations between the use of performance indicators and the role of individual companies within supply chain coordination process (SCCP). Five performance indicators were found to have usage patterns and also presented significant predictability levels related to the role of individual companies within SCCP in a statistically significant way. These findings suggest that metrics selection criteria within in the context of supply chain can be based on both individual motivations and objectives.

2. SUPPLY CHAIN MANAGEMENT

The expression “supply chain” was first reported in the literature by Oliver and Webber (1982). Since then, this expression has been used to represent several aspects regarding planning activities, quality control and flows of material and information, as well as both internal and external logistics activities derived from the supply process among chain of companies (Cooper, Lambert & Pagh, 1997).

Supply chain management was originally placed into both academic literature and business practice as an effort aiming to reduce large amounts of stocks that had been accumulated, as well as the following goals regarding the management of supply chains, such as:

- Reduction of investment in inventories across the structure of the chain;
- Increase of service levels offered to customers;
- Increase the competitiveness advantage for chain members (Cooper & Ellram, 1993).

The reduction of investment in inventory across the structure of the chain involves a significant effort from individual participants regarding their specific role in the various operational processes performed within the supply chain. This reduction may represent the generation of significant savings for the entire supply chain due the improvement of effective management of inventory through information sharing and synchronizing managerial decisions.

The increase of service levels offered to consumers is related to the reduction of investments in inventories since the improvement of these services provided will rely on the elimination of unnecessary stocks as well as ensure sufficient inventories to meet the security levels for the expected services. In order to accomplish this, sharing consistent information regarding the expected demand is critical to carry out both reliable and appropriate forecasts to meet the real needs of customers.

Regarding the information sharing that takes place along the structure of the entire supply chain, three relevant aspects are needed to be made. Firstly, the literature indicates that to accomplish an effective management of any given supply chain, individual participants must provide continuous information sharing. This is due to increase the level of knowledge about the demand and contributes to both the improvement of forecast accuracy and the reduction of uncertainty (Conceição & Quintão, 2004).

More importantly, this information sharing should not only consider collected data about customers, it must support sales planning as well as information exchange between all individual supply chain participants. Secondly, the traditional need for information within the entire supply chain structure regarding specific products has relevant importance for managerial purposes. It has been observed very often that information flow is somehow disconnected due to the fact that each stage of the supply chain keep their own information regarding inventory levels, sales forecast and distribution planning at the organizational level and they do not share them with other supply chain participants (Battle & Scramim, 1999). Thirdly, the increased level of services derives from two main objectives for information sharing between supply chain participants. According Battle and Scramim (1999), information should be shared between all members in order to provide is feedback about how the performance of an individual supply chain participating is being perceived by others as well as by consumers. Information sharing is important due to both reduced inventory investment and continuous improvement of products as well as services offered to customer from the perspective defined by Cooper and Ellram (1993).

The development of competitive advantages for supply chain members can be achieved by inventory reduction which contributes to minimizing total cost of production and can make product prices become more competitive within the market. Another issue associated with the development of competitive advantages is the increase of service level offered to customers due to the managerial support generated from an adequate flow of information between the all supply chain participants.

Another relevant aspect related to the theoretical understanding of supply chain management refers to buyer-supplier relations. According to Chen and Paulraj (2003), these relations have five specific characteristics, namely:

- Reduced supplier base;
- Long-term relationships;
- Communication;
- Multi-functional teams;
- Involvement of suppliers.

Buyer-supplier relations have been receiving a large amount of attention from managers given that the notion that successful trade relations are more likely to occur when mutual cooperation is widespread. The traditional managerial approach based on bargaining power and coping relations has been replaced by a new conception of management guided by cooperation and integration (Browercox & Closs, 2001).

According to Ballou, Gilbert and Mukherjee (2000), supply chain management covers three distinct dimensions:

- Intra functional coordination;
- Cross-functional activities coordination;
- Inter-organizational activities coordination.

The first one refers to managerial activities and processes regarding the logistics functions of individual supply chain participants. The second one refers to managerial activities between different functional areas from individual supply chain participants. The third one refers to the managerial activities among different individual supply chain participants.

Over the past two decades, the management of supply chains has emphasized the need of interdependence of purchasing companies and suppliers to work collaboratively in order to improve the performance of the chain as a whole (Shin, Collier & Wilson, 2000).

The management of chain components, such as a framework (set of tasks and activities performed by individual companies), product flow structure (supply, production and distribution along the chain), and planning and control of operations are considered by Pires (2004) as important elements for the integration process within the supply chain.

Interdependence between supply chain participants have motivated both academics and practitioners to seek managerial ways to coordinate business operations as well as relationships between individual companies in order to integrate key processes through association of different supply chain links in search for sustainable competitive advantages over other competing chains. In this context, supply chain management plays the role of management model that seeks to overcome the existing traditional conflicts between companies and promote effective integration to achieve superior collaborative performance.

The understanding of the role played by supply chain coordination has become increasingly important once individual companies should keep direct business links in search of adding value to products from both a set of activities and important strategic processes performed by different companies. Under these circumstances, the establishment of cooperative relations among supply chain participants can significantly increase the

competitiveness of all individual companies involved. In addition, these dedicated chain management actions, designed for the achieving of common strategic objectives, are the strengthening of important competitive elements.

According to Cooper and Ellram (1993), supply chain management addresses the vertical integration cooperation in the various different levels of the structure of the chain through information sharing, technology, infrastructure and skills in search of quality standards considering specifications required by end consumers. In this type of integration, a focal company is expected to carry out the main tasks regarding the supply chain management control activities over the others and the decisions concerning the implementation of vertical integration relate to several specific factors such as scale and types of services. Operations are carried out through managerial control implemented by the focal company which is responsible for the decision-making processes regarding most major supply chain issues as well as the coordination of the entire supply chain.

Another relevant aspect is the understanding of the relations between supply chain participants along the supply chain structure from the identification of each individual participating company, as well as the analysis of its structural dimensions. According to Pires (2004), individual participant companies are organizations that interacts directly and indirectly with the focal company whether upstream and Downstream from raw material suppliers to end customers.

Individual companies that make up a supply chain can be classified as primary and supporting participants. Primary participants are seen as individual companies that take direct action within the value-adding process of products considering both demand and needs of particular customers or markets (Pires, 2004).

Support participants are in charge of providing knowledge, facilities and assets for primary chain participants. It is worth noting that the participants to be considered whenever mapping the structure of any given supply chain and require managerial attention are those which are critical to the accomplishment of goals.

The identification of primary participants is relevant to all other chain participants so their efforts can focus on relations and interactions that add value to products (Morais, 2008). An individual company can play more than one role within the structure of a supply chain, acting as a supporting player within one specific operational process whole acting as a primary participant in other.

The complexity degree of a supply chain structure can be associated with either the number of stages (tiers) along the flow of materials and information regarding the number of companies in each stage (Beamon, 1998). The sequential arrangement of different stages that carry out the chain of operational activities forms integrated vertical integration, while the companies that operate in each specific stage form integrated horizontal cooperation (Callado & Callado, 2010).

In addition, the implementation of any integration model for supply chains could face several difficulties due to different individual interests from individual companies. However, in a scenario where competition takes place between supply chains instead of individual companies, the importance of effective management of processes and activities of supply chains increases and supply chain performance measurement is certainly one of them.

3. COORDINATION PROCESS AND PERFORMANCE INDICATORS SELECTION

The identification of desirable characteristics of an SC measurement system has become a target for academics and practitioners (Najmi & Fan Rigas, 2005). Traditionally,

attention on SC performance measurement has been directed toward measuring the performance of a single process applied across the chain. Recently, however, more emphasis has been given to measuring overall performance (Rafele, 2004).

However, systemic thinking does not mean sharing decisions (Holmberg, 2000). For the majority management accounting practice has limited its scope to the boundaries of the firms and this limitation makes it difficult to take advantage from synergies that exist across the supply chain. (Kulmala et al, 2002). The rational approach considers boundaries to be natural and real, corresponding to the legal borders of a firm as defined by ownership (Tharen & Hald, 2006).

Relationships between individual companies that participate in non-integrated SCs may be classified into four categories or stages:

- Autonomy;
- Serial dependence;
- Reciprocal dependence;
- Deeper mutual dependence (Berry, Cullen & Seal, 2005).

Considering different forms of interdependence within as well as among SCs makes the concepts of these categories seem fuzzy and also difficult to place managerial control (Dubois, Hulthén & Pedersen, 2004) and individual companies may possess different levels of influence about partner selection, resource integration, information processing, knowledge capturing, social coordination, risk sharing, conflict resolution, motivation and decision making relating to SC management (Harland, Lamming, Zheng & Johnsen, 2000).

Disagreements over domain of decisions are seen as cause of conflicts between SC participants (Simatupang & Sridharan, 2002). Furthermore, different interfaces within the SC structure may not deserve the same amount of integration (Van Hoek, 1998).

Controlling companies very often are responsible for the decisions addressed to key aspects relating to SC management, although the effects of these decisions may generate some conflicts between SC participants because of their impact on current activities (Kaplan & Norton, 1997).

The role of individual companies within SCCP may influence their decisions relating to SC performance measurement (Folan & Browne, 2005). If relevant issues relating to SC management considered only by controlling companies within integrated SCs (or coordinating companies within non-integrated SCs), other SC participants may not accept to sacrifice some of their respective internal efficiencies in search of overall chain-optimization as their position in SC structure may affect the relevance of specific performance metrics (Van Hoek, 1998). Differences in interest can be seen as threat over SC performance if individual participants seek their own profit instead of overall SC profit (Simatupang et al., 2002).

The effectiveness of interactions between the coordinating company which is responsible for the SCCP and SC participants may influence decisions relating to performance metrics (Folan et al., 2005) and the design of a SC performance system should consider key objectives from each participant (Lohman et al., 2004). The SCCP carried out by a coordinating company is a key aspect for the development of the decision domain (Simatupang et al., 2002).

Performance systems designed to SC should consider both performance measurement metrics prescribed by controlling/coordinating companies and specific metrics which are important to other SC participant through the establishment of a hierarchy of measures considering both perspectives (Pohlen, 2003).

The multi-dimensional and inter-organizational characteristics of SC performance measurement systems should consider the definition of weights for all individual metrics

included in it to reflect the hierarchy of relationships existing among them (Cai, Liu, Xiao & Liu, 2009, Ganga & Carpinetti, 2011) and how each individual company affects overall SC (Lambert et al., 2001).

The differences in levels of use as well as the integrating process between metrics is a relevant factor for the design of a SC performance system (Melnyk, Stewart & Swink, 2004) and managerial challenges relating to inter-organizational relations and control have been faced by management accounting considering both contexts and boundaries of individual companies (Mouritsen & Thrane, 2006). Managerial actions addressed to improving individual performance without considering the interdependence among SC participants may generate undesirable effects (Simatupang et al., 2002) as many of them may act as autonomous units instead of components of a larger system and neglect the scope of their interdependencies (Holmberg, 2000).

Decision making relating to metrics selection is an important issue for SCCP when considering the relevance of specific roles of individual participants relating to overall SC performance as different companies may use different sets of relevant metrics according to their respective characteristics and managerial needs.

4. METHODOLOGY

To develop a sufficient data-base, individual companies were contacted to verify their willingness to participate in this survey and 36 agribusiness companies located in Pernambuco/Brazil accepted. The profile of the sample analyzed is presented in Table 1.

Table 1. Profile of individual companies analyzed

Profile	Number of companies
Producers	13
Distributors	7
Retailers	16
Total	36

The following 49 performance indicators presented in Beamon (1998), Rafele (2004), Gunasekaran, McGauchey & Patel (2004) and Callado, Mendes and Callado (2013) were classified among the four perspectives of the BSC:

- Financial perspective: profitability, liquidity, revenues by product, revenue per employee, contribution margin, level of indebtedness, return over investment, unit cost, minimizing costs, profit maximization, inventory, overall earnings and operation costs;
- Customer perspective: customer satisfaction, customer loyalty, new customers, market share, brand value, profitability by customer, revenue per customer, business partners satisfaction, delivery time, responsiveness to clients, growth in market share and maximizing sales;
- Internal processes perspective: new products, new processes, productivity by business unit, products turnover, after sales, operational cycle, suppliers, waste, flexibility, response time to customers, delay in delivery, response of suppliers, storage time and information and integration of materials;
- Learning and growth perspective: investment in training, technology investment, investment in information system, employee motivation, employee capability,

managerial efficiency, employee satisfaction, innovation management, number of complains and risk management.

Data collection procedures were similarly to those applied by Chia, Goh & Hum (2009). They were carried out by structured interviews with the use of a questionnaire in which all 49 variables were showed. This approach is characterized by Chizzotti (1991) and Gil (1996) as a tool composed by pre-elaborated and sequentially placed questions with the aim to obtain answers relating to a specific subject. A questionnaire containing a list of the performance indicators was the instrument used. Senior managers from each individual company were asked to state which of the indicators were used by their business as well as to indicate the role played by their respective companies within SCCP (participants or coordinators).

Given the size of the sample studied as well as the nature of the variables, a non-parametric statistical technique was chosen. Non-parametric statistics are capable of providing evidence without making any assumptions about the distribution of the variables studied (Bisquerra, Sarriera & Martinez, 2004). They also are recommended when the assumptions required by other techniques are not met, nor when it is not possible to verify these hypotheses due to small sample sizes (Stevenson, 1986). Fisher's exact test was used. This statistical test to be not appropriate when the nature of the data does not allow the use of other more sophisticated statistical techniques (Levin, 1987). The level of significance adopted as acceptable for rejection of the Null Hypothesis was 95%.

To address the predictive capability of the performance indicators tested of identifying the role played by individual companies within SCCP, a logit model was used. This model was used to estimates the likelihood of these two options considering the use patterns (Picchetti, 2000, Maddala, 2001).

5. RESULTS

Initially, responses obtained from senior managers of the individual companies investigated were used to analyze the statistical significance of the relations between the use of performance indicators and their respective role within the SCCP. The results relating to performance indicators from the financial perspective are presented in Table 2.

Table 2. Fisher's exact test results regarding the use of financial performance indicators considering the role in supply chain coordination process

Performance indicators	Participants	Coordinators	p	test result
Profitability	66.67	75.00	0.44	Does not reject H_0
Liquidity	41.67	58.33	0.27	Does not reject H_0
Revenues by products	66.67	62.50	0.53	Does not reject H_0
Revenue per employee	16.67	25.00	0.45	Does not reject H_0
Contribution margin	33.33	45.83	0.36	Does not reject H_0
Level of indebtedness	16.67	37.50	0.18	Does not reject H_0
Return over investment	16.67	8.33	0.40	Does not reject H_0
Unit cost	58.33	50.00	0.45	Does not reject H_0
Minimizing costs	66.67	66.67	0.64	Does not reject H_0
Profit maximization	58.33	29.17	0.09	Does not reject H_0

Inventory	66.67	25.00	0.02	Reject H_0
Overall earnings	33.33	25.00	0.44	Does not reject H_0
Operation costs	66.67	29.17	0.03	Reject H_0

The results show that only two financial performance indicators obtained results that reject the null hypothesis. Both inventory and operational costs have been used among SC participants more often than among SC coordinators. The performance indicators relating to profitability and minimizing costs have been broadly used by both groups (more than 65% of individual companies pointed out the use of these two indicators). Revenues per product also have high use pattern among SC participants, but did not present significant results from the statistical test. Return per employee and return over investment obtained low use pattern values.

Similarly, the responses obtained from senior managers of the individual companies investigated were used to analyze the statistical significance of the relations between the use of performance indicators and the role played in SCCP. The results relating to the use of performance indicators from the customer perspective of the BSC are presented in Table 3.

Table 3. Fisher's exact test results regarding the use of customer performance indicators considering the role in supply chain coordination process

Performance indicators	Participants	Coordinators	p	test result
Customer satisfaction	75.00	79.17	0.54	Does not reject H_0
Customer loyalty	58.33	62.50	0.54	Does not reject H_0
New customers	50.00	54.17	0.54	Does not reject H_0
Market share	58.33	45.83	0.36	Does not reject H_0
Brand value	41.67	29.17	0.34	Does not reject H_0
Profitability by customer	58.33	33.33	0.14	Does not reject H_0
Revenue per customer	66.67	54.17	0.36	Does not reject H_0
Business partners satisfaction	50.00	29.17	0.19	Does not reject H_0
Delivery time	91.67	83.33	0.45	Does not reject H_0
Responsiveness to clients	33.33	12.50	0.14	Does not reject H_0
Growth in market share	25.00	25.00	0.66	Does not reject H_0
Maximizing sales	66.67	54.17	0.36	Does not reject H_0

It can be observed that none of the performance indicators from the customer perspective obtained significant results that would reject the null hypothesis, indicating that the managerial concerns of both SC participants and SC coordinators share similar approaches relating to the measurement of performance regarding to customers. The performance indicators relating to customer satisfaction and delivery time have been broadly used by both groups. These two performance indicators obtained 75% of higher responses of use from individual companies from both SC participants and SC coordinators. Revenues per customers and maximizing sales also present high use pattern among SC participants, but did not present significant results from the statistical test.

The data collected from senior managers of the individual companies were also used to analyze the statistical significance of the relations between the role played in SCCP and the use of performance indicators from the internal processes perspective of the BSC. The results are presented in Table 4.

Table 4. Fisher's exact test results regarding the use of internal process performance indicators considering the role supply chain coordination process

Performance indicators	Participants	Coordinators	p	test result
New products	58.33	45.83	0,36	Does not reject H_0
New processes	50.00	41.67	0,45	Does not reject H_0
Productivity by business unit	50.00	20.83	0,08	Does not reject H_0
Products turnover	66.67	50.00	0,27	Does not reject H_0
After sales	41.67	41.67	0,64	Does not reject H_0
Operational cycle	50.00	8.33	0.00	Reject H_0
Suppliers	41.67	45.83	0.54	Does not reject H_0
Waste	58.33	37.50	0.20	Does not reject H_0
Flexibility	50.00	41.67	0.45	Does not reject H_0
Response time to customers	33.33	12.50	0.11	Does not reject H_0
Delay in delivery	66.67	70.83	0.54	Does not reject H_0
Response of suppliers	75.00	70.83	0.55	Does not reject H_0
Storage time	58.33	41.67	0.27	Does not reject H_0
Information and integration of materials	41.67	8.33	0.02	Reject H_0

The declared use of the performance indicators relating to operational cycle and information and integration of materials presented significant results to reject the null hypothesis. These two performance indicators rarely have been used by SC coordinators. Product turnover present high percentage of use among SC participants, but did not present significant results from the statistical test. Response time to customers also obtained low percentage of use, but the statistical test applied did not present significant result.

Finally, the same statistical procedures were used to analyze the responses obtained from the senior managers of the individual companies investigated the statistical significance of the relations between the role played in SCCP and the use of performance indicators from the learning and growth perspective of the BSC. The results are presented in Table 5.

Table 5. Fisher's exact test results regarding the use of learning and growth performance indicators considering the role supply chain coordination process

Performance indicators	Participants	Coordinators	p	test result
Investment in training	58.33	50.00	0.45	Does not reject H_0
Investment in technology	58.33	62.50	0.54	Does not reject H_0
Investment in information systems	58.33	50.00	0.45	Does not reject H_0
Employee motivation	41.67	41.67	0.64	Does not reject H_0

Employee capability	58.33	33.33	0.14	Does not reject H_0
Managerial efficiency	33.33	45.83	0.36	Does not reject H_0
Employee satisfaction	58.33	54.17	0.54	Does not reject H_0
Innovation management	33.33	25.00	0.44	Does not reject H_0
Number of complains	58.33	54.17	0.54	Does not reject H_0
Risk management	50.00	12.50	0.02	Reject H_0

Only the performance indicator relating to risk management presented significant results to reject the null hypothesis. None of them present high percentage of use indicating that this perspective has been receiving less managerial attention relating to performance measurement.

Secondly, the performance indicators that did obtain significant results from fisher's exact test were used in the logit model in order to test their predictive capability relating to the role played by individual companies in SCCP. The results relating to the participant role are presented in Table 6.

Table 6. Logit model results regarding predictability capability of performance indicators relating to supply chain participant role (percentage)

Performance indicators	Capability	p
Inventory	66.66	0.01
Operational costs	66.00	0.03
Operational cycle	50.00	0.00
Information and integration of materials	41.66	0.02
Risk management	50.00	0.01

The results indicate that both performance indicators from the financial perspective (inventory and operational costs) present the best capability of prediction relating to identifying individual companies that are only SC participants. These results suggest that these SC individual companies investigated have been considering these two performance indicators as relevant managerial metrics.

At last, the same group of performance indicators was used in the logit model in order to test their predictive capability relating to the SC coordinating role played by individual companies. The results are presented in Table 7.

Table 7. Predictability capability of individual performance indicators relating to supply chain coordinating role (percentage)

Performance indicators	Capability	p
Inventory	75.00	0.01
Operational costs	70.83	0.03
Operational cycle	91.66	0.00
Information and integration of materials	91.66	0.02
Risk management	87.50	0.01

The results indicate that all performance indicators present high levels of predictability relating to identifying individual companies that play SC coordinating role. Information and integration of materials and operational cycle present excellent levels and inventory and operational costs present the lowest results (75% and 70%, respectively).

6. DISCUSSION

It is accepted in the literature (McAdam & McCormack, 2001; Thakkar et al., 2009) that the performance indicators selection criteria used by individual companies within the SC context are more likely to depend on their specific motivations and objectives. The results presented conform to this expectation. The use of five performance indicators was considered as statistically related to the role of individual companies within SCCP.

Individual companies may place greater or lesser importance on specific metrics, according to the operational contribution of the performance indicators that have being used (Van Hoek, 1998; Kleijnen et al., 2003). Individual companies within the agri-food SC context have the tendency to keep their own identity or autonomy (Van der Vorst, 2006). Within less formalized, decentralized and non-hierarchical SCs, such as agri-food SCs, the relations between individual companies are market-oriented (Kim, 2007).

In addition, the sets of performance indicators used by individual companies within the SC context are also influenced affected by the degree of interdependence and the nature of the interactions among them (Melnyk et al, 2004).

The results also indicate significant differences relating to predictability capability of the performance indicators relating to the role played by individual companies in SCCP. Inventory and operational costs were good predictors of SC participants, while operational cycle, information and integration of materials, and risk management were good predictors of SC Coordinators.

Once individual companies are legally independent entities and are part of a complex network of interactions within the SC structure, the nature of relations is influenced by the level of co-operation between them (Harland, 1996; Spekman, Kamauff Jr & Myhy, 1998). The identification of the most appropriate type of relationship between individual companies within SC should consider product and market conditions and management practices should be adapted to that relationship (Matikainen, 1998). This suggests that specific roles in SCCP may also influence performance indicators selection criteria and the measurement system applied may be imposed to SC participants by power leverage (Gregory, 1986).

Furthermore, centralization of network relationships has been observed within industries due to the presence of big corporations that outsource some of their operational functions in order to focus on the business core (Kulmala et al, 2002).

7. CONCLUSIONS

The objective of this study was to investigate the relations between the use of performance indicators and the role of individual companies within supply chain coordination process. To accomplish this objective, 36 individual Brazilian agribusiness companies were investigated. The results present significant evidence relating to relations between the use pattern of five performance indicators and the role played by individual companies within the coordination of SC.

The results also pointed out that these performance indicators obtained significant levels of predictability regarding to individual companies that play both participant and

coordinating role in SC, indicating that their use patterns reveal specificities from managerial practices of performance measurement among individual agribusiness companies in the context of SC.

Therefore, SCCP should be included in the managerial agenda of management controlling research. Further studies may generate both deeper and detailed information about the nature performance indicators selection criteria within the context and contribute to the improvement of the existing knowledge about this field.

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