

Abstract Number: 007-0583

Title: Metrics for Agribusiness Supply Networks

Authors:

Natércia Carona

FGV/EAESP - Fundação Getúlio Vargas, Production & Operations Department
Rua Itapeva, 2029 Cep:01313-902, São Paulo / SP - Brazil
Tel: 55 11 3281 7780
natercia.carona@fgv.br

Susana C. Farias Pereira

FGV/EAESP - Fundação Getúlio Vargas, Production & Operations Department
Rua Itapeva, 2029 Cep:01313-902, São Paulo / SP - Brazil
Tel: 55 11 3281 7782
susana.pereira@fgv.br

João Mário Csillag

FGV/EAESP - Fundação Getúlio Vargas, Production & Operations Department
Rua Itapeva, 2029 Cep:01313-902, São Paulo / SP - Brazil
Tel: 55 11 3281 3247
joao.mario.csillag@fgv.br

POMS 18th Annual Conference
Dallas, Texas, U.S.A.
May 4 to May 7, 2007

Key Words:

Agribusiness; Supply Networks; Collaborative Relationships; Performance Metrics.

Metrics for Agribusiness Supply Networks

Abstract

The agribusiness has become more and more important in the last decade especially in the meat market. However, new risks such as the bird flu, though being a business opportunity for some countries, raise some concerns in the consumer market.

Therefore the challenge for the agribusiness is to invest and improve supply chain performance and management. In the academic field new studies are needed, that analyze the efficiency level of the actual networks more exposed to the global markets.

Considering that managing implies the definition of performance metrics this study presents a review of the literature of performance measurements for the agribusiness and establish the gaps considering new global scenarios.

We expect the results to contribute for better understanding of the agribusiness supply chain performance and its challenges.

Introduction

As other sectors, the agribusiness has been receiving growing attention from researchers with supply chain approach, since it can contribute for the development of trust among actors and therefore develop greater odds of survival and capacity improvement for all the participants (Batalha, 2001). According also to Lambert, Cooper e Pagh (1998) and Mentzer et al. (2001), relationships between companies tire the success of each with all the supply chain to which they belong. For those authors, the supply network approach, and its collaborative relationships, can be considered one of the last frontiers of competitiveness.

The better those relationships are known, more can the management contribute for strengthens of all relationships and consequently to improve performance of each actor, all the network and at the end, the sector (Harland et al., 2001). Nevertheless it is necessary to measure the performances so management can be effective and efficient towards the competitive objectives. According to Carona and Csillag (2004), the lack of performance measures, when analyzing collaborative relationships, is one of the causes for deficient management of supply networks.

Bearing in mind the above stated, the present work aims to review the literature of performance measurements for the agribusiness and establish the gaps taking into account the new global scenarios.

In the next section some considerations about the agribusiness are presented. Other section presents the performance measurements of the supply chain approach review and finally conclusions and future work suggestions are discussed.

Agribusiness

The international competition is demanding greater efficiency to all companies. The academic is expected to present studies which evaluate the efficiency of the systems exposed to the global market pressures. Being one of the biggest food producers of the world, the Brazilian economy is not an exception and companies in the meat market are concerned, specially in the poultry segment, where new risks such as bird flu arise the need of entanglement between actors of the supply chain.

According to the Brazilian Association of Chicken Producers and Exporters ABEF (Associação Brasileira dos Produtores e Exportadores de Frango), Brazil is now

the biggest trader of chicken meat, and in January 2006 has negotiated 213.720 tons, reflecting a growth of 14% when comparing with the same month of 2005. The incomes for that period represented US\$280,7 millions, 41,5% more.

Table 1: World Exportation of Chicken Meat

| Main Countries (1999 - 2006**) | | | | | | |
|--------------------------------|--------|-------|----------------|---------|-------|-------|
| Thousand Tons | | | | | | |
| ANO | Brazil | EUA | European Union | Tailand | China | World |
| 2000 | 907 | 2.231 | 774 | 333 | 464 | 4.856 |
| 2001 | 1.265 | 2.520 | 726 | 392 | 489 | 5.527 |
| 2002 | 1.625 | 2.180 | 871 | 427 | 438 | 5.701 |
| 2003 | 1.960 | 2.232 | 788 | 485 | 388 | 6.022 |
| 2004 | 2.470 | 2.170 | 813 | 200 | 241 | 6.043 |
| 2005* | 2.846 | 2.335 | 740 | 240 | 331 | 6.680 |
| 2006** | 3.050 | 2.404 | 720 | 300 | 375 | 7.046 |

* Preliminary ** Prevision

Fonte: USDA/ABEF (2005)

To maintain the achieved position and expand to new markets, the companies need to invest and develop its capacities of managing and measure the performance of the supply networks to which they belong. Studies have been made in several segments that pursue this goal, such as Azevedo (2002), Canever (1997), Martins (1996), Nicolau (1994), Saenz (1996), e Pereira (2003), Carona e Csillag (2004).

Batalha Coord. (2001a) presents the agribusiness in Brazil, from three perspectives “agro industrial system”, “agro industrial complex”, “agro industrial production chain” (APC) and above those the “agribusiness”. All referring to the same problem but have different levels of analysis and different purposes .

The two main streams are “Commodity System Approach” (CSA) and the French industrial economy school approach “*Filières Analysis*” or ACP. The main difference is in the starting point of analysis: CSA is the first basic product at the beginning of

production. For ACP is the final product, to final consumer. By leaving the classical classification of economic sectors, where agribusiness is the denominated the first sector, both approaches have a more complex system vision. They have characteristics of mesoanalysis and systemic vision. This is to say “structural and functional analysis of subsystems and their interdependence within integrated systems” (BATALHA, Coord., 2001a). This notion brings the systemic vision of supply chain to the agribusiness. Pinazza e Alimandro (1999) in their study in the agribusiness field, corroborate that the achievements in efficiency and effectiveness of each participant reflects to all the chain.

Then the three levels are identified: Agro industrial System (AS), Agro industrial Complex and Agro industrial Production Chain (APC). The AS does not have any specific starting point for its analysis, and therefore it is close to a more general overview of the agribusiness. It analyses any participant directly involved with the product line transformation. However it excludes all the support industries.

The Agro industrial Complex begins with a base product and traces all its developments to several final products. (De Paula and Faveret, 1998; Batalha Coord., 2001a).

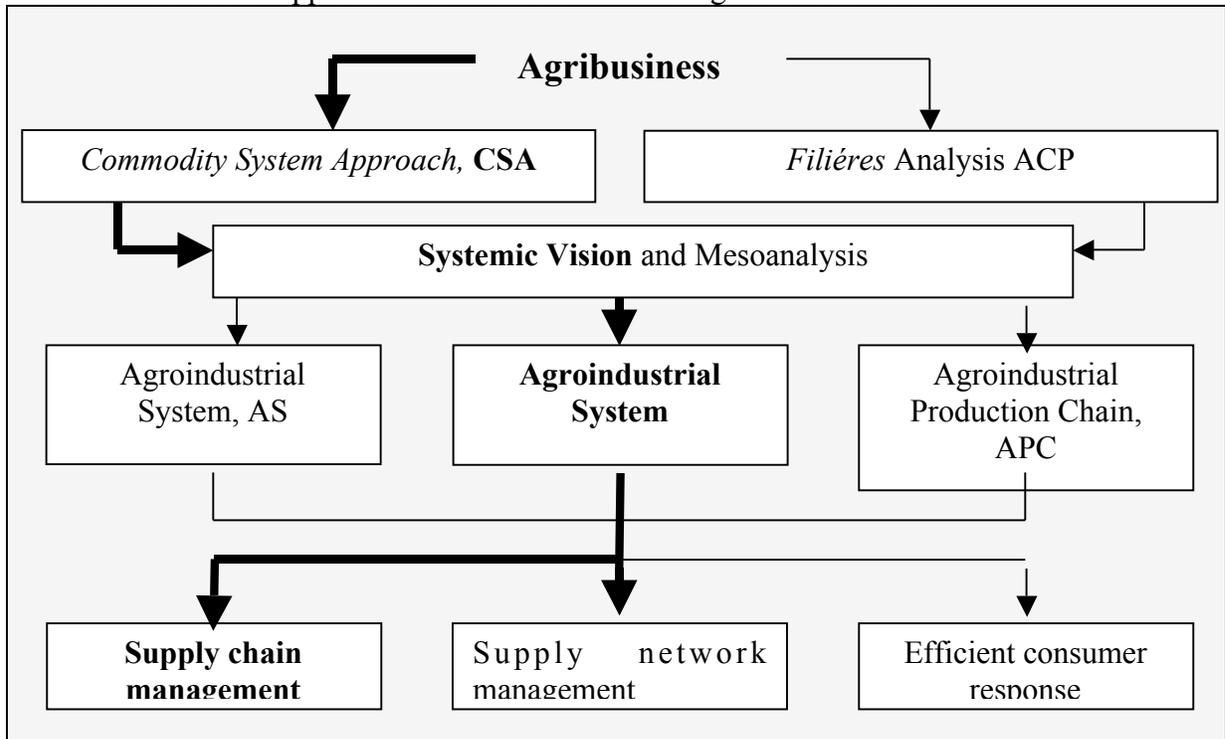
Finally, the APC starts with the final product and moves back up to the production line, observing technical, logistics and commercial operations.

All these approaches aim to understand the activities in such way that management can pursue efficiency, competitiveness, agility, flexibility and quality. The ones with more systemic and collaborative views are the most indicated for the future of the agribusiness: Efficient Consumer Response, Supply Chain Management and Supply Networks Management (Batalha Coord., 2001a).

Traditionally, the agribusiness has been studied through the Cost Transaction Theory with special attention to stock and logistic, with great influence of macro economy and political interests. However, as a result of globalization, supply chains and networks are becoming more and more important (Hobbs; Young, 2000).

Box 1 resumes the above described theoretical approaches of research in the agribusiness field. The path chosen by the authors to research in the field are marked by bold arrows.

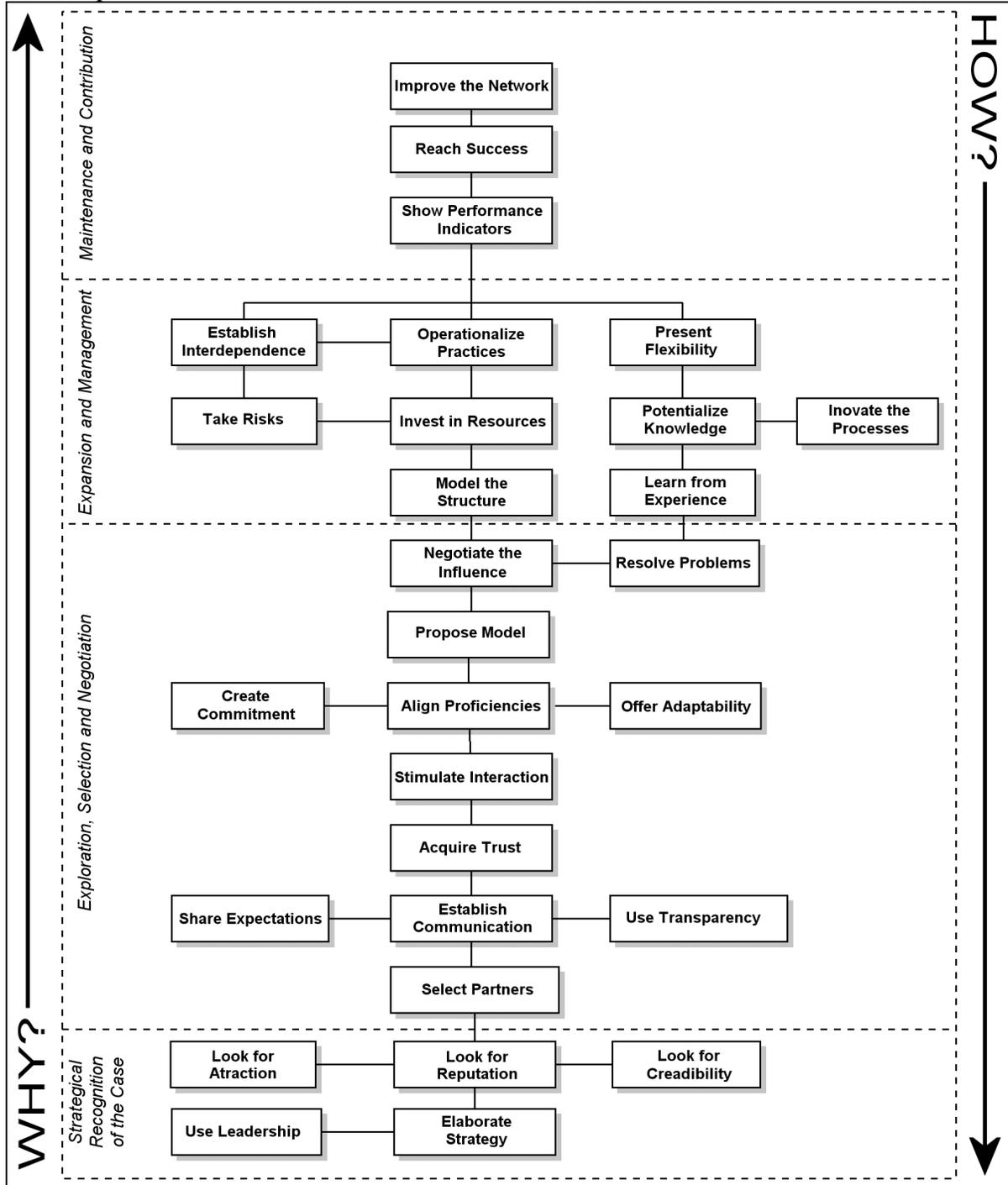
Box 1: Theoretical Approaches Of Research In The Agribusiness Field.



Source: Carona, 2004.

The results of a case study in the agribusiness field (Carona and Csillag, 2004) identified one possible structure to the collaborative relationships in the supply networks (Box 2). Showing performance indicators of all the process of developing and maintaining such relationships was it self considered an important step for reach success of the collaborative strategy.

Box 2: Fast Diagram of development and maintenance of Supply Networks Relationships



Source: Carona (2004)

The identification of ten elements that characterize relationships and the parameters that comprise each one of them refer to an order of events as suggested by

Dywer, Schurr and Oh (1987) and Dyer, Kale and Singh (2001). Starting with the main objective, from top to bottom we have the question “how?” and from the bottom to the top, the question “why?”. For example figure 2, where indicated by checkered arrow: How may I acquire trust? By establishing transparent communication and by revealing my expectations. Why should I establish transparent communication and reveal my expectations? In order to acquire trust.

The process begins with the elaboration of a collaboration strategy, in which the leadership role is considered important for extending and effectively implementing it. The first step is to identify those actors in the network that are attractive, interesting - those who have a sufficiently good reputation and credibility to establish partnerships and collaboration.

In the second phase of the process, once partners are identified and selected, the communication flow begins. Using transparency to expose the real expectations of the actors as far as the relationships are concerned. This is the first contribution towards establishing trust among the actors. It is necessary to establish trust for there to increase interaction, or, in other words, to expand the processes of both formal and informal exchange among actors, with the intention of aligning the skills, proficiencies that each actor can contribute. This interaction tests and develops the capacity of the actors to adapt. While the actors contribute to the formation of a model of collaborating relationships, commitment between them grows. Formation of this model will dictate the rules of the relationship and it is also the arena for negotiation, in which each actor will try to influence in favor of their own preferences. The ability to resolve any eventual problems, conflicts, that may arise in this phase is crucial for the beginning of the next

stage. New knowledge comes from conflict solving, learn from experience, that may help innovate processes. It is the moment to invest in resources in order to create the necessary structure to implement the model of the negotiated relationship. Risks are taken and interdependence is established. The actors should have the flexibility to accommodate innovations and avoid difficulties at the moment they operationalize into practice the collaborating relationship. When the relationship has already started, it is necessary to know which contributions will be made by the actors and by the network. In order to recognize success it is necessary that the results not only be measured and evaluated, but also made available, show performance indicators, in order to continue the incentive for the collaboration strategy, acquirement of knowledge and improvement. The final objective of managing collaboration relationships in networks is for the actors and companies to become highly successful so that their success reflects upon and contributes to the benefit, improvement, of the network as a whole, as far as win-win principles are concerned. However there was not evidence that sufficient measures were available to all the required steps.

Do the recognized frameworks or models for performance measurement in supply chain cope with the needs of the growing supply networks of the agribusiness field?

The Performance Measures Review

According to De Toni e Tonchia (2001), the main changes and tendencies in the performance measurement systems, presented in the literature can be summarized as in Box 3. The new approach goes further the classical financier indicators. Not only they are concerned with value creation but also with some intangible indicators such as those

brought by collaborative relationships. They have also developed and validated two models (boxes 4 and 5) for performance measurement systems.

Box 3: Performance Measurement Systems Evolution

| Traditional Approach | Innovative Approach |
|---|---|
| Cost and Efficiency based | Value based |
| Profit oriented | Customer oriented |
| Short-term oriented | Long term oriented |
| Individual measures prevail | Group measures prevail |
| Functional measures prevail | Process measures prevail |
| Comparisons with pre-established patterns | Continuous improvement |
| Evaluation focus | Evaluation and people involvement focus |

Source: De TONI e TONCHIA, 2001

Box 4 – *Framework* of the characteristics of a performance measurement system

| Characteristics | | Variables | |
|----------------------|---|---|---|
| FORMALIZATION | Measures (what to measure) | Object Definition | Object identification/phenomenon to be measured, definition of best indicators, possibility of sharing measures, compatibility with already existent measures, identification of the measure user/or de usefulness of the measure (decision, synthesis or evaluation) |
| | | Responsibilities indication | Facility of identifying the responsibilities for the given data (individual or group) |
| | | Degree of detail | |
| | Measurement (how to measure) | Compilation report | |
| | | Definition of the measurement procedure | Measure criteria (when, were e how); frequency; pattern cost; obligations and responsibilities, precision and accuracy.. |
| INTEGRATION | Account systems | Account balance | |
| | | Cost Analytical Account | |
| | | Budget | |
| | Planning and production control systems | Stocks | |
| Production Processes | | | |
| Costumer demands | | | |
| | Strategic Planning | | |
| UTILIZATION | Activity coordination and control planning | | |
| | Employees control, involvement and evaluation | | |
| | <i>Benchmarking</i> | | |

Source: DE TONI e TONCHIA, 2001

Box 5 – *Framework* of the measures for a performance measurement system

| PERFORMANCE MEASURES | | | |
|----------------------|-------------------|---------------------|--|
| COST | Production Costs | Labor and materials | |
| | Productivity | Total | |
| NON-COST | | Time | Internal |
| | External | | Production (productivity of labor, equipment saturation, finished product stock and process stock) |
| Quality | | Produced quality | Cycle and <i>set-up time</i> |
| | Perceived quality | | Holding and handling times |
| Flexibility | | In-bound quality | Systems times |
| | Quality costs | | Speed and trust of delivery |
| | | | Time-to-market |

Fonte: TONI e TONCHIA, 2001

For the supply chain or networks approach, researches developed by the *Council of Logistic Management* (1995, p. 220) identified that the number of indicators usually used by world class companies to evaluate logistic performance have been growing, and there is a tendency to establish systems that embrace five areas of performance: assets, costs, consumer service, people quality and productivity and; equipments.

Beamon (1999) argues that choosing performance measures is a critical step to the project and evaluation of any system. The bigger and more complex a system becomes, the greater is the necessity to obtain effective measures. Therefore it is quite difficult, the author emphasises, to analyse a chain or network. Different organizations are working in new measures to be generalized into the chain. One example of this initiative are the metrics suggested by a consortium between industries and academics with the objective of facilitating the communication between partners in the chain – Box 6 (CLM, 1995, p. 239).

Box 6 – Integrated Metrics Model for Supply Chains

| Kind of Metric | Outcoming Metrics | Diagnostic metrics |
|-----------------------|---|---|
| Consumer satisfaction | Perfect fulfillment of demand and wishes of costumers. | Delivering in due time; guarentee costs; discounts and returns; costumer doubts and reply time. |
| Quality | Product Quality | Specific for each industry |
| Time | Time for order full | Cycle time for doing or buying; Chain response time; Production plan result. |
| Cost | Supply total costs | Value-added productivity |
| Assets | <i>Cash-to-cash cycle time; inventory days-of-supply; asset performance</i> | Prevision Prediction; Stock Age; Capacity utilization. |

Source: COUNCIL OF LOGISTIC MANAGEMENT, 1995, p. 239

According to Beamon (1999), different types of metrics are used to chain performance evaluation (Box 7). But only two are more used: cost and consumer response.

Box 7- Types of metrics to chain performance evaluation

| Metrics | Authors (Year) |
|-----------------------------|------------------------------|
| Cost | Cohen and Lee (1988) |
| | Cohen and Lee (1989) |
| | Cohen and Moon (1990) |
| | Lee and Feitzinger (1995) |
| | Pyke and Cohen (1993) |
| | Pyke and Cohen (1994) |
| | Tzafestas e Kapsiotis (1994) |
| Cost and time activity | Arntzen <i>et al.</i> (1995) |
| Cost and consumer response | Altiok and Ranjan (1995) |
| | Christy and Grout (1994) |
| | Cook and Rogowski (1996) |
| | Davis (1993) |
| | Ishii <i>et al.</i> (1988) |
| | Newhart <i>et al.</i> (1993) |
| | Towill (1991) |
| | Towill <i>et al.</i> (1992) |
| Wikner <i>et al.</i> (1991) | |
| Consumer response | Lee and Billington (1993) |
| Flexibility | Voudouris (1996) |

Source: BEAMON, 1999

Beamon (1999), also states that despite other measures have already been identified for supply chain evaluation, they have not been used due to its qualitative nature. For example: customer satisfaction, information flow, suppliers performance and *risk management*.

Some studies have already been developed in the agribusiness field aiming to identify how the chains of that field reaches competitiveness and how it is measured.

Pereira (2003), concluded that in the poultry supply chain in Brazil, do not have a performance model or measures that cope with the all chain. Most of the measures

adopted are operational and financial, which is contrary to the above mentioned tendencies.

Carona (2004), studying the soy bean chain in Brazil, corroborates with the types of indicators and further concludes that they are not shared, remaining when existing, individual.

Is interesting to observe that Lucht (2004), was able to apply a more complete model of performance measurement in the automotive industry. The used model, developed by Brewer and Speh (2000) and based in the Balanced Score Card, included four perspectives: financial, costumer, internal process and learning. However we were not able to find any study with this broaden perspective in the agribusiness field.

Conclusions

Considering the above mentioned studies, despite the companies are more and more willing to adopt collaborative strategies, the performance measurement systems and metrics, do not follow the tendencies. The innovative approach mentioned by Tonia and Tonchia (2001) have all the characteristics of the network philosophy were relationships are developed aiming the long term results for all the participants.

The models presented in the reviewed literature seem to cope with the needs of supply networks, where the relationships have a prevailing importance in the collaborative strategy. Precisely when it comes to relationships, performance indicators should not be mainly financial and operational. On the contrary, it should focus the new innovative approach: value based, costumer oriented, long term oriented, prevailance of group measures and process measures.

Another aspect mentioned by the reviewed literature is the sharing of such measurements, which impacts in the group approach. But it seems that in the agribusiness field the trust needed to share information is hard to be conquered.

Further studies could consider the development of a performance model based on the Fast Diagram of Development and Maintenance of Supply Networks Relationships since it would generate non financial and operational metrics if the step by step of the process is adopted.

Note: The present paper is part of a research sponsored by Conselho Nacional de Desenvolvimento Científico e Tecnológico – CNPq.

References

ABEF – Associação Brasileira de Exportadores de Frango. Relatório Anual, 2005.

Disponível em www.abef.com.br, acesso fev/2007.

AZEVEDO, P. F.; et al. Diagnóstico, tendências e perspectivas para a cadeia agroindustrial de avicultura de corte: o caso da macrorregião de Ribeirão Preto. In: PAULILLO, L. F; ALVES, F. C. Reestruturação agroindustrial, políticas públicas e segurança alimentar regional. São Carlos: EDUFSCAR, 2002.

BATALHA, M.O. (coord.) Gestão Agroindustrial: GEPAI: Grupo de Estudos e pesquisas agroindustriais. Vol. 1, 3ª ed. São Paulo: Atlas, 2001.

BEAMON, B. M. Measuring Supply Chain Performance. International Journal of Operations Production Management. v. 19, nº 3, p. 275-292. 1999.

- CANEVER, M. D. Competitividade Relativa entre as Cadeias de Carne de Frango Brasileira e Argentina. Viçosa., UFV, 1997 (Dissertação de Mestrado).
- CARONA, N. F. Gestão De Relacionamentos Em Redes De Suprimentos - Um Estudo De Caso Na Rede De Soja No Brasil. São Paulo, FGV-EAESP, 2004 (Dissertação de Mestrado).
- CARONA, N. F. e CSILLAG, João Mário. Relações de Poder numa Rede de Suprimentos: Caso Soja. Anais do VII Simpósio de Administração da Produção, Logística e Operações Internacionais – São Paulo: 2004.
- COUNCIL OF LOGISTIC MANAGEMENT. World class Logistics: the Challenge of Managing Continuous Change, CLM, Oak Books, IL, 1995, 423 p.
- DE PAULA, S. R. e FAVARET FILHO, P.,: “Panorama do Complexo Soja”, BNDES Setorial N° 8, pp. 119-152, Setembro de 1998.
- DE TONI, A. e TONCHIA, S. Performance Measurement Systems. International Journal of Operations & Production, v. 21, n° 1, p. 46-70. 2001.
- DYER, Jeffrey; KALE, Prashant and SINGH, Harbir. Strategic Alliances Work. MIT Sloan Management Review. Summer 2001; pp.37-43.
- DWYER, F. R., SCHURR, P. and OH, S.; Developing Buyer-Seller Relationships. Journal of Marketing, vol. 51, 1987, p.p. 11-27.
- HARLAND, C. M.; LAMMING, R., ZHENG, J., JOHNSEN, T.; A Taxonomy of Supply Networks. Journal of Supply Chain Management, Vol.37, Issue 4, Fall 2001, pg.21.
- HOBBS, J. e YOUNG, L.; Closer Vertical Co-ordination in Agri-food Supply Chains: a conceptual framework and some preliminary evidence. Supply Chain

Management: An International Journal. Vol.5. N.3 .2000. pg.131-142.

LAMBERT, Douglas M., COOPER, Martha C., PAGH, Janus D. Supply chain management: Implementation issues and research opportunities. International Journal of Logistics Management. 1998. Vol. 9, Iss. 2; p. 1.

LUTCH, R. R. Desempenho de Cadeias de Suprimento no Ambiente de Negócios da Era Digital: um estudo dos elos da indústria de autopeças brasileira. São Paulo, FGV-EAESP, 2004 (tese de doutoramento)

MARTINS, S. S. Cadeias Produtivas do Frango e Ovos: Avanços Tecnológicos e sua Apropriação. São Paulo, FGV-SP, 1996 (Tese de Doutorado).

MENTZER, J., DeWITT, W., KEEBLER, J., MINS.; Defining Supply Chain Management. Journal of Business Logistics. Vol. 22, Issue 2, 2001, pp. 1-25.

NICOLAU, J. A. A organização das cadeias agroindustriais de arroz irrigado e frango de corte: uma abordagem de custos de transação. São Paulo, FEA – USP, 1994. (Tese de Doutorado).

PEREIRA, S.; Gerenciamento de Cadeias de Suprimentos – Análise da avaliação de desempenho de uma cadeia de carne e produtos industrializados e frango no Brasil. São Paulo, FGV-EAESP, 2003 (tese de doutoramento).

PINAZZA, L. A. e ALIMANDRO, R. (orgs.) Reestruturação no Agribusiness Brasileiro: agronegócios no terceiro milênio. Rio de Janeiro: Associação Brasileira de Agribusiness, 1999, 280 p.

SAENZ, C.A.G. A cadeia agroindustrial do frango - Coordenação do sistema - A experiência em duas áreas da América Latina: Panamá e São Paulo - Brasil. São Paulo, Departamento de Administração FEA –USP, 1996. (Tese de Doutorado).