

## Quality Management in Supply Networks: The Production Chain of the Baby Fashion Cluster in the State of Parana / Brazil

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**Abstract.** The study of the clusters is of interest in the academic research due to their specific characteristics. The objective of this research is to analyze the quality management system in the production chain of the baby fashion cluster in the county of Terra Roxa, State of Parana, Brazil. We made a survey research with descriptive approach involving all the manufacturers of the cluster, using questionnaires with closed questions. The results showed that no matter their products are considered of good quality in Brazil and the manufacturers of this baby fashion cluster see quality as an important instrument to be competitive, just a part of them use quality management system and basic quality tools to improve their production processes.

**Keywords:** Cluster, Quality, Networks, Supply Chain, Baby Fashion

### 1 Introduction

The quality management system and the basic quality tools are being used as a strategy to be competitive in an increasingly globalized world of constant technological and market changes [1]. In parallel, new forms of organizational arrangements are emerging, such as the interorganizational networks, subject of much research in the last decades [2], [3].

The interorganizational networks can be understood as a system of interdependent organizations, involving production, distribution and use of goods and services. These networks are central themes in organizational theory, consisting of a way to regulate the interdependence of complementary systems, such as production, research, engineering and coordination, differently than the analysis of individual companies [4], [5].

In this context, the study of clusters, a group of companies in the same industry, which develops similar activities, are highlighted in the academic literature, given that the main objective is to expand collective efficiency gains, understood as competitive advantage derived from local external economies and joint action among the actors that make up the clusters [1], [5], [6].

The clusters have numerous emerging challenges due to the changes observed in the industrial production, especially with the inclusion of new technologies, management processes, communication and control systems in the network [3], and also with the quality in the supply chain linked to the manufacturing processes. To overcome these challenges studies were made, tools were developed, and techniques were directed to improve processes to meet the needs required by the customer [7]. The research made by Lau [8] confirms that the use of quality tools have positive results in the development of processes and efficiency of performing activities.

The main objective of this research is to analyze the quality management system in the production chain of the baby fashion cluster in the county of Terra Roxa, State of Parana, Brazil.

It is inferred that when there is quality management system in the companies of the interorganizational network, as well as in their supply chains, the clusters become more competitive, allowing local and regional growth [1], [8].

### 2 Theoretical Background

## 2.1 Quality Management System

Quality is a philosophy which aims at the elimination of rework. The "zero defect" program of quality is a tendency in many organizations that want to stay in the market with profits, because the customers are being each time more rigorous and conscious of the power they have, choosing products/services that match to their level of expectations [9], [10].

The quality must be seen based on two points of view: the one of who produces, and the one of who consumes. The quality management process aims to direct all actions of the production process for the full customer service, through the elimination of losses, elimination of the causes of losses, and process optimization. The determinants of quality are the project, the conformity, the usability, and the customer service after delivery. [11], [12].

The modern quality management system, such as **Statistical Process Control (SPC)** and **Total Quality Control (TQC)**, gives more attention to prevent errors than to their identification after the occurrence. Currently the business community demonstrates a broad interest in improving the quality and the competitiveness [1], [8].

### 2.1.1 Standardization and Quality Certification

Although in its origin the standardized systems of the quality area have been prepared by governments and military organizations, this kind of norm quickly spread in the environment corporate [13].

The ISO 9000 series of standard (NBR 9000 in Brazil) is of special interest because it focuses on implementing a quality management system by companies and other organizations [14].

## 2.2 Quality Tools

Developed by Kaoru Ishikawa, from Japan, the quality tools serve as a support for decision-making and solving certain quality problems [7].

The quality tools are: **Ishikawa diagram or diagram of cause and effect** - The diagram allows to view the relationship between the causes and effects; **Check list** - for registration of everything that was verified in a process; **Flowchart** - to order the sequence of steps; **Histogram** - column charts that show how often a certain value or group of values occurred; **Pareto diagram/graph** - to see and identify the causes and/or most important problems; **Scatter plot** - to identify the relationship between two variables; **Process control graphics** - to check if a process is in control.

In order to improve the working conditions and create a favorable environment to work, making it highly stimulating so that people can turn their potential into achievement, it was created the quality tool called the **5S**: *seiri, seiton, seisou, seiketsu e shitsuke* [15].

## 2.3 Clusters of Production

Due to the complexity of the competition of the modern days [1], organizations cannot compete alone, but in networks. An interorganizational network is made up of interdependent organizations systems involved in the production, distribution and use of goods and services [16], [17], and the interest of the study is in the nodes (lines or edges), that is the relationship that interconnects the actors.

Porter [1] and Amato Neto [5] define interorganizational networks as the method of organizing economic activities and/or inter-firm cooperation.

A cluster is an agglomeration of a considerable number of companies, in an area especially enclosed, with clear profile of expertise, in which trade and inter-firm specialization are substantial.

This geographical proximity of manufacturers of the same production chain facilitates the process of generation and dissemination of knowledge that is relevant to the development of collective efficiency among the economic actors [5], [7].

Clusters and interorganizational networks have no owners, formal executives, employees nor agents, do not pay taxes and have no addresses. They should be perceived as "system", with organizations interacting with each other, and the result of these interactions is a remarkable ability to compete, resulting in competitive advantage for the economic geography of the region. [5], [7].

### 3 Methodology

The research was made in the county of Terra Roxa, state of Parana, Brazil. Using secondary data, the members that compose the production chain of the baby fashion cluster were identified. After that, we made a survey research with descriptive approach [17], [18], [19], [20], involving all the manufacturers of the cluster, using a questionnaire with closed questions.

We sent an email to each manufacturer explaining the survey; the next day we sent the questionnaire by email, and two days later we got in touch with them by email to check whether they received the questionnaire, if there was any doubt and asking to arrange a meeting to personally collect the questionnaires.

The results obtained in the questionnaires were tabulated and processed using descriptive statistics [21].

The questionnaire aimed to analyze the quality control, the basic tools for quality improvement, and the quality certification of the production chain of the baby fashion cluster. The quality control of the suppliers and partners (outsourced) was also investigated.

The sample size of the population was composed by 19 manufacturers, characterized by 26% micro enterprises, 53% small enterprises and 21% medium to big enterprises.

### 4 Results and Discussion

This research analyzed the quality management in a supply network that is a new direction and a hotspot of the industrial cluster theory [22].

The county of Terra Roxa was a big producer of coffee until the 70s, when the collapse of this agriculture activity forced their people to look for alternatives to survive. One entrepreneur established the first factory to produce baby clothing, and others entrepreneurs seeing his success imitated him, establishing new factories, and so the baby fashion cluster emerged [23].

In February 2005 the baby fashion cluster impacted the competitiveness, creating new jobs in the companies that belonged to this segment. Currently 19 (nineteen) companies belong to this cluster operating as manufacturers, 7 (seven) companies as factions, and 2 (two) companies as service providers, totaling 28 (twenty eight) companies. The sector of baby fashion in Terra Roxa has also 250 (two hundred and fifty) individual micro entrepreneurs (IME) working on their own.

The baby fashion cluster production chain consists of suppliers, manufacturing industries, outsourcing, distributors and retail stores. Fig. 1 shows the entities involved, which are called "nodes" of the cluster supply chain, as well as "links" (the relationship, the flow of goods, financial flows and information) among the entities of the network.

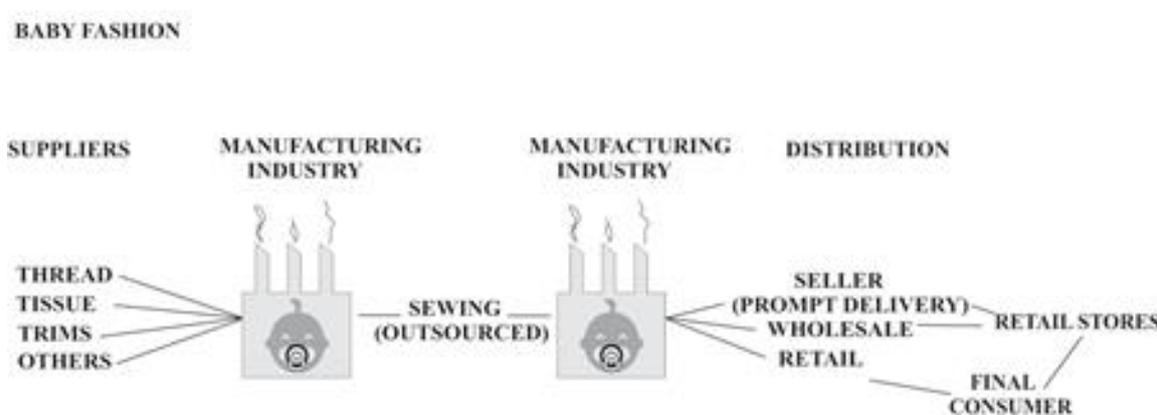


Figure 1: Baby fashion cluster production chain (Source: Authors).

The survey revealed that from 19 (nineteen) manufacturers analysed, 57.9% supply retail and wholesale, 26.3% supply retail, distributor and wholesale, 5.3% supply wholesale and distributor, and 10.5% supply retail, as shown in Fig. 2.

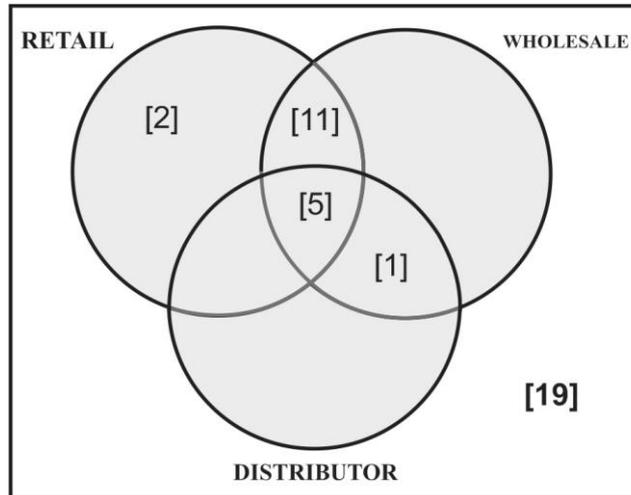


Figure 2: Production members and their distribution channels (Source: Authors).

We found that 52.6% of the respondents also sell their products to the final consumer.

#### 4.1 Analysis of the Cluster Quality Control

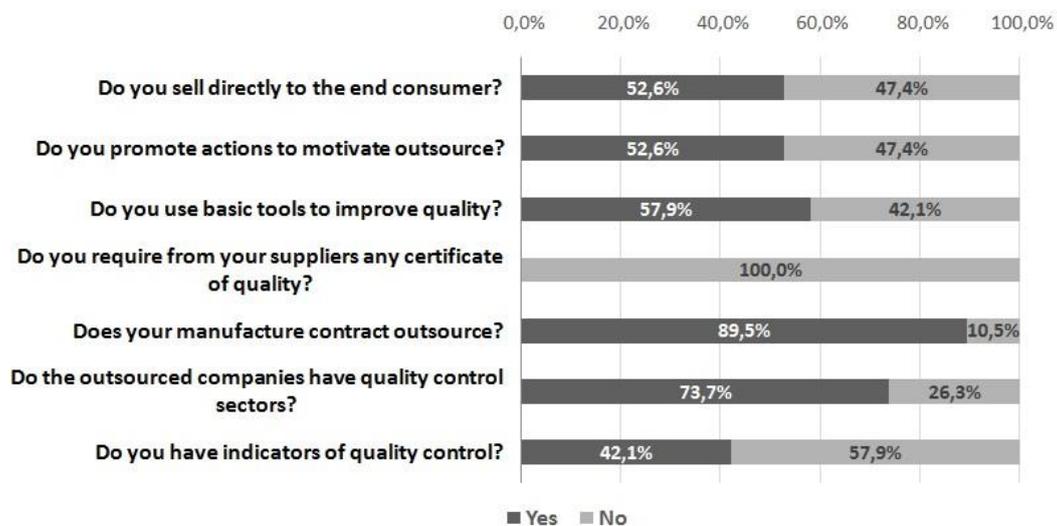
In the cluster studied 89.5% hire outsourced services to process their products, and from this amount, 52.6% utilize actions to motivate their partners (outsourced).

The research revealed that 73.7% of the partners (outsourced) have a sector responsible for the quality, and the cluster production members do not require any certificate of quality from their suppliers.

Another important aspect in relation to the quality control is the perception of the end consumer satisfaction; the survey revealed that 57.9% of the respondents do not have this indicator control.

The statistic with the answers of the respondents is presented in Figure 3.

In relation to the quality control employed by the manufacturers and the use of a **quality management system**, the research showed that 42.1% do not use any quality management system indicator to control quality in the shop floor, only 5.3% use the Statistical Process Control (SPC), 10.5% use the Total Quality Control (TQC), and the remaining 42.1% use informal quality management system, or other form of control.



**Figure3:** Statistic of the data presented by the survey (Source: Authors).

From the total manufacturers of baby clothes, only Manufacturer 1 (one) uses a combination of that quality management system to control its process, as it can be seen in Table 1.

**Table1:** Manufacturers that use a formal quality management system (Source: Authors).

Quality Control	SPC	TQC
Manufacturer 1	X	X
Manufacturer 9		X

It is worth noting that no manufacturer had a quality certificate such as the standard ISO/NBR 9000 series to base the management of the quality system.

In regard of the use of some of the basic **quality tools** for improving the quality system, 42.1% did not use any of these tools, 21.1% used the 5S, and 21.1% used the checklist. The quality tools, such as histogram, Pareto chart, Ishikawa diagram and Scatter Plot were mentioned only once by the respondents. The process control chart was used by 21.1% of the respondents. Table 2 shows the manufacturers that use more than one quality tool (31.6% of the total of the survey), distinguishing the manufacturer 13 (thirteen), that made great use of these tools for quality improvement.

**Table 2:** Basic tools for quality improvement used by manufacturers (Source: Authors).

Basic Tools	5S	Check List	Histogram	Pareto Chart	Ishikawa Diagram	Process Control Chart	Scatter Plot
Manufacturer 1	X		X			X	
Manufacturer 6		X				X	
Manufacturer 7	X						
Manufacturer 11	X	X				X	X
Manufacturer 13		X		X	X	X	
Manufacturer 14	X	X					

To check the quality management system and the quality tools in the production chain of the baby fashion cluster of the county of Terra Roxa, we asked to the manufacturers participants of the survey if their **supply chain** uses some **quality management system**. The survey revealed that 73.7% did not know this information, 15.8% said that their suppliers had no formal quality management system, and 10.5% said that they used informal quality management system. The Manufacturer 1 (one) said that its suppliers used the 5S, SPC and the TQC, and the Manufacturer 12 (twelve) informed that its suppliers used the 5S.

With regard to the **certification** of the **suppliers**, the survey revealed that 73.7% of the respondents did not know if their suppliers had any certificate of quality, and the other 26.3% said that their suppliers did not have this certification. In reality, 100% of the respondents did not require any certificate of quality from their suppliers.

## 5 Conclusion and Outlook

The objective of this research was to analyze the quality management system in the production chain of the baby fashion cluster in the county of Terra Roxa, State of Parana, Brazil, as the quality of their products are considered good by the Brazilian and foreign consumers.

We made a survey research to collect the data, which indicated that in the quality management system, the basic quality tools for improving the production process are present in 57.9% of the members of the baby fashion cluster; however, only 42.1% have some quality control indicator.

In respect to the outsourced (partners), the respondents said that 73.7% have a sector responsible for the quality, but no formal certificate is required from them.

It is worth noting that the manufacturers that participated of this research mentioned that the main factor to be competitive in the baby fashion market is to have a good quality. They agree that the quality control applied in interorganizational networks and their supply chains is of utmost importance, as it contributes

to improve operational processes, and allows them to be more competitive, supplying products of quality and reaching the customer satisfaction.

Just a part of the manufacturers is using the full potential of the quality system management to control their processes, and so being able to guarantee the production of products accordingly to the quality required by their customers, with minimum defeats, at competitive costs. The other part does not have control over the process or over the suppliers, and so they may lose competitiveness.

We hope that, with the feedback of this research, the manufacturers of the baby fashion cluster in the county of Terra Roxa can see the importance and the need to improve their quality management system, in order to be more competitive in an increasingly globalized world of constant technological and market changes.

For further researches, we suggest in-depth study to check what quality tools are more adequate to increase productivity to this baby fashion cluster, a limitation of this study.

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## References

1. Porter, M.: Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*.vol.14, p.15 (2000).
2. Tilahun N., Fan Y.: Transit and Job Accessibility: an Empirical Study of Access to Competitive Clusters and Regional Growth Strategies for Enhancing Transit Accessibility. *Transp. Policy* vol. 33, pp.17-25 (2014)
3. Huggins R., Izushi H.: Competition, Competitive Advantage and Clusters: The Ideas of Michael Porter. Oxford University Press (2011)
4. Lima E. M. M.; Pona J, G.A; Sacomano J, B. Reis, J, G, M; Lobo D. S.: Relationships and Centrality in a Cluster of the Milk Production Network in the State of Parana/Brazil. *IFIP Advances in Information and Communication Technology* 459, pp.11-19 (2015)
5. Amato Neto J.: *Gestão de Sistemas Locais de Produção e Inovação (clusters/APLS): um Modelo de Referencia*. Sao Paulo: Atlas (2009)
6. Roy, R. B., Sarkar U. K.: Identifying Influential Stock Indices from Global Stock Markets: A Social Network Analysis Approach. *Procedia Computer Science*. 5, pp.442-449 (2011)
7. Reis, J. G. M.; Neto, M. M.; Vendrametto, O.; Costa Neto, P. L. O.: *Qualidade em redes de suprimentos: a qualidade aplicada ao supply chain management*. Sao Paulo: Atlas (2015)
8. Catherine Y. Lau, M.D.: *Quality Improvement Tools and Processes*. *Neurosurg Clin N Am* 26, pp.177-187 (2015)
9. Costa Neto, P. L. O; Canuto, S. A.: *Administracao com qualidade: conhecimentos necessarios para a gestão moderna*. Sao Paulo: Blucher, (2010)
10. Macchion, L.; Moretto, A.; Caniato, F. Caridi, M.; Danese, P. Vinelli, A.: production and supply network strategies within the fashion industry. *Int. J. Production Economics*, 163. pp.173-188 (2015)
11. Garvin, D. A.: *Managing Quality: The Strategic and Competitive Edge*: The Free Press (1988)
12. Teboul, J.: *Managing Quality Dynamics*. New York: Prentice Hall (1991)
13. ABEPRO – Associação Brasileira de Engenharia de Producao, <http://www.abepro.org.br> (2015)
14. Gil, A. L.: *Auditoria da Qualidade*. 3.ed. Sao Paulo: Atlas (1999)
15. Silva, J. M. da.: *O ambiente da qualidade na prática 5S*. Belo Horizonte: Fundação Christiano (1996)
16. Lazzarini, S. G.: *Empresas em rede*. Sao Paulo: Cengage Learning. (2008)
17. Wäsche H.: *Interorganizational Cooperation in Sport Tourism: A Social Network Analysis*, *Sport Management Review*. (2015)
18. Mohammadi H. K., Hosseinzadeh M., Kazemi A.: Women's Position in Intra Organizational Informal Relationship Networks: An Application of Network Analysis Approach. *Procedia – Social and Behavioral Sciences*. 41, pp.485-491 (2012)
19. Hahn, M. H., Lee C., Lee D. S.: Network Structure, Organizational Learning Culture, and Employee Creativity in System Integration Companies: The Mediating Effects of Exploitation and Exploration. *Contents in Human Behavior*. 42, pp.167-175 (2015)
20. Shao J., Zhang J., Guo B.: Research on the Influencing Factors of Customer Referral Behavior Based on Social Network -Application in the Catering Industry. *Journal of High Technology Management Research*. 25, pp.163-171 (2014)
21. Locklear, T. M. A descriptive survey research study of the student characteristics influencing the four theoretical sources of mathematical self-efficacy of College Freshmen. *Theses and Dissertation-Science, Technology, Engineering and Mathematics (STEM) Education* (2012)

22. Min, Z.; Feigi, D.; Sai, W. Coordination game model of co-opetition relationship on cluster supply. *Journal of Systems Engineering and Electronics* 19, pp 499-506 (2008)
23. Willers, E. M.; Lima, J. F. de; Staduto, J. A. R.: Desenvolvimento local, empreendedorismo e capital social: o caso de Terra Roxa no estado do Parana. *Interacoes, Campo Grande*, v.9, n1, pp. 45-54 (2008)