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THEORETICAL MODEL OF INTELLECTUAL CAPITAL FOR THE REVERSE LOGISTICS POST-SALE PROCESS: Case of Refrigeration Appliances

MODELO TEÓRICO DE CAPITAL INTELECTUAL PARA O PROCESSO DE LOGÍSTICA REVERSA DE PÓS-VENDA: Caso de Aplicação em Refrigeradores

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ABSTRACT

This article aims to present a theoretical conceptual model of intellectual capital for the process of reverse logistics of refrigeration appliances. In this way, the research hypothesis is: Isn´t there significant influence of intellectual capital in all these stages of reverse logistics aftermarket refrigerators? In this context, this research offers a systematic analysis of the literature for the development of the constructs, variables and measurable indicators, based on the method Proknow-C. A literature review was performed on four databases from CAPES in 2012 and found3748 articles, after the filtering process 73 articles remained for content analysis, from which the constructs and variables were extracted to form the theoretical model. The constructs and variables of Intellectual Capital are: Human Capital subdivided into Skills, Relational Capital in Customer Relationship Intensity and Market and Structural Capital on Organizational Structure, Process and Operational System Information. And for Reverse Logistics are: Operating Process Efficiency, Quality Process and Legislation. For each construct and its variables measurable indicators were established. Eigth indicators were established for Human Capital, nine for Structural Capital, six for Relational Capital and fourteen for Reverse Logistics post-sale. This theoretical conceptual model is applied to refrigeration appliances due to large amount of waste discarded and major environmental problems caused by having chemicals and toxic gases inside it that act directly on the greenhouse effect. Therefore, to occur all these aspects the organization needs to enhance the skills of intellectual capital in their activities to provide a more efficient process, and adding value, even increase the competitive advantage of the company to the market.
Key Words: Indicators; Intellectual Capital; Reverse Logistics; Refrigerators.

RESUMO

Este artigo tem como objetivo apresentar um modelo teórico conceitual de capital intelectual no processo de logística reversa de pós-venda de refrigeradores. A fim de responder a hipótese da pesquisa: há influência

significativa do capital intelectual em todas essas etapas do processo de logística reversa de pós-venda de refrigeradores? Esta pesquisa trata de uma análise sistemática de revisão de literatura para construção dos constructos, variáveis e indicadores mensuráveis, com base no método Proknow-C. A revisão de literatura foi realizada em quatro bases de dados do portal da CAPES em 2012, encontrando 3748 artigos, realizado as filtragens pelo método aplicado, restaram para análise de conteúdo 73 artigos, os quais foram analisados e retirados os constructos e variáveis para o modelo teórico. Os constructos e variáveis encontrados para Capital Intelectual foram: Capital Humano subdividido em Competências, Capital Relacional em Relação com o Cliente e a Intensidade de Mercado, e Capital Estrutural em Estrutura Organizacional, Processo Operacional e Sistema de Informação. E para Logística Reversa foram: a Eficiência do Processo Operacional, Qualidade do Processo e Legislação. Para cada constructo e suas variáveis foram estabelecidos indicadores mensuráveis e apresentando uma definição própria a respeito de cada um dos elementos. Para Capital Humano foram estabelecidos oito indicadores, o Capital Estrutural em nove, o Capital Relacional em seis e a Logística Reversa de pós-venda em 14 indicadores mensuráveis. O processo de logística reversa de pós-venda baseado para a aplicação deste modelo teórico conceitual é o dos refrigeradores, devido a grande quantidade destes resíduos descartados e aos grandes problemas ambientais causados, por possuírem componentes químicos e tóxicos, no seu interior que atuam diretamente no efeito estufa. Portanto, para que ocorram todos esses aspectos a organização precisa potencializar as competências do capital intelectual em suas atividades para proporcionar uma maior eficiência no processo, além de agregação de valor, até mesmo aumentar a vantagem competitiva da empresa ao mercado.
Palavras- chave: Indicadores; Capital Intelectual; Logística Reversa; Refrigeradores.

OVERVIEW

Intangible assets are highlighted since the middle of the 80's, with two economic forces related one each other: first, the business competition driven by trade globalization and deregulation in key sectors; second, the coming of information technologies (PACHECO, 2005).

Due to the relevance of intangible assets and their incidence in business, this research pays special attention to the assets which form the intellectual capital of firms.Following Peter Drucker's view on intellectual capital, we sought to analyze elements involved in value generation of organizations (GRACIOLI, 2005).

For Stewart (1998), the intellectual capital corresponds to the set of knowledge and information found in organizations, which adds value to products and/or services under intelligence applying rather than monetary capital to the enterprise.

The ability of a company to manage its intellectual capital tends to be increasingly important in the quest for competitiveness and better organizational performance. Is this asset, which enables companies to develop new products and services to meet ever-changing needs. Due to the rapid development of technology and the accelerating obsolescence of products, especially electronics, have a life cycle shrinking, thus generating a huge amount of disposable waste, causing major environmental problems.

The consumer electronics industry has established throughout the years a competition pattern based on the launch of new products by focusing on technology, design and added features by shortening the average life cycle of their products. For example, it is common for a consumer to purchase a new cell phone even when the old one is still in full operation. Such behavior results in the creation of a growing used electronics market, where the equipment is

still functioning informally sold or donated for reuse. This creates what we call a second life for electrical and electronic equipment which sometimes extends to a third, fourth or fifth life (INVENTTA, 2012).

Refrigeration appliances are among the equipment that represent the largest share in residential electric energy consumption in Brazil.Increasing the efficiency of energy consumption by providing the same service provides both environmental and economic advantages: saving natural resources, reducing the potential for environmental degradation and the need for investments in the expansion of the electric energy generation (MELO and JANUZZI, 2008).

At the end of their life, these products become electrical and electronic equipment waste (EEEW).Ideally, they only reach to this point once all possibilities of repair, upgrade or reuse have been exausted.Some of them, notably telecommunications equipment, have a shorter obsolescence cycle.In other words, due to the introduction of new technologies or the unavailability of spare parts, they are replaced - discarded - faster (INVENTTA, 2012).

Nevertheless, this global trend has generated a new profile of consumers which are more aware and concerned with environmental issues, opening an opportunity to add esteemed value to ecologically friendly products and therefore making the environment an influencing factor of competitiveness among firms.

The concept of Corporate Logistics or Business Logistics has gained room in the corporate world by taking into account the management of material, services and information flows. Also, the globalisation of the economy has generated a dynamicity in companies as never seen before, producing changes in processes and in consumer service (GUARNIERI et al., 2006).

The interest on Reverse Logistics began in the 90's, similarly to the interest of materials resource planning, when logistics professionals recognized the significant amount of costs involved in raw materials, parts, components and supplies and the need to manage them in a proper way.

Reverse Logistic comprises all of the previously described processes, but in a backward flow. According to Rogers and Tibben-Lembke (1999) Reverse Logistics is the process of planning, implementation and control of the efficient and low cost of raw materials, stock in process, finished product and related information, from the consumption to the origin point, aimed at value recuperation or proper discard for trash collection and treatment.

"After sale" or "Post-sale" reverse logistics can be characterized when there is reuse, resale as a second-line product or recycling. If well managed, it can offer firms a source of competitive advantages by means of differentiation in customer service, adding value to customers and very significant for e-commerce (OLIVEIRA, 2011).

Therefore, reverse logistics policies require trained human resources aligned with activity and new technologies development. The demand for technological innovation in order to follow legal requirements and reverse channel structuring, as an activity in which the experience is still inceptive,needs investment for human and intellectual capital grounding in order to increase economic, social and environmental sustainability, states Pacheco (2005).

Norton and Kaplan (2000) reported on a study of different companies, the book value of tangible assets was not higher than

15% of its market value, the remaining amount was allocated to intangible assets associated with knowledge, capital intellectual and human.

The evolution of new technologies and the growth of service activities has profoundly altered the structure of industrial economies. Since 1980, companies undertake an intense reflection on the value of information and recognition of intellectual capital (PIERRAT, 2000).

Numerous studies argue that spending on intangible assets are variables that significantly influence the performance of the companies says Quinn (1992), which is a real change of industrial paradigm. The companies are aware that the power of men and work organization factors is often essential to create value.

Mazars (2000) conducted a survey of 450 executives to assess their views on intellectual capital. As a result, about 90% of respondents confirmed their interest in the strategic importance of intellectual capital. Leaders are between 58% and 69% recognizing the importance of human capital in its structure. They are between 19% and 26% perceiving customer relationships as a critical variable in your organization.

Regarding this aspect, Stewart (1998), admits that to understand what the customer needs or wishes of a product and / or service. The company needs to include a group where you have logistics experts, marketing, accounting, engineering and others to build relational capital or customer capital, leaving the relationship entirely in the hands of a seller or a buyer.

Regarding this aspect, a problem arises: *How to analyze the influence of intellectual capital in the process of post-sales reverse logistics in refrigeration appliances?*

Thus the aim of this article is: *To develop a model of theoretical constructs that describe the intellectual capital and the post-sale reverse logistics in refrigeration appliances companies.*

In order to find the variables and indicators on the subject to be searched, Ensslin (2011) states that it is necessary realizer a content analysis through bibliometrics and systemic analysis, which is defined as the process used to a world view (theoretical affiliation) defined and explained by your lenses analyzing a sample of items representative of a given subject of research, aiming to highlight each lens and globally, to the established view, the highlights and opportunities (needs) of knowledge found in the sample.

RESEARCH PROCEDURES

First, we perform a bibliometric and systemic analysis related to the main studies, authors, journals and key words of the subject under investigation - reverse logistic chain *versus* intellectual capital - in the journal portal of CAPES, as well as in the scientific data bases *Web of science, SCOPUS, Science Direct and Scielo* (Brazil); in order to identify the research gaps, literature review and subject detailing, using as keywords: "*reverse logistic" and "intellectual capital"*.

Then, we develop a theoretical model from this set of constructs, each one representing essential element of the phenomenon under investigation: human capital, structural capital, relational capital and reverse logistics. These constructs will be connected through hypotheses around the relationships in between.

After this procedure, it will be verified the semantic appropriation of the proposed indicators regarding to the constructs that are

aimed to be measured. Then, it will be verified the semantic appropriation to the constructs to be measured. So, the theoretical model will undergo to judges (doctors, professor, experts in this field – nationally and internationally) for analysis in electronic sheets.

RESULTS AND DISCUSSIONS

Review of literature

The method of intervention *ProKnow-C* proposed by Ensslin et al.(2010) for the selection of a portfolio literature.

The literature review was performed in 2012. In the first search, only eight (8) articles were found, linking Intellectual Capital and Reverse Logistics, out of which only four (4) were available through Library Subscription. In this sense, we opted for performing a second search, using both keywords separately, but using the same parameters for both (subject focused on industrial engineering, knowledge management and logistics). Figure 1 shows the quantity of articles found and their respective filtering.

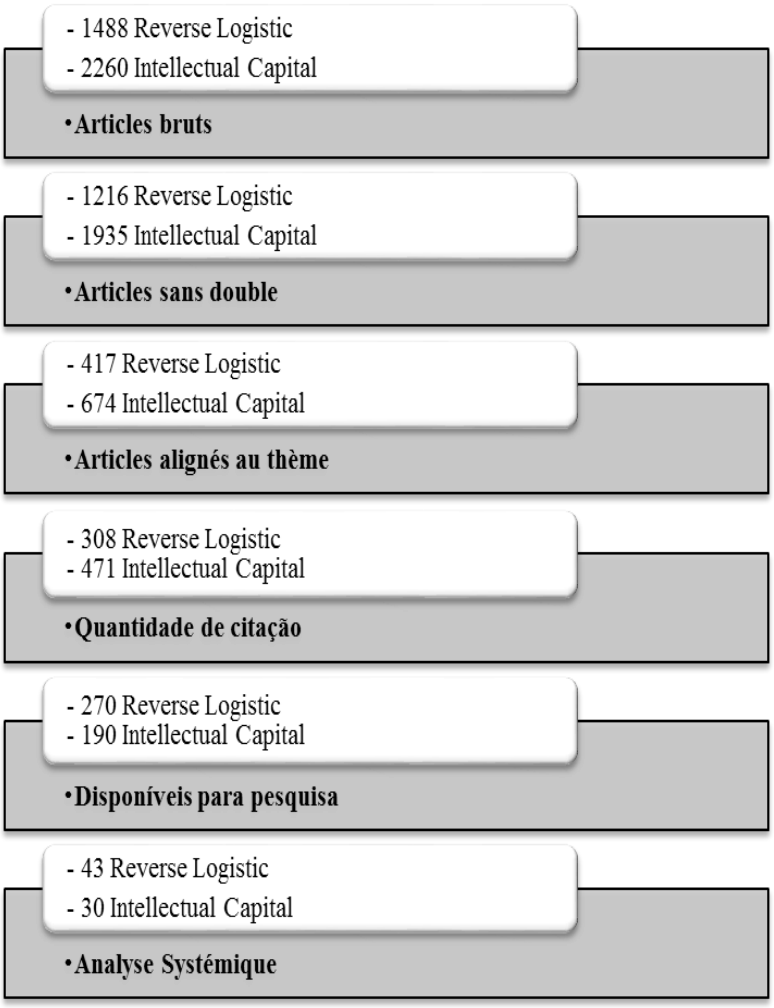


Figure 1 – Analysis and Filtering of literature review

Finally, after the detailed reading of the articles, it was found that out of the 73, only 51 articles really approached the subject of the search, 22 articles were excluded from the analysis.Yet, 27 articles were theoretical and 24 presented a case study in several companies from the metal industry, universities information technology.

The methodologies employed by the authors of these articles are bibliometric analysis, modeling, statistical analysis, case studies, *surveys,* using likert scales, analysis of variance, multiple regression and content analysis.All articles bring satisfactory results of research proposals, noting that the intellectual capital provides the added value

in the process and increases the competitive advantage of companies.In relation to the constructs, all items have definitions of research topics, which were used for the construction of the theoretical model.

Construction of the theoretical model

Intellectual Capital

Definition: Intellectual capital is the set of knowledge or information found in organizations, which adds value to the product and / or services through the application of knowledge and non-monetary capital.

Intellectual capital is often called "intangible assets" or even "invisible assets" because it is an abstract concept, difficult to define, measure and manage. It is a form of capital dynamic and not static (BONTIS, 1998), which largely depends on the social and economic value of a company (O'REGAN et al., 2000).

Expertise, training, know-how of employees are examples of intellectual capital. More specifically, intellectual capital can be defined as "the accumulation of knowledge and skills of individuals, skill, competence and knowledge embodied in the human brain" (STEWART, 1994), "the intellectual material that has been formalized, obtained and put into action to produce a most valuable asset "(Klein and Prusak, 1994) and" all recorded information that has a business and intellectual property, such as information, knowledge, intellectual property and experience that can be used to create wealth "(STEWART, 2000).

Human Capital

Definition: Human capital is considered to be the thinking being of the organization including their tacit knowledge and their skills abilities and attitudes.

Human capital is all the capacity, knowledge, skill and experience of individual workers, such as creativity, capacity for teamwork and interpersonal skills, leadership, proactive, competence, among others (EDVINSSON and MALONE, 1998).

To analyze the extent of human capital, it is necessary to define the sub-dimensions applied to the process of reverse logistics aftermarket, which is constituted by the construct: competence (savoir, savoir-faire, savoir-etre).

- Competence

Definition: all knowledge, skills, experience and training of an individual transported to the process and that can be applied to leverage the process of reverse logistics aftermarket.

MEDEF (1998) gives the following definition of competence: "Professional competence is a combination of knowledge, experience and behavior involved in a specific context. She noted during its execution in a professional situation, from which it can be validated. This is a company that belongs to locate, evaluate, validate it and make it evolve. "

Montmollin (1994) considered the jurisdiction of mental structures around which revolve all the data that the operator performs its task knowledge learned, but knowledge derived from experience and practical implementation strategies and applying knowledge to solve a problem.

The most widely accepted definition in the field of Industrial Engineering in

France is that competence is the result of the combined application of three basic components (BOUCHER et al., 1999) and (VERNADAT, 1999):

- Knowledge (*savoir*), also called "academic skills", corresponding to the knowledge acquired through training and information media;
- Know-how (*savoir-faire*), called "life skills" and based on the operational capacity and expertise;
- Relationship (*savoir-etre)*, which are individual characteristics that allow to adopt a certain behavior in a certain situation. They are mainly divided "social skills" (representing interpersonal skills, a willingness to engage collectively, etc.) And "cognitive" (mainly related to the ability to solve problems). The indicators for the construct are shown in table 1.

Table 1 - Indicators of competence

INDICATOR	DESCRIPTION
CH1	The team has the knowledge and skills necessary for performing the process
CH2	Individuals were assigned to process roles and activities according to their specialties and interests
CH3	Individuals have experience in technologies used to process
CH4	Individuals have experience in the area of application of information system developed in the process
CH5	The process of reverse logistics aftermarket has professionals trained in the knowledge of the process of interest
CH6	The individual s ability to demonstrate learning through the process of reverse logistics
CH7	Individuals to participate in the show pleased reverse logistics process

Source: Adapted from Coser (2012), Rodrigueset al.et al.(2009) e Gubiani (2011).

Structural Capital

Definition: Structural capital is understood as the organizational structure of both tangible physical form, as intangible assets consists of the skills, experience, knowledge of the company institutionalized, ie, explicit knowledge by means of information technology (IT), patents, manuals, routines , flow charts, protocols and procedures of the organization, culture and business values.

Structural capital is analyzed by the knowledge and know-how (structured), intangible and non-human organization. Considered by some authors as the part that does not think, serves as a framework that provides support for human capital. In the company, their analysis considers the part related to the infrastructure available to improve the efficiency of human capital (GUBIANI, 2011).

To analyze the extent of structural capital, it is necessary to define the sub-dimensions applied to the process of reverse logistics aftermarket, which will consist of the constructs: organizational culture, business processes and information systems.

- Organizational Culture

Definitions: *Represents aspects of organizational culture that held reverse logistics post-sales his vocation for the realization of the process and the search for the best performance.*
However, Gubiani (2011) points out that organizational culture assesses whether the institution favors the availability of knowledge in the organizational environment. Still, the literature considers the

availability of internal and external knowledge as a differentiator in the practice of innovation. The skills and knowledge embodied in physical systems and management form the culture of the company. Culture is seen as key to the development of resources and skills for innovation. The indicators for the construct are shown in table 2.

Table 2 - Indicators of organizational culture

INDICATOR	DESCRIPTION
CE1	The company understands that the process of post-sale is the proper way to organize the development of reverse logistics
CE2	The company understands the importance of the success of the reverse logistics aftermarket for its prosperity (organizational image)
CE3	The company individuals feel valued for their role in the process of reverse logistics aftermarket

Source: Adapted Coser (2012) and Gubiani (2011).

Definitions: Evaluates operational processes that promote the proper conduct of activities in the process of post-sale reverse logistics.

A process can be defined as an organized set of tasks. Capital Process is the organizational structure of a company, it is not recognizable as such and is the result of a combination of different factors, such as organizational goals and resources involved. The process must meet customer expectations, capitalizing effectively a form of organization of production and management of adequate quality (ESCAFRE, 2002).

Capital process effectively contributes to the operation of the logistics business, when it is made and used in accordance with a specific goal set by the strategic entity within the company. This goal is customer satisfaction, which is achieved when the company ensures that the capital process is supported by activities to validate and support the quality of production of goods or services (ESCAFRE, 2002). The indicators for the construct are shown in table 3.

Table 3 - Indicators of operational processes

INDICATOR	DESCRIPTION
CE4	The company uses only a standard process to be followed in conducting all returns of raw materials
CE5	The company has processes that govern the relations of individuals with external entities
CE6	The process of reverse logistics aftermarket was adapted to the organization

Source: Adapted Coser (2012).

- Information Systems

Definitions: *These represent the informatics tools that support the generation, storage and transmission of information within the company and can be applied in favor of the reverse logistics performance aftermarket.*

In order to support the reverse logistics process, the information system must take measurements to manage information relevant to each of the activities necessary for the management of returns, inventory management, production planning

and product development (RIOPEL et al. 2011).

According to Coser (2012) a framework of appropriate systems can bring enormous benefits to the organization, facilitating the flow of information, increasing operational efficiency and accelerating the learning process. The indicators for the construct are shown in table 4.

Table 4 - Indicators of information systems

INDICATOR	DESCRIPTION
CE7	Information systems provide adequate support to the execution of the process of reverse logistics aftermarket
CE8	Information systems facilitate communication and collaboration among individuals in the process of logistics
CE9	Information systems facilitate the generation and reuse of organizational knowledge

Source: Adapted Coser (2012).

Relational Capital

Definition: The relational capital is represented by customers, suppliers, shareholders, partners, alliances, partnerships, external agents, society, government, stakeholders and other interest groups to organizations that must work collaboratively.

The relational capital or customer capital, refers to the ongoing relationships with people and organizations to which companies sell their products and services (STEWART, 1998).

To Gubiani (2011) relational capital summarizes the value of all relationships of the organization. Learning occurs in different ways, the experience gained over time, sources internal and external to the organization.

For analysis of the size of relational capital is necessary to define the sub-dimensions applied to the process of reverse logistics aftermarket, which will be constituted by the constructs: customer relations and market assets.

- Relationship with the client

Definition: Describes aspects of the relationship between the client and the individuals of the process, as well as between the client company reverse logistics, which can influence the process performance aftermarket.

Rodrigues et al. (2009) explains that customer is seen as a source of new ideas and innovation, especially when directly involved in the development of solutions. For clients who are starting cash flow, thereby justifying the importance of measuring this strength and loyalty.

According to Stewart (1998) states that the connection between the organization and its environment is the element that makes it unique and how firms innovate. And customer feedback promote the renewal of knowledge involving the company more efficient and innovative. The indicators for the construct are shown in table 5.

Table 5 - Indicators of customer relationship

INDICATOR	DESCRIPTION
CR1	Established a partnership relationship with the client throughout the process
CR2	The communication channel with the client remained constantly open during
CR3	Meetings were held with the client in several points of process execution
CR4	The product has a customer relationship with the company

Source: Adapted Coser (2012) and Gubinai (2011).

- MarketAssests

Definition: Represents the company's relationship with other partner companies to exchange knowledge and competitive advantage.

This dimension mainly composed this, the value generated by the company's relationships with its customers (EDVINSSON and SULLIVAN, 1996).

Brooking (1996) calls this dimension of market assets as resources that grant the company competitive because of the potential that derives the relationship with the market.

The network of external partners, when strong and well managed creates a shield against over-confidence in the internal perspective which can disrupt the dynamics of creativity and value capture. Thus, external partners are a potential endless source of ideas and of new knowledge, enabling yet not guaranteeing the company to innovate (Rodrigues et al., 2009). The indicators for the construct are shown in table 6.

Table 6 - Indicators of market assets

INDICATOR	DESCRIPTION
CR5	The realization of the process is supported by partnerships with other organizations
CR6	Individuals process interact with other individuals from other companies or different sectors of the company in search of solutions to problems in the process of post-sale

Source: Adapted Coser (2012).

Post-SalesReverse Logistics

Definition: Process of managing and controlling the flow of materials from their point of consumption to its point of origin for the purpose of recovering value, disposal, collection and proper treatment of the products.

Thierry et al. (1995), presents the approach of reverse logistics under the name of product recovery management as: "the management of products, components and materials used or disposed that fall on the responsibility of the manufacturer. The goal of recovery management products is to remove the maximum economic and environmental value, reasonably possible product. "

The returns of products are usually associated with the after-sales service offered to retailers in order to allow the exchange or refund goods that do not meet customer expectations (RIOPEL et al., 2011).

To analyze the size of reverse logistics aftermarket, it is necessary to define the sub-dimensions applied to the process, which will consist of the constructs: process efficiency, quality of the process and laws.

- Efficiency of the process

Definition: *Evaluates the form of how the process was performed, considering the productivity of the process and adherence to the allocated resources.*

According to Coser (2012) efficiency is linked to the quality of the process, thus characterizing subjective perception of how the process of reverse logistics after sale was executed.

According to Rodriguez and Moreira (2013) agility and service quality and cost to the consumer are the main values related logistics efficiency.

In this context, this agility to react quickly to changes increases (demand / supply) in the short term. The flexibility and adaptability, the changes regarding the structures, technologies, processes, products and market strategies.The speed in delivery of products to customers.

Balou (2007) defines the level of service (efficacy) and a reasonable cost (efficiency). The concept of logistics is directly associated with the two goals of any process, efficiency and effectiveness. Achieve stated objectives and use the resources used in the process so that there is a maximization of process outputs. The indicators for the construct are shown in table 7.

Table 7 - Indicators of process efficiency

INDICATOR	DESCRIPTION
LRE1	The productivity of the reverse logistics process achieved exceeded expectations
LRE2	The processing times were well controlled and affected
LRE3	Process costs were within the expected
LRE4	The amount of product produced exceeded expectations

Source: Adapted from Coser (2012).

- Quality of the process

Definition: *Evaluates the quality as the process and the products were run, the fulfillment of requirements and customer satisfaction with the results produced.*

According Escafre (2002) there are two levels of quality assessment. The first deals with the internal quality, which is measured by the producer of goods or supplier of services and the second, the external quality that makes a subjective judgment of the client.

Therefore, the quality approach is based on the relationship between the different activities for the production of a product or a service. The indicators for the construct are shown in table 8.

Table 8 - Indicators of process quality

INDICATOR	DESCRIPTION
LRQ1	The quality of processed products exceeded expectations
LRQ2	The requirements were met by the customer
LRQ3	The customer is satisfied with the results of the process
LRQ4	Reliability is a remarkable quality of the reverse logistics process developed since worked flawlessly, without generating waste
LRQ5	The performance is a remarkable quality of the reverse logistics process developed because the response time to commands and speed of operations
LRQ6	Flexibility is a quality evident in the reverse logistics process, it must have a facility to process change in relation to our client's needs and technological changes

Source: Adapted from Coser (2012).

- Legislation

Definition: *The reverse logistics process must complain with the laws and regulations set for the recycling, reuse and remanufacturing post-sales products.*

There is a clear trend in environmental legislation towards making companies mor responsible for the entire lifecycle of their products. This means being legally responsible for their destination after the delivery of products to customers and the impact these have on the environment. A second aspect concerns the increased environmental awareness of consumers that expect companies to reduce the negative impacts of their activities on the environment. This has generated actions by some companies seeking to communicate to the public an institutional image "ecologically friendly" (Lacerda, 2002). The indicators for the construct are shown in table 9.

Table 9 - Indicators legislation

INDICATOR	DESCRIPTION
LRL1	The recycling process meets the established laws
LRL2	The reuse process meets the established laws
LRL3	The treatment process meets the established laws
LRL4	The screening process meets the established laws
LRL5	The entry process of the product the company meets the established laws
LRL6	The shipping process meets the established laws

Source: Authors own.

Semantic Analysis of the Model

Coser (2012) and Pasquali (1999) state that for the effectiveness of the survey instrument developed from the theoretical model, the quality of the definitions and the validation of the items, it is necessary to perform a semantic analysis of the theoretical model. In this research the semantic analysis, the theoretical analysis of the items was done through the analysis of expert judges.

Thus, Pasquali (1999) defines a minimum 80% agreement among judges can serve as a criterion for deciding on the relevance of the item to factor that in theory we refer.

The survey instrument was sent via *google docs* to 30 experts (national and international) in the area of Intellectual Capital and Reverse Logistics, from professors, experts, business managers, managers and consultants. Composed the sample, employees from various organizations such as BNDS, University of Toulouse, Université Paris Sud, Federal University of Santa Catarina. Which evaluated whether the proposed items referred or not the construct in question. Which evaluated whether the proposed items referred or not the construct in question. However, we obtained only 18 responses from the judges.

After the theoretical validation, in addition to modifications of items with dubious sense or lack of clarity, the total six items were excluded from the instrument to cause disagreements and lack of understanding in the majority of judges. They were: i) individuals have experiences in the technologies used in the process, ii) the process of reverse logistics aftermarket has professionals trained in the knowledge of the process of interest, iii) meetings were held with clients several points execution of the

reverse logistics process, iv) the customer's recycled product has a good relationship with the company; v) processing times were well controlled and affected vi) the company is aware that the reverse logistics process is satisfactory to organization.

And two items were added to complement the construct of human capital: i) individualsholdsknowledgenecessary for implementingreverse logistics process, ii) individualsholdsskillsnecessary for implementingreverse logistics process.

Thus the research instrument consists of 35 items, 22 for Intellectual Capital and 13 for Reverse Logistics.

The Theoretical Model

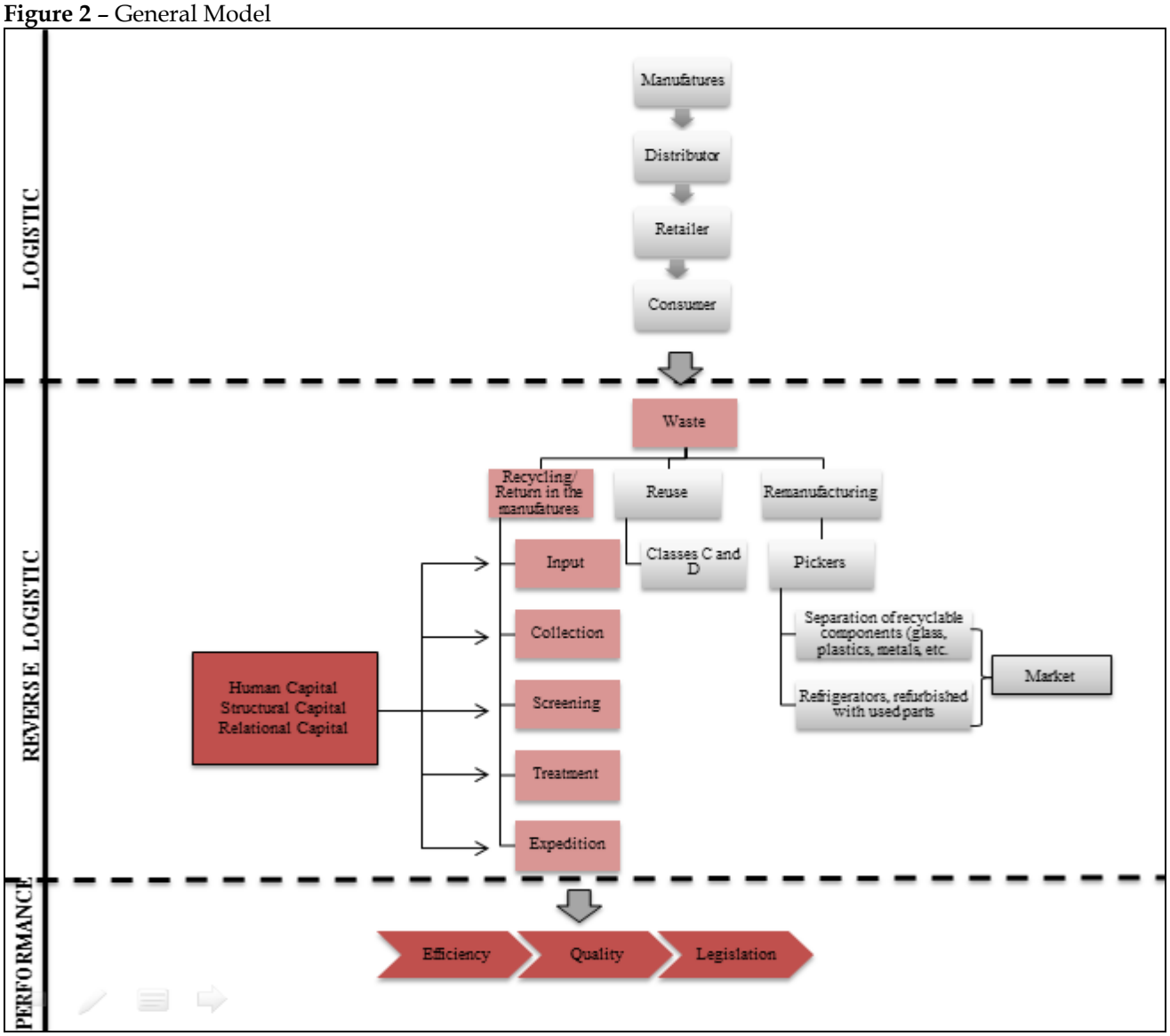
Therefore, the general architecture of the theoretical model relating the influence of intellectual capital in the reverse logistics process is presented in Figure 2. The process begins by the conventional logistic process from the factory to the end-consumer. In the refrigerator reverse logistics process, there are three stages or phases: return to the factory (recycling), reuse and remanufacture.

In this general model we opted to study the process of "return to factory", which is subdivided in entrance of the product to the factory, gathering and classification, treatment and the final dispatch. In all these processes, there are inputs from the competencies of the firm's intellectual capital (human capital, relational capital, structural capital) and outputs (performance indicators of reverse logistics in issues of efficiency, quality and compliance to legal requirements).

Chaves (2009) notes that the efficiency to have the reverse process, seeks to have reduced cycle time of the products, ie the time between the identification of the need to return the end of the process. Although the author complements that long cycle times add unnecessary cost to the process and may be caused by insufficient control inputs, lack of specialized human and physical structure and lack of clear procedures for handling exceptions.

Following the direct logistics flow (from raw materials to the consumer, ending with disposal) with appropriate returns in production that are performed by reverse logistics, this process can be measured from financial indicators (earnings, etc.), or is, measured as tangible process assets.

Figure 2 – General Model



Finally, the figure 2 shows the importance of intangible assets, from the perspective or lens of intellectual capital to add value in a process or organization. From their elements (human, structural and relational).

Thus, the variables presented in this paper will verify the possible influences of the elements of intellectual capital (human, structural and relational) and can be defined and / or seen as necessary skills knowledge to compose and interact with reverse logistics, to bring the largest company profit and efficiency in the process and thus increase competitive advantage.

Rogers, Melamedand Lembke (2012) report that there are many modeling techniques to maximize the efficiency and effectiveness of the logistics. And show new modeling techniques to improve the management of reverse logistics, to maximize their efficiency, especially with respect to a matter of cost within the organization, whether suppliers or buyers.

This interaction of intellectual capital through its elements, human capital, structural and relational, can enable the

reverse logistics of aftermarket greater efficiency in the process of collecting, package, ship, return to supplier, resell, refurbish, recycle and up the same rule. For all of the chain are interconnected.

In studies Demajorivic et al. (2012) on disposal of company communication batteries and cell phones, for example, show that the information is not integrated with the logistics channels, so as to leave consistency and effectiveness of corporate programs, such as the Nokia and Motorola. The results also indicate that companies do not perform efficiently communication management with its internal stakeholders (employees) and external (service centers, authorized distributors, operators). They also claim that it is no use just having reverse channels because they do not work correctly if the information on how to return are not fully disclosed.

But the work of Abdullah and Sofian (2012) to verify the relationship of intellectual capital and corporate performance in the Malaysian PLCs companies. The results of the general correlation analysis clearly show that all four components (human capital, structural, relational and spiritual) of intellectual capital have a significant positive impact in relation to business performance, mainly the relational capital that is most influential, followed by Spiritual capital, structural capital and human capital.

FINAL CONSIDERATIONS

In search of the literature and systemic analysis of the selected articles were not identified studies directly linking the concepts of intellectual capital and reverse logistics aftermarket. Thus, as Coser (2011) and Gracioli (2005) it was found that there are several studies that demonstrate intellectual capital as an important factor of the performance of the organization.

The conclusion is thus that the judges analysis was important and necessary to validate the theoretical model created from the literature. Because it enables the understanding and vision professionals in the area, giving greater effectiveness in the variables stipulated and creating measurable indicators to later turn into questionnaire for companies.

The model enables to identify the intellectual capital elements in the firm dimension through the analysis of the reverse logistics "after sale" or "post-sales" process, to raise conclusions of the potential of knowledge creation and of the competitive advantages of the process.

Therefore, to occur all these aspects the organization needs to enhance the skills of intellectual capital in their activities to provide a more efficient process, and adding value, even increase the competitive advantage of the company to the market.

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