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HOW MICRO AND SMALL COMPANIES TREAT THEIR SOLID WASTE UNDER FEDERAL LAW N ° 12.305/10

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ABSTRACT

Objective: The objective of this research is to investigate the influence of Federal Law No. 12,305/10 on the management of solid waste from micro and small enterprises in the Guarulhos region.

Methodology: In examining the effects of this law, the study used a descriptive and exploratory survey and qualitative data analysis. The sample consisted of forty-eight small businesses in various fields of activity in the region of Guarulhos/SP

Relevance: This goal is relevant, considering this statute established a national policy for solid waste, imposing regulations for its sorting and disposal. This regulation requires companies to dispose of their solid waste at predetermined locations.

Results: By aggregating the percentages found, we prepared an index of adherence to the legislation on solid waste management.

Contributions: The contribution of the research is based on the information of the previous studies and on the direction for solid waste management in the micro and small enterprises of the region, supporting local sustainability.

Conclusion: The aspect of the legislation, in which micro and small business in the region of Guarulhos has demonstrated a degree of suitability that is linked to lack of knowledge required by the law of solid waste.

Keywords: Reverse logistics. Solid waste. Micro and small business.

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COMO AS MICRO E PEQUENAS EMPRESAS TRATAM OS SEUS RESÍDUOS SÓLIDOS FRENTE À LEI FEDERAL N° 12.305/10

RESUMO

Objetivo: O objetivo desta pesquisa é investigar o grau de influência da Lei Federal n°12.305/10 na gestão dos resíduos sólidos das micro e pequenas empresas na região de Guarulhos.

Metodologia: Na busca deste objetivo foi utilizado o método classificado como descritivo e exploratório, levantamento que, no primeiro momento, faz uma abordagem de análise qualitativa dos dados. A amostra foi constituída por quarenta e oito estabelecimentos de diversos ramos de atividade da região.

Relevância: O tema abordado é relevante, tendo em vista que essa Lei supracitada estabeleceu uma política nacional de resíduos sólidos, classificando-os e normatizando a destinação dada a eles. Essa regulamentação obriga as empresas a destinar os seus resíduos a lugares pré-estabelecidos

Resultados: Por intermédio da totalização dos percentuais encontrados, elaborou-se um índice de adequação à legislação de resíduos sólidos.

Contribuições: A contribuição da pesquisa fundamenta-se na informação dos estudos prévios e no direcionamento para a gestão dos resíduos sólidos nas micro e pequenas empresas da região, dando suporte à sustentabilidade local.

Conclusão: Sob o aspecto da legislação, as micro e pequenas empresas da região de Guarulhos demonstraram possuir uma condição.

Palavras-chave: Logística reversa. Resíduos sólidos. Micro e pequena empresa.

COMO LAS MICRO Y PEQUEÑAS EMPRESAS TRATAN SUS RESIDUOS SÓLIDOS FRENTE A LA LEY FEDERAL N ° 12.305/10

RESUMEN

Objetivo: El objetivo de esta investigación es investigar la influencia de la Ley Federal No.12,305/10 en la gestión de residuos sólidos de micro y pequeñas empresas en la región de Guarulhos.

Metodología: Al examinar los efectos de esta ley, el estudio utilizó una encuesta descriptiva y exploratoria y un análisis de datos cualitativos. La muestra consistió en cuarenta y ocho pequeñas empresas en varios campos de actividad en la región de Guarulhos/SP.

Pertinencia: El tema es relevante, ya que este estatuto establece una política nacional para residuos sólidos, que impone regulaciones para su clasificación y eliminación. Este reglamento exige que las empresas eliminen sus residuos sólidos en ubicaciones predeterminadas.

Resultados: Al agregar los porcentajes encontrados, preparamos un índice de cumplimiento de la legislación sobre la gestión de residuos sólidos.

Aportes: La contribución de la investigación se basa en la información de los estudios anteriores y en la dirección para el manejo de los desechos sólidos en las micro y pequeñas empresas de la región, apoyando la sostenibilidad local.

Conclusión: El aspecto de la legislación, en el cual las micro y pequeñas empresas en la región de Guarulhos ha demostrado un grado de idoneidad que está vinculado a la falta de conocimiento requerido por la ley de residuos sólidos.

Palabras-clave: Logística inversa. Residuos sólidos. Micro y pequeñas empresas.

1. INTRODUCTION

Processes in the production chain that generate solid waste, plus other waste from post-use and after-sales, cause environmental impacts with harmful effects on the environment, both at the moment of disposal and in the future. Therefore, there is a growing concern about the ecological effects of solid waste disposal.

The term 'solid waste' refers to any material, substance, object, and that requires disposal. It may be composed of material from residences, trades, service, industry, or agriculture that becomes 'garbage' and needs to be treated or recycled. It has a broad range of physical, chemical, and biological characteristics that vary according to the source and can be classify according to the nature and risks of contamination of the environment.

This research aims to identify the degree of influence of Federal Law n° 12.305/10 in the way that micro and small companies in the region of Guarulhos treat their waste. This statute, enacted on 2 August 2010, established the Brazilian Solid Waste Policy (Plano Nacional de Residuos Sólidos - PNRS). It establishes and elaborates essential tools and guidelines to further advances necessary to address environmental, social, and economic problems arising from the inadequate management of solid wastes.

Mueller (2005) observes that, since the Industrial Revolution, most products are no longer handcrafted. Rather, they generally are fabricated in production lines. This process requires an increasing amount of raw material, thus generating a greater amount of industrial waste. However, Donaire (1994) points out that, in later times, environmental problems of various industries were small, due to smaller production scales and comparatively smaller populations. Ecological requirements were few; indeed, chimney smoke was a symbol of progress (as proudly proclaimed in the marketing of various industries). The worsening of ecological problems has profoundly altered this framework, generating an increasing level of demands for the reduction of emissions and other toxic effects of industrialisation (Donaire, 1994).

This view is shared by Ahorn (2006); however, this author includes in his discussion micro and small enterprises (MSEs). He states that small industries often work as subcontractors for large companies and are mainly present in sectors characterised by highly ´intense resource use – thus producing the largest share of waste. Ahorn further asserts that MSEs do much less than large companies to handle their solid waste properly. Demajorovic and Santiago (2011) corroborate Ahorn, noting that most MSEs do not adopt environmental management practices. However, Souza, Ribeiro, and Ferreira (2010) have a more optimistic view on waste disposal, emphasizing the progress that is reflected in Federal Law No. 12,305/10. Still, regardless of the size or type of company, the period of compliance to this legislation ended in 2012.

With these considerations in mind, it is important to identify the degree of influence exerted on the management of solid waste in micro and small enterprises (MSEs) based on the growing concern of society with environmental protection.

2. THEORETICAL FOUNDATION

2.1. Micro and small businesses

In Brazil, companies are categorised as micro, small, medium, and large. The criteria used for these classifications are: number of employees, billing volume, annual revenue, and net worth (Rocha & Simonetti, 2008). In the view of Quadros et al. (2012), most researchers in management consider the study of MSEs to be complicated by the extreme diversity that exists between them. This heterogeneity would explain, in part, the inadequacy of many investigations that examine MSEs, and, as well, the difficulty of proposing correct theories and conclusions. Such issues are quite different from research into larger companies. Indeed, previously, Esteves and Nohara (2011) asserted that a relevant issue to studied about MSEs is their classification itself.

The criteria and concepts used to classify the size of a company are an essential factor in supporting SMEsMSEs. They allow enterprises, within established limits, to enjoy the benefits and incentives provided in the 2010 legislation. In the same sense, Moori, Konda, and Gardesani (2011) also consider that MSEs have come to represent a significant part of the world economy, as demonstrated by their participation in the GDP of both developed and emerging countries. Their importance has grown as large companies have changed their production processes, breaking away from traditional chains and creating spaces for small businesses, even in the high-technology sectors.

According to the Brazilian Micro and Small Business Support Service (SEBRAE-SP, 2013) in Brazil, there are 5.1 million companies, of which 98% are MSEs. In Brazilian territories, several standards establish business classifications. One of them involves the company's microenterprise and small business status. In this regard, complementary Law No. 123 of 14 December 2006 is one of the most used. It references the elaboration of policies that respect the differentiated and simplified legal treatment of enterprises, as determined by the federal Constitution in its articles No. 170 and 179 (Cunha & Soares, 2010).

Table 1 below shows the criteria used by some Brazilian agencies to characterise the MSEs, taking into account annual revenues:

Table 1 - Characterization of companies by billing (MSEs Statute)

INSTRUMENT	MICRO COMPANY	SMALL COMPANY
MSE statue Annual Gross Revenue	R$ 433.755,14	R$ 2.133.222,00
MSE Statute SIMPLES	< R$ 360.000,00 to R$ 360.000,00	> R$ 3.600.000,00

Source: SEBRAE/SP, (2013)

Table 2 presents the criteria used by SEBRAE/SP (2013) to characterise MSEs, taking into account the number of employees.

Table 2 - Characterisation of the companies by the number of employees

INSTRUMENT	MICRO COMPANY	SMALL COMPANY
SEBRAE (Industries) Number of employees	Até 19	Entre 20 a 99
SEBRAE (services) Number of employees	Até 9	Entre 10 a 49

Source: SEBRAE/SP, (2013)

However, in this article, we use the number of employees determined by SEBRAE/SP (2013), as a factor of selection of the companies surveyed, since it is possible there may be some difficulty in achieving the billing value of the companies surveyed.

2.2- Business Logistics

According to the view of Slack, Chambers, Harland, Harrison, and Johnston (2011), logistics originated in the arena of world conflict (with the transfer and coordination of troops, armaments, and ammunition to selected sites). The business world places logistics as the area responsible for handling and coordinating end products. Both Ballou (2011) and Pozo (2015) assert that business logistics have various meanings for different people and entities, and that there is no specific definition yet established to identify it. The National Board of Administration of Physical Distribution of the United States understands that the logistics area is represented by a range of sectors (e.g. transportation, and supply).

Following a similar perspective, Bowersox and Closs suggest that 'logistics add value when the stock is correctly positioned to facilitate the sale' (2001, p. 21). They emphasize that logistics are aimed at providing products or services to consumers at the most optimal; thus organizations are faced with the large challenge of implementing logistic practices to fit into global competition.

Dornier, Ernst, Fender, and Kouvelis (2000) present an expanded view of logistics, suggesting that logistical flows can be subdivided into direct streams and reverse flows. The definition of logistics, they note,

> has broadened to encompass all forms of product and information movement such as empty returned packages, delivery points to the loading points; products and components sold and returned from delivery points to the initial position of storage or manufacture; used/consumed products to be recycled re-used or made available retreads. (pp. 39-40)

Therefore, an essential and fundamental element for more comprehensive work in business logistics is to evaluate the effectiveness of training on solid waste, also relating the problem to reverse flows (see also Zajac, Fernandes, David, & Aquino, 2016).

2.3- Reverse Logistics

When using the word 'logistics', one common construct considers the management of material flow, from its point of acquisition to its final stage: consumption. There is also the converse of this sequence, the *reverse logistics flow* i.e. from the point of use to an initial stage or end of acquisition (Pedrosa, 2008).

In the late 1990s, Rogers and Tibben-Lembke (1999) presented reverse logistics as:

> a process of planning, implementing and controlling the efficiency, cost-effective flow of raw materials, process inventories, finished products, and their respective information, from the point of consumption to the end of origin, with the purpose of recapturing value or adjusting its destination. (p. 2)

According to Leite (2006), the importance of the use of reverse post-consumer and after-sales channels is as a strategic objective to recapture the financial value of the goods (with resale in primary or secondary markets – utilising dismantling, remanufacturing, or recycling as an essential and strategic factor). Already in Reza's (2008) approach, reverse logistics is

subdivided into two main areas of activity, differentiated by the stage at which the product is or by the phase of the life cycle of the returned merchandise.

At the national level, Marchi (2011), in line with Federal Law No. 12,305/10, considers reverse logistics as an instrument of economic and social development, characterised by actions to facilitate the collection and restitution of solid waste to generators to be treated or reused in new products (in the form of modern inputs, in their cycle or other production cycles, aiming at reducing the generation of waste).

In the opinion of Leite (2012), reverse logistics is an area receiving a growing amount of academic and business interest. Transacted volumes, great product variety, shortened product lifecycles, increased environmental legislation, the need for companies to differentiate themselves, and the satisfaction of multiple interests all justify a major business concern in organising the return logistics of goods not consumed or already consumed and recovering sale value.

According to Engelage, Borgert, and Souza (2016), the importance of identifying reverse logistics practices is based on the growing prominence of logistics and sustainability axes. It should be noted that logistic activities occupy a prominent place in operating costs and are eminently understood throughout the production chain. Figure 1 below shows the types of reverse flow and the destination given to the products or solid waste.

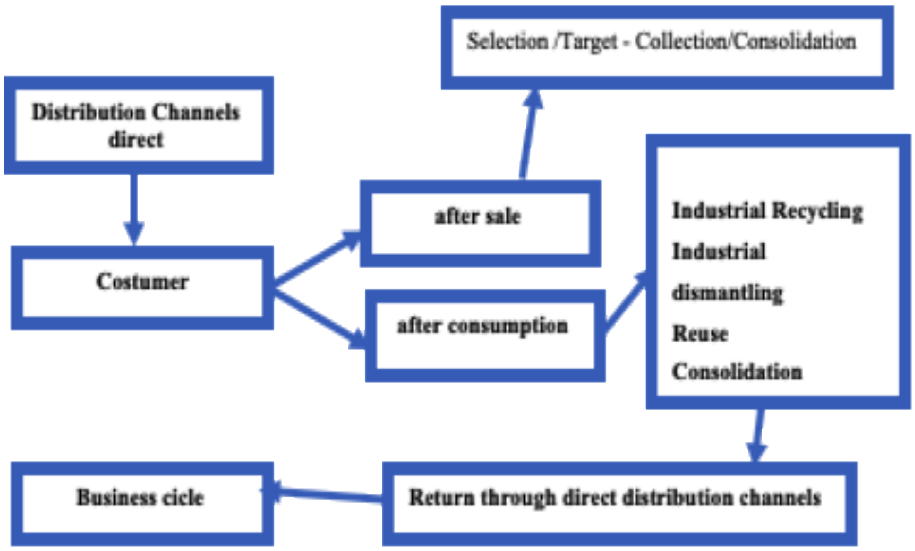

Figure 1 - Types of reverse flow
Source: Adapted from Leite (2002)

2.3.1- After-sales logistics

According to Giacobo, Estrada, and Ceretta (2003), it is necessary to bear in mind that the process of marketing a product does not end at the moment of its delivery. For several reasons, a product may present problems and, consequently must be returned to the supplier. However, Leite (2002) refers to post-sale reverse logistics (the specific area of reverse logistics that deals with the equations and operationalisation of the physical flow and logistical information corresponding to after-sales goods). Products of little utility or those that were not used by the consumer, for various reasons, these will be returned via the various links of the direct distribution chain (i.e. through the reverse channels). Figure 2 below shows the reverse logistics flowchart.

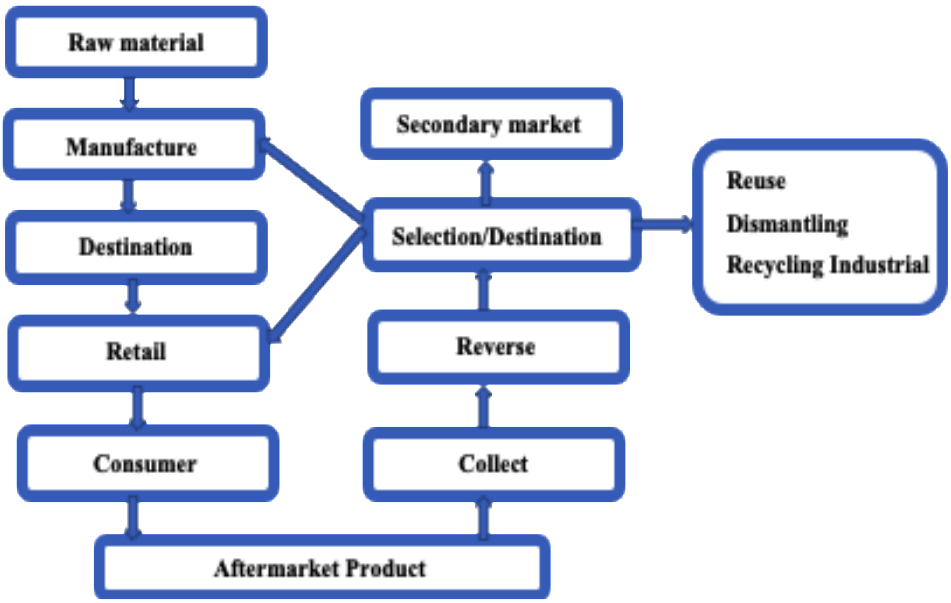

Figure 2. Post-Sale Reverse Logistic Flowchart
Source: Adapted from Milk (2002)

As pointed out by Gonçalves and Marins (2006), efficient after-sales reverse logistics is one of the fundamental factors for maintaining a company's good image: if a consumer returns the purchase (based on the consumer protection code) or in the case of a product defect that causes the change of the same, it is necessary to have in place an excellent reverse channel, operating quickly and efficiently to meet customer needs.

2.3.2- Post-consumption logistics

For Mueller (2005), the reverse logistics of post-consumption has the function of managing the physical flow of materials, together with the information corresponding to consumer goods discarded by the consumer. These goods can be selected as follows: products at the end of their useful life or used products with the possibility of reuse of industrial waste. In the same vein, Leite (2009) considers that accelerated technological development is bringing about early obsolescence of consumer goods, thus producing an increase of products with shorter life cycles and consequent solid residues.

According to Moretti, Lima, and Crnkovic (2011), post-consumer reverse logistics are different from what happens with after-sales: it plans and controls goods that have reached their full life cycle, caused by constant use or by discarding from industrial processes. Rodrigues, Rodrigues, Leal, and Pizzolato (2002) refer to the destination of post-consumer products when they propose three options for the disposal of products after being used by the consumer:

- transportation to a safe disposal site, i.e. landfills and specific deposits;
- transport to an unsafe destination, being discarded in nature and, of course, contaminating the environment;
- alternatively, the return to the reverse distribution chain.

Figure 3 below shows the flow diagram of the post-consumer reverse logistics:

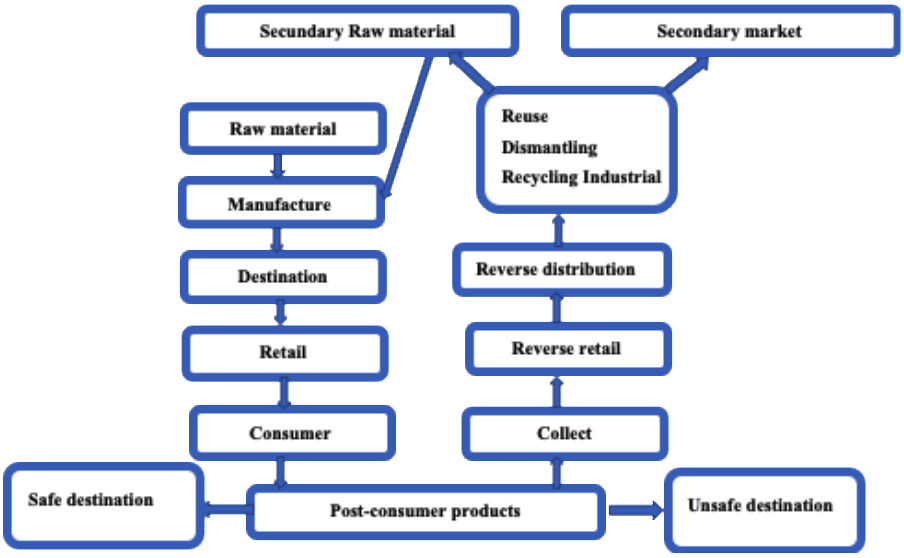

Figure 3. Post-Consumption Reverse Logistic Flowchart
Source: Adapted from Leite (2002)

2.4 - Factors for the implementation of reverse logistics

In the view of Demirel and Gökçen (2008), in order to design an efficient reverse logistics channel, companies must determine what elements and functions should exist in the logistics network and where these elements and services should be updated, logistics and reverse channels. According to Lacerda (2002), several reasons can be listed for implementation of reverse logistics by a company (often determined by the strategy favoured by management). In this sense, Adlmaier and Sellitto (2007) point out that, according to the REVLOG (reverse logistics) group of international workers for the study of reverse logistics – involving researchers from several universities around the world and under the coordination of Erasmus University Rotterdam in the Netherlands – the main reasons that drive companies to act more vigorously in reverse logistics are:

- environmental legislation, which forces companies to return their products and take care of the necessary treatment;
- economic benefits from the use of products returned to the production process, rather than bearing the high costs of proper disposal;
- the growing environmental awareness of consumers.

For Chaves and Batalha (2006) environmental awareness will persist, because there is a reorientation in production and consumption, serving as a premise for corporate sustainability. One of the functions of reverse logistics should be to minimise the environmental impact caused by waste from the various stages of production, including waste from post-consumption.

The studies by Tachizawa (2012) suggest that the expansion of the collective consciousness concerning the environment, coupled with the complexity of the current social and environmental demands the community places on enterprises, can result in new positioning on the part of the entrepreneurs and executives in the face of such questions. However, Daher, Silva, and Fonseca (2006) report that, due to increasingly rigid environmental laws, the manufacturer's responsibility for the product is widening. In addition to the waste generated in its production process, the company is now often held responsible for the product until the end of its useful life. This has broadened an activity that heretofore was restricted to its premises.

The synergy between the fundamentals of environmental issues discussed in everyday life and the advantages of reverse logistics is indisputable. Contributions such as reduction of the concentration of waste products make reverse logistics an excellent instrument for the preservation of the environment, favoring the creation of a new social mentality (Pedrosa, 2008). For Silva, Callegari, Silva, and Francisco (2011), the implementation of reverse logistics can be achieved through governmental actions (such as the imposition of laws that oblige companies to collect the products they manufacture after being discarded by consumers so that they have a destination). However, Palhares (2011) argues that, relative to other countries in the world, Brazil has an underdeveloped reverse logistics (see also Silva et al., 2011). In this way, the incipient creation of an environment capable of assuming the integrated management of solid waste, with the population responsible for public cleaning, City Hall – together with the practices of the whole society – is able to develop and balance the impacts caused by aggressive solid waste generation.

However, a significant step was taken since – after more than two decades in the National Congress – on 2 August 2010, Federal Law No. 12,305 / 10, instituting a national solid waste policy – came into force. In the same sense, Marchi (2011) corroborates Palhares (2011) stating that the law requires solid waste to reused in the form of new products, in their ongoing cycle or in other production cycles (with the consumer, public services, the manufacturer, and the merchants all committed to the exercise of the role due them, in the search for success in its application.

2.5- Important aspects of reverse logistics

The determination of the essential elements to implement reverse logistics is a fundamental factor for its execution. In this regard, one has the view of Liva, Pontelo, and Oliveira (2003), who report that – through the use of reverse logistics – companies reduce the impact of their operations on the environment and, therefore, are considered to be ecologically sound. In this same sense, Saen (2010) corroborates Liva et al. (2003), who state that reverse logistics focuses mainly on bringing products and recovering them efficiently, saving natural resources, protecting the environment, and increasing business competitiveness.

In the opinion of Daher et al. (2006), there are no accurate data on the value that reverse logistics costs represent in the Brazilian economy. Taking into account the estimates for the US market and extrapolating them to Brazil, the costs of reverse logistics represent approximately 4% of total logistics expenditures. All these factors lead us to conclude that a reverse logistics system, while involving the same essential elements of a traditional logistics system, should be planned and executed separately and as an independent activity (Daher et al., 2006).

Already, Lacerda (2002) recognises that the concept of the life cycle is broader than that of reverse logistics. From the logistic point of view, the life of a product does not end with its delivery to the customer. Products that become obsolete, damaged, or do not work must return to their point of origin to be adequately discarded, repaired, or reused. However, Martins (2011) and Lacerda (2002) both acknowledge that there is a clear tendency for environmental legislation to move towards making companies increasingly responsible for the life cycle of their products and services. The means being legally responsible for the destination after delivering the products and services to their customers and, as well, for the impact they produce on the environment.

According to Leite (2012), a corporate image can be understood as a combination of feelings, ideas, and attitudes, in which consumers can recognise the company brand. This perception is formed through the relationship of the company with consumers of its products, from pre-sale to post-sale.

A modern vision of social, environmental, and mainly corporate ethical responsibility, if adopted by companies serving as links in the production chain of goods in general. As well the governmental entities and others involved in some way in the process.Even if involuntary, suggests that corporate images will be increasingly influenced by environmental preservation issues. Consequently, actions appropriately aimed at ecological preservation, within this contributory vision of social and environmental marketing, will undoubtedly be rewarded with good differentiated image returns as a competitive advantage (Leite, 2003.

For Giacobo et al. (2003), reverse logistics can be much more than a cost center, becoming a lever for increased profitability of the company, the ability to add value to the product, and satisfying the needs and expectations of customers. Besides, having a well-planned process that is appropriate to the company's reality enables, through reverse logistics, a great competitive differential in the face of competition.

Along the same lines, Janse, Schuur, and Brito (2010) reaffirm the importance of reverse logistics for the corporate image of companies, suggesting that a poor product recall can have a dramatically adverse effect. Further, not only the consumer but the general public is starting to put pressure on corporations with regard to the proper disposal of products at the end of their life cycle. However, Tachizawa (2012) maintains that only in the future will consumers influence not just the price and quality of products, but also the social behaviour of the companies that manufacture these products. The customer will continue to penetrate the company more and more in a progressive escalation, and his/her request will guide strategic decisions within the organisation.

However, Tachizawa (2012) states that transformation and ecological influence in a business increasingly felt and with ever more profound economic effects, leading organisations to seek significant competitive advantages, including cost reduction and increase in profits in the medium and long term. Already previously, Lacerda (2002) showed that the initiatives related to reverse logistics had brought considerable returns to companies, reducing the cost with the use of returnable packaging or reusing materials for production, enabling gains, and stimulating new initiatives.

2.6- Solid Wastes

In the opinion of Pedrosa (2008), who understands the consumption culture currently adopted by our society – given the intense strategic market actions to create additional needs and customs – has stimulated an extraordinary increase in the launching of new products, technological innovations, and mass production However, a large portion of these products is not entirely consumed, leaving a significant amount of waste. Silva and Candido (2012) consider solid waste one of the most aggressively harmful substances to the environment (and that solid waste originates from the evil disposition of undesirable materials to the human being, harming the quality of life of the population). In the view of Russo (2003), minimising the production of solid waste is a gigantic task that presupposes the awareness of political and economic agents and the population in general so that everyone feels responsible for the implementation of measures aimed at reducing waste.

According to Barreto and Pozo (2011), business management or even the coordination of activities should reflect and direct the thinking or the business vision – being the representation of its principal shareholder, not giving space to parallel views that may deviate from the goal. Coelho, Lange, Jesus, and Sartori (2011) suggest that ‘the destination must comply with the classic concept of the hierarchy of solid waste management, which is oriented from non-generation to final destination, in this order of priority, through minimization of waste generation, reuse, recycling, and treatment’ (p. 308). Thus, the adequate management of solid waste acquires a unique character, mainly because it is easy to embrace the idea that a reduction

in the generation of waste produces a raw material economy, clearly translating into the decrease in the costs of operation. These authors also consider that:

> the destination must comply with the classic concept of the hierarchy of solid waste management, which goes from non-generation to final disposal, in this order of priority, through minimization of waste generation, reuse, recycling and treatment. (p. 308).

The legislation recommends recycling, reuse, recovery, and composting and, where this is not possible, disposal in landfills with appropriate standards to avoid damage or risks to public health and safety and minimising environmental impacts. However, licensed landfills today do not exist in sufficient numbers to meet the demand of the private sector (Souza et al., 2010). Figure 4 below presents the principle of the hierarchy of waste management operations.

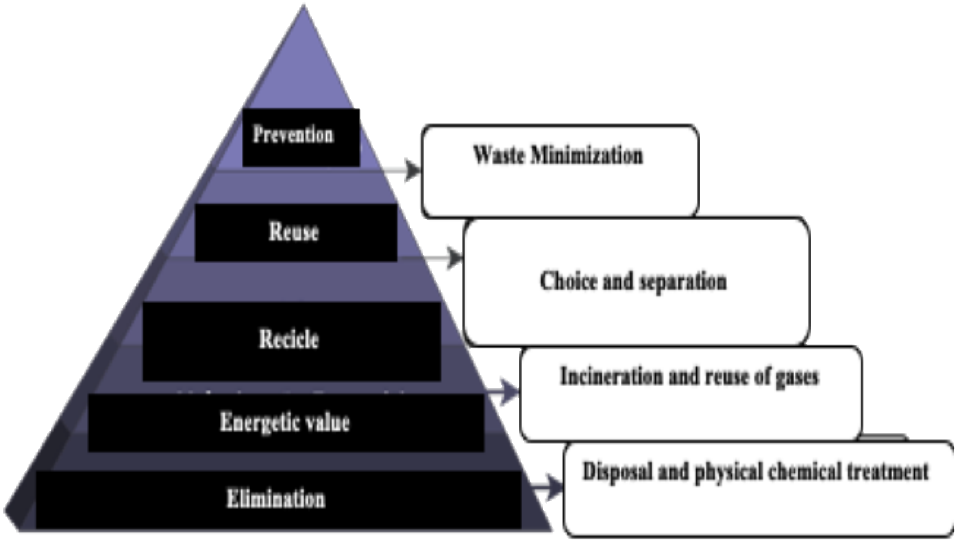

Figure 4: Principle of the Hierarchy of Waste Management Operations
Source: Adapted from Fernandes (2009)

In Sisinno's view (2003):

> the reality experienced by the industrial sector in Brazil is quite peculiar, although the generator is responsible for the destination of its waste, the scarcity of information and alternatives available for this purpose and the lack of specialized personnel causes that some industries give little or no attention to such responsibility. (p. 370)

3. METHOD

The research method is the basic structure of a study and provides general guidelines for an investigation. Defining and organising the standards according to which data collection and analysis will be performed; Creswell (2003). The current research is classified as quantitative-descriptive. This characteristic implies the technical procedure used and requires the use of statistical tools as a basis for analysing the problem.

The present research, for its objectives, is seen as exploratory and descriptive. It is characterised as exploratory since it comprises the collection of bibliographic data. The primary function of the research is to describe the characteristics of a given population or phenomenon through questionnaires (Gil, 2002).

The population studied is concentrated in the region of Guarulhos, the metropolitan area of the state of São Paulo. This region was chosen because it has a large variety of MPEs, thus providing the study of the reality of different branches of companies, coupled with support

offered by the regional office of SEBRAE-SP, which provided the list of respondent companies. The city of Guarulhos presents similarities with most other Brazilian cities in terms of demography, geographic space occupied, economic changes, political characteristics, and urban development. This study can therefore be reproduced, thus providing management analyses of companies from other regions.

The population universe was composed of 48 MPEs of various transformation sectors, using as a standard for the selection of the companies to research, the concept developed by SEBRAE-SP based on the number of employees (i.e. MPEs, industries with 1 to 99 employees and commercial establishments with 1 to 49 employees).

The name of each respondent company was not disclosed, with the intention of not exposing it in the analysis of the data, Further, all information obtained was analysed under the general context. Based on this information, initially, from a total of 75 companies surveyed, 48 companies were selected, whose respondents had decision-making power regarding solid waste management. Among the companies surveyed, those whose respondents claimed to hold one of the following positions were selected: owner, administrator, director, manager, or supervisor.

The data collection for the development of this research was started in September, by the business consultants of the SEBRAE-SP, Guarulhos regional office. As an initial step, a training was given by the researcher, in which all the methodology of application of the questionnaire was demonstrated (during special visits presential and the lectures and courses developed by this institution.

This survey was carried out using a Likert 1-5 questionnaire, where Marconi and Lakatos (2009) affirm that this type of questionnaire, named Likert 1–5, allowed the quantification of information from January to April 2015. This instrument was composed of multiple propositions, all of which were related to the fundamental aspects of the Federal Solid Waste Law No. 12.305/10. Each proposal presents a statement, directly linked to the objectives of the research, and the collection instrument is composed mostly of closed questions, adopting the format of Likert scale 1–5, where the respondent should respond: I totally disagree (DT); Disagree (D); Indifferent (I); I agree (C); I totally agree (CT).

For construction of the 17 propositions included in the structured questionnaire, the theoretical reference of Section 2 was used, along with the articles of Federal Law 12.305 / 10 of solid waste.

4. DATA ANALYSIS AND INTERPRETATION

The data were analysed based on the data and classification elaborated by the Federation of Industries of the State of São Paulo (FIESP), an institution that made available the most frequently asked questions about solid waste legislation that the entity use with its associates (FIESP 2012). This paper presented answers to the questioning of entrepusereneurs regarding solid waste legislation, utilising a specific classification, and whose responses selected on the following topics: concept, structure, and solid waste management.

The results obtained during field research are considered one of the most essential points of a study because they allow the establishment of considerations regarding the objectives of the article. The results obtained from the questionnaire are presented in Table 3 below (and with a descriptive analysis).

Table 3. Analysis of the questionnaire responses.

QUESTIONS	PROPOSITION (variables)	ANSWER	%
1	Knowledge of the solid waste law	Know	35,9
2	The degree of adherence to the new waste legislation	Training	12,5
3	Technical qualifications required by law for the reparation of the solid waste management plan	Agree	12,6
4	The company is obliged to keep the competent team informed regarding the management of solid waste	Agree	60,4
5	Control waste produced and withdrawn by other competent	Agree	66,7
6	Produce products with longer life cycle	Agree	70,8
7	Use packaging that can return to the production cycle	Agree	50,8
8	Reapprove the solid waste produced by it	Agree	62,5
9	Decrease the amount of solid waste generated by it	Agree	66,7
10	To plead fiscal or financial incentives granted by government agencies for the implementation of the solid waste plan	Agree	77,1
11	Develop a solid waste management plan	Agree	43,8
12	Thank you for providing an environmentally appropriate final destination for their solid waste	Agree	39,6
13	The company is obliged to draw up an inventory for the system annual declaration of solid waste	Agree	54,2
14	Low average solid waste compliance rate	Agree	33,3
15	To know the classification of solid waste produced	Agree	47,9
16	Know the steps required to prepare the plan waste management	Agree	45,8
17	The company can include in the solid waste from another company	Agree	31,2

Source: Research data

Regarding Proposal 1, few are aware of the relevant legislation. Proposal 2 presented the least degree of adequacy for the new waste legislation, with interviewees stating they did not know the technical qualifications as determined by law. In Proposition 3, it identified a probable cause for the lack of knowledge of the professional qualification required by law for preparation of the solid waste management plan by the respondents. The interviewees stated they did not participate in a course or lecture about solid waste regulations. The group selected for application of the questionnaire evaluated these items as below average in relation to the adequacy of the solid waste legislation.

Items 4 to 10 showed that most managers (65%) agreed that the company is obliged to meet the requirements of the official control bodies. Concerning Items 11 to 17, the results showed indices below the average (42.2%), compared to medium and large companies (SEBRAE, 2015). The most significant data verified in the quantitative research step are presented below. In Table 4, the data of variables, mean, standard deviation, and coefficient of variance of the quantitative analysis obtained by SPSS are displayed:

Table 4: Mean, standard deviation, the coefficient of variance (CV)

STATISTIC OF ITEM				
Question	**VARIEBLE**	**AVERA=GE**	STANDARD DEVIATION	**C V %%**
1	Knowledge of the Law of Solid Waste	4,17	0,78	0,18
2	Degree of adequacy to the new waste legislation,	4,49	0,66	0,15
3	Technical qualification required by law for the preparation of the solid waste management plan	4,46	0,71	0,16
4	The company is obliged to keep the management of solid waste.	4,17	0,82	0,21
5	Control waste produced and withdrawn by other companies	3,68	0,80	0,22
6	Produce products with longer life cycle.	4,27	0,64	0,16
7	Use packaging that can return to the production cycle.	4,33	0,77	0,17
8	Reapprove the solid waste produced by it.	4,32	0,58	0,15
9	Decrease the amount of solid waste generated	4,19	0,87	0,20
10	Seek for fiscal or financial incentives granted by government agencies for the implementation of the Solid Waste Plan.	4,44	0,75	0,17
11	Develop a solid waste management plan	0,98	0,25	0,24
12	Have to give an environmentally appropriate final destination	4,16	0,88	0,20
13	The company is obliged to draw up an inventory for the system	4,21	0,77	0,19
14	Adequacy index to solid waste legislation below average	3,74	0,85	0,22
15	To know the classification of solid waste produced	4,12	0,91	0,24
16	Know the steps required to prepare the plan	4,25	0,77	0,18
17	The company can be included in the solid waste management plan of another company.	3,91	0,95	0,26

Source: Research data

In the analysis of the data of Table 4 above, in the comparison of data sets, the mean and the standard deviation were used. Thus, with the coefficient of variation one can analyze the dispersion in terms relative to its mean value when two or more series of values have different units of measure. Thus, the coefficient of variation expresses the variability of the data, excluding the influence of the order of magnitude of the variable.

Checking Items 1 to 7 that correspond to an analysis of the managers' perception and answers about solid waste, we found that all the variables have low dispersion coefficients of variation (<20%); they are therefore homogeneous data. For Items 8 to 17 that correspond to an analysis of the perception and answers of managers on knowledge about the subject, all the variables had a coefficient of variation of low dispersion, confirming the data as homogeneous. In Table 5, the data related to the correlation between the search variables is shown:

Table 5. Correlations between variables

Correlações	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	t
VAR 1 Pearson	1	,159**	,385**	,483**	,240**	,412**	,159*	,567**	,204**	,176*	,398**	,495**	,475**	,328**	0,102	0,048	,389**	,213**
Sig.2 extremidad.	0,002	0,041	0	0,002	0	0,04	0	0,009	0,023	0	0	0	0	0,189	0,535	0	0,001	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 2 Pearson	,412**	1	,354**	,286**	,166*	,322**	,184*	,311**	,263**	0,087	,355**	,391**	,270**	,310**	,157*	,156*	,377**	,201**
Sig.2 extremidad.	0	0	0	0,033	0	0,018	0	0,001	0,265	0	0	0	0	0,044	0,044	0	0	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 3 Pearson	,446**	,438**	1	,286**	,203**	,356**	0,089	,549**	0,144	-0,015	,201**	,399**	,443**	,319**	,179*	0,076	,209**	,252**
Sig.2 extremidad.	0	0		0,009	0	0,255	0	0,064	0,851	0,01	0	0	0	0,021	0,331	0,007	0,005	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 4 Pearson	,224**	,456**	,166*	1	,203**	,264**	,160*	,221**	0,116	-0,077	0,127	,205**	,305**	,160*	0,023	0,127	,181*	0,137
Sig.2 extremidad.	0,004	0	0,009		0,001	0,039	0,004	0,138	0,323	0,103	0,008	0	0,039	0,772	0,103	0,02	0,046	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 5 Pearson	,388**	,329**	,322**	,356**	1	,264**	,262**	,235**	0,14	,171*	,260**	,363**	,405**	,359**	0,016	0,101	,183*	0,142
Sig.2 extremidad.	0	0	0	0,001		0,001	0,002	0,072	0,028	0,001	0	0	0	0,841	0,197	0,018	0,139	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 6 Pearson	,174*	0,088	,184*	0,089	,160*	1	,262**	,207**	,215**	0,148	0,143	,154*	0,15	,199*	0,01	0,134	0,096	,204**
Sig.2 extremidad.	0,025	0,261	0,255	0,039	0,001		0,007	0,006	0,057	0,067	0,047	0,054	0,01	0,896	0,084	0,216	0,129	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 7 Pearson	,524**	0,054	,311**	,549**	,221**	,235**	1	,207**	,246**	,169*	,442**	,632**	,644**	,390**	,214**	0,093	,403**	,290**
Sig.2 extremidad.	0	0,487	0	0,004	0,002	0,007		0,001	0,029	0	0	0	0	0,006	0,234	0	0	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 8 Pearson	,194*	,349**	,263**	0,144	0,116	0,14	,215**	1	,246**	0,067	0,047	,257**	0,123	,172*	,258**	,291**	,501**	,372**
Sig.2 extremidad.	0,012	0	0,064	0,138	0,072	0,006	0,001		0,39	0,548	0,001	0,115	0,027	0,001	0	0	0,073	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 9 Pearson	,159*	,220**	0,087	-0,015	-0,077	,171*	0,148	,169*	1	0,067	,453**	0,146	,178*	,382**	0,057	,317**	,196*	,192*
Sig.2 extremidad.	0,041	0,004	0,851	0,323	0,028	0,057	0,029	0,39	0	0	0,061	0,022	0	0,466	0	0,011	0,796	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 10 Pearson	,354**	,204**	,355**	,201**	0,127	,260**	0,143	,442**	0,047	,453**	1	,440**	,436**	,429**	0,098	,191*	,372**	,184*
Sig.2 extremidad.	0	0,008	0,01	0,103	0,001	0,067	0	0,548	0	0	0	0	0	0,208	0,013	0	0,001	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 11 Pearson	,438**	-,828**	,391**	,399**	,205**	,363**	,154*	,632**	,257**	0,146	1	,440**	,689**	,406**	,276**	0,097	,328**	,294**
Sig.2 extremidad.	0	0	0	0,008	0	0,047	0	0,001	0,061	0	0	0	0	0	0,216	0	0	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 12 Pearson	,456**	,475**	,270**	,443**	,305**	,405**	0,15	,644**	0,123	,178*	,436**	1	,689**	,484**	,290**	0,08	,360**	,353**
Sig.2 extremidad.	0	0	0	0	0	0,054	0	0,115	0,022	0	0		0	0	0,304	0	0	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 13 Pearson	,329**	,328**	,310**	,319**	,160*	,359**	,199*	,390**	,172*	,382**	,429**	,406**	1	,484**	,456**	,392**	,365**	,361**
Sig.2 extremidad.	0	0	0	0,039	0	0,01	0	0,027	0	0	0	0		0	0	0	0,092	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 14 Pearson	0,088	0,102	,157*	,179*	0,023	0,016	0,01	,214**	,258**	0,057	0,098	,276**	,290**	1	,456**	,438**	,205**	,420**
Sig.2 extremidad.	0,261	0,044	0,021	0,772	0,841	0,896	0,006	0,001	0,466	0,208	0	0	0		0	0,008	0,276	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 15 Pearson	0,054	0,048	,156*	0,076	0,127	0,101	0,134	0,093	,291**	,317**	,191*	0,097	0,08	,392**	1	,438**	,215**	,338**
Sig.2 extremidad.	0,487	0,044	0,331	0,103	0,197	0,084	0,234	0	0	0,013	0,216	0,304	0	0		0,005	0,401	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 16 Pearson	,349**	,389**	,377**	,209**	,181*	,183*	0,096	,403**	,501**	,196*	,372**	,328**	,360**	,365**	,205**	1	,215**	,429**
Sig.2 extremidad.	0	0	0,007	0,02	0,018	0,216	0	0	0,011	0	0	0	0	0,008	0,005		0	
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	
VAR 17 Pearson	,220**	,251**	,323**	,215**	,155*	0,115	-0,118	,278**	0,139	0,02	,258**	,346**	,405**	0,131	0,085	-0,066	1	,323**
Sig.2 extremidad.	0,004	0	0,005	0,046	0,139	0,129	0	0,073	0,796	0,001	0	0	0,092	0,276	0,401	0		
N	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	166	

Source. Search Data

Note: *. The correlation is significant at the 0.05 level (2 extremities

**. The correlation is significant at the 0.01 level (2 extremities)

These analyses indicate that the model used in this study is consistent. This allows advancing to the structural equations model, as shown by the correlation matrix that measures the degree of linear relationship between paired sample values and their correlation ensuring consistency. The t-test used to analyse the significance of regression coefficients confirms that the variables used in the regression contribute to sample compliance rigidity, as shown in Table 5 above.

Cronbach's alpha of the questions relating to the 17 variables was 0.849. This is considered above the ideal of 0.70 and therefore a value of high reliability. Table 6 below shows the Cronbach's alpha obtained.

Table 6. Cronbach's Alpha

Alfa de Cronbach	N de itens
0,849	17

Source. Research data

In the sample, a statistically significant correlation was found between all dimensions of these variables. Although statistically significant, the correlations observed were not high. The highest value found was the Pearson coefficient (0.689). Linear regression showed a positive result, above 42%.

Therefore, the statistical data confirm the influence of Federal Law No. 12,305/10 on the way in which micro and small enterprises in the Guarulhos/SP region treat their solid waste/ They system is still insufficient and inadequate due to lack of training and greater orientation, based on the data obtained for Items 1, 2, and 3 of the survey questions (where the degree of knowledge of the Solid Waste Law is 35.9%, while the degree of adequacy to the new waste legislation and in relation to the management plan of solid waste is only 12.5%).

5. FINAL CONSIDERATIONS

Solid waste legislation was promulgated recently; however, it brought an window for compliance for companies (ending in August 2012). Almost three years later, through the survey carried out, it was possible to identify the difficulties found by MPEs in the region of Guarulhos to comply with solid waste legislation.

The greatest difficulty encountered by MPEs in the Guarulhos region to comply with the solid waste legislation, as verified by interpretation of the collected data, is the lack of knowledge of the mandatory items for elaboration of the waste management plan (as reported by Silva et al., 2011 and Daher et al., 2006). Solid waste legislation, in which the MSEs in the region have shown a lower degree of suitability, involves knowing the technical qualification required by law for the elaboration of the management plan.

The data collected through the research served as the basis for the construction of an adequacy index for solid waste legislation. The average degree of adequacy was 41.50%, thus evidencing an increased risk of MSEs in the Guarulhos region receiving some assessment by the bodies responsible for solid waste control.

Based on this research, one can conclude that MPEs in the Guarulhos region were not extensively influenced by Federal Law No. 12,305 / 10, when solid waste was disposed of, since they had little knowledge of current legislation.

As limitations of the research, the first concerns the fact that few companies proposed to respond to the questionnaire, thus we had a smaller sample than expected. The second limitation concerns being restricted to a single region, that of Guarulhos.

It recommended that future work, involving new regions of the state and other localities of the country, could expand the analysis of the legislation and the performance of companies involved in solid waste disposal in Brazil. Companies in specific areas of the agricultural, industrial, civil construction, commercial, services sectors.

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