

Sustainable Cuisine: analysis of reverse logistics in restaurants of Florianópolis, Brazil

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Abstract

Reverse logistics deals with the recovery and the management of goods, being able to add values to an image of the company and the environment. We aimed to analyze the logistics process in the activities of the restaurants of Greater Florianópolis. Data were collected through a questionnaire quantitatively applied to a non-probabilistic sample of 24 establishments selected for convenience, located in three gastronomic routes: Coqueiros, Sambaqui, and Ribeirão da Ilha. It was observed that these are restaurants and practices that are positive and negative for the environment regarding reverse logistics, and the positive ones are the recycling of cooking oil, solid waste and the collaborators' training. The negative ones are related to reuse and recycling of packaging, lack of composting, and a small number of vegetable gardens in restaurants. We concluded that the environmental concern of the managers is only a requirement of the legislation and not the philosophy of the company. We observed lack of incentives and governmental supervision concerning environmental aspects as well as academic research in differentiated segments.

Keywords: reverse logistics, gastronomy, sustainability, restaurants, environmental management.

Resumo

Gastronomia sustentável: análise da logística reversa em restaurantes de Florianópolis, Brasil

A logística reversa trata da recuperação e do gerenciamento de bens, podendo acrescentar valores para a imagem da empresa e o meio ambiente. Analisar o processo desta logística nas atividades dos restaurantes da Grande Florianópolis foi o objetivo deste trabalho. Os dados foram coletados de forma quantitativa através de um questionário aplicado a uma amostra não-probabilística de 24 estabelecimentos selecionados por conveniência, localizados em três rotas gastronômicas: Coqueiros, Sambaqui e Ribeirão da Ilha. Observou-se que os restaurantes têm práticas positivas e negativas para o meio ambiente sob o aspecto da logística reversa, sendo que os positivos tangem à reciclagem do óleo de cozinha, dos resíduos sólidos e a capacitação de colaboradores. Já os negativos têm relação com a reutilização e reciclagem das embalagens, a falta de compostagem e o pequeno número de hortas nos restaurantes. Concluiu-se que a preocupação ambiental dos gestores é somente com o que já é exigido pela legislação e não uma filosofia da empresa. Observa-se a falta de incentivos

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e fiscalização governamental sobre os aspectos ambientais, assim como pesquisas acadêmicas em segmentos diferenciados.

Palavras-chave: logística reversa, gastronomia, sustentabilidade, restaurantes, gestão ambiental.

Resumen

Alimentaria sostenible: análisis de la logística inversa en restaurantes de Florianópolis, Brasil

La logística reversa trata de la recuperación y de la gestión de bienes, pudiendo añadir valores para una imagen de la empresa y medio ambiente. Analizar el proceso de logística en las actividades de los restaurantes de la Grande Florianópolis para el objetivo de este trabajo. Los datos fueron recolectados de forma cuantitativa a través de un cuestionario aplicado a una muestra no probabilística de 24 establecimientos seleccionados por conveniencia, ubicados en tres rutas gastronómicas: Coqueiros, Sambaqui y Ribeirão de la Isla. Se observó que son restaurantes y prácticas positivas y negativas para el medio ambiente bajo el aspecto de la logística reversa, siendo que los positivos tangen al reciclaje de aceite de cocina, de los residuos sólidos y de la Capacitación de empleados. Los negativos tienen relación con una reutilización y reciclaje de envases, una falta de compostaje y un pequeño número de huertas en los restaurantes. Se concluyó que la preocupación ambiental de los gestores es sólo una exigencia de la legislación y no una filosofía de la empresa. Se observa la falta de incentivos y fiscalización gubernamental sobre los aspectos ambientales, así como investigaciones académicas en segmentos diferenciados.

Palabras clave: logística, alimentos, sostenibilidad, restaurantes, gestión ambiental inversa.

INTRODUCTION

Society is demanding restaurants to be suitable for a new reality of Cleaner Production (CP), in order to remain competitive in the market and to be sustainable. One of the solutions is the so-called reverse logistics (RL) (Chieregatto & Claro, 2010).

According to Fernandes (2015), in order to achieve a sustainable food production, it is necessary to involve issues related to the productive process, menu planning, suppliers, recycling, and waste management.

Thus, RL is committed to the recovery and management of equipment, products, ingredients, and materials. This process involves, for instance, basic resale, remanufacturing or recycling process, and it can add value regarding environmental aspects, market competition, and corporate image (Costa & Valle, 2006). RL presents immeasurable contributions to several sectors that do not have this knowledge yet such as the food sector. Chaves (2009, p. 19) stated that "there are not many studies addressing the operation of reverse logistics in some important sectors of the economy such as the food industry." Santos, Loureiro and Oliveira (2013) consider the development of actions that encourage companies to be responsible for the end-of-life of their products essential. In addition, there is a small number of published research on environmental management and sustainability in Brazilian restaurants (Gurgel, Carvalho, & Salles, 2015), hence the importance of this type of research for the food sector. Therefore, this

article aims at analyzing the reverse process of the activities in restaurants of Florianópolis (Santa Catarina state, Brazil) and proposing actions to managers through the analysis of the current situation.

Our study is characterized as a quantitative, exploratory research, based on bibliographical research, for which we prepared a questionnaire with 18 questions that was applied in 24 different establishments in Florianópolis. The results enabled us to analyze the characteristics of each gastronomic route. We also analyzed positive and negative impacts, correlating the results with the theories of the authors of the bibliographical reference.

THEORETICAL REFERENCE

Reverse logistics in gastronomy

For Gurgel et al. (2015), the lack of a proper environmental management in restaurants is due to not only lack of interest, but also the lack of this knowledge and its benefits. Consequently, companies do not have enough information to deal with decisions inherent in the practice of this process, which arises a lot of uncertainty. To elucidate the main themes related to reverse logistics, we show the surveyed authors in Chart 1.

Chart 1 – Studies found on the surveyed topics.

Topic	Authors (year)
Reuse of packaging	Siqueira (2002); Estival (2004); Costa & Valle (2006); Castanho (2006); Campos (2006); Adlmaier & Sellitto (2007); Chaves (2009); Chieregatto & Claro (2010); Uda (2010); Cortez (2011); Souza (2011); Lago (2013).
Recycling of packaging	Estival (2004); Costa & Valle (2006); Castanho (2006); Sousa, Leal & Soares (2006); Campos (2006); Adlmaier & Sellitto (2007); Chaves (2009); Uda (2010); Souza (2011); Cortez (2011); Nery, Conto, Zaro, Pistorello & Pereira (2013); Lago (2013); Gurgel, Carvalho & Salles (2015).
Recycled cooking oil	Schneider, Santos, Klamt & Machado (2006); Silva (2008); Bilck, Silva, Costa, Benassi & Garcia (2009); Netto (2010); Rocha (2010); Zhang, Wang & Mortimer (2012); Silva et al. (2012); Zucatto, Welle & Silva (2013); Nery et al. (2013); Lago (2013); Acre & Castilho (2013); Kremer, Costa & Mondo (2013); Oliveira (2014); Puntel & Marinho (2015); Gurgel et al. (2015).
Solid wastes	Ribeiro (2002); Schneider et al. (2006); Silva (2008); Bilck et al. (2009); Novaes & Estival (2009); Chieregatto & Claro (2010); Uda (2010); Zucatto et al. (2013); Lago (2013); Nery et al. (2013); Kremer et al. (2013); Acre & Castilho (2013); Amaral, Costa, Corrêa & Freitas (2014); Puntel & Marinho (2015); Fernandes (2015); Pistorello, Conto & Zaro (2015).

(continues...)

Chart 1 – Continuation

Topic	Authors (year)
Production of fertilizer from wastes (composting)	Venzke (2001); Siqueira (2002); Legaspe (2004); Silva (2008); Bilck et al. (2009); Freeman (2011); Furtado & Gadelha (2012); Lopes, Reis & Bezerra (2012); Nery et al. (2013); Acre & Castilho (2013); Amaral et al. (2014); Gurgel et al. (2015); Puntel & Marinho (2015); Pistorello et al. (2015).
Vegetable garden in restaurants	Nowak (2004); Blyth & Menagh (2006); Engelhard (2010); Freeman (2011); MacRae et al. (2010); Gurgel et al. (2015); Puntel & Marinho (2015).
Collaborators' training	Siqueira (2002); Ribeiro (2002); Estival (2004); Schneider et al. (2006); Silva (2008); Bilck et al. (2009); Novaes & Estival (2009); Acre & Castilho (2013); Kremer et al. (2013); Krause & Bahls (2013); Oliveira (2014); Puntel & Marinho (2015).

Source – Elaborated by the authors (2016)

Environmentalists, companies, and society as a whole know that the industry is a major generator of waste, which ends up camouflaging the catering sector and its social and environmental responsibility (Gurgel et al. 2015). As an aggravating factor, Silva (2008) considers that the term “sustainable” is glutted and it became a label for questionable activities, aiming to make them acceptable, and hindering the identification of establishments that really employ sustainable measures.

Cleaner production is considered a tool of environmental management that companies develop to be more responsible in a social and environmental way (Filho & Sicsú, 2003). It comprises the implementation of a preventive strategy applied to processes, products, and services, aiming at obtaining economic and social benefits for companies, reducing risks to health and the environment (United Nations Environment Programme, n.d).

In this sense, Acre & Castilho (2013) suggest some activities essential to the gastronomic sector be considered effectively sustainable. These activities include environmental education in the training of collaborators, to have a good power efficiency management, to seek partnerships with local producers and suppliers, to opt for the strengthening of the brand through the Green Marketing, and to obtain the certifications NBR ISO 9001:2015 (which certifies quality management systems), ISO 14001:2015 (which certifies environmental management systems), and ISO 22000:2006 (which certifies management systems for food safety).

According to Costa & Valle (2002), for supporting sustainability, reverse logistics can act and generate benefits in several ways: by decreasing disposability, it also decreases the consumption of raw materials, which consequently reduces the environmental impact. As a benefit to society, reverse logistics helps in preserving the environment, saving energy, and generating jobs. To achieve these benefits, it is necessary to deepen the aspects raised by the authors regarding RL in Chart 1, which are individually presented next.

Reuse of packaging

Campos (2006) states that the package is no longer merely considered a vessel containing the product. In fact, it is constantly evolving to effectively meet the requirements of all stakeholders. Thus, integrating environmental aspects in the development of packaging prevents and minimizes impacts, in addition to its social benefits. To understand the environmental impact of packaging, we must first know its three different types: disposable, reusable, and returnable.

Disposable packages are used only once. They are little resistant and responsible for most of the discarded materials (Campos, 2006). According to Chiregatto & Claro (2010, p. 101), we are in “the era of disposable,” in which “drink and food packages started to be produced on a large scale, replacing containers that until recently were totally reusable such as glass bottles.” Such reusable packages are usually received by suppliers and can be reused in other ways (Campos, 2006; Chieregatto & Claro, 2010). On the other hand, returnable packages are those that return to the industry and must go through the steps of transportation, washing, and sterilization, which still impacts the environment, but with less consumption of natural resources (Cortez, 2011). For Costa & Valle (2006), the applicability of the RL is driven by economic and environmental considerations/issues, leading companies to opt for the use of returnable packages, for example. Corroborating such idea, the study by Adlmaier & Sellitto (2007) showed that the use of returnable packaging brought financial benefits, reduction of environmental attacks, and logistical benefits to the surveyed exporting company.

Recycling of packaging

Cortez (2011) states that recycling acts where the materials that would be discarded, or even those which have already been discarded, are diverted, collected, separated, and processed aiming at being used as raw materials in the manufacture of goods. On the other hand, Castanho (2006, p. 49) believes that recycling is “redoing the cycle, bringing back to the source as raw materials, materials that do not easily degrade and which can be reprocessed while keeping their basic characteristics.”

An important part of the recycling process is the selective collection. For Sousa, Leal & Soares (2006), when it is well managed, it can decisively contribute to the increase in recycling efficiency. According to the authors, the recycling process should only be used if the waste recovery is technically and economically feasible and hygienically usable, in addition to considering whether the characteristics of each material are respected.

Recycling benefits all the involved parts: suppliers, consumers, the government, the environment, the community, employees, and shareholders, in addition to supporting a change in attitude, values, and practices (Sousa et al. 2006). Cortez (2011) also states that recycling brings benefits to the environment, since it allows saving natural resources, water, energy, and raw material, generating jobs and income from the sale of recyclables for the society.

Recycling, remanufacturing, and reusable packaging are present both in reverse logistics and in green logistics, considering that both activities deal with the flow of the return of after-sales products and, at the same time, are concerned about environmental preservation (Adlmaier & Sellito, 2007; Lago, 2013).

It is noteworthy that the particularities of each waste must be considered to define whether the element will be recycled, reused, or returned. For instance, we can mention packages of cleaning products, which can be reused, and those of the lamps of the establishment, considered as hazardous waste and which should have a separate destination (Domingues, 2013).

Recycled cooking oil

The oil used for frying is considered the largest and the most worrisome pollutant generated by food establishments. If not properly disposed, the losses are almost immeasurable: only 1 liter of oil can pollute approximately 1 million liters of water. Furthermore, it can clog the sewer system, thus damaging the environment; when dumped into rivers, it can prevent the entry of light and oxygenation, harming marine animals; and its excess forms a fat layer on water banks, aggravating the flooding risk (Abrasel, 2012; Acre & Castilho, 2013; Silva et al. 2012; Bilck, Silva, Costa, Benassi & Garcia, 2009).

Oil recycling happens differently from the recycling process of other products, and thus it requires a different reverse flow when compared with other recyclables. To do so, we should “plan and map the entire route, seeking to make the collection at points close to each other, in an interconnected way and with sufficient quantity for this activity to be productively performed” (Oliveira, 2014, p. 34).

Performing the correct disposal of residual oil brings several benefits to the society and the environment, reduces costs in maintenance of sanitation networks, minimizes effects of pollution, and promotes social inclusion throughout the collection network (Rocha, 2010; Zucatto, Welle & Silva, 2013).

Another activity is the production of homemade soap from used cooking oil. However, Netto (2010) and Oliveira (2014) do not recommend such activity, since it uses corrosive materials and strict rules must be followed for its production. Therefore, there are entities specialized in collecting oil, soap manufacturing, and the distribution of the product back to the locals which provided the residue.

Solid wastes

According to Acre & Castilho (2013), there is a big problem in the food industry regarding the amount of solid waste and the neglect on the part of both governments and entrepreneurs. For this reason, authors emphasize the importance of complying with the laws and following the *Política Nacional de Resíduos Sólidos* (Brazilian Policy of Solid Waste – PNRS) (Nery, Conto, Zaro, Pistorello & Pereira, 2013; Amaral, Costa, Corrêa & Freitas (2014); Lago, 2013; Fernandes, 2015).

The PNRS (Law no. 12,305, August 2, 2010) is formed by the set of principles and actions defined by the Federal Government in order to perform an environmental management that is suitable to solid wastes, defined by law as:

“[...] material, substance, object, or disposable good resulting from human activities in society, whose final destination proceeds, intends to proceed, or must proceed in solid or semisolid states, as well as gases contained in vessels and liquids whose specific characteristics makes its release in public sewers or water bodies unfeasible, or which require for such technical or economically unviable solutions regarding the best technology available.” (BRASIL, 2010)

Reverse logistics is considered to be one of the tools of the PNRS; therefore, it is also one of the ways for waste generators to comply with their environmental obligations. This is defined in Chap. II, Art. 3rd, as:

“[...] an instrument of economic and social development characterized by a set of actions, procedures, and means aiming to enable the collection and return of solid waste to the business sector, to reuse in its cycle or in other productive cycles, or other environmentally appropriate final disposal.” (BRASIL, 2010)

The law does not have specification on restaurants, but defines as solid waste generators “individuals or legal entities, public or private, that generate solid waste through their activities, including consumption” (BRASIL, Chap. II, Art. 3rd, IX, 2010), enabling non-industrial sectors to be responsible for their waste as well.

To minimize the environmental impact and effectively leverage by-products, the study by Bilcketal. (2009) proposed to the owners of restaurants: to encourage the practice of recycling among the collaborators; to establish actions for minimizing waste production; to use recyclable materials of less environmental impact; to stimulate the collaborators’ awareness of environmental preservation; and to establish partnerships with non-governmental organizations (NGOs) or private companies for waste collection. In addition, Chieregatto & Claro (2010) consider extremely important to improve the efficiency to reduce, eliminate, or prevent losses.

Pistorello, Conto and Zaro (2015) emphasize the importance of restaurants to carry out the waste mass balance, i.e., to identify the difference between the amount of food used in the preparation and consumed and the amount of solid waste found. Similarly, Silva (2008) states that restaurants must identify the types of waste found in leftovers and the factors that bring this about, in order to reduce them and reuse them in other preparations, during the pre-preparation. Analyzing the weight of the leftovers for each composition is one of the ways mentioned to this identification, and therefore owners of restaurants can take corrective actions and act in such a way to optimize the results (Ribeiro, 2002; Silva, 2008; Nery et al. 2013).

Novaes & Estival (2009) argue that restaurant managers can receive financial benefits and gain on corporate image in selling solid waste to pickers’ cooperatives, mitigating costs of waste storing and cleaning.

Production of fertilizer from wastes (composting)

According to Amaral et al. (2014), restaurants and industrial kitchens are large waste generators, mainly organic waste, which can be reused. Legaspe (2004) states that composting is the simplest and most viable mean to treat and reuse these residues.

In Florianópolis there is the Procomposto, a private company active in waste management of restaurants since November 2014 (Procomposto, n.d). The activities of the organization involve waste transportation; weighing of the material and the delivery of a balance report; online availability of information such as date, time, collected amount, and place of waste disposal; guidelines to collaborators of restaurants on the correct separation and storage of organic waste; and the transformation of waste into fertilizers for composting.

If the restaurant does not want to establish a partnership with a private company to outsource the composting, collaborators can be oriented to properly separate organic waste, separating them from the others, for later composting. This practice requires packing and transportation care because of the weight, moisture, and perishability of the material. Solutions are not standardized, in such a way that the process of storage, collection, transportation, and disposal should be observed on a case-by-case basis (Amaral et al. 2014).

For Freeman (2011), the benefits of composting include opening of competitive advantage, strengthening of the ties with the local community, and it is also one of the reasons for restaurants to have their own vegetable garden.

Vegetable garden in restaurants

There are three types of vegetable gardens, according to Nowak (2004): the first is the simplest and the cheapest, with plants in containers. The second consists in transforming the entire roof of the restaurant in a vegetable garden. This process requires a greater investment, but it has advantages, such as the retention of rainwater and construction of thermal and acoustic insulation of the building; it provides natural habitat for animals (such as birds and butterflies) during their migrations (Nowak, 2004); it helps to save electricity in terms of temperature control; it raises the possibility to create different menus according to seasonality; it offers a pleasant and calm aesthetic appearance (Blyth & Menagh, 2006); it improves air quality; and it mitigates environmental impacts (Engelhard, 2010).

The third possibility raised by Nowak (2004) is the cultivation of hydroponic plants, i.e., plants that require no soil, but which are planted in water with a nutrient solution. Regarding weight, this option is the lightest of the three, and it offers faster growth of the vegetable garden.

A limitation that must be considered is the fertility of the soil. However, Blyth & Menagh (2006) state that the leftovers of restaurants can be a way to work around the problem through composting. The authors also consider, in the case of vegetable gardens in roofs, if the structure of the establishment is compatible with the amount of the production weight and the irrigation and drainage system. Besides, in order to prevent the water and the roots to

compromise the roof, it is important to have a waterproof membrane beneath the soil of the garden.

Collaborators' training

The term "environmental education" is discussed since the Stockholm Conference in 1972 (Siqueira, 2002), but only in 1999 the Brazilian Environmental Education Policy was introduced in Brazil. Such policy encharges all companies, professional entities, and public and private institutions to promote training programs for the qualification of collaborators, aiming at improving the work environment and the impact of the productive process on the environment (BRASIL, 1999).

Consequently, for Krause & Bahls (2013), collaborators who lack motivation or are unprepared and who do not correctly work can ruin the sustainability policies of a restaurant. The constant occurrence of new trainings, considering the high turnover, contributes to a negative result of the professional trainings. Hence, employees need to receive incentives in order to have a perception of a career in the food industry, since there is low growth prospect in the business. Ribeiro (2002) considers that the work of employees who work with food production can often be considered problematic due to lack of technical and operational knowledge, being aggravated by the lack of training on the part of managers. As a workaround, Krause & Bahls (2013, p. 447), claim that

A managerial approach of long-term incentives tend to reverse the high turnover and, in some cases, the neglect of the work members concerning the quality provided by the enterprise. In the case of sustainability, this aspect tends to be neglected by an unprepared group, since it is a new subject and often unknown to most of the gastronomy employees (Krause & Bahls, 2013, p. 447).

The research of Bilck et al. (2009) shows the difference between a restaurant that invested in proper training for collaborators and one that did not invest. In the first case, it was noticed that there was commitment only to collect aluminum cans for separation because of the monetary value when such were sold. Regarding the second restaurant, trained employees were considered very ecologically conscious.

METHODOLOGY

Our research is characterized as quantitative, i.e., it translates information into figures in order to classify and analyze it (Prodanov & Freitas, 2013), and exploratory, whose basis is literature research.

A questionnaire with 18 closed-ended and of multiple choice questions was developed based on the authors presented in Chart 1. It was applied to managers/people responsible for the establishments of three distinct gastronomic routes located in Florianópolis, Santa Catarina state – Brazil. In the Coqueiros neighborhood (referred to as B1), nine restaurants were

researched on May 05, 2016; in Sambaqui (referred to as B2) there were seven questionnaires on May 13, 2016; and in the third route, Ribeirão da Ilha (referred to as B3), eight questionnaires were applied on June 16, 2016. The establishments were chosen by non-probabilistic sampling, according to which the selection of the population partly depends on the judgment of the researcher in the field (Mattar, 2014). The selection of the sample was carried out for convenience depending on the choice of the interviewer (Malhotra, 2012), being available to establishments that have agreed to participate in the survey, responding to a structured questionnaire, applied as an interview.

The research has reached a total of 24 food establishments, of which 63% were *à la carte*; 9%, bakeries/confectioneries; 8%, confectionaries; 8%, buffet service; 4%, *gelaterias*; 4%, burger restaurants; and other 4% of frozen foods for sale. According to Fonseca (2014), an *à la carte* restaurant is like a traditional restaurant, which has an extensive menu with preparations of general acceptance. On the other hand, in confectioneries, according to the author, one can sell sweets such as pies and cakes and/or bakery products. Lippel (2002) mentions the buffet restaurants with variety and rapidity, and the service is performed almost entirely by the clients themselves. The *gelaterias*, for Fonseca (2014), are part of specialized restaurants, emphasizing a specific preparation, as well as the burger restaurants, which predominantly offer a menu of sandwiches and burgers, but prepared with top quality ingredients (Fonseca, 2014).

The data were organized according to the neighborhoods and the applied questions. Further, they were analyzed according to the answers to each question. In order to simplify the comparison of data of each neighborhood for the analysis, we have developed charts with the individual and the total percentage of the research.

Data analysis

The questionnaire comprised the knowledge of managers on the reverse logistics in the food sector, whose data can be observed in Chart 2.

Chart 2 – Do you know reverse logistics in the field of gastronomy?

Answer	B1	B2	B3	Total
Yes	22%	0%	25%	17%
No	78%	100%	75%	83%

Source – Elaborated by the authors (2016)

We perceive, considering Chart 2, the lack of knowledge about reverse logistics in every neighborhood, since only 17% of the restaurants knew the term, which reinforces the need for environmental awareness of those responsible for the establishments. Regarding such aspect, for Silva (2008), the companies producing goods and services consume a lot of non-renewable

natural resources, and awareness of their managers causes an even higher increase of the environmental impact.

Another explanation of this lack of knowledge about reverse logistics is given by Soares, Streck, Trevisan & Madruga (2016), who state that RL only began to be recognized in Brazil recently, from the PNRS, and it can still be more deeply explored.

Chart 3 – Do your suppliers use some type of returnable packing?

Answer	B1	B2	B3	Total
Yes	33%	43%	75%	50%
No	67%	57%	25%	50%

Source – Elaborated by the authors (2016)

Regarding returnable packaging, in Chart 3 we can perceive that, specifically in B1, the amount of returnable packaging is only 33%, a disparate datum compared with the 75% found in B3. Castanho (2006) considers the use of reusable and recyclable packaging a trend, since it reduces costs, complies with the laws, and is suitable for the market. Suitability for a new market trend is not fast and homogeneous, which may explain the difference concerning the data on returnable packaging between B1 and B3.

When the restaurants of this research were surveyed regarding the type of packaging used, it was argued that 88% are disposable, and 75% of them are not reused in any way. Both in B1 and B3, all restaurants have disposable packaging, while in B2 only 57% of the restaurants use them.

Chart 4 – Do you have any association with a cooperative that recycles oil?

Answer	B1	B2	B3	Total
Yes	67%	100%	87%	85%
No	33%	0%	13%	15%

Source – Elaborated by the authors (2016)

Considering Chart 4, we perceive that most restaurants of all neighborhoods (85%) have partnered with a cooperative that recycles the used cooking oil. Only in B1 this number was lower, accounting for 67%. Of 15% of the total that do not have partnerships with any cooperative, the reason given by all was the lack of knowledge or of an offer on the part of these companies. These data were similar to those found in the research by Chieriegatto & Claro (2010), in which 81% of the restaurants had a partnership with a cooperative that trades oil for cleaning products, and also to the research by Silva (2008), in which all surveyed restaurants claimed to have difficulty in allocating the residual oil by lack of knowledge of existing cooperatives, and this issue was mitigated with the offering of this service to restaurants.

Chart 5 – Have you already produced something from frying oil?

Answer	B1	B2	B3	Total
Soap	33%	71%	70%	58%
Biodiesel	0%	0%	20%	8%
None	67%	29%	10%	34%

Source – Elaborated by the authors (2016)

Chart 5 shows that the residual oil from restaurants is transformed into soap by cooperatives in 58% of cases, and 8% claimed it was transformed into biodiesel. Of the total, 34% had no knowledge about the final destination given to oil by cooperatives.

Chart 6 – Does the region has selective collection of wastes?

Answer	B1	B2	B3	Total
Yes	100%	71%	87%	88%
No	0%	29%	0%	8%
I do not know	0%	0%	13%	4%

Source – Elaborated by the authors (2016)

According to the Municipality of Florianópolis (2015), the selective collection routes meet 100% of the neighborhoods of the city. Nevertheless, according to Chart 6, in B2, 29% claimed to not have the service, and in B3 13% were unaware of it.

When asked about the wastes of the establishment, 96% of respondents claimed to perform separation, and only 13% of restaurants in B3 do not, totaling just 4% of the total in Florianópolis. Such datum is similar to the study by Silva (2008), in which 100% of respondents were interested in properly allocating the waste. On the other hand, in the research by Chierogatto & Claro (2010), 69% of restaurants performed separation for disposal, while 31% did not have an organization that allows performing the separation.

Chart 7 – What type of separation do you perform?

Answer	B1	B2	B3	Total
Paper/cardboard	15%	9%	16%	13%
Metal	14%	12%	19%	15%
Glass	18%	16%	18%	18%
Plastic	14%	19%	13%	15%
Oil	14%	19%	18%	18%
Non-recyclable waste	7%	0%	0%	2%
Organic	14%	22%	13%	17%

(continues...)

Chart 7 – Continuation

Answer	B1	B2	B3	Total
Recycled General	4%	3%	0%	1%
Others	0%	0%	3%	1%

Source – Elaborated by the authors (2016)

In Chart 7 we can observe that residual oil, glass, and organic waste are the most separated ones by the establishments. Such datum does not agree with the research by Bilck et al. (2009), according to which the commitment of the employees of restaurants was greater in collecting aluminum cans for their sale price, if compared with other less valued materials.

In our survey, when asked about the type of waste individually, only 12% of establishments had a superficial notion of the amount generated by the restaurant, although none performed the total mass balance or of each element. The importance of weighing is presented in the studies by Silva (2008) and Pistorello et al. (2015), which discuss, respectively, the purpose of implementing actions to reduce waste and improve the productivity, in addition to the optimization of procedures within the gastronomic planning and adoption of techniques for reuse of waste.

Regarding the leftovers of the inputs in restaurants, 54% are discarded and 8% of establishments claim to not have any to spare. Considering what is not directly allocated to disposal, 11% of establishments allocate leftovers for composting; other 11% give them to homeless people, although this practice is not in accordance with the legislation; 8% allocate them to farms that have pig breeding and aquaculture; and 4% of the restaurants make their own detergent with residual oil. The low number of actions on the leftovers is explained by Silva (2008, p. 35), who claims that “since, overall, people do not identify leftovers as generators of environmental impacts, the search for solutions to the problem is not a priority.” One of the reasons for food waste is mentioned in the research by Pistorello et al. (2015). In a restaurant in a hotel in Rio Grande do Sul, the waste occurred because the provision of food is much larger than the consumption, with the aggravation of the lack of mass balance of the waste and an appropriate planning of the menu, which results mainly from the poor management of the establishment. Concerning this, the authors stress that “considering the environmental dimension in the planning of gastronomic activities is undisputed to minimize the environmental impacts resulting from this activity” (p. 339). For the authors, one of the ways to reduce this impact would be allocation, in order to reuse the inputs such as composting.

Chart 8 – Does the restaurant make composting of organic inputs?

Answer	B1	B2	B3	Total
Yes	11%	57%	12%	25%
No	89%	43%	88%	75%

Source – Elaborated by the authors (2016)

We perceive in Chart 8 that only a quarter of restaurants perform the composting of organic inputs. A low number, which ties in the small number of establishments that have vegetable garden, or intend to have it, as shown in Chart 9.

Chart 9 – Is there a vegetable garden at the restaurant?

Answer	B1	B2	B3	Total
Yes	11%	14%	25%	17%
No	89%	86%	75%	83%

Source – Elaborated by the authors (2016)

In Chart 9 we observe that 83% of restaurants do not have a vegetable garden, and only 25% plan to implement one in the future. Of those that do not plan to implement one, 67% claimed the fact there is no space; 9% do not produce at the restaurant; 8% say they would use it little; 8% do not have it because of the on-site beach; and other 8% consider having other priorities. MacRae et al. (2010) also state that the lack of space is one of the factors typically considered to limit urban food production. However, alternatives, such as the vegetable gardens on the roofs of hotels and restaurants, re already becoming popular around the world (Nowak, 2004).

Chart 10 – Do you provide training about environmental education and good practices?

Answer	B1	B2	B3	Total
Yes	100%	71%	100%	92%
No	0%	29%	0%	8%

Source – Elaborated by the authors (2016)

We can observe in Chart 10 that a total of 92% of respondents claim to perform some kind of environmental education training or good practices of handling. Such training are mostly (42%) carried out by a specialized company, with 27% of them being taken outside the company. In 15% of cases, nutritionists go to the restaurants to train the employees, and 16% are the owners themselves, managers, or the chef of the establishment that play this role. Such data contrast with those of Kremer, Costa & Mondo (2013), who showed that only 25% of the 35 restaurants surveyed in Florianopolis, a small portion, conduct training on environmental awareness with a specialized consultant.

Mitigation of negative impacts and maximization of the positive ones

In Chart 11 we present a survey of topics covered in the research, in accordance with the authors of Chart 1. We aim to broadly elucidate positive and negative impacts that we found.

Chart 11 – Positive and negative impacts of the research

Topic	Data	Impact
reuse of packaging	Of the restaurants that have packaging, 75% do not reuse them in any way.	Negative impact
Recycling of packaging	The vast majority (88%) only use disposable packaging.	Negative impact
Recycled cooking oil	Most (83%) restaurants use frying oil on the menu. Of these, 85% have partnership with a cooperative that recycles oil.	Positive impact
Solid wastes	A total of 96% of the restaurants practice the separation of waste, although none conduct the weighing of such waste.	Positive impact
Production of fertilizer from wastes (composting)	Most restaurants (75%) do not make any type of composting with the leftovers. As an aggravating factor, more than half (54%) of these leftovers are discarded.	Negative impact
Vegetable garden in restaurants	A total of 83% of establishments have no garden, being the lack of space the main reason for such. Only 25% are interested in planting one in the future.	Negative impact
Collaborators' training	A total of 92% of employees are trained in some way about good practices and environmental education.	Positive impact

Source – Elaborated by the authors (2016)

- Reuse of packaging/Recycling of packaging:** most restaurants use disposable packaging, generating a negative environmental impact. These could be reused or recycled, and only a few establishments do such activity. The policy of the 3 Rs of sustainability (reduce, reuse, and recycle) can be one of the ways to mitigate this impact (Puntel & Marinho, 2015). Other solutions are raised by the authors for the issue of packaging such as the use of returnable packaging (Campos, 2006; Costa & Valle, 2006; Adlmaier & Sellito, 2007; Cortez, 2011) or biodegradable packaging (Castanho, 2006).
- Recycled cooking oil:** On the frying oil, almost all restaurants that feature fried items on the menu have partnered with cooperatives that recycle oil, which is a very positive aspect. To maximize the positivity of this datum, restaurants can make use of products made with recycled oil such as the use of biodiesel in delivery vehicles. Another way was studied in the research by Puntel & Marinho (2015), in which only 1% of restaurants of Florianópolis used soap made from recycled oil to wash the dishes, one of the proposals raised by authors for reducing the environmental impact.
- Production of fertilizer from wastes (composting):** Only 25% of the restaurants perform or have partnership with a composting company, a small number considering the benefits that the activity can bring. As a solution, Venzke (2001) suggested that organic leftovers in restaurants were no longer

seen as waste, but rather as nutritious raw material that can be reused for preparation of a new product through composting, for example. In addition, Novaes & Estival (2009) suggest giving these foods to animal farms.

- **Vegetable garden in restaurants:** It is understood that the lack of vegetable gardens in the restaurants of Florianópolis is a consequence of the lack of composting, since the fertilizer produced with the leftovers could be used in the vegetable garden of the restaurants, aiming at having local and organic food and reducing costs. Unfortunately, very few restaurants have it or plan to do it. Blyth & Menagh (2006) state that if there are no means of the restaurant to have a vegetable garden on the roof, the use of containers is a great option, which are easier to manage, occupy less space, and have reduced workforce cost.
- **Collaborators' training:** This research found that most employees receive proper training on good practices and handling and environmental education. For Silva (2008), this is one of the key factors to avoid food waste in restaurants. The next step would be encouraging specialization, which generates a career perception and enables employees with more technical knowledge, a solution advocated by the authors Krause & Bahls (2013) for the restaurant to be sustainable and have qualified and motivated employees.

CONCLUSION

We achieved our purpose with the research, which was to analyze the reverse logistics of restaurants in Florianópolis. With the bibliographical research it was possible to raise the object definitions, reverse logistics, as well as all topics related to the reverse process of the restaurants, which were individually deepened.

We concluded that there is a need for academic research addressing reverse logistics in other market segments in addition to the industry as well as important government incentives to restaurants to practice the RL. We also observed the need to monitor the parameters that have already been established in the PNRS concerning reverse logistics and waste management.

On the part of managers of restaurants, it is necessary a greater awareness of the use and recycling of packaging, of the management of the leftover and their recycling through composting, which could be even used in a vegetable garden of the restaurant. The adaptation of business processes is also reflected in maintaining market competitiveness of the organization, since there is an increasingly discussion of the issue (Spezamiglio, Galina & Calia, 2016).

Overall, we noticed some concern on the part of most sustainability managers, but only about what is required or supervised by law. This insertion process in organizations requires a high cognitive effort of interpretation. Only systematically the involved parts will notice issues related to economy, society, and the environment (Nobre & Ribeiro, 2013). With this research restaurants are expected to become more responsible for their waste and to perform an

environmental management, specifically the reverse logistics completely, as the philosophy of the company.

It is understood that the contribution of this research to the state-of-the-art is the perception and the relevance of the good practices that are carried out. This contribution highlights the importance of studying in greater depth the application of reverse logistics in the gastronomic field, in order to educate managers and employees on investment concerning the addressed topics.

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