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Food losses and waste: how Brazil is facing this global challenge?

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ABSTRACT

By 2017, Brazil seems to have finally awakened to the problem of food loss and waste. In this article, we resume the topic started in the article "*Postharvest losses of perishables in Brazil: what do we know so far?*" published earlier this year, but now with an emphasis on food losses and waste (FLW). We divided this article into four sections: (a) search for scientific publications on postharvest losses (PHL) and food waste (FW) in Portuguese; (b) social classes and food consumption in Brazil and household food waste; (c) the national legal framework on FLW; and (d) current food security policies and civil society actions on FLW. Google Scholar searches yielded 46,100 records for FW and 16,100 for PHL, but only 37 and 19 records, respectively, when the searches were restricted to the title of the papers. There is a clear division of subjects: PHL is more related to Agriculture and Economy and FW to Health, Nutrition and the Environment, and reasons and consequences are discussed. Food consumption and waste in Brazil must take into account the great social heterogeneity and high income inequality, as well as some unexpected driving cultural reasons. About 30 bills related to food waste have been discussed in the Brazilian Congress since 1997, with a low expectation of approval in the short term. In the absence of a regulatory framework to reduce losses and facilitate the donation of food, society has found its own way of dealing with the problem. Some initiatives are presented here, along with some governmental food security policies which had positive impacts in reducing FLW, such as National School Feeding Program (PNAE), food banks and popular restaurants. Some international movements are also beginning to gain strength in Brazil, e.g., the purchase of fruits and vegetables outside of aesthetic standards, "SaveFood Brasil", "Slow Food", among others. These are all put in perspective.

Keywords: food security, national policies, legal framework, wastage, food waste.

RESUMO

Perdas e desperdício de alimentos: como o Brasil tem enfrentado este desafio global?

Em 2017, o Brasil parece ter despertado para o problema de perdas e desperdício de alimentos (PDA). Neste artigo, retomamos o tema iniciado no artigo "*Postharvest losses of perishables in Brazil: what do we know so far?*", publicado no início deste ano, agora com ênfase em desperdício de alimentos. Dividimos este artigo em quatro partes: (a) buscas pelos termos em Português "desperdício de alimentos" e "perdas pós-colheita" no Google Acadêmico, SciELO e Portal de Periódicos da CAPES; (b) classes sociais e consumo de alimentos no Brasil e desperdício de alimentos domiciliar; (c) situação do marco regulatório nacional sobre PDA e; (d) políticas de segurança alimentar e ações da sociedade civil em PDA. No Google Acadêmico, foram encontrados 34.800 registros para "desperdício de alimentos" e 14.100 para "perdas pós-colheita"; mas apenas 37 e 19 registros, respectivamente, quando a busca foi restrita ao título dos documentos. Existe uma clara divisão das áreas, sendo perdas pós-colheita mais relacionada a agricultura e economia e desperdício de alimentos à saúde, nutrição e meio ambiente. As consequências desse fato são discutidas. No Brasil, o consumo e o desperdício de alimentos devem levar em conta a grande heterogeneidade social e a alta desigualdade de renda, além de razões culturais inesperadas e relevantes. Cerca de 30 projetos de lei relacionados ao desperdício de alimentos foram discutidos no Congresso brasileiro desde 1997, com baixa expectativa de aprovação no curto prazo. Na ausência de um quadro regulatório para reduzir perdas e facilitar a doação de alimentos, a sociedade brasileira encontrou sua própria maneira de lidar com o problema. Algumas iniciativas são apresentadas aqui, assim como políticas governamentais de segurança alimentar que tiveram impacto positivo na redução de perdas, como Programa Nacional de Alimentação Escolar (PNAE), bancos de alimentos e restaurantes populares. Atualmente, alguns movimentos internacionais também começam a ganhar força no Brasil, como a aquisição de produtos hortícolas fora de padrões estéticos, "SaveFood Brasil", "Slow Food", entre outras. Todos eles são colocados em perspectiva.

Palavras-chave: segurança alimentar, políticas nacionais, marco regulatório, descarte, desperdício de alimentos.

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In this paper, we resume the topic Food Losses initiated in the article "*Postharvest losses of perishables in Brazil: what do we know so far?*" published earlier this year in *Horticultura Brasileira* (Henz, 2017). This time, we shed some light on the relevant second half of the plot: food losses and waste (FLW). In the first article, we were surprised by the number of publications about postharvest losses of perishables in Brazil - more than 100! At the same time, we realized that most of them were practically unavailable for the international scientific community because of the idiom barrier, since almost all of them were written in Portuguese. Would it be also the case for the Brazilian literature in food waste?

In 2014, the FAO published the document "*Definitional Framework of*

Food Loss", broadening the FLW concept and drawing attention to the second part of the postharvest chain: food wastage in households. Traditionally, there was a clear division in Brazil regarding postharvest losses and food waste. Since the 1970s, postharvest losses are studied primarily by agronomists and economists, focusing on the problems and additional costs occurring from harvest to the retail market (Henz, 2017). On contrary, FLW seemed to be more related to Health Sciences and Nutrition, and more recently to Environmental Sciences, because of organic residues. Since the seminal study from FAO was published, food waste has become also a relevant research theme in the area of transformative consumer research.

However, more in-depth discussions about food waste are relatively new in Brazil. Only recently the subject started drawing the national media attention, with several television programs being broadcasted and articles and editorials being published in newspapers and magazines. Apparently, food waste did not arouse the same interest in the research field as compared to postharvest losses, since there is not much scientific bibliography available on the subject in Brazil.

Brazil has also committed to the United Nations Sustainable Development Goal Target 12.3 *to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains by 2030*. Hence, reduction of FLW has emerged also as a priority at the national political agenda.

Agriculture and Food Security in Brazil

From 1960 to 1990, Brazilian agriculture experienced a rapid development. There were many key factors for the success of agriculture, such as farmers' entrepreneurial spirit, expansion of the agricultural frontier, adoption of modern production techniques and investment in research, development, and innovation. Presently, Brazil is an agricultural powerhouse, ranked among the top five producers and exporters of agricultural products in the world. Exports of commodities and food products closed 2016 at US$ 84.9 billion and, from January to October 2017, reached US$ 82 billion (Agrostat, 2017).

Despite such abundance in food production, food insecurity is still present in the country and FLW restrains the capacity of increasing food availability for the internal market. Although severe food insecurity among the Brazilian population has decreased from 7% in 2004 to residual 3% in 2013, there are still 52 million Brazilians, about ¼ of the population, threatened by food insecurity if one considers its three levels (low, moderate and severe) (IBGE, 2014). At the same time, tons of still consumable food is discarded daily at the end of the food chain. In addition, at the global level, recent data on food security point out to a possible reversal of trends worldwide. After more than 10 years declining, famine figures in the world are estimated to have increased to 815 million people in 2016, up from 777 million in 2015, although still below from about 900 million in 2000 (FAO, 2017).

Food Policies

The food waste issue started being studied in Brazil with more emphasis in the late 1990s when food security became more frequently debated in the Brazilian society. A landmark was the Zero Hunger program launched in 2003, which aimed, along with other social programs, at the implementation of food security policies (Belik, 2012a,b). Public policies and programs, such as strengthening local economies, raises in the minimum wage, direct income transfers and the inclusion of people in Social Security, helped to improve the national status regarding food security. Other novel programs were the Food Procurement Program ("PAA - Programa de Aquisição de Alimentos") and the National School Meals Program ("PNAE - Programa Nacional de Alimentação Escolar").

In 2014, Brazil was for the first time removed from the World Hunger Map (*The State of Food Insecurity in the World*). According to the report, the number of undernourished people had fallen by more than 80% in ten years. The new status was achieved through a mix of public policies and increased food supply in the internal market, due to the outstanding performance in agricultural production.

Present time

Sustainable food production and consumption in Brazil face constant challenges, with strong tendency to become serious problems in the future due to postharvest losses and food waste. Traditional farming systems will face increasing challenges to maintain and expand their current levels of food production due to climate change, intensive use of inputs and natural resources and, above all, changes in the eating habits of the Brazilian population. Moreover, the scenario increasingly deteriorates as the low economic growth persists.

Since 2015, issues related to postharvest losses and food waste are constantly present in the national media in the wake of the huge political and economic crisis Brazil currently faces. The country struggles with high unemployment (estimated at 14 million people in 2017), with great impacts on the standard of living of a substantial part of Brazilian society. Social inequality is increasing again, after a couple of years of discreet improvement. Some successful governmental food security programs are suffering budget constraints. All combined, these factors place strong pressure on the recent social progress Brazil achieved in food security. The current situation has affected food consumption to the point of increasing the number of people at risk of food security, which makes the discussion about postharvest losses and food waste absolutely relevant and urgent.

Therefore, the main objective of this article is to portray the situation of food losses and waste in Brazil in a comprehensive approach. For that, we divided this article into four sections:

(a) A search for scientific publications using the terms "postharvest losses" and "food waste" in Portuguese, resulting in an inventory of the what has been

published so far;

(b) A discussion on social classes, food consumption and household food waste in Brazil;

(c) The national legal framework on FLW, still pending in the Congress;

(d) The identification and brief description of initiatives that address FLW in the country, such as food security policies and civil society actions.

FOOD WASTE (FW) OR POSTHARVEST LOSSES (PHL): WHICH IS MORE IMPORTANT?

The first section of this paper deals with bibliographic searches performed in databases available in Brazil to know what has been published so far in FW and PHL. Our main goal was to trace the evolution of the interest of the scientific community on each subject since it has been difficult to find scientific papers on food waste in Brazil. Bibliographic searches were carried out using Google Scholar (in Brazil known as *Google Acadêmico*: *https://scholar.google.com.br*), the SciELO (Scientific Electronic Library Online) database (*www.scielo.org*) and the portal of journals of CAPES [Coordination for the Improvement of Higher Education Personnel (*www.periodicos.capes.gov.br*)], using the terms *postharvest losses* ("perdas pós-colheita") and *food waste* ("desperdício de alimentos") in Portuguese. At Google Scholar, idiom was set to Portuguese (Brazil) and searches were performed by decade and, later on, with the two terms in the title, excluding patents and citations. At SciELO, searches were made in the Brazilian journals using the terms "food waste" and "postharvest losses" in all indexes (author, year, periodical, abstract, title, funding agency) in the "integrated mode". At CAPES, searches were performed with the two terms in the title and on the subject ("and").

In Google Scholar, 46,100 records were obtained for "food waste" and 16,100 for "postharvest losses" when searching for the two terms anywhere on the text. The number of hits was reduced to only 48 and 24 records when the search for both terms was restricted to the title. In SciELO, the search resulted in 22 references for PHL and 14 for FW, for the two terms in all indexes using the integrated search mode. Only seven references for PHL and five for FW were retrieved in CAPES for searches with at least one term in the title (Table 1).

In Google Scholar, classification by relevance resulted in 1,950 records for food waste, covering different topics, such as waste management, centesimal composition and alternative food use. At the bottom of the results page of Google Scholar, the "related searches" terms for FW were "Brazil", "restaurants", "hospital facilities", "data", "schools", "hunger", "Food and Nutrition", "reduction", and "evaluation". For PHL, classification by relevance yielded 2,060 records, and the "related research" terms were "Brazil", "fruits", "vegetables", "evaluation", "reduction", "data", "transportation", "cereals" and "alternative technologies".

Searches in SciELO and CAPES produced similar results, with more references on PHL as compared to FW. Most of the papers published on PHL were about specific topics, such as handling systems, postharvest diseases and mechanical injury, or about the application of postharvest technologies in fruits and vegetables, such as refrigeration and packaging, controlled/modified atmosphere, minimally processed products, use of edible coatings and waxes, physical and chemical treatments. Articles were published in eleven Brazilian journals of Agricultural Sciences, Horticulture, Rural Economics and Sociology between 1981 and 2016. For FW, 14 scientific papers were found in eight different Brazilian journals listed in SciELO, covering Health, Nutrition, Environment and Agriculture. Most articles were about centesimal composition, physical and chemical characterization, evaluation of food waste in institutional restaurants and waste management.

There was a significant growth of records for both PHL and FW over decades at Google Scholar, particularly after the 2000s (Figure 1). For FW, records ranged from 635 (1970s) to 14,600 (2010s) and, for PHL, from 11 (1970s) to 9,430 (2010s). Some possible explanations are: (a) popularization of internet and increased availability of electronic documents as opposed to hard copies in libraries as before; (b) "food" alone is a more powerful term in broad searches than "postharvest" or "losses"; (c) most of the records are generic publications, often related to only one of the search terms.

Most of the records retrieved in broad searches using Google Scholar are grey literature, such as newspapers articles, editorials, academic papers (theses, dissertations), abstracts, reports and technical documents published only in Portuguese. The largest number of records in Google Scholar for FW compared to PHL can be related to the impact and comprehensiveness of the term in searches across all knowledge areas. PHL is more closely related to Agricultural Sciences, Economics

Table 1. Number of records in search engines for postharvest losses (PHL) and food waste (FW), respectively "desperdício de alimentos" and "perdas pós-colheita" in Portuguese, as in December 2016. Brasília, Embrapa, 2016.

Search engine	Nr. of records	
	"Perdas pós-colheita" (PHL)	"Desperdício de alimentos" (FW)
Google Scholar*	24 (16,100)	48 (46,100)
SciELO[1]	22	14
CAPES Portal**[2]	7 (16)	5 (8)

*Records retrieved using the two terms in the title. In brackets, records retrieved using the two terms anywhere in the text; **Records retrieved using the two terms in the title. In brackets, records retrieved using the two terms in the subject field; [1]Database of the Scientific Electronic Library Online (www.scielo.br); [2]Database of the Journal Platform of Capes (Coordination for the Improvement of Higher Education Personnel) (www.periodicos.capes.gov.br)

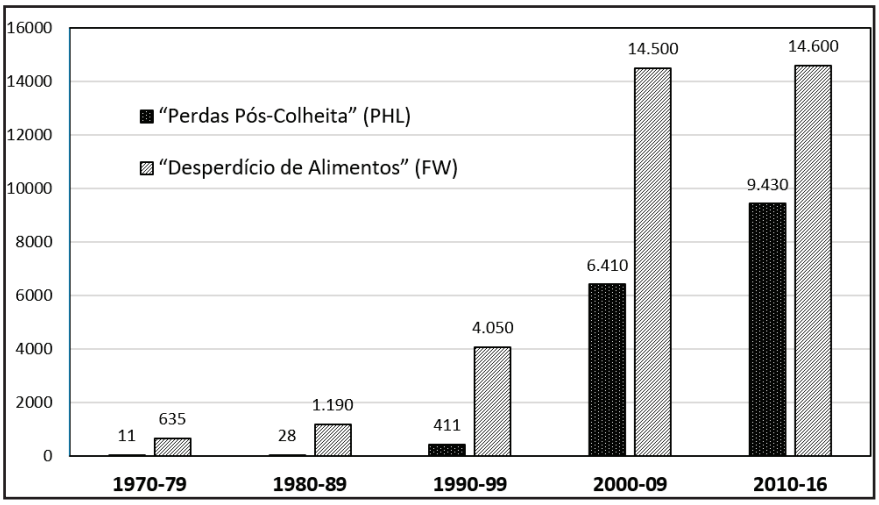

Figure 1. Number of records[1] by decades in Google Scholar for postharvest losses (PHL) and food waste (FW), respectively "desperdício de alimentos" and "perdas pós-colheita" in Portuguese, performed in December 2016. Brasília, Embrapa, 2016. ([1]Records retrieved by searching for the two terms anywhere in the text).

and Management, and usually limited to agricultural products. *Food* ("alimentos", in Portuguese) includes not only the same agricultural products but also meat, dairy products and all sort of processed food. Furthermore, FW is linked to Health, Nutrition and Food Sciences, areas with a larger number of scientific journals and postgraduate courses in Brazil. Since the 2000s, there is growing interest and awareness on food waste because of governmental programs on food security and also waste management and apparently less interest on PHL, not reflected in scientific papers yet.

Silverio & Oltrami (2014) published a review on food waste in Brazil based on bibliographic searches carried out with Google Scholar, LILACS and SciELO, from 1998 to 2008. Descriptors were Portuguese terms "Unidades de Alimentação e Nutrição" (Units of Food and Nutrition), "sobras" (leftovers), "desperdício" (waste) and "restos" (scraps). They list 19 papers, abstracts and theses, and used as references 9 books and technical publications, all of them in Portuguese. In a critical review of global food losses and food waste, Xue *et al*. (2017) pointed out that most existing publications on FLW were conducted in a few industrialized countries. In this study, only one in 202 papers was carried out in Brazil, published in English in an international journal by Fehr & Romão (2001).

In conclusion, there are relatively few scientific papers published in Brazil about FW and PHL retrievable by search engines. Moreover, fast and friendly-use Google Scholar broad searches retrieve all sort of grey literature. One must consider also, as shown by our results, that research on FW in Brazil is dispersed in subareas, such as Health, Nutrition, Consumer Behavior and Organic Residues Management. Because of this, it is important to manually analyze all publications to mine reliable data. So far, FW and PHL tend to be considered as distinct subjects in Brazil, lacking more comprehensive publications that consider simultaneously both areas and their complementarities, as currently regarded by the international scientific community (HPLE, 2014não está nas referencias).

A search for research teams at the Brazilian National Council for Scientific and Technological Development (CNPq) yielded 31 groups in Postharvest, studying 264 research lines; 50 groups on Solid Residues, with 280 research lines; and 59 groups on Food Security, with 225 research lines (Machado, 2017a).

Publications and research on FLW

In terms of academic work, FLW has been studied with different theoretical approaches, according to researchers' topics of interest and academic background. Our searches in Google Scholar, SciELO and CAPES were useful to identify main groups of interest of researchers working with food waste in Brazil in recent years. The main groups that came out from our analysis were: evaluation of wasted parts and correction factor in perishables, centesimal composition, food alternative use, food waste assessment in institutional restaurants, organic waste and household food waste.

Goulart (2008) published a four-page article describing the situation of food waste at that time. Brazil was regarded as one of the top ten countries in food waste in the world, despite the 54 million people living under the poverty line. Several publication were quoted describing some general estimates, such as 15% of food waste in restaurants and 20% in households; 39 tons of food waste daily; 60% of the household garbage were food leftovers and scraps; 15% to 50% of food waste in restaurants, bars and fast food outlets; and discharge of 20% to 30% of edible parts of vegetable crops.

Discarded Parts and Product Correction Factor

Marchetto *et al*. (2008 não está nas referencias) evaluated the reuse of discarded parts of fruits and vegetables, considered as losses. Five fruits and five vegetables were purchased and the edible portion of their weight (mass) was calculated after removing the inedible parts, such as peels, seeds, peduncles. For fruits, the discarded portion was 21.3% for papaya, 42.1% for watermelon, 45.3% for pineapple, 45.7% for guava and 55.3% for melon; while for vegetables, it was 15.2% for pumpkin, 18.2% for cassava (*Manihot esculenta*), 19.3% for beet, 29% for chayote and 41.6% for zucchini.

Another concept to be considered when studying FLW is the correction factor (CF), used by nutritionists and other professionals to determine the ideal quantity and nutritional value of a given food in the quantitative planning of meals. The CF is an indicator of waste, defined as the ratio between the mass of the raw food, that is, how it

was purchased, and its net mass after cleaning and preparing. Therefore, it can be considered as an index of loss or waste. Lemos *et al*. (2011 não está nas referencias) determined the CF for leafy vegetables (lettuce, escarole, endive, chicory, rocket, water crest, mustard, cabbage, kale) commercialized at the wholesale market in Brasilia, Brazil, in four periods (April, May, June, October). Correction factors ranged from 1.75 to 2.75 for watercress and from 1.11 to 1.15 for cabbage. During postharvest handling and marketing of leafy vegetables in Brazil, trimming the damaged, crushed, cut or diseased leaves is a very common practice, and therefore, a source of loss.

Food waste in restaurants

There are several articles on food waste in popular and institutional restaurants in Brazil. In this segment, waste involves several aspects, such as parts of foods that are not actually used, food prepared that are not consumed, and leftovers in consumer's dishes. Two concepts widely used in these studies are leftovers and remains. Leftovers are food which was prepared, but not served, being subdivided into usable (clean) and non-usable (dirty). Remains are all foods that were distributed but not consumed, which should always be discarded. Ingestion remains is the ratio between the remains returned in the dish and the amount of food served. Generally, 3% of leftovers and up to 10% of ingestion remains are considered acceptable loss levels.

Varela *et al*. (2015) evaluated the cost of food waste in the restaurant of the Federal University of Rio Grande do Norte, in Natal, Northeast Brazil, one of the 47 Brazilian university restaurants subsidized by federal public funds. The evaluation was performed for 61 days. The average amount of wasted meals was 11% of the total. The mean ingestion remains was 11.15%, ranging from 5.58% to 20.71%. Food waste in popular and institutional restaurants results from inadequate meal planning, daily user frequency, food preferences, and employee training in preparing and portioning foods. In a study carried out at a popular restaurant in Santa Catarina State, Parisoto *et al*. (2013) evaluated the remains/indigestible index before and after an intervention in the form of food preparation sheets, nutritional education of diners and training of employees. As result, they obtained a reduction in the remains/indigestible index from 4.77% (before) to 3.39% (after).

Organic Residues

In the period of August 1998 and March 1999, a study was carried out to understand the dynamics of food losses and waste in Uberlândia, state of Minas Gerais, then a medium-sized city in Central Brazil, with about 400,000 inhabitants (Fehr & Romão, 2001). Losses for fruits and vegetables were estimated at 6.28% in the wholesale market; 11% in retail, 11.67% in street markets, 12.56% in grocery stores and 8.76% in supermarkets. Household waste was evaluated in two residential buildings. Biodegradable waste corresponded to 66.6% of the total collected, 13.2% were characterized as food waste and 86.6% as disposable waste (Fehr & Romão, 2001). This is one of the few Brazilian papers on FLW cited abroad, having been published in English in an international journal.

Another major source of organic residues and food waste as well are the open air food markets present all over Brazil. In São Paulo capital, for instance, the city council has estimated that 160 tons of foods, mainly fruits and vegetables, are wasted per day (Secom SP, 2017) in street markets. São Paulo metropolitan area has 871 open-air markets and there is a clear opportunity to assign the food surplus from these venues for NGOs and other institutions committed to assisting those in food insecurity condition.

Residues generated at CEAGESP, in São Paulo, the biggest and most important wholesale market in Brazil, were evaluated in 2012 and 2013 (Câmara *et al*., 2014 não está nas referencias). Waste was classified according to its destination in four categories: garbage, composting, recycling, and donation to food banks. In 2013, 3.4 million tons were traded, of which 96.8% were fruits and vegetables; the rest were flowers and fish. The total waste generated was 1.7%, most of which was considered as garbage (78.8%), and the other 21.2% could be used for consumption, recycling or composting. The products donated to the food bank corresponded to 0.04% (2,072 t) and 0.06% (1,522 t) in 2012 and 2013, respectively. The main products donated were tomato, melon, onion and papaya.

The scientific papers listed above are just a few examples of some research lines found in our search. Certainly, there are much more publications on FLW not retrievable with the specific search terms we used. Nevertheless, there are relatively few scientific papers. Most of the information on the subject is press editorials and news, followed by reports, abstracts, theses and dissertations.

SOCIAL CLASSES AND FOOD CONSUMPTION

In Brazil, there are five social classes, referred to by letters (A, B, C, D, E), with different incomes and characteristics. What is known as "middle class" in Brazil is different in several ways when compared to the US or Europe. Much has been commented on the rising of 40 million Brazilians to a new low middle class, with a huge impact on domestic consumption. In an economy with rapid and unpredictable changes, the impacts on inflation and food prices pose an additional challenge to understand consumer behaviors and their effects on food production and consumption.

According to Maluf (1999), food consumption in Brazil must take into account the great social heterogeneity that characterizes the country, due to the high inequality of income, with a different weight to food expenses in the composition of household expenditures in different strata of income. According to IBGE, there was a decrease of 24.4% in annual household *per capita* consumption of vegetables between 1987 and 1996 and of 23.29% for tropical fruits, as opposed to an increase in the consumption of biscuits (24.47%), and beef (9.96%).

Although appreciation of food perceived as sustainable is a consolidated trend, there is also a large segment of

the population, notably in countries such as Brazil, which is beginning to enter the market and tends to consume more processed food products. If on the one hand there is the search for green consumption, on the other, the largest portion of the consumer market of class C is abandoning diets considered healthy, based on fresh food. The inverse relationship between income and consumption of processed foods contributes to the growth of food industries in Brazil, but, at the same time, obesity levels have increased in the low-income population. The trend of fruit and vegetable consumption, for example, is higher among the highest income segment, which requires Brazil to establish distribution strategies and nutritional education to serve the lower middle class.

Household food waste in Brazil

In Latin American countries, household food waste is a growing threat. Recently, FAO (2014) estimated that 28% of the food reaching the end of the chain is wasted by consumers, a percentage equal to losses at the production stage. It is likely that individual analysis in each of the countries in the region would give a clearer picture of food waste, given the socioeconomic and cultural differences among countries. These FAO data and empirical evidence from recent studies (Porpino *et al*., 2015; (2016 não está nas referencias)) change the idea that consumer food waste is a threat only to developed nations.

The Brazilian case seems to have peculiarities when compared to other emerging countries, although the estimates of losses and food wastage are very scarce in Brazil to provide precise explanations. In addition to substantial postharvest losses, a feature similar to that of developing countries, Brazilian households also discard considerable amounts of food due to cultural factors. Cooking more than necessary and serving large portions of foods is a common cultural trait in some Latin countries. In Brazilian households, in particular, abundant food stocks are highly valued, and for low-income families, it is a signal of wealth (Porpino *et al*., 2015). Stockpiling food products in abundance goes back to the hyperinflation period of the 1980s and early 1990s, but, in the low-income context, it is also driven by the necessity to assure that the most consumed foods, such as rice, will last the entire month.

In an ethnographic study carried out among 30 middle-low income families in São Paulo and Brasília, Porpino *et al*. (2015) identified five major categories of food waste: (1) excessive purchasing, (2) abundant preparation, (3) caring for a pet, (4) leftovers avoidance and (5) inadequate food preservation. Empirical evidence also shows that people responsible for food preparation who have experienced scarcity in the past tend to keep stocks high as a precaution, and as a consequence tend to prepare plentiful portions. Low-income consumers tend also to be highly socially connected in their communities, and having too much food serves as a guarantee that they can offer food to a neighbor or unexpected visitor, for example. Having surplus foods is a way of distancing oneself from the state of poverty, and is also related to the hospitality and affection by the family (Porpino *et al*., 2015).

THE NATIONAL REGULATORY FRAMEWORK ON FLW

Up to this date (December 2017), there is no approved regulatory framework on food losses and waste in Brazil. The National Congress is bicameral, composed by the Federal Senate (the Upper House) and the Chamber of Deputies (the Lower House). All the proposed bills must be approved by the two Houses, after being reviewed by thematic Commissions involved on the subject. According to the Brazilian 1998 Constitution, parliamentary initiatives cannot increase public spending (Fiscal Responsibility Law). In addition, from a legislative point of view, food waste is related to environmental and food safety issues and must consider the legal provisions of other approved National Policies and Regulatory Frameworks, such as the Environmental Policy (1981), Environmental Education (1999), Climate Change (2009) and Solid Waste (2010), as well as the National System of Food and Nutrition Security (2006).

Federal Senate's Legislative Consultants Peixoto & Pinto (2016) published a comprehensive report on the socio-environmental, economic and regulatory issues of food waste in Brazil. In this document, they list all the bills (around 29!) under discussion in the Congress up to 2016, most of them fortunately appended to more recent and comprehensive bills. In 1997, a "Brazilian Good Samaritan" law – clearly inspired by the US Bill Emerson Good Samaritan Food Donation Act of 1996 – was proposed to the National Congress. The bill intended to exempt from civil and criminal liability the donation of food without the subsequent characterization of intent or negligence. Twenty years later, its approval is still pending in the Congress.

Most of these bills on FLW are basically related to food distribution and consumption. These bills authorize or, in general, require establishments that trade food to donate to charitable or philanthropic entities, food banks, or directly to food insecure people. Donors or receiving entities are responsible for assessing food safety according to Brazilian Public Health and Food Quality standards. Donors are exempt from possible harm to the health of consumers in the absence of malice or negligence. However, bills do not eliminate the legal risks that donors are subjected by the Civil and Consumer Defense Codes, in case of health problems of the donation recipients, even if made in good faith (Peixoto & Pinto, 2016).

More recently, the food processing industry and retailers like supermarket chains are complaining about the high costs of donating food due to several taxes and levies, since tax exemption is limited to a percentage of the net income. Governmental agencies are against tax exemption for donation of processed foods.

Another problem with the current bills pending in the Congress is about donation to food banks, which includes only those which have specifically

a *social purpose* in their bylaws. If approved, this bill would prevent all government food banks and also "Mesa Brasil SESC", one of the largest and most traditional parastatal network of food banks in the country, from receiving donations from supermarkets chains and food industries.

In the absence of a regulatory framework to fully support food donation and reduce losses, Brazilian society has found its own way of dealing with the problem, as we try to demonstrate next.

FOOD SECURITY POLICIES AND CIVIL SOCIETY ACTIONS ON FLW

Public Policies to tackle FLW

In Brazil, Food Security and Nutrition public policies are coordinated by the Ministry of Social Development ("MDS - Ministério do Desenvolvimento Social"). The first discussions on hunger and food security date back to the 1940s. However, only after the formal establishment of the National Council for Food Security (CONSEA) in 1993, several governmental initiatives were adopted to reduce food insecurity and improve access to food. Since the 2000's, CONSEA created the National System of Food Security and Nutrition (SISAN) and launched the National Policy of Food Security and Nutrition (PNSAN), two National Plans and held five National Conferences (MDS, 2017; Machado, 2017a).

One of the most important policies was the Zero Hunger Project ("Fome Zero", in Portuguese), a program for the eradication of hunger and misery launched in 2003 by the Federal Government, which replaced the Community Solidarity Program (Decree Nr. 1.366 dated of 12 January 1995). The actions of the program were classified into three types: (a) structural actions: directed to reduce the deeper causes of hunger and misery, by fostering smallholders agriculture, intensification of agrarian reform, conceding school grants and minimum income; (b) specific actions: taking care of families in food insecurity situation; (c) local actions: implemented by municipal governments and civil society, such as popular restaurants, food banks and partnerships with retailers (Belik, 2012a).

In 2015, during the 5th National Conference of Food Security and Nutrition held in Campinas, state of São Paulo, a workshop entitled "*Formation of a network to reduce food losses in Brazil*" was organized by University of Campinas (Unicamp) and Embrapa. The objectives included the discussion of data and information available on FLW; FLW causes and impacts; public programs and successful experiences and; the proposal of an implementing agenda (Machado, 2017a).

Below, we briefly describe some of these initiatives:

National School Feeding Program (PNAE)

The program was established by Law Nr. 11.947/2009 and earmarks at least 30% of the financial resources transferred from the National Education Development Fund (FNDE) for school meals to purchase food from smallholder farmers through the Food Procurement Program (PAA). The purchase of food will preferably be carried out in the same municipality of schools, with priority for agrarian reform settlements, traditional indigenous communities and African descent communities ("quilombolas", in Portuguese). In 2012, the government spent R$ 839 million (around US$ 256 million) on the program. Due to political changes and economic crises, PAA budget suffered a 66% cut in only one year, from R$ 439 million (US$ 134 million) in 2016 to R$ 150 million (US$ 45 million) in 2017.

Brazilian Network of Food Banks

The Brazilian Network of Food Banks was created to strengthen and integrate the performance of food banks and contribute to the reduction and prevention of food waste. The Network was officially established on April 15th, 2016 and is coordinated by the Brazilian Ministry of Social Development (MDS). Food banks under federal, state or municipal governments can join the Network, as well as state-owned wholesale markets and civil society organizations. Federal public education and research institutions that develop studies and technologies for food banks and other entities of the National System of Food and Nutrition Security (SISAN) can also integrate it. Currently, there are 249 food banks identified by the network. Of these, 83 were funded by MDS. Banks receive donations of food considered to be non-standard for marketing, but adequate for consumption. Food is passed on to non-profit civil society institutions that produce and distribute free meals to people in situation of food vulnerability.

Popular restaurants

There is a federal government policy that stimulates municipal and state governments to implement popular public restaurants. The target audience is families and people at risk of nutritional insecurity. Local public government is responsible for the management, and goals were set to a minimum production of 1,000 meals a day at lunchtime, for at least five days a week. There is no standard for the amount charged for meals since the operation is under the responsibility of the local public authority. The Ministry of Social Development only recommends charging affordable prices to the low-income population of the region, and that the meal is good, proper and healthy. The price of meals has been varying between R$ 1.00 and R$ 2.00 (approximately US$ 0.30 to US$ 0.60).

Non-governmental initiatives

Brazilian civil society is learning how to get involved in important social issues and also take action. It is impressive the number of non-governmental initiatives to reduce food loss and improve food security in Brazil, with companies, class associations, NGOs and other entities leading different projects.

Food Banks

The first food banks in Brazil were NGO "Banco de Alimentos", in São Paulo, "Mesa Brasil SESC", in Rio de

Janeiro, and "Banco de Alimentos do Rio Grande do Sul", in Porto Alegre. The first governmental food bank was launched by the municipality of Santo André, in the state of São Paulo, in 2000. Since the launch of the Zero Hunger Program, funds have been made available for the implementation of several food banks now operating in many Brazilian cities. Food banks in Brazil operate in distinct ways, depending on their legal figure (governmental, private, NGO, parastatal, class association) and have different sizes and goals. Some work as national networks (*Mesa Brasil Sesc*) or regional networks (*Banco de Alimentos do Rio Grande do Sul*), others operate from wholesale markets (*Banco CEAGESP de Alimentos*) or by NGOs (*Banco de Alimentos*), and a great majority belong to municipalities. Below we will briefly describe just a few of them as examples of the diversity of initiatives.

Banco de Alimentos (*www.bancodealimentos.org.br*): *Banco de Alimentos* is an NGO created to eliminate food waste and reduce hunger. To do this, they carry out the so-called *urban harvest*, collecting food in perfect condition that would be discarded as surplus in several commercial establishments (restaurants, bakeries, grocery stores, etc.) that are collected and redistributed to charities. They also offer lectures and workshops to raise awareness among citizens and companies about sustainable consumption. *Banco de Alimentos* has 50 registered donors, serves 42 institutions and distributes 30 tons of food per month to 22,000 beneficiaries.

Mesa Brasil SESC (*www.sesc.com.br/mesabrasil/*): food and nutritional security program of the Social Service of Commerce (SESC), a Brazilian non-profit private institution. *Mesa Brasil* was created in 2003 based on educational actions and food distribution surplus or out of commercial standards. It is a national network of food banks that aims to reduce hunger and food waste. The program helps about 1.6 million people in 523 Brazilian cities and serves 6,000 entities with the participation of 3,000 companies and individuals (SESC, 2017).

Rede de Bancos de Alimentos do Rio Grande do Sul (*www.redebancodealimentos.org.br***)**: The Network of Food Banks of the state of Rio Grande do Sul was created in 2007 with the objective of supporting and stimulating the creation of new Food Banks in Brazil, as well as strengthening the existing ones. The Network is supported by many private companies, such as banks, supermarket chains, food industries, class associations, TV networks, real state companies, universities, among others. Currently, the Network has 22 Associated Food Banks in the state of Rio Grande do Sul and one in Rio de Janeiro, which together benefit 900 institutions, donating approximately 500 tons of food per month.

Banco CEAGESP de Alimentos (*www.ceagesp.gov.br***)**: CEAGESP, in São Paulo city, is the main wholesale market in Brazil, with eleven units all over the state of São Paulo. *Banco CEAGESP de Alimentos* was created in 2003 to collect, select and distribute foods offered by producers and wholesale merchants (CEAGESP permission holders) to social entities in the state of São Paulo. In recent years, 166 tons of food per month has been distributed to more than 160 institutions, in addition to banks located in other municipalities. The discards unfit for consumption are transformed into organic fertilizer by composting. CEAGESP also promotes the recycling of straw, wood, iron and carton boxes. In 2012, the food bank collected 2,000 tons and served approximately 370,000 beneficiaries per month (Fagundes *et al*., 2012).

ABRAS (Brazilian Association of Supermarkets)

Since 2009, ABRAS has been publishing an annual report on losses in the retail sector, including food. In 2016, 399 enterprises with 4,242 stores and 27,158 checkouts joined the loss survey (ABRAS, 2017). Of these, 39% were small supermarkets (stores less than 500 m^2). The enterprises had a gross income of R$ 58 billion (around US$ 18 billion) in 2016. Perishables ranked first in losses (6.09% of gross income), followed by bakery (4.7%), ready-cooked meals (3.99%), fish (3.26%) and meat (3.07%). The Association also has a Committee on Loss Prevention, which offers regular training to retail employees. ABRAS actively participates in discussions about the legal framework for food donation.

Civil society initiatives

In the last couple of years, there is an increasing awareness on FLW in Brazilian society, particularly in metropolitan areas. Individuals and NGOs are engaged in finding creative solutions towards a more sustainable way of life and at same time tackle hunger and food waste. We list just some we find on the web as examples:

"Comida Invisível"* (Invisible Food,** *https//:comidainvisivel.com.br)**: NGO engaged in education campaigns against food waste through workshops, courses, lectures and digital channels. They recently developed an app that facilitates food donation, connecting donors to recipients in a map. Restaurants, bars, supermarkets, hotels and other donors can register for food donation, with validity, date and form of delivery. After being registered in the system, food becomes available to institutions that prepare or distribute it in the vicinity. When a donation is accepted, the donor confirms whether the food will be delivered or should be withdrawn.

"Fruta Imperfeita"* (Imperfect Fruit,** *https//:frutaimperfeita.com.br)**: internet business that tackles food waste through the dissemination of conscious consumption acting as a connecting agent between smallholder growers and consumers. They have 850 clients that can choose from 14 non-standard perishable products to be delivered on a weekly basis in recyclable carton boxes. In a two-year period, they saved more than 300 tons of fruits and vegetables

and reused 25,000 units of carton boxes.

International initiatives in Brazil

"SaveFood Brasil"

SaveFood is a joint initiative of FAO, UNEP, Messe Düsseldorf Group and Interpack that periodically brings together businessmen, politicians and researchers to stimulate dialogue and find solutions to reduce losses in food value chains. In Brazil, it is coordinated by the FAO Office in Brazil, WRI Brasil and Embrapa. Its objectives are: (1) to form a national network of specialists, active and interested in the theme of "reducing food losses and waste"; (2) to stimulate and facilitate inter-sectoral dialogue, disseminating best practices and innovation processes in the area; (3) to inform the network about contents, news and relevant events; and (4) to raise awareness about the subject. SaveFood Brasil website displays news, infographics, reports, bulletins, events, videos and quizzes on FLW (SaveFood Brasil, 2017).

"Slow Food Brasil"

The Slow Food movement is a proposal of a new gastronomy, in clear opposition to the ubiquitous global system of fast food. Carlo Petrini, the movement founder, delegates to the gastronomer a new role, that of "co-producer", that is, someone who knows in depth the agriculture and livestock, the conditions of field workers and the origin of the food, instead of being the usual final element of the food production chain (Petrini, 2009). In Brazil, the organization maintains a website with news, campaigns, publications, recipes and other useful information (Slow Food Brasil, 2017). Slow Food Brasil organizes events such as "Terra Madre Brasil", with debates and workshops and conferences on family and organic agriculture, as well as fair and exhibition of products, keeps records of Brazilian communities by region and carries out education and awareness campaigns, serving in festive events food prepared from discarded vegetables ("Disco Xepa").

The "Ugly Fruit" campaign

This movement demystifies the issue of the impeccable appearance of vegetables adopted in marketing, such as uniform size, shape and color, shifting the focus to nutritional quality and mode of production. Fruits and vegetables are usually commercialized through strict classification systems, which determine their market value. Non-standard products, which are irregularly shaped, have different sizes and maturity, are usually discarded, directed for processing or marketed at a lower price. If all types of products are offered on the market, regardless of their appearance, the trend is to increase supply, balance prices and reduce postharvest losses throughout the chain. Farmers can improve their incomes and make their production more sustainable. In the 'ugly fruit' campaign, non-standard products are sold cheaper. In Rio de Janeiro, supermarkets "Zona Sul" and SuperPrix" have already engaged in similar programs. In November 2017, Carrefour announced launching this campaign in Brazil, whose name is "Único" (meaning *unique* or *distinct* in Portuguese).

Penalty for food waste in supermarkets

France recently adopted fines for supermarkets with stores with an area of over 400 m^2 that discard food. Establishments should undertake to donate non-commercialized but still consumable food to charities for use as animal feed or agricultural composting in order not to suffer penalties. Inspired by recent French legislation, the governor of the Federal District in Brazil approved on August 8, 2016, Law Nr. 5694 aimed at preventing food wastage in supermarkets and hypermarkets within the Federal District. The bill was proposed in October 2015 and determines that supermarkets and hypermarkets with an area greater than 400 m^2 in the Federal District should prevent and avoid wasting food whose expiration date is close to expiration. Food stocks that are not sold should go to charities or to social welfare. Leftovers can also be used for animal feed and composts. Fines of up to R$ 10.000,00 (around US$ 3,000) are foreseen in case of breach of the law. Apparently, the new law is not been enforced till this date.

2017: a memorable year for FLW in Brazil

We regard 2017 as a remarkable year because FLW was finally established in the government's agenda, with many positive outcomes. Furthermore, the subject was also discussed in meetings and seminars with relevant stakeholders and the civil society, generating greater awareness and attracting media interest, amid the current political and economic crises. Our opinion is based on the following events:

CAISAN's Technical Committee on FLW

Since 1993, the Brazilian government has been issuing several positive policies to foster food and nutritional security in the country. The Interministerial Committee for Food Security and Nutrition (CAISAN) is composed of 20 Ministries and Secretariats and other stakeholders. CAISAN launched two National Plans and held five National Conferences on Food Security and Nutrition. In March 2017, the government officially established the Technical Committee on FLW by a CAISAN's resolution published on the Government Gazette. The Technical Committee was composed of relevant stakeholders representing both government and private sectors and had held several meetings throughout this year. In August 2017, the Technical Committee proposed a draft of a national plan with four pillars: (a) Research and Technological Innovation; (b) Education and Communication; (c) Promoting Public Policies; and (d) Legal Framework. This draft proposal was approved during the last CAISAN's meeting on November 27th, 2017. By the end of December 2017, CAISAN is expected to officially launch the National Strategy to Reduce FLW by publicizing it on the Government Gazette.

FAO Brasil

In 2017, FAO's Brazilian office, in Brasília, contracted an external consultant (Project TCP/IRLA/3610/

C2) to make an inventory on the situation of FLW in Brazil, in order to support the FLW Technical Committee activities. Consultancy goals were (a) to attend and participate in the meetings of Technical Committee on FLW; (b) to prepare a comprehensive report on food losses and waste situation in Brazil, with a survey of loss measurement methodologies; (c) to identify stakeholders involved with the theme in Brazil (public, private, NGOs); (d) to map existing guidelines and strategies in food security and FLW; (e) to propose a strategic alignment of governmental actions to reduce FLW; (f) to drawn up a proposal and validate an action plan to curb FLW (Machado, 2017a). Two outcomes of the consultancy were a comprehensive review on FLW in Brazil published as a report (Machado, 2017a) and a proposal of a strategy of action of the government and civil society to tackle FLW (Machado, 2017b). Both reports were presented and discussed with stakeholders during meetings of the FLW Technical Committee.

SaveFood Brasil Meeting

In September 2017, SaveFood Brasil organized a meeting in São Paulo to discuss challenges to reduce FLW in Brazil, in a partnership with Embrapa and the World Resources Institute (WRI). Forty stakeholders from government, public and private enterprises, NGOs, universities, FAO, class and trade associations were present at the meeting. Strategies to curb FLW in Brazil were divided into three panels: (a) measurement; (b) legislation, food donation, and food banks; (c) technology and innovation (SaveFood Brasil, 2017). A Portuguese version of WRI's executive summary of "Food Loss and Waste Accounting and Reporting Standard" was officially launched by Dr. Kai Robertson during the meeting.

"Seminário Sem Desperdício - Dialógos UE-Brasil"

Project "Sem Desperdício" (*No Waste*, in Portuguese) is part of Sector Dialogues platform, a strategic partnership between the European Union and Brazil to promote the exchange of knowledge, experiences and best practices on topics of mutual interest. Food losses and waste were selected as an important subject for further discussion and exchange of experiences. The European Union delegation invited member countries Denmark, Netherlands, Sweden, France, Belgium, Spain and Germany to engage with the project. The seminar took place on October 31st in Rio de Janeiro and its main goal was to broaden the discussion and sharing of experiences to reduce losses and waste of food. The event discussed national strategies and other instruments aimed at the food industry, retail and consumer, that is, for the final stages of the food chain. To address specific practices or broader strategies already in place, success stories from European countries were presented that can be implemented elsewhere and serve as a basis for structuring actions (Embrapa, 2017).

Some final remarks about FLW in Brazil

Presently, food waste has been arousing more attention that postharvest losses in the media (press, broadcasting). Nevertheless, there are few data, figures and relevant information available on FLW, as well as few scientific publications;

There has been progress in public policies to reduce losses and food waste in the last decade, such as the implementation of food security policies, social grants, popular restaurants and food banks. Some of the successful food security programs are in jeopardy because of political changes in government and economic and social crises;

A constant challenge in Brazil is how to reduce food waste in the face of cyclical economic and social crises in a society with great social heterogeneity and high income inequality, while at the same time promoting the sustainability of supply chains and ensuring food security;

Household food waste is a social phenomenon that is only now beginning to be studied and better understood. Brazilian low-income consumers paradoxically waste food because of five major antecedents: excessive purchasing, over-preparation, caring for a pet, avoidance in consuming clean leftovers from previous meals and inappropriate food conservation;

Non-governmental entities are fully engaged in FLW reduction, as the impressive number of food banks operating in the country and other relevant initiatives point out;

Educational campaigns to reduce FLW may have an important role and positive effects on the near future, particularly strategies and nutritional education to serve the lower middle class;

One of the main risks of the to-be-approved national regulatory framework on food losses and waste is to be ignored or not complied with. As seen in previous cases involving legal frameworks issued by the Congress, in those cases where laws are too restrictive or punitive, Brazilian civil society or stakeholders simply do not adhere.

REFERENCES

ABRAS. 2017. Associação Brasileira de Supermercados. *17ª Avaliação de Perdas no Varejo Brasileiro de Supermercados.* Available in www.abras.com.br. Accessed in November 12, 2017.

AGROSTAT. Estatísticas do comércio exterior do agronegócio brasileiro. Available at *http://sistemasweb.agricultura.gov.br/pages/AGROSTAT.html*. Accessed in November 17, 2017.

BELIK, W. 2012a. A política brasileira de segurança alimentar e nutricional: concepção e resultados. *Segurança Alimentar e Nutricional* 19: 94-110.

BELIK, W. 2012b. Perspectivas para segurança alimentar e nutricional no Brasil. *Saúde e Sociedade* 12: 12-20.

EMBRAPA. 2017. União Européia e Brasil discutem desperdício de alimentos. Não faltam dados?

FAGUNDES, PRS; SILVA, ROP; NACHILUK, K; MONDINI, L. 2012. Aproveitamento de resíduos gerados no entreposto terminal de São Paulo da CEAGESP. *Informações Econômicas* 42: 65-73.

FAO. 2014. *Definitional Framework of Food Loss – Working Paper*. Roma: FAO/Global Initiative on Food Loss and Waste Reduction. 18p.

FEHR, M; ROMÃO, DC. 2001. Measurement of fruit and vegetable losses in Brazil – a case study. *Environment, Development and Sustainability* 3: 253-263.

GONÇALVES, BS (Coord). 2005. *O Compromisso das Empresas com o Controle ao Desperdício de Alimentos – Banco de Alimentos, Colheita Urbana e Outras Ações*. São Paulo: Instituto Ethos. 80p.não consta no texto

GOULART, RMM. 2008. Desperdício de alimentos: um problema de saúde pública. *Integração* 14: 285-286.

HENZ, GP. 2015. Perishables postharvest losses in Brazil: a review and a current view of an old problem. 2015. *Proceedings of the First International Congress on Postharvest Loss Prevention*. Rome, Italy, October 4-7. ADM. Institute for the Prevention of Postharvest Loss. University of Illinois. Urbana-Champaign. P.6-8

HENZ, GP. 2017. Postharvest losses of perishables in Brazil: what do we know so far? *Horticultura Brasileira* 35: 6-13.

IBGE. 2014. Instituto Brasileiro de Geografia e Estatística. Available in *www.ibge.gov.br*. Accessed in October 10, 2014.

MACHADO, AG. 2017a. *Diagnóstico do tema Perdas e Desperdícios de Alimentos (PDA) no Brasil*. Brasília: FAO Brasil. 72p. (FAO Brasil. Consultant Report).

MACHADO, AG. 2017b. *Estratégia para a Redução das Perdas e Desperdícios de Alimentos no Brasil*. Brasília: FAO Brasil. 31p. (FAO Brasil. Consultant Report).

MALUF, RS. 1999. *Consumo de alimentos no Brasil: traços gerais e ações públicas locais de segurança alimentar*. Available in *www.polis.org.br/uploads/846/846.pdf*. Accessed in July 8, 2017.

MDS. 2017. Ministério do Desenvolvimento Social. *Segurança Alimentar*. Available in *www.mds.gov.br*. Accessed in July 10, 2017.

PARISOTO, DF; HAUTRIVE, TP; CEMBRANEL, FM. 2013. Redução do desperdício de alimentos em um restaurante popular. *Revista Brasileira de Tecnologia Agroindustrial* 7: 1106-1117.

PEIXOTO, M; PINTO, HS. 2016. Desperdício de alimentos: questões socioambientais, econômicas e regulatórias. Brasília: Núcleo de Estudos e Pesquisas/CONLEG/Senado, fevereiro/2016 (Boletim Legislativo Nr. 41, de 2016). Available in *www.senado.leg.br/estudos*. Accessed July 24, 2016.

PÉRA, TG; GAMEIRO, AH; BACCHI, DB; ROCHA, FV; CAIXETA FILHO, JV. 2015. An overview of the state-of-art of postharvest losses in Brazil. *Proceedings of the First International Congress on Postharvest Loss Prevention*. Rome, Italy, October 4-7, 2015. ADM Institute for the Prevention of Postharvest Loss, University of Illinois. Urbana-Champaign. p.39-40.

PETRINI, C. 2009. *Slow Food – Princípios da Nova Gastronomia*. São Paulo: Editora SENAC, 2009.245p.

PORPINO, G.; PARENTE, J.; WANSINK, B. 2015. Food waste paradox: antecedents of food disposal in low income households. *Intl J Consumer Studies* 39: 619-629. (DOI: 10.1111/ijcs.12207).

SAVEFOOD BRASIL. 2017. SaveFood Brasil. Available in *www.savefoodbrasil.org*. Accessed in November 8, 2017.

SECOM SP - SECRETARIA ESPECIAL DE COMUNICAÇÃO DE SP. 2017. Entenda a política municipal de combate ao desperdício de alimentos. Available at *http://www.capital.sp.gov.br/noticia/entenda-a-politica-municipal-de-combate-ao-desperdicio-de-alimentos*. Accessed in November 16, 2017.

SESC. 2017. SESC - Serviço Social do Comércio. *O Mesa Brasil SESC*. Available in *www.sesc.com.br/mesabrasil/omesabrasil.html*. Accessed in November 10, 2017.

SILVERIO, GA; OLTRAMI, K. 2014. Desperdício de alimentos em Unidades de Alimentação e Nutrição brasileiras. *Ambiencia* 10: 125-133, 2014.

SLOW FOOD BRASIL. 2017. Slow Food Brasil. Available in *www.slowfoodbrasil.com*. Accessed in November 12, 2017.

VARELA, MCMS; CARVALHO, DR; OLIVEIRA, RMA; DANTAS, MGS. 2015. O custo dos desperdícios: um estudo de caso no restaurante universitário da Universidade Federal do Rio Grande do Norte. Anais do Congresso Brasileiro de Custos. 16p.

XUE, L; LIU, G; PARFITT, J; LIU, X; VAN HERPEN, E; STENMARCK, A; OCONNOR, C; ÖSTERGREN, K; CHENG, S. 2017. Missing food, missing data? A critical review of global losses and food waste data. *Environmental Science & Technology*. (DOI: 10.1021/acs.est.7b00401)