Food Loss in Meat Sector

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Food losses and wastage are one of the most important problems of the modern world. The scale of this phenomenon is so large that it should be treated as a global problem. Food losses occur at every stage of the agri-food chain, from primary production (ag-riculture), through storage, processing, transport, distribution and consumption.

food loss food waste meat sector

1. Introduction

Food losses and wastage are one of the most important problems of the modern world. The Food Waste Index report prepared by the United Nations (UNEP) shows that 931 million tons of edible food are wasted annually worldwide, or 17% of the food that was available to consumers in 2019. On the one hand, there is an overproduction of food and its waste all over the world, on the other hand, the problem of hunger is growing [1]. [2] and Torero [3] the spread of COVID-19 and introducing measures to increase social distancing have drawn further attention to the risks of food loss due to supply chain disruptions and demand to drop in many countries.

In this context, food waste generation is becoming particularly important as it means missing opportunities to feed the growing world population and consuming scarce resources, such as land, water and energy used in the production, processing, distribution and consumption of food. The ecological significance of food losses depends not only on the quantity, but also on the type of food, the place in the food chain where it is lost and the way it is recycled or disposed of [4]. The problem of the impact of food waste on the climate and greenhouse gas emissions is constantly being raised [4]. Given that most food waste in Europe arises at the consumption level, reducing it at the food service and household stage can make a significant contribution to achieving part of sustainable development 12.3, i.e., halving global food waste by 2030 [5].

Therefore, reducing food losses and wastage is widely recognized as a way to meet the challenges of global food security, global warming, the protection of natural resources and ecosystems and access to food for those in need [6]. Food waste and losses has become an important political issue as the demand for food on a global scale is steadily increasing due to the increase in population and consumption [7][8].According to the literature, the generation of food waste along the food value chain occurs in most stages from field to fork, including in agricultural production, postharvest handling and trade, manufacture processing, food services, wholesale, retail and final household consumption [9][10].Literature shows a number of solutions that may be implemented in the appropriate management of food waste, among which the most sought-after solutions are currently represented by

avoidance and donation of edible fractions to social services. [11] indicate that it is necessary to combine the reduction of waste during food processing with the valorization of waste, including the saving of water and energy and the use of biodegradable packaging materials. Food processors and consumers can benefit not only from the development of sustainable processes, but also from the production of food products with better quality, safety, properties and shelf life, as well as the use of food waste to produce, e.g., biomaterials, fuels, biogas [11].

The aim of the article is to present data on the scale of food waste in the meat sector and to emphasize the need to disseminate measures to reduce the number of losses in this sector. The article discusses food waste in the meat sector as a current, widespread and serious problem.

2. An Overview of the Food Loss and Waste Problem

Even though in recent years the topic of food loss and waste has been placed at the forefront of political and research agendas, and at the same time the literature on the problem and its associated environmental and economic impacts has become rich, reliable dates on food loss and waste in supply chains are still limited. In the literature, a large variation in the results for the total amount of food losses and wasted food published by various authors [12][13][14][15][16][17][18]. Differences in outcomes may be due to different definitions of food loss and waste, data sources and quantification methods. The amount of food loss and waste varies between countries due to the society's income, urbanization and economic growth [19].

In recent years, the studies have been published [20][21] in which improved methodologies for measuring food loss and waste have been proposed. These have had a significant impact on the development of new accounting and reporting standards protocols for food loss and waste to be implemented by companies, governments and others. In May 2019, the European Commission (EC) adopted a delegated act establishing a common methodology for measuring food losses and waste. It aims to help Member States quantify food waste at all stages of the food production and supply chain.

30% of wasted food in the entire food chain. There is little data available on food loss and wastage for the meat sector, although the production of meat and meat products is characterized by an unfavorable impact on the environment, which requires rational management of these products in the entire chain (production, processing, transport and consumer stage). Determining the size and causes of formation as well as the methods of reducing food losses and food waste throughout the meat sector is important both for economic and environmental reasons. For example, active packaging and radio frequency identification (RFID) technologies can be used to extend the shelf life of meat products and minimize losses along the food supply chain due to inadequate handling and storage conditions [11].

A systematic and comprehensive article retrieval strategy that provided a general impression of the food loss and waste with particular emphasis on the meat sector. The Web of Science was searched up to March 2021 using search terms for English publications. Many relevant articles were obtained by combing the keywords (food loss,

food waste, meat sector) in a more detailed retrieval strategy. In the second phase, food loss and waste in the meat sector was estimated, the causes were recognized.

3. Food Loss and Waste in Meat Sector

In line with the demand, meat production in the world is steadily increasing. In 2018, the world meat production was around 340 million tons, which corresponds to more than three times the quantity of meat produced fifty years ago. Within Europe, large variations in meat production can be observed. As a global average, per capita meat consumption has increased approximately 20 kg since 1961; the average person consumed around 43 kg of meat in 2014 [22].

As indicated by Gerber et al. The largest share in the formation of greenhouse gases has beef production (35.3%) and dairy cattle (30.1%), followed by swine (9.5%) and poultry (8.7%). In addition, the authors report that of the total greenhouse gas emissions attributed to global food animal production, almost half are related to the production, processing and transport of feed. The enteric methane emissions from ruminants and methane and N2O emissions from manure storage are responsible for about 39.1% and 9.5%of the total greenhouse gas emissions attributed to food animal production, respectively.

The available literature lacks studies that would adopt a systematic approach to accounting for food waste in the meat sector, providing disaggregated values according to the stage of the food supply chain. [23] presented a top-down approach to accounting for food waste in the European Union. Based on these data, Figure 2 illustrates the amount of food waste generated in the meat sector at each stage of the food supply chain expressed as a percentage of the amount of meat entering the food supply chain (defined as ‘EU available’ and calculated as production plus import minus exports of primary commodities minus non-food uses). This confirms the well-known relationship that in more developed regions such as Europe, most of the loss and waste occurs toward the end of the food supply chain, at the retail and consumer levels [24].

Data presented by Flanagan et al. [25] shows that meat only comprise about 4% of global food loss and waste, however it has a higher economic value compared to other groups of food. Thus, although the amount of meat wasted is lower than that of other product groups such as cereals, fruits and vegetables, the economic and environmental impacts are significant. [26], meat has the highest emissions per kilogram of food compared to other food products.

Buzby and Hyman [27] estimated the total value of meat product waste in the USA at US$ 83,127 million. According to their study, consumers were responsible for around 35% of the total waste produced. A study carried out by Abdulla et al. [28] indicated that in Canada red meat accounted for 39.73% of the total waste and poultry waste was estimated to be around 40.74%.

There are many reasons for food loss and waste throughout the supply chain, including in the meat sector. The reasons vary depending on the stage of food supply chain. Losses observed in the meat sector at the stage of

primary production are mainly due to the farming/rearing conditions and the conditions of transport to slaughter. In Finland, the amount of livestock losses during primary production, according to statistics, is 3.5% [29].

[30] pointed to a few basic causes of food losses at the processing stage: incorrect transport, product changes, human error and product defects. Moreover, Lipinski [31] suggests that one frequent cause of loss or waste in the animal-based food industry is spoilage during storage. Additionally, the shelf life of meat and meat products is relatively short. It is one of the reason that meat products immediately go to waste if not sold within the labelled expiry date and this is the main reason for wastage at the retail stage.

Improper packaging has a significant impact on the amount of damage occurring during transport, as well as the exposure of the cargo to the adverse effects of weather conditions during loading/unloading and transport of products. The problem of risk reduction in the meat supply chain with redirection options was taken up by Bogataj et al. [32]. Other authors [33][34] also point to the impact of inadequate packaging on the level of food loss and waste.

The main factors influencing the observed food losses related to the mentioned stage are expiring shelf life, too short shelf life, mechanical damage to unit packages related to the breach of the protective barrier of products and without breach of unit packages crease, cavity or other deformation deteriorating the quality of the product. [35] indicated the occurrence of losses of these products due to defects in product management processes (organization of deliveries, improper packaging and standardization of expiry dates). The total annual loss of meat products in the distribution process in the examined distribution center was estimated at 1.25% of distributed products. According to the authors, the key area of product management in the context of minimizing their losses in the supply chain (trade and distribution) is therefore to prevent exceeding the use-by dates, which at the same time will prevent the elimination of these products for consumption purposes.

Magalhães et al. [36] analyzed 16 causes of food loss and waste in the Brazilian beef supply chain using an integrated interpretive structural modeling and matrix impact of cross-multiplication applied to classification methodology. The analysis highlights the “Lack of transportation infrastructures”, “Inadequate handling”, “Poor operational performance”, “Variety of products available in supermarkets” and “Unhealthy animals and outbreaks of disease” as the most influential causes.

4. Food Waste Generated at the Stage of Consumption

The stage of consumption in food supply chain is very important in the context of food losses as the greatest losses are generated at the stage of consumption (households and catering services) in Europe [23]. The consumption stage is responsible for the largest share of food waste generation for most food groups (cereals, potatoes, eggs, dairy, meat) as illustrated by Figure 3. Meat food waste in household and food services represents 64% of total food waste in food supply chain for this food group. However, households generate much more food waste compared to food service for all of the above-mentioned food groups.

[37] reported that companies form HORECA, which include hospitality, restaurant and catering represent a considerable share of total food waste. According to the authors, these companies are generally characterized by low sense of awareness about the sustainability-oriented innovation opportunities and challenges of minimizing food waste. Researchers [38][39][40] highlighted the scale of the problem of food waste in restaurants. They highlighted the scale of the problem of food waste in restaurants.

Various causes of food waste at the consumption stage are mentioned by the authors as showed in Table 2. [41] while conducting research in the hospital kitchen found that larger portion size encourages more food intake thus creates more plate waste. [42] suggests that the attitudes and behaviors around food waste in restaurants play major roles in the amounts of food discarded therefore access to information about how to prevent and manage food waste is according to these researchers the optimal strategy in reducing waste. According to these authors, 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.

On the consumer stage meat and meat products food loss and waste tends to be due to improper storage condition such as failure to maintain the proper low temperature, failure to freeze food before it spoils or insufficient knowledge about how to prepare food. The latter reason may lead to the preparation of a dish that does not meet the expectations of the consumer and therefore may be treated as waste [31]. The mentioned reasons for meat product waste include packaging size and date confusion among consumers as well as misunderstandings of the meaning of food date labels [43][44].

With regard to food waste in households, Qi et al. [45] explored the interaction between household food waste and home livestock production. Based on the obtained results, the authors indicated that intensified livestock production caused less uneaten food being used as animal feed. Thus, there was less discarded food in these households.

Awareness and knowledge of the places where food is wasted and lost in the food supply chain gives the opportunity to plan and implement actions to reduce them, especially in the stages that generate the most food loss and waste. Generally, countries around the world promulgate policies and initiatives aimed at food supply chain actors (from farmers to consumers) that directly address food loss and waste perceptions, attitudes and behaviors. [46] presents a range of waste management initiatives including the distinction between revolving around work processes and technologies named incremental innovations and innovations exploring opportunities to significantly change waste management approaches as radical innovations. The mentioned study also showed different approaches to food waste related to management practices and management's beliefs, knowledge and awareness.

[47] identified interventions that can be implemented at the consumption stage in the supply chain to prevent food waste through a quick review of the global scientific literature from 2006–2017. Interventions that changed the size or type of plates were shown to be effective, leading to a 57% reduction in food waste. Revision of the school

nutrition guidelines was reported to have reduced vegetable waste by up to 28%. The authors also pointed to the effectiveness of information campaigns in reducing food waste (up to 28% in a small sample).

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