# Distribution of Food Loss and Food Waste of the Main Food Categories Related to Food Chain

**Anamaria Roxana Martin[1,2], Ioana Mihaela Balan[1*], Ioan Brad[1], Remus Gherman[1], Tiberiu Iancu[1,2]**

[1] *Banat's University of Life Sciences "King Mihai I" from Timisoara – Romania, Faculty of Management and Rural Tourism*

[2] *Institution Organizing Doctoral Studies - University of Life Sciences "King Mihai I" from Timisoara, Doctoral school Plant and Animal Resources Engineering*

**Abstract**

The purpose of this paper is to analyse the distribution of food loss and food waste of the main food categories related to the food supply chain respectively cereals, roots and tubers, oilseeds and pulses, fruits and vegetables, meat, fish and seafood and milk, in Europe including Russia, North America and Oceania, Industrialized Asia, Sub-Saharan Africa, North Africa, West and Central Asia and South and Southeast Asia. An estimated 30 % of the food produced globally for human sustenance is lost or squandered along the food supply chain. In the meantime, the global population is estimated to reach 9.1 billion by 2050, necessitating a 70% increase in food availability. A significant portion of this growth will occur in developing countries, where growing urban populations persist to create complex and lengthy food supply chains involving numerous actors, facing challenges for the delivery of secure, nutrient-rich, high-quality food.

**Keywords**: food loss, food waste, food supply chain, production.

## 1. Introduction

When the Food and Agriculture Organization of the United Nations (FAO) was founded in 1945, its mandate included the reduction of food losses. [10] In 1974, the first World Food Conference highlighted post-harvest loss reduction as a component of the solution to world famine. At this point, a general forecast for post-harvest losses of 15% had been proposed, and it was decided to minimize these losses by 50% by 1985. In response, FAO created the Special Action Programme for the Prevention of Food Losses. [8]
At first, minimizing durable grain losses was the primary priority; however, by the beginning of the 1990s, the work's focus had expanded to include fresh fruits and veggies, tubers, and roots. A more comprehensive strategy was created as a result of the low acceptance rates of initiatives and the realization that a solely technological concentration was insufficient for addressing issues within the sector. [2]
The definition of food loss and waste is the reduction in the quantity or quality of consumable food intended for human consumption. [14] Redirecting edible food for use as animal food, converting edible food to bioenergy, and disposing of edible food in landfills are indications of a reduction in quantity. It is essential to differentiate food loss and food waste, as well as the circumstances regarding their occurrence, when identifying causes and creating solutions and interventions to address this matter. [9]
The malfunction of the food production and distribution system or its administrative and policy framework is the primary cause of food waste. [7] This may be the result of managerial and technical

* Corresponding author: ioanabalan@usab-tm.ro

constraints, such as inadequate storage amenities, cold chain, food management practices, infrastructure, packaging, or marketing systems. [4]

Food waste is the loss of food from the food supply chain that is still suitable for human consumption. This is done by choice or after the food has deteriorated or expired as a result of incorrect stock management or neglect.

Food waste usually but not entirely occurs at the retail and consumer levels, whereas food loss occurs at the production, post-harvest, and processing stages of the food supply chain (FSC). [6]

FSC is the distribution of goods and services through the value-added chain of food products with the goal of maximizing consumer value while minimizing costs. FSC differs from other supply chains in that it addresses complex issues, such as the perishable character of a product, interaction with numerous stakeholders, and cross-sector influence. The complexity of FSC relates to concerns regarding the safety, sustainability, quality, and productivity of the processes. [11]

Inefficiencies in the FSC, contributing to the production of food loss and waste, occur at all FSC phases. It is also possible for the cause of FLW at one stage to be concealed at a later stage.

Recognizing the interdependencies between the various phases of the food supply chain is crucial to the development of effective solutions for reducing food loss and waste. [12]

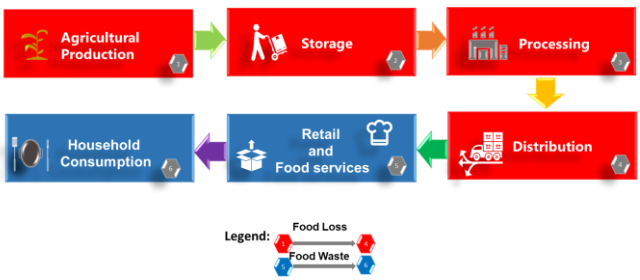


**Figure 1.** Food loss and food waste on food chain
Authors own adaptation by [13]

In addition, the performance of each actor and the price of activities in upstream segments of the food supply chain could impact the quality of the product further downstream. In this integrated supply chain approach, special consideration should be given to the effect of technical interventions on the social context and environment, and the proposed solutions should not exceed the cost of food loss. Developing on-farm storage capacities to reduce post-harvest losses, for instance, should be coupled with appropriate market access strategies and interventions. [5]

In areas with low incomes, solutions must prioritize the producer by enhancing harvesting techniques, agricultural education, storage facilities, and refrigeration chains. [3] In developing nations, however, solutions at the producer and industrial levels would be ineffective without education for consumers and proper stock management at the point of sale. [1]


**Figure 2.** The map of food loss and food waste
Authors own adaptation by [15]

## 2. Materials and methods

The main objective of this paper is to highlight the losses of the main food categories along the entire food chain according to geographic areas. The research is based on second and third party data provided by Food and Agriculture Organization of the United Nations.

Food losses refer to the reduction in edible food quantity along the section of the supply chain that results in consumable food for humans. The losses that occur at the final stages of the food chain (retail and consumption) are referred to as "food waste," which is related to the behavior of retailers and consumers.

## 3. Results and discussion

In Europe including Russia, cereals, meat, fish and seafood and milk have the highest percentage of loss in the consumption stage. Presenting roots

and tubers, oilseeds and tubers and fruit and vegetables, in the first part of the food supply chain, respectively in agricultural production, the highest amount of losses is generated. (Figure 3)

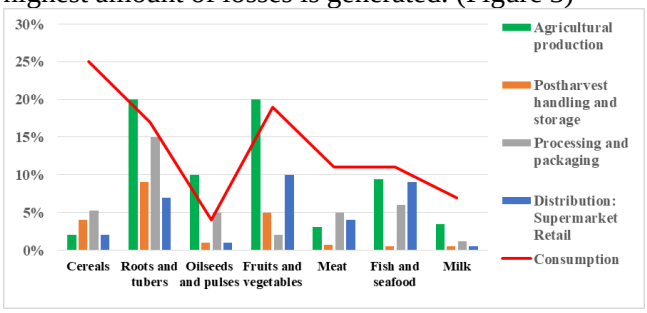


**Figure 3.** Distribution of food loss and food waste in Europe incl. Russia

In North America and Oceania, a thing to highlight is the fact that six of the analysed food categories precisely cereals, roots and tubers, fruits and vegetables, meat, fish and seafood and milk produce the highest quantity of waste in the last stage of the food supply chain, respectively consumption. Oilseeds and pulses is the only category that has the highest percentage of losses in agricultural production. (Figure 4)

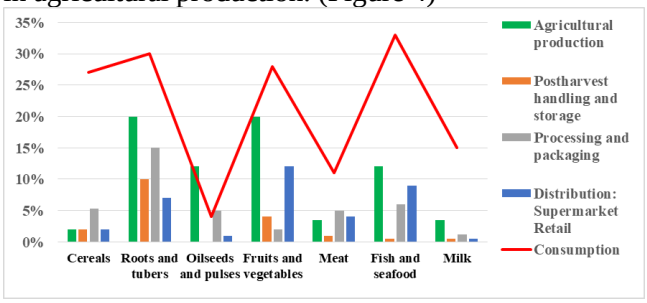


**Figure 4.** Distribution of food loss and food waste in North America and Oceania

In Industrialized Asia, an important thing to mention is that for cereals, fruits and vegetables, meat and milk, the highest quantity of waste is generated in the consumption segment. Roots and tubers, oilseeds and pulses and fish and seafood have the highest amount of waste in production. (Figure 5)

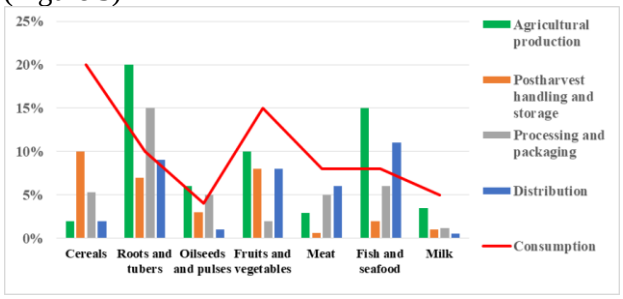


**Figure 5.** Distribution of food loss and food waste in Industrialized Asia

In Sub-Saharan Africa the situation regarding the distribution of food loss and food waste is different. Three of the analyzed food categories, precisely cereals, roots and tubers and milk have the highest quantity of food loss in postharvest handling and storage. Oilseeds and pulses and meat have most of the food loss in the agricultural production segment. Fruits and vegetables produce most of the food loss in processing and packaging and fish and seafood in distribution stage. (Figure 6)

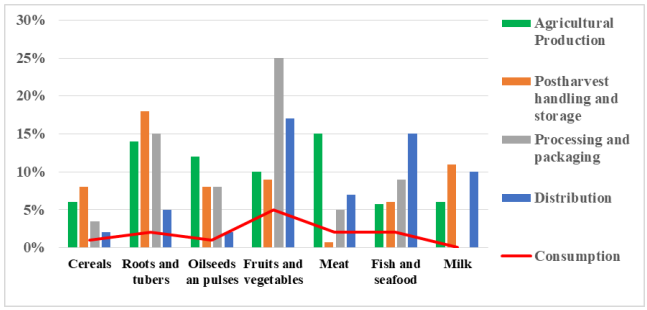


**Figure 6.** Distribution of food loss and food waste in Sub-Saharan Africa

In North Africa, West and Central Asia a fact to underline is that oilseeds and pulses is the only one catefory of food that has the most quantity of waste in agricultural production. Roots and tubers and fruits and vegetables produce the loss in processing and packaging. Speaking about cereals and meat, they have the highest quantity of food waste in the last segment of the food chain, in consumption. In the distribution stage, fish and seafood and milk are leading with the highest amount of food loss. (Figure 7)

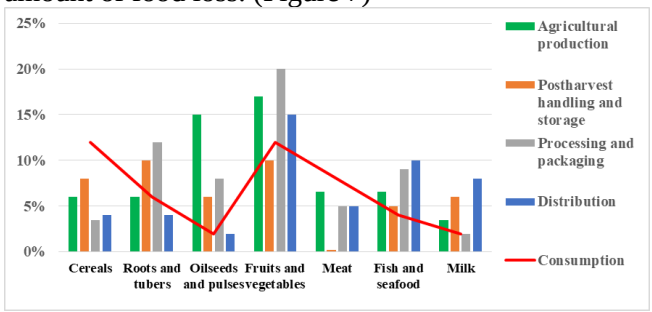


**Figure 7.** Distribution of food loss and food waste in North Africa, West and Central Asia

In South and Southeast Asia, cereals, roots and tubers and oilseeds and pulses generate most of the food loss in postharvest handling and storage. Another segment of the food chain that produces the highest value of food loss for three of the food categories, precisely meat, fish and seafood and

milk is distribution. Fruits and vegetables have the most of their losses in processing and packaging. (Figure 8)

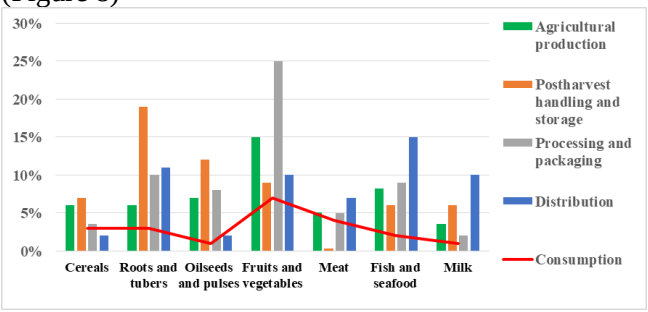


**Figure 8.** Distribution of food loss and food waste in South and Southeast Asia

It is necessarily to underline the the values of consumption of the analysed foot categories around the world. North America and Oceania is ranking the first with the highest values of food loss on the whole food chain. The second geographic area in the classament is Europe including Russia. Industrialized Asia and North Africa, West and Central Asia are in the middle of the classification. Sub-Saharan Africa produces the least of the food loss, followed by South and Southeast Asia. (Figure 9)

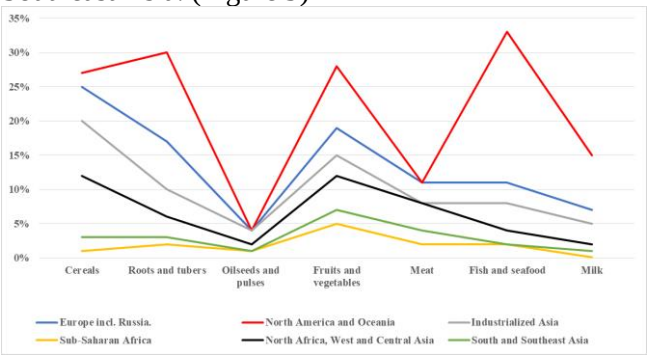


**Figure 9.** Consumption according to geographic areas

## 4. Conclusions

In consideration of the fact that food security is a significant concern in many parts of the developing world, it is necessary to perform additional research in this area.

Reducing loss and waste all over the food supply chain should be viewed as an efficient approach for reducing the environmental impacts of agriculture, boosting the income and standard of living of chain actors, as well as improving the food and nutrition security of low-income consumers.

Increasing urban population, modifying food consumption patterns, and globalization of trade have made food supply chains highly complex and lengthy, necessitating changing from the conventional method of addressing the reasons of food loss at each stage of the FSC to an integrated approach.

Since what is done (or not done) in a particular part of the chain has consequences on other parts, actions should not be directed exclusively at isolated stages of the chain. Making an investment in efficient, cheap, and sustainable processing technologies, appropriate storage and packaging, transportation infrastructure and market linkages, and additionally offering training and education to chain individuals, including consumers, are among the tried-and-true interventions that increase the chain's efficiency and thus reduce food loss and waste.

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