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RESEARCH ARTICLE

FOOD WASTAGE: CAUSES, IMPACTS AND SOLUTIONS

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ABSTRACT

Each year one third of all the produced food for human consumption is lost or wasted. Food wastage scales up the number of hungry people throughout the world and impairs the global food security. Food wastage not only decreases the availability of food, it also reduces the resources needed to produce food for future generation. In many low-income countries, there is considerable loss due to poor storage facilities and lack of capacity to transport produced food immediately after harvesting. Confusion arising from the existence and poor understanding of different food date labels are a major indirect causes of food wastage in developed countries. The quantitative and qualitative impacts of food wastage can be addressed through food wastage footprint. The total food wastage accounts for 3.3Gtonnes of CO₂ equivalent. Globally, the blue water footprint of food wastage is about 250km³ equivalent to three times the volume of Lake Geneva. Produced but uneaten food occupies almost about 1.4 billion hectares of land; this represents close to 28% of the world's agricultural land area. It is difficult to estimate the impact on biodiversity at global level. The impacts are assessed through deforestation due to agricultural expansion and species threatened during agricultural practices. Food wastage also leads to loss of economic value of food entities. Each year, 1 trillion USD is lost through food loss and waste at global level. The broad level of causes and impacts enable us to identify number of solutions to reduce food wastage. Improved practices at harvest and post-harvest stages by adopting new technical innovations could be the best way to mitigate losses in developing countries. Consumer's behavior should be modified to reduce waste at down-stream level. The government and development partners have to develop sustainable initiatives through effective policies and raise awareness among the people to solve food wastage problem.

KEYWORDS

low-income, capacity, footprint, broad level, economic, post-harvest, sustainable.

1. INTRODUCTION

Around the world, 821 million people do not have enough food which they need to live an active and healthy life (WHO,2018). One in every nine people goes to bed hungry each night (WHO,2018). The hungry are most numerous in Asia but expanding fastest in Africa. The report forecasts over 272 million more people will be at risk of becoming acutely food-insecure due to COVID-19 pandemic (World Bank, 2021). The total population of the world is expected to reach 9.7 billion by the year 2050 A.D. (UN, 2019). To feed this population with safe and nutritious food, total food production of the world should be increased by 70%. To scale up our production to this level is definitely more challenging. But greater challenge in front of us is to reduce wastage of this produced food. Each year the global volume of food wastage is estimated at 1.6Gtonnes (FAO, 2011). The total food wastage for the edible part only is about 1.3Gtonnes (FAO, 2011). This can be weighed against the total agricultural productions of all the countries which is about 6Gtonnes per year (FAO, 2011).

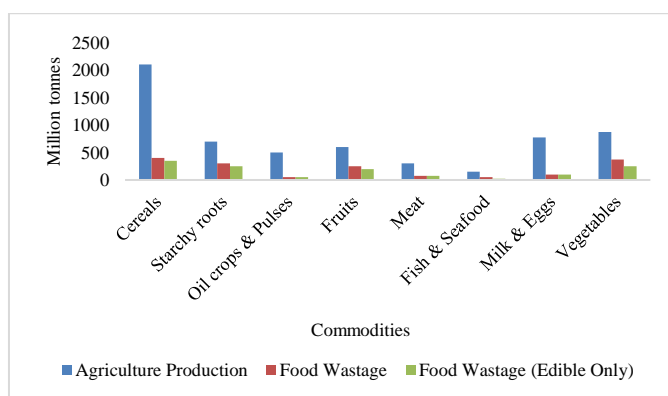


Figure 1: Agricultural production volumes vs. Food wastage volumes (FAO, 2011a)

So, to combat this issue, sustainable development goal 12 (responsible consumption and production) has target to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses(UN, 2015).

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Food wasteage refers to any food lost by poor post-harvest handling practices or waste by discarding food fit for consumption. Equationally, it can be expressed as,

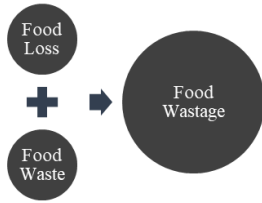


Figure 2: Equationally of food wasteage

The decrease in quantity or quality of food resulting from decisions and actions from harvesting up to (and not including) the retail level is food loss and that at retailers and consumers level is food waste. To measure these losses and waste, FAO has developed two sub-indicators; Food Loss Index and Food waste Index (UNEP, 2018). Out of the total food wasteage, up-stream (harvesting, drying, storage, and transportation) contributes to 54% whereas down-stream (processing, distribution, and consumption) contributes to 46% of food wasteage.

2. CAUSES OF FOOD WASTAGE

In developing countries, food wasteage occurs mainly in the post-harvest and processing stage, which accounts for 44% of global food wasteage. This is caused by poor practices, technological limitations, financial restrictions, and lack of proper infrastructure for transportation and storage. The developed countries produce 56% of the world food wasteage. Of this, 40% of food wasteage in developed countries occurs in the consumption stage, which is driven mostly by consumer behavior, values, and attitudes. A large portion of food waste occurs after preparation, cooking as well as misunderstanding the dates 'use by' and 'best before'. Research in 2018 shows, 10% of 88 million tonnes of food wasted in EU are linked to date marking (EC, 2018). Among causes of food wasteage at consumer level are often mentioned:

- poor planning of purchases often leads to buy more than need,
- poor storage and management in the home,
- excess portions prepared and not eaten,
- over-merchandizing and over-ordering in food stores and supermarkets,
- poor food preparation techniques,
- lack of knowledge about the storability of different foods

3. IMPACTS OF FOOD WASTAGE

This global food wasteage accounts threatening impact on food security as well as on climate, water, land, biodiversity and economy. Food wasteage footprint shows the quantitative as well as qualitative impact of food lost and wasted throughout the supply chain.

3.1 Climate

The carbon footprint (total amount of greenhouse gases it emits throughout its life cycle) of global food wasteage excluding land use change is estimated to 3.3Gtonnes of CO₂ equivalent (FAO, 2013). This also includes the impact of putting waste at disposal, with emissions of methane. By commodity, cereals, meat, and vegetables account for 34%, 21% and 20% of carbon footprint respectively (CCAFS, 2020).

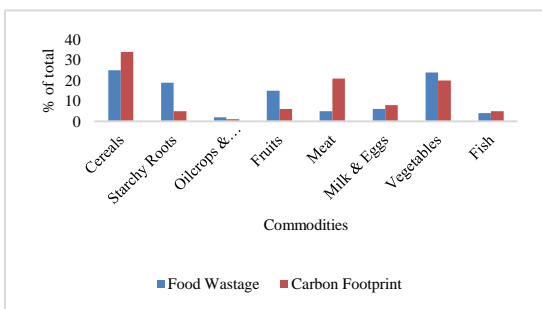


Figure 3: Carbon Footprint of food wasteage by commodity (FAO, 2011a)

Being the highest producer and having high consumption of rice, both the up-stream loss and down-stream waste is higher in China. So, this also becomes one of the reasons behind the highest carbon footprint of China around the world. Remember that the waste of rice from your plate accounts more carbon footprint than the loss during harvesting. As a country, food wasteage ranks as the third top emitter of GHGs (WRI, 2012) after China (9.3GT) and USA (4.8GT) (IPCC, 2014). Meat with high carbon intensity (5 times the waste) has led developed countries to account more carbon footprint (60%) than developing countries (40%) (CCAFS, 2020).

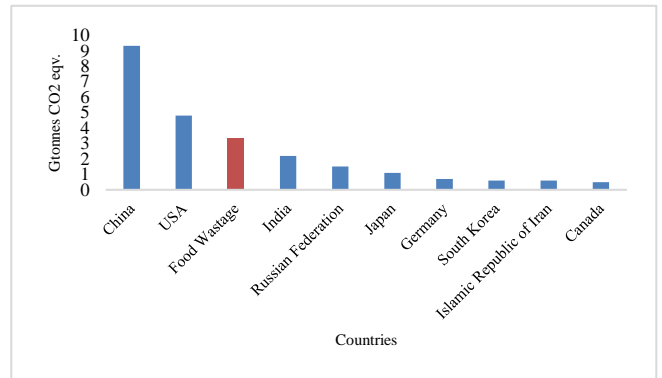


Figure 4: Greenhouse gases emission by countries (FAO, 2011a)

3.2 Water

Food lost and waste is also water waste as large amount of water is used to produce the lost food. Impact of food wasteage on water is quantitatively presented through water footprint. The total volume of fresh water that is used directly or indirectly to produce the product gives the water footprint of that product. Water footprint has three sub-components:

- 1) Blue water – consumptive use of irrigation water from ground or surface water.
- 2) Green water – rainwater (minor environmental impact)
- 3) Grey water – theoretical volume of water required to dilute pollutants (not accounted for footprint)

So, blue water footprint of total food wasteage is about 250km³ (FAO, 2013) which is equivalent to three times the volume of Lake Geneva and annual water discharge of Volga River. As a country, food wasteage ranks as the first top consumer of water for its production followed by India (225km³), China (140km³), and Pakistan (70km³). By commodity, the water footprint of cereals is highest among all the lost or wasted food i.e., 52% followed by fruits (18%) (FAO, 2013). An apple requires 125 liters of water (FAO, 2013) throughout its lifecycle. So, the flooded system of irrigation in cereals and perishable fruits loss during transportation has led developing countries to account 67% of total water footprint. Similarly, 1000 liters of water is wasted if one glass of milk is poured down the drain.

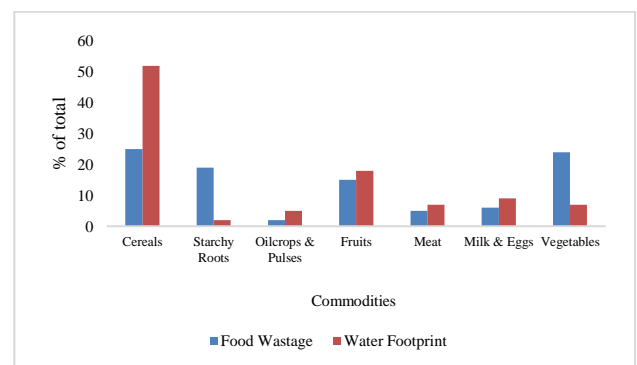


Figure 5: Water Footprint of Food wasteage by Commodity (FAO, 2011a)

3.3 Land Use

Land occupation assessment describes the surface of land, including cropland and grassland, necessary to produce foodstuff but uneaten because of wasteage. Total amount of food wasteage occupies almost 1.4 billion hectares which is almost equal to 28% of the world's agricultural land area (FAO, 2013). Land use by food wasteage ranks as the second

largest country of the world after Russia (1.7 billion hectares). Surprisingly, land occupied by meat & milk is highest as it occupies 78% of total land occupied by food waste (FAO, 2013). It is because the land occupation assessment of livestock production requires specific accountings of the agricultural surfaces occupied for producing animal feed and surfaces used for grazing. Land occupation intensity is much higher in developing nations (70%) than developed nations (30%). The reason behind this is the lower yield of grassland which results in low livestock productivity and consequently, large areas are required to feed animals.

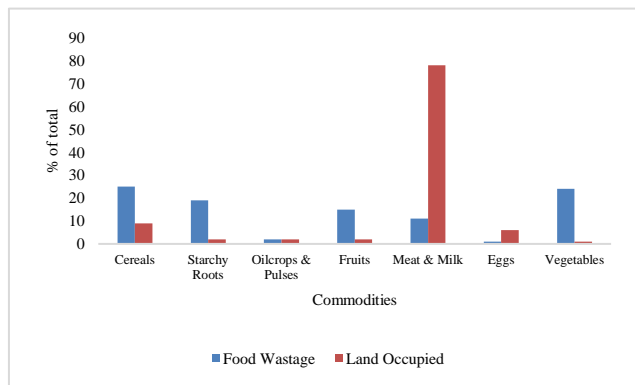


Figure 6: Land occupied by each commodity of food waste (FAO, 2011a)

3.4 Biodiversity

The impact of food waste on biodiversity is focused on the agricultural production phase. Damages to the natural habitat is greater during production phase than impacts due to unused parts of food. Besides other impacts of food waste, biodiversity assessment is a qualitative review. Biodiversity impacts are assessed both at ecosystem level through deforestation due to agriculture and at species level through red listed species threatened by agriculture. Crops are responsible for 44% of species threatening in developed countries whereas 72% of species threatening in developing countries (DOI, 2019). Grassland for livestock provides habitat to some species. So, its impact is relatively lower than crop production.

3.5 Economy

Food waste is essentially a loss of economic value for food business entities. The value of food loss and waste at the global level is estimated at 1 trillion US dollars (SAVE FOOD, 2015). Today, the food industry chains are more globalized. Foods that are sold in international markets and lost in one part of the world can affect the price and availability of food in another part. Excluding the cost due to loss of land, water and biodiversity, the direct economic cost of food waste is USD 750 billion, equivalent to the GDP of Switzerland in 2011 A.D. (FAO, 2013). So, the economic assessment is the first step that calls for further research to quantify the cost along supply chain.

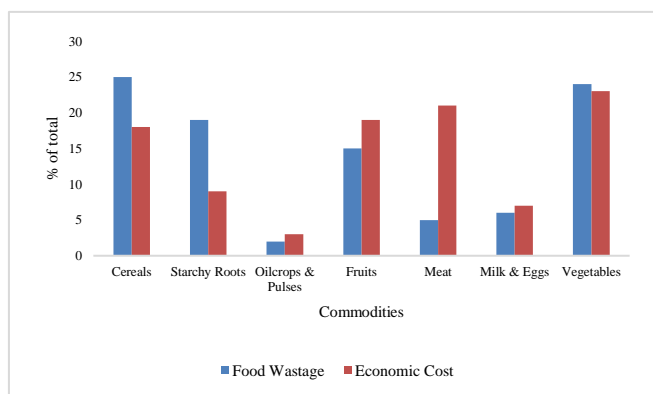


Figure 7: Economic Cost due to wastage of each Commodity (FAO, 2011a)

4. SOLUTIONS TO FOOD WASTAGE

The wide range of causes, organized in different levels, calls for a wide range of solutions. Solutions to reduce food waste includes:

- Individual technical or behavioral action by single actors along the food supply chain.
- Good practices in crop and animal production.
- Development of proper infrastructure for storage facilities (e.g., use of metal silos to reduce post-harvest losses of grains).
- Technical solutions in transportation, processing, and packaging.
- Ensure proper capacity building, education, training, and extension services.
- Develop early warning systems and information management for food demand and supply outlook.
- Promote consumer behavior change.
- Integrate food waste concerns into policies.
- Give value to the surplus "saved" food.
- Divert surplus food to the possible management practices (feed people in need, feed animals, composting/renewable energy).

5. DISCUSSION

Food waste impact food security by three main ways. First, a reduction on the availability of food. Second, a contribution to tightening the market and raising prices of food. Third, a long-term effect by unsustainable use of natural resources on which future production depends. Mainly vulnerable communities, children and women are greatly affected which ultimately leads to global inequality and undo the decades of progress on gender equality. Both the developed and developing countries have been contributing equally to give rise to this problem. So, the joint efforts from all the nations become significant to cope with the problem of food waste. Though it's an enormous issue, it also provides an opportunity to improve our different sectors for better future at the same time. Reduction of food waste may not only increase food availability on the national and global levels; it may also reduce the resources needed to produce. Moreover, this will also contribute to positive climate effects. Achim Steiner, former UN Environment Program Executive Director, who currently serves as the Administrator of the UNDP, said UNEP and FAO have identified food waste as a "major opportunity for economies everywhere to assist in a transition towards a low carbon, resource efficient and inclusive Green Economy" (UN News, 2016). Chris Cochran, executive director of Rethink Food Waste Through Economics and Data (ReFED) says "It is not only an enormous issue, but it is solvable. It has huge opportunity for financial and economic benefit as well as for environmental and social benefits (Waste 360, 2019).

6. CONCLUSION

Food waste has been taken as one of the threatening global issues. In this article, the causes of food waste at different levels, its impacts and the solutions to cope with this issue are discussed. Infrastructural and financial constraints are the main reasons for the loss of food in developing countries. Whereas, the behavior of consumers drives them to waste more food in developed countries. Food waste impacts the environment releasing harmful gases into the atmosphere and declining the quality of biodiversity. This also drives up prices, reducing the number of people who can afford the healthy food they need. Every single actor along the supply chain should play their role to improve technical and behavioral aspects. Better understanding of dates as well as being aware of own needs will be pivotal in dealing the food waste issue. International organizations and bodies, national organizations and youth groups should raise awareness of the importance of reducing food waste and disseminate information about its impacts to all the people around the world. They should develop guidelines to assist governments in an assessment of their food system with a view to reduce food waste and consider convening an inclusive meeting to share successful experiences, challenges faced and lessons learned from food waste initiatives. States and other stakeholders should invest in research and development to minimize food waste and especially design adequate research and extension services.

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