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Food Waste: A Critical Element to End Global Hunger

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Abstract

Food is produced in sufficient quantities to feed everyone on the earth today. However, on the other hand, hunger is on the rise in some regions of the world, with an estimated 800 million people suffering from chronic malnutrition while in other countries there are occasional food crisis. Food security and environmental implications, such as resource depletion and greenhouse gas emissions attributable to food waste, have heightened public attention on the issue. Food loss and waste (FLW) is a significant challenge in several nations throughout the world and a serious threat to food security. Perpetual food loss and waste, COVID-19 and Russia Ukraine war has further aggravated the situation. In this context, the current paper aims to explore through quantitative analysis that the reduction in food loss and food waste has the capacity for ending global hunger and would generate economic – environmental benefits also. The study will be an attempt to highlight the need to take constructive actions to tackle severity of the problem. The specific area of contribution is in scoping out the magnitude and causes of food waste caused by people with the aim of policy identifying actions required to reduce it. In terms of Food Waste Prevention and Management Strategies, the articles proposed a variety of food waste recovery strategies, ranging from food waste prevention to food surplus redistribution and food waste recycling.

Keywords: Food Waste, Food Loss, Food Security, Hunger, Sustainable Development

1. Introduction

The earth currently feeds 7.2 billion people and by 2050, the population is predicted to reach 9.6 billion. This means that by the end of the century, there will be at least three billion more people to feed from the already scarce resources (United Nations, 2014). On the one side of the coin we are having a great number of people lacking access to food security while on the other side of the same coin we are wasting a tremendous quantity of food. Among the current population, over 850 million people worldwide lack access to the food they require for a healthy and productive life on the one hand and on the other hand, about 1.3 billion tonnes of the food produced for human consumption each year is wasted in the waste stream. So, diverting the wasting food for those in need is the need of the hour (FAO, 2011). Hence, Food scarcity isn't the cause of global hunger as the earth produces enough food to feed every child, woman, and man on the earth, but about

one-third of all food produced each year is wasted or lost before being consumed. So hunger crisis can be countered to a great extent if food loss and waste is reduced systematically (WFP, 2020 ; WIRE,2021).Moreover the major challenges to global food security and World hunger are Food waste-which happens to be the root cause worldwide, chronic poverty, conflict, and natural catastrophes(UNWFP, 2021). The World Economic Forum's Global Risks Report recognized food crises as a key danger which COVID-19 pandemic has aggravated further by closing eateries and disrupting supply systems (WEF,2020). In a world where the number of people impacted by hunger has been slowly rising since 2014, and thousands of tonnes of edible food are lost or wasted every day, reducing food losses and waste is critical.

In context of the aforementioned recognized environmental-economic challenges of food loss and waste, the paper shall present reduction in food loss and waste as a tool to end Global Hunger. The paper in addition to introduction is structured into Section 2: Methodology. Section 3: Elaborates the meaning of food loss and waste. Section 4 demonstrates how FLW and global hunger have a close relationship with another. Section 5 & 6 accordingly highlights the causes and consequences of FLW respectively. Section 7 explains why hunger crisis need to be revisited. Section 8 argues why reduction in FLW is important. Section 9 is all about some of the initiatives taken in some countries for reduction of FLW. Conclusion and recommendations have been given in section 10 and section 11 respectively.

2. Food Loss and Food Waste

Food loss and food waste are two different things. When food waste occurs in the early phases of the food supply chain (e.g., harvesting, transit, storage), it is referred to as “food loss” and when it occurs later in the chain (e.g., retail, distribution and consumption), it is referred to as “food waste”. Food loss refers to a reduction in the quantity or quality of food as a result of food supplier’s decisions and actions (SOFA, 2019).It occurs when edible food is lost after harvesting but before reaching sale (Baig et el,2018). Food waste is the loss of quantity or quality of food as a result of retailer, food service provider, and consumer decisions and behaviours (SOFA, 2019). Lipinski et al. (2013) define food waste as the food that is of good quality and fit for human consumption but that does not get consumed, because it is discarded – either before or after it spoils. Collectively Food loss and waste (FLW) is defined as a decline in food that was originally meant for human consumption, regardless of cause, at all stages of the food chain, from harvest to consumption. The characteristic feature of FLW is that the food that is or was edible, or that could have been utilized in other ways, is thrown away or incinerated.FLW is prevalent throughout the food supply chain, from harvesting to transportation, storage, processing/packaging, distribution, and consumption (Baig et el, 2018).

3. Food waste and global hunger are linked, here is how

Due to food loss and waste both economy and natural resources suffer. Millions of people suffer from hunger around the world, but as already mentioned 1.3 billion tonnes of food, enough to feed the world's hungry, is thrown away each year, worth almost US $1 trillion. (WEF, 2020; WFP, 2021). Around 14% of food produced is lost between harvest and retail, while an estimated 17% of total world food production, worth $400 billion, is wasted. Lost and wasted food accounts for 38% of total energy use in the global food system. (United Nations; FAO 2019 ; UNEP, 2021). The magnitude of FLW is so huge that the direct economic impact of food waste (excluding fish and seafood) is about $750 billion per year. (FAO**:** Food wastage: Key facts and figures.)

The amount of food lost or wasted varies in different countries.FLW is found in most of the countries of the world but the developed world has a greater share. According to the United Nations' Food and Agriculture Organization

(FAO), the Middle East and North Africa (MENA) wastes about 250 kilos of food per person each year, totaling $60 billion. These figures are particularly alarming given that the region already has a paucity of natural resources and relies heavily on global food imports. The scarcity of resources and the heavy reliance on food imports does not prevent them from countering food waste (Shields, 2018).Same is the case with the six GCC countries who also to a great degree are reliant on food imports to fulfill rising food consumption, and they are, unfortunately and ironically, among the world's top food wasters.(Abu Dhabi Environment Agency, 2013). They waste nearly a third of imported food, and their per capita food waste is much higher than in industrialized North American and European countries. The European developed world on the one hand produce food items but on the under hand they have a role in the FLW as well. But when it comes to the GCC countries, they did not produce food rather they only waste a large amount of it. According to EcoMENA, a Qatar-based think tank that advocates sustainable development, " The oil-rich Gulf nation wastes more food than any other in the Middle East", which according to analysts might be due to the inhabitants being affluent and can afford the associated losses (Shields,2018). Food wastage is alarmingly high there, leading to increasing reliance on food imports and putting pressure on the region's limited natural resources.FLW has many other consequences including waste of natural resources such as water and arable land and limited soil nutrients, which are even more valuable in the GCC region than elsewhere, and indicates an inefficient use of domestic resources (Bilali & Hassen, 2020).

Among the GCC countries Saudi Arabia is heavily dependent on food import from the rest of the world as she had the least arable land per capita in the world, making it the greatest importer of food and agricultural products, with 80 percent of food requirements imported in 2013 (USDA Foreign Agricultural Service, 2014). Different sources have given the annual economic consequences of food wastage in Saudi Arabia e.g for the Saudi Ministry of Environment Water & Agriculture estimates, food wastage costs the country $13 billion annually (Whitman, 2016), for Baig e t el.,(2019), food wastage stands at US $12 billion per year and according to the Middle East Monitor (2016), the country spends SR49.833 billion yearly on the food which stands wasted . Food accounts for around 27% of the average Saudi citizen's income. (Gain Report, 2015 ; USDA, 2014).Quoting the report of the seminar on ''Reducing Food Waste," held in Riyadh, Whitman (2016) reported that Saudi Arabia wastes US $35 million worth of food per day. According to another estimate, food worth 70 million Saudi Riyals goes to waste every day at the household level. So far as the wastage of food is concerned, a typical Saudi may waste 1.2 to 1.4 kilogrammes of food every day, or 511 kilogrammes per year. (Arab News, 2016). According to the Barilla Food Sustainability Index, Saudi Arabia is the world's top per capita food waster, wasting 427 kilogrammes per person per year, more than double the FAO's estimate. (Barilla Ctr for Food & Nutrition and Economist Intelligence Unit, 2016).According to the results of a poll done by YouGov, an internet-based market research company, 78 percent of respondents in the Kingdom of Saudi Arabia waste food every week to create way for new supplies of groceries (Jiwaji, 2014). This amount of food waste equates to 8 million meals every day, or 1.65 million tonnes of food wasted each year in domestic kitchens. (Baig et el.,2019). Saudis are estimated to discard 35 to 40% of cooked rice each year, equivalent to SR 1.6 billion. (Saudi Gazette, 2014). According to a 2008 report, Arab cities such as Riyadh, Doha, and Abu Dhabi generate about 1.5 kg of solid garbage per capita each day, making them among the most solid garbage generators in the world (Baig et el., 2018).

Same is the case with other GCC countries that is the less the resources are the more is the wastage but one feature common to all of them is that they all are rich oil producing nations. Qatar is one of the top ten countries in the world in terms of per capita food waste; which ranges from 584 to 657 kg per year, according to Bennbaia et al. Food waste accounts for approximately 1.76 kg per

capita per day of municipal solid trash in Abu Dhabi (UAE) residential areas, according to Abu Qdais et al., implying that each Emirati's average food waste was around 321 kilogrammes per year in 1997. Kuwait produces a lot of waste, with organic waste accounting for half of it. Kuwait has a surplus of products, which regrettably contributes to an abundance of garbage." More over 18 square kilometres of Kuwait's 17,820 square kilometres are occupied by landfills, indicating a pressing need to eliminate food waste. (Malek, 2019). Analysts in Qatar believe that over half of the food cooked during Ramadan will be wasted. According to Abdel Wahab, food waste accounts for 60% of the total amount of food produced in Egypt throughout the annual observance. In Egypt, 30 percent of the amount is squandered annually (Shields, 2018).

Table 1: The financial consequences of food waste, determined by the amount of money spent on food per capita in GCC countries in 2018

Country	Amount Spend on Food in US $	% age of total expenditure
UAE	1951.9	13.71
Kuwait	1910.5	19.22
Qatar	1755.7	12.27
KSA	1689.6	20.62
Bahrain	1674.1	13.24
Oman	1329.1	22.65

Source: *Knoema Expenditures Spent on Food.*(Tabulation: Authors own)

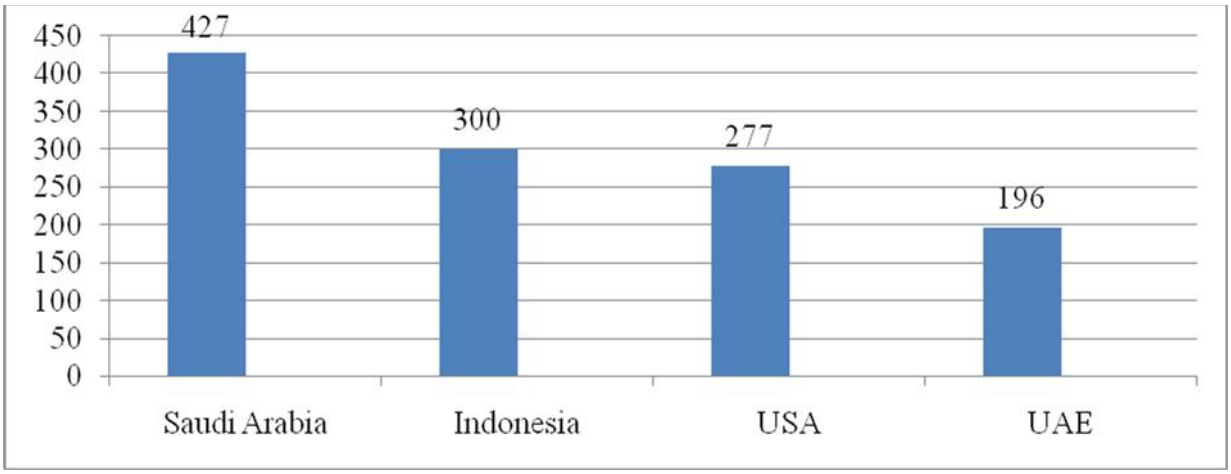
Food waste is not confined to the GCC countries but to other regions of the world as well. According to the FAO (2011), the North Africa, West and Central Asia region produces 210 kg of food loss and waste per capita each year, with 68 percent occurring during production, handling, processing, and distribution, and the remainder occurring during consumption, especially in urban areas. In the NENA (Near East and North Africa) region also, food waste is a severe challenge. As per the estimates of FAO, around 34% of food is lost or wasted in the region (FAO: Global Food Losses and Food Waste: Extent, Causes and Prevention; FAO: Rome, Italy, 2011.).

We have the challenges of food waste in the developed world as well. The food produced in some poor nations is almost equal or nearly comparable to the food wasted in the world's richest countries. The US Department of Agriculture's Economic Research Service, propounds that around 30% to 40% of food in the US is wasted. This equates to more than 20 pounds of food per person being wasted each month at all three levels: production and supply chain, retail, and consumer (UNWFP, 2021). In 2010, Americans squandered 34 million tonnes of food, or 115 kilogrammes per individual anually (Myers, 2015),Where as the figure is 89 million tonnes annually in the European Union; analysts project that this number will be 126 million tonnes by 2020 if reforms are not made. (WRAP, 2011).According to the United Nations Environment Programme, rich countries waste as much food as Sub-Saharan Africa produces. Each year, industrialized countries in North America, Europe, and Asia squander 222 million tonnes of food. Sub-Saharan African countries, on the other hand, produce 230 million tonnes of food each year. That indicates that the food produced in Sub-Saharan Africa is nearly comparable to the food wasted in the world's richest countries. (UNWFP,2021). In this respect, According to the FAO (FAO:Food Wastage Footprint. Impacts on Natural Resources; FAO: Rome, Italy, 2013.**)**, FLW is worth around 680 US billion dollars in rich nations and 310 US billion dollars in developing countries.

4. Causes:

Both the developed world as well as the developing world is responsible for the deterioration of this precious natural resource. While in the industrialized world, the factors that are responsible for food waste are very much different from those of the underdeveloped world. The majority of waste in richer nations occurs after market, in supermarkets, and in homes (Deen,2018). More than 40% of losses occur at the retail and consumer level (WFP,2020). Much of the waste originates from people buying too much and tossing away what they don't eat. While on the other hand in developing countries, it is primarily the result of inadequate farming and a lack of adequate storage facilities where Post-harvest and processing losses account for 40% of all losses (Hornby,2013).Same is the case with the NENA region where causes include insufficient and weak infrastructure (e.g., cold chain, markets), ineffective regulatory and policy frameworks, and institutional shortcomings, according to FAO (2013). However According to UNEP, the global average of 74 kg of food wasted per capita per year is similar in lower-middle-income and high-income countries, indicating that most countries can improve (UNEP,2021).Carelessness or a deliberate decision to discard food are also its causes in some regions depending on economic condition of the people. In Saudi Arabia, culture, food valuation, policy and industrial factors, and awareness are major contributors to waste (Baig et el., 2019). In the Gulf, socio- religious gatherings have contributed to the food waste surges as per the findings of few studies. (Bilali & Hassen, 2020).However precision agriculture and investments in post-harvest procedures are the methods of technological interventions that will not only help us to reduce food waste if not to eliminate entirely it but ill also on the one hand contribute to the preservation of this significant natural resource and on the other hand will definitely push us forward towards attaining food security.(Deen,2018).

Table 2 : Amount of Food wasted in Kg's (per person per year) in different countries.



Source: Baig, M.B., et al. Understanding and addressing waste of food in the Kingdom of Saudi Arabia.(Bargraph:Authors own)

5. Consequences of Food loss and waste

Is it critical to prevent food loss and waste? The answer is yes and here is why.FLW is an emerging challenge with huge environmental, economic, and social consequences. It is also an ethical catastrophe in a world when over 820 million people are still hungry. It threaten the sustainability of our food systems. Beyond financial losses, wasting food includes wasting water, land, energy, labour, and capital in the production, processing, distribution, and preparation of food, as well as contaminating water, air, and soil.

5.1. Environmental Impact

In case we don't have any FLW, still environment is feeling the pressure of food production as it has provide various resources essential for food production in the form of soil, water etc. FLW comprises the use of 1.4 billion hectares of agricultural land, the generation of 3.3 billion tonnes of CO2 and the use of over 25% of fresh water, (Bilali & Hassen,2020).So if there is food waste, it causes environmental harm not only at the point of disposal, but also on a global scale due to food imports and pollution diffusion ending up with impacting all three aspects of sustainability – environment, economy and social issues hence regarded as a key issue within the Sustainable Development Goals. (Baig et el, 2019). Food waste is also a source of greenhouse gases thereby contributing to the reduction in the quantity of food in two ways. One when we waste food it is the reduction in the quantity of food and two, when dumping food in the form of waste in landfills takes place, sit results in climate change which in turn, could reduce crop production by more than 25%, undercutting existing efforts to combat hunger (Deen,2018).According to estimates, food that is not consumed accounts for 8-10% of worldwide greenhouse gas emissions. It's ironic that in growing crops, we are contributing to climate change, which has put food security in risk. (UNEP, 2021).

Huge amounts of food thrown out in landfills release excessive amounts of methane (CH4)- one of the most dangerous greenhouse gases that also contributes to climate change- carbon dioxide (CO2) and the chlorofluorocarbons (CFCs) present in the atmosphere absorb infrared radiation and heat up the earth's atmosphere, contributing to global warming. Global warming can result in many serious alterations to the environment, eventually impacting human health. It can also cause a rise in sea level, leading to the loss of coastal land, a change in precipitation patterns, increased risks of droughts and floods, and threats to biodiversity. *CFCs* react with the ozone gas in our atmosphere and leave us vulnerable to *harmful effects* of ultraviolet radiations of the sun. Food decaying along with Industry, agriculture and waste management are all sources of methane emissions. Despite having a far shorter lifetime in the atmosphere than CO2, CH4 is 25 times more effective and proactive at absorbing radiation as a greenhouse gas. (Baig et el.,2019). The UN has estimated that if wasted food was a country, it would be the third largest greenhouse gas emitter and top user of blue water for agriculture (UN FAO, 2013).Food systems are responsible for about 70% of water extraction from the biosphere (UNEP, 2021).The total amount of water utilised to produce food that is lost or wasted annually (250km3) is thrice the volume of Lake Geneva (FAO: Food wastage: Key facts and figures). Moreover it would have been the world's third-largest carbon dioxide producer, following United States and China. (Hornby,2013 ; Shields, 2018).

5.2 Economic Impact

We are paying a heavy price today as well as in future for food loss and waste we make both in economic terms as well as by depleting our resources. Global food waste is so huge that it has been predicted to cost $2.6 trillion in terms of economic, environmental, and societal consequences, which is nearly equal to the GDP of France rather it is more than the GDP of some more than a half dozen poor countries from the developing world (FAO, 2014). FLW comprises the annual consumption of more than 300 million barrels of oil around the globe(Hornby,2013). Food systems are responsible for about 60% of biodiversity loss .Loss of biodiversity means loss of resources as biodiversity is proving a number of services like Medicine, tourism and much more(UNEP, 2021). Food loss and waste can have detrimental implications for food security and availability, and it can also contribute to inflation in food prices as well (Baig et el., 2019 ; WIRE, 2021).

6. Hunger Crisis need to be revisited

Food waste is a cause of global hunger and malnutrition. In the words of QU Dongyu,

Director-General of the UN FAO, "We cannot end hunger and all forms of malnutrition if we do not address the high levels of food loss and waste". So Food loss and wastees must be reduced if we are to solve global hunger, combat climate change, and promote healthy food systems, and in achieving so everyone can contribute. Food loss is one of the core reasons of hunger worldwide, alongside chronic poverty, conflict, and economic shocks (UNWFP,2021) . The UN has observed a substantial increase in world hunger as one of the knock-on impacts of the COVID-19 outbreak. As per the State of Food Security and Nutrition in the World, one tenth of the globe's population – 811 million people – remained undernourished in 2020, an increase of 118 million from 2019. On the one hand two billion people are overweight or obese while on the other hand two billion individuals today are affected by Micronutrient deficiencies (UNEP,2021). The UN is fighting against difficult odds: an estimated 800 million (820 million for SAVE FOOD) people still live hungry, despite warnings that the world will need to produce at least 50% more food by 2050 to feed the world's expanding population of 9.0 billion people—20 years well beyond UN's goal (Deen,2018). Conflict-affected nations in the Arab world are most devastated, such as Syria, Iraq, and Yemen, with the number of undernourished virtually doubling between 2010 and 2018 while is case of the Lebanese inhabitants, Hunger affects one in every three. Same is the case with other poor nations of Africa and Asia (Malek, 2019).

The affluent society struggles with a cost-of-living crisis, the globe's most vulnerable people face severe hunger, malnutrition, and the possibility of famine. There are currently 923,000 people living in famine-like conditions, a 550 percent increase since March 2021, while worldwide hunger grew by 25% in 2020, after decades of reduction. In several hunger hotspots around the world, the situation is deteriorating. The amount of people who are extreme hungry to the point of death is stunning. There are 45 million people who are hungry in 43 nations (World Vision International).

The number of people experiencing extreme food insecurity has more than doubled, with up to 811 million people going to bed hungry every night. In 45 nations, about 50 million people are suffering from acute hunger. Within only two years, the number of people suffering from extreme food insecurity has risen by more than 200 million, from 135 million in 53 countries prior to the COVID-19 pandemic to 345 million in 82 nations. A fatal combination of four factors has contributed to the current hunger crisis: Covid-19 Pandemic, Conflict, Climate Shocks and the cost of reaching out to those in need is increasing. Money, on the other hand, is insufficient to reach Zero Hunger. Only political will can put an end to conflict in areas like Yemen, Ethiopia, and South Sudan, and without a solid political commitment to limit global warming, as required in the Paris Agreement, the primary causes of hunger will persist.(World Food Programme :A hunger catastrophe).

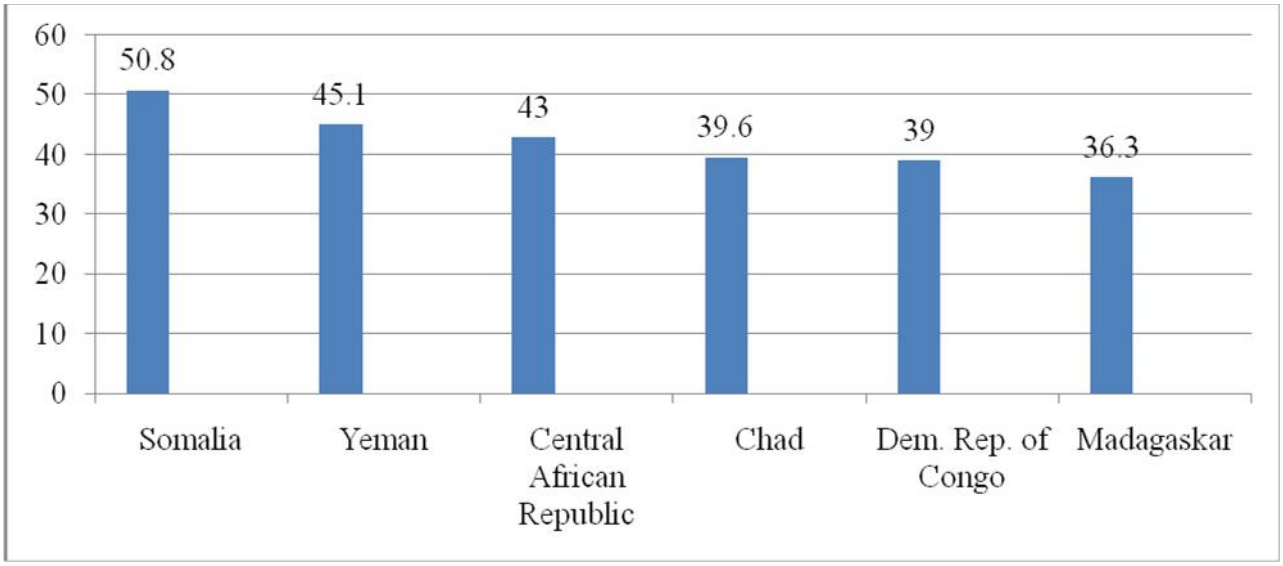
The number of undernourished persons increased by 161 million from 2019 to 2020.Conflict was the leading cause of hunger for 99.1 million people in 23 countries in 2020. Severe acute malnutrition, often known as severe wasting, affects an estimated 14 million children below the age of five around the globe.(Action Against Hunger :World Hunger).

Hotspots of extreme hunger include Yemen, the Central African Republic, Afghanistan, Venezuela, the West African Sahel, Ethiopia, Sudan, South Sudan, and Syria where the food crisis has deteriorated as a result of the pandemic. Hunger has also worsened in emerging hunger hotspots such as Brazil, India, and South Africa, which have also seen among of the highest COVID-19 infection rates.(Oxfam International)

As per the Global Hunger Index 2021, adopted by International Food Policy Research Institute, Somalia was the country most stricken by hunger and malnutrition, with an index of 50.8. Yemen was next, with a 45.1 index. The World Hunger Index takes into account three factors: undernourishment, child underweight, and child mortality.

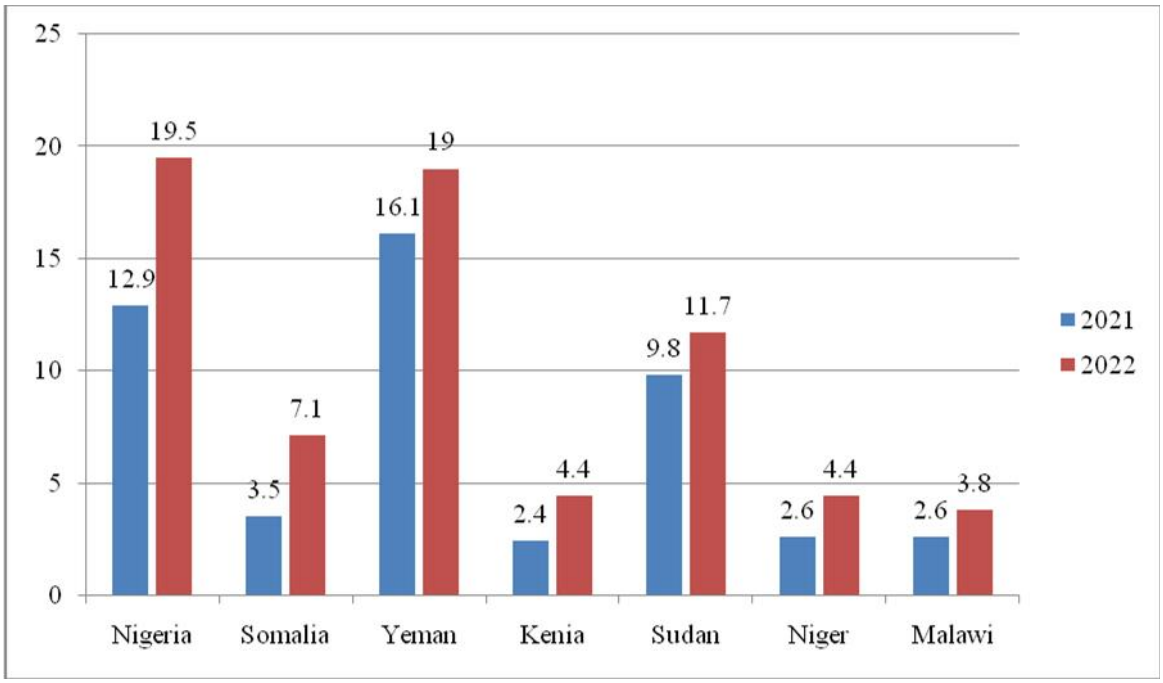
After going through the above mentioned vital statistics, we came to know that food loss and waste is one of the gravest challenges humanity in general and most affected people in particular are facing. It is the need of the hour to take strict actions individually and collectively in order to reduce the FLW thereby preserving both our resources as well as our economy.To put it in the words of Hoffman (2013), "In order to restore and build healthier and more reliable food systems reduction in food loss and waste is critical. As a result, any solutions to world hunger must begin with a significant reduction in food waste". In a world where the percentage of people impacted by hunger has been gradually rising since 2014, and tonnes and tonnes of edible food are lost or wasted each day, minimizing losses and waste is critical. Food loss and waste must be minimized in order to achieve Hunger free world and the Sustainable Development Goals particularly SDG 2 (End Hunger) and SDG 12 (Ensure sustainable consumption and production patterns). From an ethical standpoint, it's critical to project a sense of solidarity with the millions of individuals around the globe who struggle to eat a single meal every day. (Baig et el., 2019; Project Drawdown).Not just to for the sake of the food, but also for the resources that go into it, we all have a role to play in minimizing food loss and waste. Food loss and waste has become a major challenge of societal concern. The United Nations' 2030 Agenda for Sustainable Development indicates a growing worldwide awareness of the issue. Target 12.3 of the Sustainable Development Goals asks for decreasing global food waste per capita at retail and consumer levels by 2030, as well as minimizing food losses along the supply and production chains (FAO: Food Loss and Food Waste). FAO aims to raise awareness of the importance of food, and the farmers who produce it, the natural resources used in its production, and the people who are deprived of it (SAVE FOOD).

Table.3.Countries that are most affected by hunger and malnutrition according to the Global Hunger Index 2021



Source:- Statista: Global Hunger Index 2021(Bargraph: Authors own)

Figure 4: No. of people in millions in different countries / territories with an Increase of More Than 1 Million People in Integrated Phase Classification Phase 3 or Above Between 2021 and 2022 .



Source: Global Report on Food Crises 2022 Mid-Year Update (Bargraph: Authors own)

7. Why reducing food loss and waste is Important

We are already producing a large amount of food that can feed all the individuals on the face of the earth. The portion of the food that remained unconsumed is enough to feed all the hungry around the globe. All of the food that is produced but never consumed is enough to feed two billion people. That's more than twice the amount of individuals that are malnourished around the world (Hornby,2013).But on the other side if food loss and waste has not been reduced according to Hoffman (2013), “the globe will need to produce 70% more food in just 30 years to feed the predicted 9 billion people on the earth”. The more we waste the more we need to produce in the future from the already scarce resources to feed the rapidly growing world population. Food is both a major worldwide health issue and a significant climate concern. Not only are we producing what makes us sick and harms the earth, but we are also subsidizing it with billions of dollars every year. The negative impacts of food waste did not only have consequences for the countries who are more responsible for it but its victims are those countries as well who have least contribution to it.The poorest people on the planet, as well as the regions least responsible for their creation, are adversely impacted by these developments (Deen, 2018). So, Food waste recycling is the need of the hour which has a variety of direct and indirect outcomes. Direct outcomes include a decrease in the amount of waste that goes to landfill. Indirect a advantages include the utilization of food waste products like biochar and compost, which can improve soil fertility while simultaneously increasing soil carbon sequestration potential, so assisting to deal with climate change (Bilali & Hassen,2020). Good governance, human capital development, teamwork, and partnerships are all required to facilitate and enhance positive effects of minimizing food loss and waste. (FAO**.** International Day of Awareness of Food Loss and Waste).The following are some of the advantages of reducing food loss and waste:

1. Reducing food loss and waste can help to bridge the roughly 60% gap between today's food and what will be required in 2050, so assisting in the eradication of hunger (Project Drawdown) and will also relieve pressure on limited natural resources. (Hornby,2013).

2. Less food loss and waste results in more effective land use and improved water resource management, this does have a positive effect on climate change and livelihoods.

3. Compost made from recycled food waste enhances soil health and structure, improves drought resistance, and decreases the need for additional water, fertilizers, and pesticides. (Bennbaia et al., 2018)

4. Food loss and waste reduction is a vital strategy for sustaining our food system's long-term viability and enhancing planetary health.

5. Reducing FLW is critical if the world is to achieve long-term food security and sustainability.

6. Recovery and redistribution make better utilization of extra food while reducing food waste and assuring economic, environmental, and social advantages. Food waste diverted to composting is preferable to landfill disposal, but avoiding food waste from being wasted in the first place is an even better strategy to reduce environmental effect.

8. Initiatives

In order to reduce food loss and waste, all have a role to play. In recent years, many food waste management structures or pyramids have been devised. These emphasize waste prevention and control at the source, as well as show a list of waste consumption, re-use, recycling, and treatment preferences (Bilali & Hassen, 2020). As a result, the FAO collaborates with a wide range of stakeholders and allies to address the issue. At a macro level, FAO coordinates with governments and other international organizations to raise awareness about the concerns, advocate for change, and set standards to minimize FLW (FAO: Food Loss and Food Waste). The United Nations launched the 2030 Agenda for Sustainable Development in 2015, which is a framework for world peace and prosperity. There are 17 objectives to be met by 2030. Goal 12 of the Sustainable Development Goals aims to ensure sustainable consumption and production patterns and includes cutting food waste in half by 2030 (UNWFP,2021). One of the United Nations' primary aims is to cut global food waste by half until 2030 (WFP, 2020).

The Environmental Protection Agency (EPA), an independent executive agency of the United States federal government, conducting environmental assessment as well as research and education pertaining to environmental protection matters, has given some suggestions for Food Recovery in a hierarchical order. The Food Recovery Hierarchy assesses the activities that organizations can take to minimize and redirect food waste. The Food Recovery Hierarchy is divided into levels, each of which focuses on a different management approach for discarded food. The uppermost levels of the hierarchy are the best approaches to minimize and redirect wasted food because they have the greatest positive impact on the environment, society, and economy.

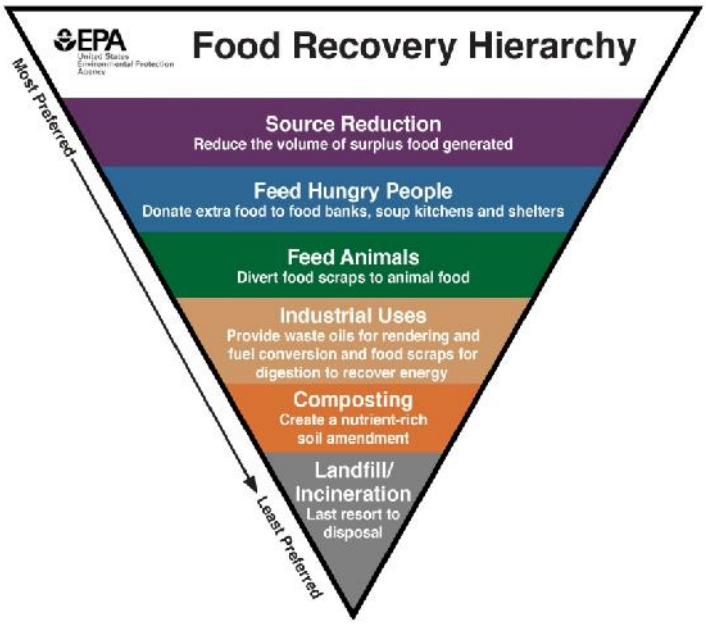


Fig.3. United States Environmental Protection Agency.

As the world moves toward achieving the United Nations Sustainable Development Goals for hunger, food security, and nutrition, several regional efforts are attempting to assist the Arab world. The Middle East is coming up with new sustainable solutions that are reinventing agriculture, farming, and the food sector, from Kuwait and Lebanon to Palestine, Iraq, Egypt, and the United Arab Emirates. (Malek,2019). In the Middle East, a movement is gaining ground to fight rising food waste, which results in billions of dollars in lost revenue each year. In fact, groups such as Qatar's *Wahab* have sprung up all throughout the area to provide this service. (Shields,2018). The FAO is aiming to increase capacity in the Middle East to reduce food losses. Their strategy focuses mostly on food losses early in the supply chain, with minimal emphasis on consumer-level activities. A number of initiatives have taken root in the UAE, including My Arabian *Almanākh*, an urban gardening journal that raises awareness even in urban environments like Dubai, and the Ramadan Sharing Fridges Campaign, which has about 200 fridges spread across Dubai where people can donate food to the less fortunate. (Malek,2019). The Saudi Food Bank, or *Etaam*, has called on the government to make waste punishable. *Etaam* gathers extra food from hotels and wedding halls and gives it to the poor. In Kuwait, Re: Food helps redistribute supplies, while in Egypt, *Sekem* works with local producers. (Malek,2019). Meanwhile, in Egypt, where millions of people are poor and roughly 20% of the population is food insecure, a group of young computer programmers developed the "Wasteless Egypt" app which allows users to enter the foods they want to contribute, and then the technology matches them with the person in need closest to them. (Shields, 2018).

Although such projects had enormous progress in reducing FW from sources, more stakeholder's initiatives are required as thousands and thousands of tons food is either lost or wasted still today. On the other hand government's positive support and regulations are required to achieve the objectives of such initiatives, as the earth needs so much response as the number of people suffering from hunger has gradually risen.

Conclusion

Food waste reduction is a significant physical issue. However, it offers several socio-economic, environmental and health benefits. Reducing FLW can play its role in eliminating hunger globally. Our food systems cannot be robust unless they are also sustainable, necessitating the use of integrated measures to reduce food loss and waste. To consume the most of the food we produce, we need to take action both internationally and locally. The introduction of technologies, innovative solutions, new methods of working, and best practices to control food quality and prevent food loss and waste are critical to bringing about this transformation. Greater spending in harvesting equipment, together with enhanced market access, can assist farmers in low and middle-income nations reduce field losses and lift millions out of poverty.

Recommendations

1. Government engagement, stronger legislation, and faith-based campaigns can all contribute to raising global awareness of food waste. Bringing staff expertise in community/adult training to solve the country's food waste is one prospective new function, aligned with the goal of satisfying the country's food security needs.
2. Challenges and concerns to natural resource sustainability and food security cannot be tackled with a unique solution, but instead demand a holistic approach across society. Extension Education Programs are expected to have a stronger impact if they are implemented in a public-private collaboration to address this complex global issue.
3. Encouraging a rise in food waste recycling will result in better food quality management.
4. Reducing food waste is a practical initial step in achieving long-term food consumption and production.
5. Standards for reducing food waste should indeed be specified not only at the national level, but also at the corporate, supplier, and consumer levels. To induce behaviour change, waste reduction measures should be devised and offered.

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