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Reducing Food Loss and Waste Through the Implementation of the SDGs and the Adoption of Good Agricultural Practices in the Arab Region[1]

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ACRONYMS

AOAD	Arab Organization for Agricultural Development
CFS	Committee on World Food Security
ESCWA	Economic and Social Commission for Western Asia
FAO	Food and Agricultural Organization
FAO-RNE	FAO Regional Office for the Near East
GAFTA	Greater Arab Free Trade Area
GAPs	Good Agricultural Practices
GLFI	Global Food Loss Index
HLPE	High Level Panel of Experts
ICARDA	International Center for Agricultural Research in the Dry Areas
LAS	League of Arab States
SCP	Sustainable Consumption and Production
SDGs	Sustainable Development Goals
Sida	Swedish International Development Agency
UN	United Nations

ABSTRACT

This technical paper discusses food loss and waste in the Arab region and assesses opportunities to address the issue through the implementation of the Sustainable Development Goals (SDGs) and the adoption of Good Agricultural Practices (GAPs) to enhance food safety and quality. There are many challenges facing the food sector in the Arab Region including inefficiencies in the supply chain, protracted conflicts and rising scarcity of natural resources to name a few, and food loss and waste is rapidly becoming a cause of concern of its own while there is still limited awareness on its magnitude, scope and impact. Addressing food loss and waste can help support the achievement of the SDG2 related to zero hunger while on the other hand implementing the SDGs could also help reduce its magnitude and impact. The GAPs, which promote the use of enhanced technological systems and technical and managerial skills to improve food safety and quality and efficiency throughout the food supply chain, is also an important tool in addressing food loss and waste.

INTRODUCTION

This report on "Reducing Food Loss and Waste through the Implementation of the SDGs and the Adoption of Good Agricultural Practices in the Arab Region" aims to provide an overview of the issue of food loss and waste and as it pertains to the Arab Region and opportunities to address the issue through the adoption of Good Agricultural Practices (GAPs) that enhance food safety and quality. Addressing food loss and waste has the potential to put the region on a path to achieve Goal 12 of the Sustainable Development Goals (SDGs) ("ensure sustainable consumption and production patterns"), target 12.3 ("by 2030, 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").

This paper is an expansion of an earlier version that was presented at a conference on "Reducing Food Loss in the Arab Countries to Achieve Arab Food Security," which was organized by the Arab Organization for Agricultural Development (AOAD) in Khartoum, Sudan, in September 2016. The conference brought together experts from the Arab Region and from international organizations to debate and exchange ideas on key issues related to food waste and loss. Debates focused on key topics such as indicators to measure food loss and waste and appropriate related technologies. Specifically, the conference considered commodities such as dates, olives, cereals fruits and vegetables and fishery products at country level. The conference also reviewed the Food and Agriculture Organization (FAO)'s framework for food loss and waste and the High-Level Panel of Expert (HLPE) of the Committee on World Food Security (CFS)'s report on Food Security and Nutrition.

Food loss and waste has moved to the forefront of national and international debates as the result of the large amount of losses and wastes occurring along the entire food supply chain: from production in the field and on the farm through retail and consumer levels. As a matter of fact, it is often argued that the impact of the worldwide food loss and waste, most notably through emissions, has the third highest global environment impact after the United States and China. Thus, many advocates and an ever-increasing number of consumers have pushed the issue front and center onto the international stage where it has received increased attention particularly following the food crisis of the late 2000s and rising concern about how to sustainably feed the burgeoning world population, which is expected to reach 9 billion by 2050 (UN, 2015a).

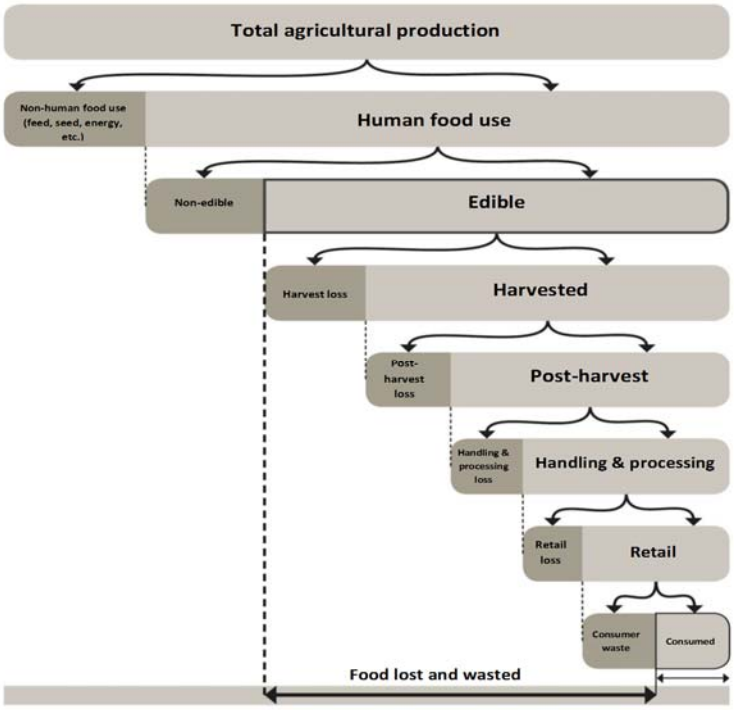
Food loss and waste is a result of prevailing inefficiencies within the food supply chain. These include inadequate technologies; poor infrastructure and logistics; lack of adequate skills, knowledge or other capacities; lack of access to markets; occurrence of disasters; and bad consumer shopping and eating habits, among others. In most cases, these issues result in the loss, damage or deterioration of food before it is consumed. GAPs, which primarily aim to improve food safety and quality, could help address both food loss and food waste. This could be achieved through adopting improved technologies and maintaining proper records throughout the food supply chain, among other strategies. In addition, new practices, new management and additional investments associated with the adoption of GAPs could further improve the efficiency within the food system. The regional adoption of GAPs could enhance the standardization and harmonization of food safety and quality, which could in turn enhance regional trade, thereby opening new markets into which excess food could be channeled before it is lost or wasted.

I. WHAT IS FOOD LOSS AND WASTE?

Food loss and waste refers to the food that is appropriate for human consumption but that is not consumed. In the landmark publication for the FAO by Gustavsson et al (2011), food loss and waste is defined as a "decrease in edible food mass throughout the part of the supply chain that specifically leads to edible food for human consumption." The definition is further refined to highlight that food loss includes any food mass reduction that occur along the food supply chain prior to retail and consumption, whereas food waste relates to any decrease that

happens thereafter, i.e., at retail and consumer levels. Food loss and waste only take into account the food destined for human consumption and as such exclude edible food not intended for human consumption, including feed, seeds and bio-energy, as well as parts of edible food products that are not themselves edible, such as bones, peels, grains, etc. (Figure 1). Throughout this paper, food loss and waste will refer to the loss and waste that occurs between harvest and consumption (Lipinski et al, 2013; FAO, 2013).

Figure 1: ***Representation of food waste and loss***



Source: Adapted from HPLE (2014)

Food loss and waste is still an evolving concept that is confusing at times. For example, some products originally destined for human consumption end as non-human uses such as feed, seed or bio-energy; in these cases, the food is counted as lost or wasted although the reality is that it is not. Gustavsson et al (2011) acknowledge the notion of "planned" and "unplanned" non-food uses with the latter being counted as food lost or wasted. A further complication is that some food products might be considered edible in some cultures and not edible in others, such as offal, animal legs or certain types of seafood, to name a few. These discrepancies add to the confusion about what food should be considered when assessing food loss and waste. The resulting uncertainty is reflected in the terminology used in the literature, which often uses variants such as "food loss," food waste," "food loss and waste" or "post-harvest food loss" interchangeably, despite the fact that they do not mean the same thing or cover the same scope all the time (IFPRI, 2016).

The debate around the concept of food loss and waste extends to the differing perspectives used for its analysis. The issue is sometimes approached from a purely food-based perspective when the objective is to assess the impact of food loss and waste on food availability, access, utilization and/or stability – or in other words, food security. The topic can also be approached from a waste-focused perspective when concerns are geared towards the environmental impact of food loss and waste such as the loss of biodiversity; carbon and other greenhouse gas

emissions; or the lost water, energy and nutrients used during the production process or throughout the food supply chain, among other issues. Food loss and waste can also be approached through a socio-economic lens when more consideration is given to associated opportunity costs, such as lost income, higher food prices, reduced production, lower wages, lower nutritional value or potential health risks. This multiplicity of approaches to viewing, assessing, quantifying and qualifying food loss and waste leads to unclear delimitation when it comes to establishing its extent and/or scope. As well, it prohibits a unified methodology for measurement, including the standard to be used to collect related data. In most cases, these differing vantage points result in non-uniform and barely comparable methodologies and data (HLPE, 2014; Barret, 2015).

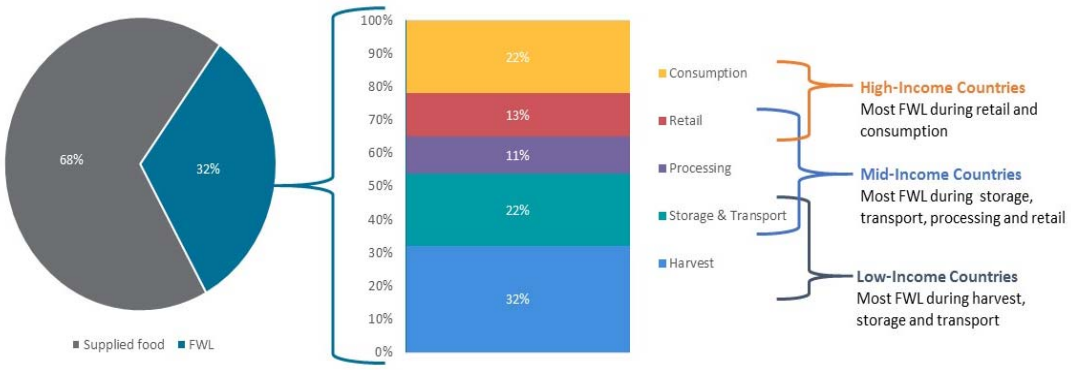
The aforementioned difficulties in clearly delineating, identifying and assessing food loss and waste become an impediment in pinpointing and forecasting where food loss and waste occurs along the supply chain, as well as the causes of either an increase or a decrease in the food lost or wasted. The lack of widely agreed-upon measurement methodology at the global level is also apparent in the Arab Region. While food loss and waste initiatives in the region are still scattered and localized, and assessments are made in an incomparable manner, these initiatives are nevertheless important in highlighting the magnitude of national or regional food loss and waste. With the adoption of the SDGs within which a specific target for food loss and waste is embedded it could be anticipated that tangible results will be achieved.

II. MAGNITUDE, OCCURRENCE AND QUANTIFICATION

The FAO (2013) estimates that about one-third (32 percent), or 1.3 billion tons, of the food produced globally is lost or wasted each year. In caloric terms, the food lost and wasted represents about a quarter (24 percent) of the global food calories produced (Lipinski, 2013). This lost and wasted food has economic, social and environmental consequences. Economically, food loss and waste causes direct financial hardship to stakeholders, e.g., farmers, middlemen, processors, retailers and/or consumers. It also represents an indirect cost to national economies as energy, water, money, time and other resources are spent producing, handling, transporting, cooling/heating or cooking the food that is ultimately not used. The food loss and waste increases the burden on stakeholders, who must get rid of the spoiled/wasted food, decreases anticipated income and results in higher costs and less choices for customers. Socially, a decrease in available food may contribute to a higher incidence of hunger and malnutrition particularly in developing countries and lead to socio-political unrests. Food loss and waste may also lead to increased health hazards from contaminated, spoiled or decomposing food. Environmentally, the lost and wasted food translates to lost water, soil nutrients and energy that were used in production and preparation for consumption while the decomposition and disposal of the food adds to the carbon and other greenhouse gas emitted. This misallocation of natural resources is a critical issue in many regions, including the Arab Region, which is already considered to have among the scarcest water and productive agricultural land in the world (Lipinski, 2013; Dijksma, 2015).

Although, food loss and waste occurs all along the food supply chain, including production, harvest, handling, transport, retail and consumption, the magnitude of loss and waste at each stage differs depending on the development status of the country. Globally, most food loss and waste happens during harvest followed by the combined storage and transport and then consumption (Figure 2). The processing and retail stages have the lowest food loss and waste shares (Gustavsson et al, 2011; FAO, 2013). In developed economies, most food loss and waste occurs at retail level and consumption level (i.e., in homes, restaurants and hotels) largely due to overstocking and preparing excess food. In middle-income economies, food loss and waste occurs mostly at the intermediate level, i.e. handling, sorting, transport and storage as chain operators try to adjust to varying and changing consumer preferences. In less developed economies, food loss and waste is concentrated in the early stages of the food supply chain, specifically during harvest and post-harvest, largely due to poor technologies and market inefficiencies.

Figure 2: ***Food loss and waste along the supply chain***

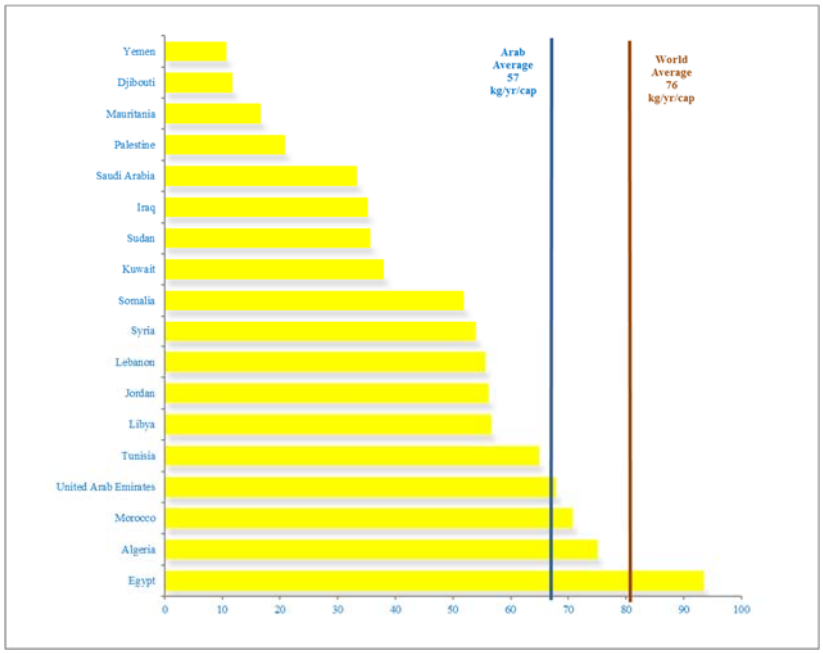


Source: ESCWA adapted from FAO (2013)

These trends hold true in the Arab Region. In the high-income Gulf Cooperation Council (GCC) countries, most food loss and waste occurs at retail and consumption stages. In the middle-income Maghreb and Mashreq countries, most food loss and waste occurs in the intermediary stages. In the low income Least Developed Countries, e.g. Sudan, Mauritania and others, food loss and waste is most during farming and post-harvest operations (Gustavsson et al, 2011; FAO, 2013; Speller, 2016).

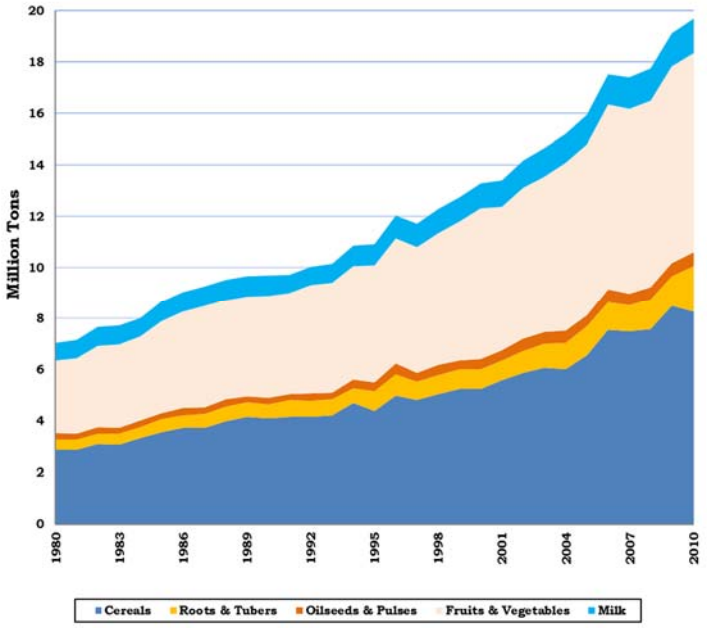
In terms of the food loss and waste magnitude, Khoury and Byiringiro (2014) notes losses and wastes in the Arab Region amount to about 57 kg/year/person, which is below the world average of 76 kg/year/person (Figure 3). The author also note that since the early 1980s, food loss and waste has been increasing. This holds true for all commodity groups though cereals and horticultural products register the largest increases (Figure 4).

Figure 3: ***Food loss and waste in the Arab region, 2011 (kg/year/cap)***



Source: Khoury & Byiringiro (2014)

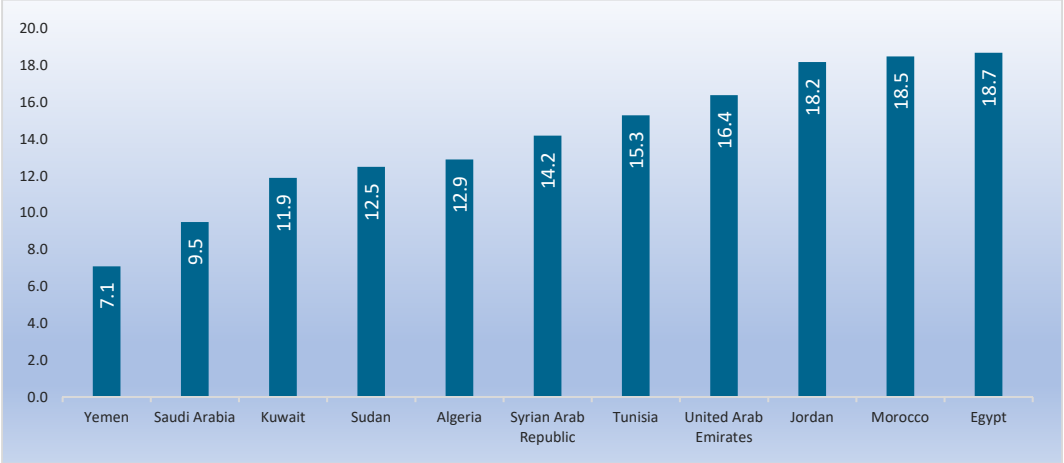
Figure 4: ***Food loss and waste in the Arab region, 1980-2010 (million tons)***



Source: Khoury & Byiringiro (2014)

The FAO (2014) estimates that food loss and waste concerns approximately 13 percent of meat, 14-19 percent of grains, 26 percent of fish and seafood, and 45 percent of fruits and vegetables. It also notes that although food loss and waste occurs at all stages of the Arab food supply chain, it is estimated to be more prevalent during pre- and post-harvest operations (comprising approximately 44 percent of food loss and waste) and at consumption stage (approximately 34 percent). Post-harvest and pre-consumer food loss ranged from about 7 percent in Yemen to 19 percent in Egypt as shown in Figure 5 below (UN, 2015b). Food loss and waste is rapidly becoming a critical issue in the Arab Region especially as there are limited opportunities to drastically increase food production.

Figure 5: ***Food loss, 2015 (percentages)***



Source: UN (2015b)

In the first Arab Sustainable Development report, the Economic and Social Commission for Western Asia (ESCWA) highlights that the reduction of food loss and waste has become a major regional issue in light of its substantial impact on the water footprint. For the North African/Western Asia/Central Asia region, the water footprint from total food loss and waste is estimated at about 40 billion cubic meters corresponding to about 90 cubic meters per capita. To better highlight the link between food loss and the water footprint, it is worth noting that a single uneaten apple represents a loss of approximately 70 liters of water excluding energy and financial costs (FAO. 2014). The water footprint from this region represents about 17 percent of the global water footprint despite that the region accounts for only 7 percent of the world population and contains less than 1 percent of the global water (UN, 2015b; World Bank, 2017). This environmental impact of food loss and waste represents a step backward in the region's ability to meet its food needs.

Quantifying food loss and waste is not easy as the methodology for doing so changes depending on whether the food loss and waste is being estimated at the individual and/or firm level or at the national level, among other considerations. At the individual or firm level, food loss and waste can be estimated in one of three ways:

(i) A mechanical measurement, which produces precise data but can be time-consuming and is thus not practical for large quantities of food loss and waste;
(ii) Approximation by visual estimation or by counting the number of trash bags or cans of a certain size, which provides an order of magnitude especially when there are large quantities; or
(iii) Inference through calculations that use secondary estimates such as differences between input and output, data from similar entities or modeling; this inference method provides a more general approximation (WRI, 2016).

Similarly, at the national level, the quantification can be conducted in at least one of two ways:

(i) Aggregation of data from the largest entities (e.g., trade boards, wholesalers, importers/exporters, restaurant chains, caterers, hotels, supermarkets/grocery store chains, schools or other public institutions, etc.), which are usually easier to compile; or

(ii) Quantification losses and wastes along the commodity supply chain such as that for apples, potatoes, fruits and vegetables, roots and tubers or animal products, wheat or cereals; this method is more accurate and detailed but can be time-consuming and expensive (EIU, 2014).

In the Arab Region, initiatives and achievements in reducing food loss and waste are still limited largely due to the lack of awareness about its importance, as well as lack of appropriate legislations aimed at tackling the issue. For example, a survey in some Islamic countries showed that most respondents did not see food loss and waste as an important problem although they also recognized their lack of awareness in circumstances including festivities, which may involve excess meal preparations. Most countries in the survey do not yet have proper policies and institutional framework in place to address and respond to food loss and waste related challenges. The issue spans over several government departments, including agriculture, health, commerce, municipalities or food and drug agencies (Table 1).

The protracted crises plaguing the region, including wars and occupation, have not been conducive to much development towards monitoring and addressing food loss and waste, and legislations were not enforced when they were present. However, Arab countries are increasingly becoming aware of the occurrence of food loss and waste, most notably following the strengthening of municipal solid waste management. Some countries are requiring consumers to sort their own waste, thereby allowing them to witness firsthand the substantial amounts of organic products that are being discarded (COMCEC, 2017). Further, on-going campaigns on food loss and waste have pushed countries to look at the issue more deeply, and have led to the introduction of new legislations together with improvements of the related infrastructure.

III. REDUCING FOOD LOSS AND WASTE THROUGH THE IMPLEMENTATION OF THE SDGs

The 2030 Agenda for Sustainable Development, with its 17 SDGs, focuses on the reduction of food loss and waste through Goal 12 on ensuring sustainable consumption and production (SCP) patterns. Specifically, target 12.3 is concerned with the reduction of food loss and waste along the food supply chains and states that "by 2030, halve per capita global food waste at the retail and consumer levels and reduce food loss along the production and supply chains, including post-harvest losses." The issue is also subsumed throughout several other goals calling for less input use for more outputs and ensuring greater efficiency. Table 2 lists the goals and targets that potentially support the reduction of food loss and waste as they promote factors such as efficiency in the use of resources, improved infrastructure, increased investments, enhanced data collection and sustained capacity building (UN, 2015c; Vionnet, no date; Espey, 2015). The reduction of food loss and waste can also benefit the pursuit of other targets most notably: Goal 1 on poverty, Goal 2 on food security, Goal 6 on water, Goal 7 on energy, Goal 13 on climate change, Goal 14 on marine resources and Goal 15 on terrestrial ecosystems.

Table 1: ***Examples of legislations related to food loss and waste in selected countries***

	Legislation and department	Details
Egypt	Environmental law Ministry of Environmental Affairs and Egyptian Environmental Affairs Agency	Preserve the environment with an emphasis on the issue of sustainable development
	Bread-subsidy smartcard Ministry of Supply	Reduce food waste associated with bread subsidies and reduce costs of importing flour
	Agricultural Strategy 2030 Ministry of Agriculture and Land Reclamation	Covers food safety and agricultural waste
Iraq	National Solid Waste Management Plan Ministry of Environment	
Jordan	Environmental Protection Law Ministry of Environment	Among others clarifies jurisdictions for waste management among government institutions
	National Agenda for Solid Waste Utilization	Promote waste management, identify sound disposal sites, and encourage recycling and minimization of solid waste generation
Kuwait	EPA law Environment Public Authority	Covers various environmental issues but does not tackle much solid waste and does not mention food loss and waste
Oman	Conservation of the environment and prevention of pollution Ministry of Environment	
	Regulations for the management of solid non-hazardous waste	
Palestine	Environmental law Palestinian National Authority	Includes issues related to solid waste management though overall implementation is handicapped by the occupation
	National Environmental Action Plan (NEAP) Palestinian National Authority	Sets actions and projects to solve or alleviate environmental problems including solid waste and food waste
Qatar	National Strategy for Solid Waste Management (NSSWM) Ministerial Cabinet	Reference point for all decisions, programmes, activities and investment plans to develop the solid waste sector
	Qatar National Development Strategy Ministry of Municipality and Environment	Include strategy to contain levels of waste generated and to promote recycling
	Solid waste management plan	Reduce household waste including food
	Qatar National Vision 2030	Link food and nutrition security to environmental and economic development
Saudi Arabia	National dietary guidelines Supreme Council of Health	Principles of food sustainability, environmental sustainability, food security, population and food waste
	Environmental Standards on Material Recovery and Recycling Ministry of Municipal and Rural Affairs; Presidency of Meteorology and Environment	Best environmental practices including waste recovery and recycling
Sudan	Environmental law Higher Council for Environment	Does not cover waste management
Tunisia	Sustainable Development Strategy Ministry of Environment; National Agency for Waste Management	

Source: Adapted from COMCEC (2017)

Table 2: ***Supporting goals and targets in the Sustainable Development Goals***

Goals	Targets
SDG2: Hunger, Food Security, Nutrition & Sustainable Agriculture	2.4 Sustainable food production & agricultural practices
	2.a Increase investments
	2.c Proper functioning of food markets
SDG8: Inclusive and sustainable growth	8.2 Achieve higher levels of productivity
	8.4 Improve resource-use efficiency
SDG 9: Resilient infrastructure & industrialization	9.1 Sustainable & resilient infrastructure
	9.4 Upgrade infrastructure and industries
	9.a Facilitate sustainable infrastructure development
	9.b Support technology development
	9.c Access information & communication
SDG 11: Cities & human settlements	11.2 Sustainable transport systems
	11.6 Reduce the adverse impact of settlements
SDG12: Sustainable consumption & production	12.2 Sustainable management & efficient use of natural resources
	12.3 Reduce food loss and waste along supply chains
	12.4 Environmentally sound management of wastes
	12.5 Reduce waste: prevention, reduction, recycling and reuse
	12.6 Adopt sustainable practices and report on them
	12.8 Provide relevant information and awareness
SDG17: Means of implementation and global partnership	17.1 Domestic resource mobilization
	17.2 Development assistance
	17.3 Mobilize additional financial resources
	17.5 Investment promotion
	17.7 Transfer of environmentally sound technologies
	17.9 Capacity building
	17.14 Policy coherence
	17.16 Global partnerships
	17.17 Public, private and civil society partnerships
	17.18 Collect reliable data
	17.19 Measure progress

Source: UN (2015c)

To achieve tangible results in reducing food loss and waste, countries need to implement the SDGs in their entirety and ensure their full integration within national policies, strategies and programmes. The importance of drastically reducing food loss and waste should also be highlighted as an effective means to improve food security; enhance wellbeing; save water, energy and soil resources; ensure a cleaner environment; and reduce greenhouse gas emissions, among other SDGs.

ESCWA supports its member countries in achieving the SDGs by supporting the implementation and monitoring of steps toward achieving them. ESCWA and its partners support member countries in reporting on the achievement of the SDGs through identified national and regional indicators, which also include food loss and waste. Among the indicators are currently being developed is the Global Food Loss Index (GFLI), which is expected to help assess losses that occur on farms and during transport, storage and processing; however, wastes occurring at retail and consumption levels will not be included (FAO, 2016).

Until the full set of indicators is developed, countries can make use of the FAO Regional Office for the Near East's strategic framework to reduce food loss and waste, which outlines a number of needed actions including on (FAO, 2014):

- Improving knowledge and collecting appropriate data and information on food loss and waste to enhance overall understanding of its occurrence and magnitude through a common methodological framework for the entire food supply chain;
- Raising awareness so that stakeholders are better informed about the impact of food loss and waste, how and where it happens, its negative influence on the social, economic and environmental dimensions of sustainable development, and what could be done to reduce its occurrence;
- Promoting good practices as most food loss and waste are a result of inappropriate behaviors of food supply chain operators (e.g., retailers, restaurants, etc.) who use inadequate technologies and practices, over-stock and/or over-produce, serve big portions, etc., all of which cause unnecessary losses and waste;
- Adopting supporting policies and an adapted regulatory framework, as policies and institutions are the driving force behind the reduction of food loss and waste; as such, they must be adequately designed, tailored and supported to ensure that stakeholders are encouraged to adhere to directives including self-regulation; and
- Promoting investments and the adoption and transfer of appropriate technologies, which involve both the public and the private sectors along the food supply chain from production to retail and consumption.

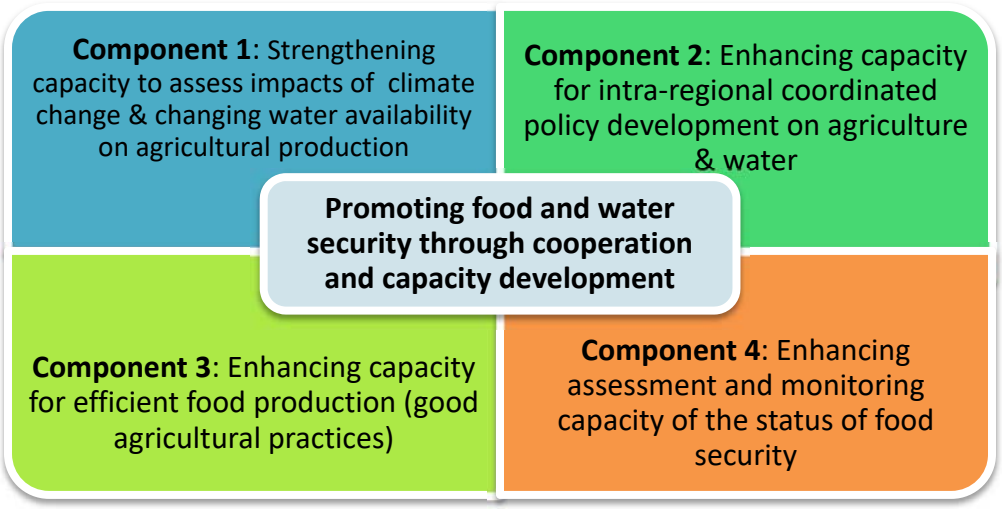
IV. ADDRESSING FOOD LOSS AND WASTE THROUGH GAPs IN THE ARAB REGION

GAPs are principles and guidelines that are applied worldwide to the production of food products, both pre- and post-harvest, in order to minimize the risk of food hazards, most notably in fruits and vegetables. GAPs enhance economic and environmental sustainability and ensure social wellbeing and equity (ESCWA, 2016). GAPs support the food sector by promoting efficiency in the food supply chain, enhancing food safety and quality and reducing food loss and waste. Specifically, GAPs support the following:

- enhanced product safety, quality and freshness
- improved handling, transport and storage including packaging, refrigeration, etc.
- investments in infrastructure and technology
- improved the food product shelf-life
- cooperation between producers and suppliers
- new market opportunities such as exporting.

To enhance the adoption and use of GAPs, ESCWA is currently implementing a project on "Promoting food and water security through cooperation and capacity development" with financing from the Swedish International Development Cooperation Agency (Sida) and in cooperation with national, regional and international partners including the League of Arab States (LAS) and its specialized institutions such as the Arab Organization for Agricultural Development (AOAD), the Food and Agricultural Organization Regional Office for the Near East (FAO-RNE), the International Center for Agricultural Research in Dry Areas (ICARDA) and a number of universities in the region. The project has four main components, of which Component 3, entitled "Enhancing capacity for efficient food production" is specifically dedicated to promoting the adoption of GAPs in the region with an emphasis on food safety, quality and traceability (Figure 6).

Figure 6: ***ESCWA's project on promoting food and water security***



Component 3 attempts to operationalize the Arab-GAP framework that was put forward by the Arab Organization for Agricultural Development (AOAD) in 2007. The aim is to put the Arab-GAP framework into practice and seek ways to incite countries and stakeholders to adopt and implement its principles. The Arab-GAP framework promotes the production of safe, fresh food produced along the food supply chain within the Arab Region and leveraging this enhancement in quality and safety to facilitate the marketing of Arab produces at both the regional and international level. It is expected that the Arab-GAP framework will provide the basis for a more efficient, responsible and accountable food chain and ultimately provide a better handle to deal with food loss and waste.

As part of the project, ESCWA reviewed the current Arab-GAP checklist/control points in order to bring them up to date and align them with the ones that are currently being used internationally. The current Arab-GAP framework builds on the 2004 version of EurepGAP, which has since evolved into GLOBALG.A.P. The upgrade will identify and emphasize practices that could help reduce food loss and waste while promoting the adoption of GAPs. The project is expected to support the mobilization and effective participation of stakeholders in the movement to improve food safety and quality along the food supply chain, which would also help reduce food loss and waste by improving coordination among operators. The project also emphasizes training the various stakeholders involved in the adoption and application of these GAPs, a process that could in turn reduce contamination and improve the shelf life of fresh food products.

The other three components of the project also contribute to the reduction of food loss and waste, though indirectly. The first component will enhance knowledge on the climate system and its impact on water and food production. This is expected to improve agricultural planning and production in terms of quantity, quality and timing, and in turn to reduce food loss and waste. The second component will enhance the governance of the food and water sectors in the Arab Region, which is expected to have favorable impacts on food loss and waste policies. The fourth component will enhance the countries' capacity to monitor food security in terms of availability, accessibility, utilization and stability, and will include region-specific indictors, including those to monitor food loss and waste.

V. IMPACT OF THE ADOPTION OF GOOD AGRICULTURAL PRACTICES (GAPs) ON FOOD LOSS AND WASTE REDUCTION

Although the link between the adoption of GAPs and the reduction of food loss and waste has never been formally studied, areas of interaction or interlinkage can easily be found. For one, GAPs support the reduction of food loss and waste by minimizing food hazards and improving product quality. Technical and managerial deficiencies are leading causes of food loss and waste along the food supply chain, and these are core issues that could be solved with GAPs. On the technical side, GAPs call for the adoption and use of simple to sophisticated techniques and technology that improve product safety and quality, which also helps to reduce food loss and waste. For example, this technology may allow the avoidance of product crushing, or contamination, and may improve conservation, among other improvements. On the managerial side, GAPs advocate for proper timing of harvests and purchases, both of which reduce the inventory on hand and therefore the likelihood of discarding unused or unsold products; they also call for the maintenance of proper records, which improve product traceability and overall efficiency throughout the supply chain. Examples of how GAPs can reduce food loss and waste may include the following:

- encouraging the use of clean water to wash products in order to reduce microbial contamination
- promoting proper irrigation techniques
- promoting agricultural inputs that will reduce chemicals residues
- improving harvesting and packaging, as well as the timing thereof, in order to deliver food on-time and in good condition
- promoting improved techniques and equipment, such as simple processing or packaging to improve products' shelf life

In general, the lack of appropriate infrastructure in the Arab Region for transportation, storage, cooling and marketing can lead to food degradation and spoilage and thus, disposal. The adoption of simple and innovative technologies could help reduce food loss and waste. For example, improved rice-storage bags that were adopted as part of GAPs in the Philippines improved product attractiveness and sales and increased shelf life, helping to cut losses by up to 15 percent. In West Africa, the adoption of solar dryers for fruits and tubers helped reduce post-harvest losses and wastes while extending the shelf life of products, thereby opening new market opportunities including shipment over longer distances, which is another component of GAPs (HLPE, 2014). Similarly, significant improvements can be made by training and encouraging farmers to adopt simple practices to improve product safety, quality and attractiveness. Farmers may also be encouraged to join a GAPs network, such as Global GAP or the Arab-GAP, which require participating stakeholders to abide by specific standards and practices and in return links them to markets, an arrangement which also helps reduce food loss and waste.

Other GAPs solutions include simple steps at the individual or local level, such as harvesting the fruits and vegetables only after a firm order has been received; improving the technology used for harvesting and storing; packaging products in a way that improves marketability and shelf life; and processing unsold fresh food to extend its conservation. There are other areas in which GAPs and food loss and waste reduction intersect, though more work needs to be conducted in order to better identify and document these overlaps. Itemized below are a few additional areas where good results and scalable solutions can be found to both adopt GAPs while reducing food loss and waste. Some of these elements have already been documented for one or the other (see also Table 3):

(i) Contract farming: Linking actors of the supply chain through formal agreements helps mitigate uncertainties, which allows for greater market efficiency through enabling a better match of supply and demand. This helps reduce food loss and waste, and in most cases, allows participating parties to agree to and hold each other to specific GAPs that will enhance product safety, quality and attractiveness;

(ii) Associations and cooperatives: Stakeholders operating as a group such as a cooperative or another association can adopt technical and management skills at lower cost and technologies (e.g., ICTs, cold chain transport, packaging) that could allow them to improve product safety and quality and thus reduce food loss and waste. . For example, the adoption and use of shared smart technologies could help in the adoption and use of GAPs while also helping to prevent food loss and waste through improved efficiency;
(iii) Financing: Making a wide range of financial products available could enhance the adoption of GAPs and reduction of food loss and waste throughout the supply chain. Financing that is available at better terms could provide the necessary working capital to promote investment in the system and make it more efficient, which would enhance trust and confidence while also enhancing competitiveness;
(iv) Technology: The adoption of adapted technologies is essential to improve production, harvesting, handling, transport, storage and processing and even retail and consumption. For example, the use of refrigerated trucks helps to reduce losses during the storage and transport of fruits and vegetables; it also reduces product deterioration or degradation, early ripping, etc.

The importance of GAPs in reducing food loss and waste is also apparent when it comes to monitoring and reporting. One of the major requirements of GAPs is that all stakeholders at all stages in the supply chain must keep detailed records on products received and shipped. For a farm to pass a GAPs certification, it must apply all the good agricultural practices that are listed as control points in the evaluation checklist, as well as provide evidence that it has adhered to them from the planting stage through to harvesting as most controls happen long after farming activities have been completed. To prove their adherence to these GAPs checklists, farms must maintain proper documentation on all activities performed.

The documentation includes information on quantities and outputs, e.g. conditions of storage, packaging, etc. These records are used to ensure food safety, but can also be used to identify issues related to food loss and waste, such as product deterioration, degradation and spoilage, which could provide an early indication on where food loss and waste occurs.

Besides allowing food to remain traceable, the maintenance of good records also improves knowledge about other aspects of the process, including where and how resources are spent, and this information can help address problem areas and minimize losses and wastes. The responsibility and impact of each supply chain participant becomes more apparent, which allows a degree of transparency around those who do not act to reduce food loss and waste (Figure 7).

Table 3: ***Possible approaches for reducing food loss and waste (not exhaustive)***

	Production & harvesting	Handling and storage	Processing and packaging	Distribution and market	Consumption
Good Agricultural Practices (GAPs)	• Ensure good water quality • Avoid the use of untreated wastewater • Use clean equipment • Avoid contamination • Attend training on good or better practices	• Use potable quality water for product washing • Use appropriate packing materials • Ensure adequate storage (temperature, ventilation, etc.) • Ensure traceability	• Maintain facilities clean & hygienic • Control environmental conditions • Define and detail all processes • Train regularly all farm workers s	• Ensure vehicles and equipment are suitable • Use clear and unambiguous labels • Record all dispatches and respect delivery schedules	• Ensure cold storage is maintained • Provide advice on handling and storing food product at home
Other approaches	• Find ways to use unmarketable products • Identify new technologies and markets • Adopt innovative techniques	• Improve storage technologies • Introduce low-carbon cold chains • Improve handling and transport • Improve rural infrastructure (e.g., roads)	• Re-engineer manufacturing processes • Improve supply chain management • Improve packaging • Optimize portion size	• Donate unsold & uneaten foods • Provide guidance on food storage and preparation • Use appropriate food date labeling practices • Use good practices for in-store promotions	• Conduct awareness campaigns • Improve consumer cooking skills • Reduce portion sizes • Promote the eating of "ugly" produces

Source: Adapted from GlobalG.A.P. (2016) and Steer & Fan (2016)

Figure 7: ***A GAPs network and maintenance of records***

Source: FAO (2007)

In addition, the maintenance of good records along the supply chain could make it easier to track, quantify and report on the movement of food. It is usually difficult to anticipate how and when food loss and waste will occur, as it is most often circumstantial. Food loss and waste may arise when the market is unpredictable, when floods occur, when transport conditions are not adequate or during catastrophic events, to name a few. However, there are other cases in which food loss and waste could be more readily anticipated through the keeping of good records, which could in turn direct focused efforts and resources to those problem areas.

Implementing an Arab-GAP framework could facilitate trade within the region by harmonizing technical requirements related to quality and safety standards and specifications, leading to an increased and more stable flow of food and the emergence of new market opportunities. These improvements and enhancements could also lead to reductions in the amount of food that is lost and wasted. Promoting the Arab-GAP aligns well with ESCWA's extensive work on regional integration and cooperation including promoting the development of the Greater Arab Free Trade Area (GAFTA). It is estimated that operationalizing GAFTA could lead to a potential growth in GDP of up to 3 percent over a 10-year period as the result of reductions in transaction cost, and improvements in the movement of goods and services (ESCWA, 2014).

VI. SELECTED CASE STUDIES FROM AROUND THE ARAB REGION

Based on the input provided by experts who attended the AOAD conference on food loss and waste in September 2016, most Arab countries experience substantial losses in their food supply chains, particularly in commodities such as cereals, dates and olives. The experts highlighted that losses and wastes result from, among other issues, the use of inappropriate practices and non-adapted or obsolete technologies; a lack of improved basic handling and processing to improve conservation; and the inadequacy of transport and other infrastructure. e. The experts indicated that in most cases countries are exerting substantial efforts and investing to improve the situation.

For example, to reduce food losses and waste in the cereal sector in Iraq, the government is introducing new cereal varieties, including adopting improved harvesting practices to replace the traditional manual system, encouraging local processing, using enhanced packaging and improving the transport infrastructure. In Algeria,

Oman, Saudi Arabia and the United Arab Emirates, there are efforts to improve the supply chains for dates. These efforts include providing greater support to farmers, introducing new and adapted practices and technologies and supporting investments, most notably for processing and marketing. In Oman and Saudi Arabia, governments are attempting to reduce losses in the fish supply chain by providing training to stakeholders on improved handling, as well as enhancing the cold chain for both storage and transport. In Sudan, a smart storage system was built, which is safe, economical and allows for longer storage of grain while preserving its optimal quality (Hader, 2016).

In Tunisia, as part of its food security strategy, the government invested to extend and strengthen the national cold chain system with a view to improve food quality and safety and minimize food loss and waste in perishable products. The cold storage capacity was increased by 65 percent over a 10-year period and involved about 3,000 refrigerated vehicles and 1,500 isotherm vehicles, of which 70 percent were used for the transport of fresh fruits and vegetables. Food loss and waste was substantially reduced, particularly in the export market (M'hamdi & Lanouar, 2014). in Egypt and Lebanon have also begun food bank initiatives, which help reduce food loss and waste despite not being considered a component of GAPs for improved food safety and quality (see also Annex).

VII. CONCLUSION AND RECOMMENDATIONS

The food sector in the Arab Region is facing numerous challenges. Different countries have reached different stages of development, with some having relatively well-developed food supply chain systems and while others facing serious deficiencies; an array of countries fall between the two extremes. In many parts of the region, the efficient functioning of the food sector is hindered by near-permanent states of conflict and war, which prevent proper investments into the functioning and efficiency of food systems. The issue of food loss and waste is not viewed as a priority, as more pressing issues need to be resolved, including, the burgeoning population, a growing number of refugees and internally displaced people and the rising scarcity of natural resources.

In-depth studies and analyses on the issue of food loss and waste need to be carried out in order to properly understand the extent of the challenge and consequently to develop appropriate programs and strategies wherever actions are needed. Many initiatives are already underway, and these could be used as best practices both at regional and national levels. There is still a need to map these efforts and to build upon them in order to assess the magnitude of food loss and waste, share experiences and implement strategies.

In particular, to the following are necessary:

(i) Gather more accurate data and information on the extent and causes of food loss and waste, which could also support monitoring;
(ii) Support the development of a sustainable food system from production to consumption;
(iii) Raise awareness about food loss and waste while also highlighting practical ways to address and reduce the issue;
(iv) Develop appropriate food policies, strategies and programs that address the issue of food loss and waste; and
(v) Invest in appropriate technologies to improve the functioning of the food supply system.

As highlighted above, Good Agricultural Practices (GAPs), which aim at improving food safety and quality, represent a possibility to address food loss and waste in the Arab Region. GAPs promote the use of enhanced technological systems, as well as improved technical and managerial skills, that are aimed at improving efficiency throughout the food supply chain. Many GAPs address food loss and waste, whether directly or indirectly. Initiatives include the development of contract farming to better equilibrate supply and demand; the

development of associations and networks, including cooperatives, that will support learning and reduce adoption costs and building capacity for both increasing food safety and reducing food loss and waste.

The 17 SDGS agreed upon at the global level endeavor to combat hunger and protect the planet, among other aims. They include many targets that, if implemented, could improve food safety and quality and reduce food loss and waste and. Thus, it is imperative that countries elevate these SDGs into national policies and ensure that they are fully implemented and monitored. ESCWA and its partners at the regional level support member countries in their endeavors to promote improved wellbeing for their populations and a sound stewardship of their natural resources. They will continue to assist countries to achieve reductions in food loss and waste and to adopt GAPs for enhanced efficiency in their food sectors.

ANNEX

INITIATIVES TO REDUCE FOOD LOSS AND WASTE IN EGYPT AND LEBANON

In Egypt, a food bank initiative is working with success with the aim to reduce food waste from hotels and restaurants. Its underlying principle is to collect and donate the unused safe and nutritious food to those in need through a programme referred to as "Not to Waste Food." The food bank has partnered with the Egyptian Hotel Association and has reached about 400 hotels and restaurants of all categories from 5-star hotels to local coffee shops. It was initiated in 2005 and is now serving more than 17 million meals per month. The programme has been so successful that it is now being expanded to include individual households as well, which are increasingly being requested to donate their surplus food and unconsumed products. Its success rests primarily on an intensive awareness raising programme that uses various means of communication and targeting all parts of the society (COMCEC, 2017).

A similar initiative has been launched in Lebanon. The Lebanese Food Bank is getting involved in collecting the food not served from restaurants and bakeries in order to redistribute them among those in need including refugees and displaced people. Several of the participating restaurants and bakeries have experienced substantial drop in the food and bakery products that used to be thrown away. Another initiative in Lebanon is the conduct of an awareness campaign on the issue of food waste in restaurant, which goes in hand with proposals on how to reduce it. The campaign has signed up about 70 restaurants, which agreed to offer their customers the option of bagging their uneaten foods in "doggy bags" to be taken away. So far, it has been well received and people seem to be happy about the idea even though the cultural stigma of taking leftovers from restaurants is still strong (Oneissi, 2014).

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