



Funded by
the European Union

Project Code: 2021-1-ES02-KA220-YOU-000028693

entre YOUTH

Entrepreneurial Youth
Worker Training
Programme on Sustainable
& Circular Urban Food
Enterprising

Sustainable & circular urban food enterprising (SURFE) curriculum



This work is licensed under Attribution-NonCommercial 4.0
International. To view a copy of this license, visit
<http://creativecommons.org/licenses/by-nc/4.0/>

Table of Contents

Chapter 1: From a Linear to a Circular Economy

- 1.1. Introduction
- 1.2. Basics of a circular economy
- 1.3. The value of wasted food
- 1.4. Supply/Demand in a food context
- 1.5. The social and environmental food impact
- 1.6 Leveraging alternative food networks
- 1.7 Conclusion

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

- 2.1. Introduction
- 2.2. Entrepreneurship theories- (Startup, scaleup, accounting, pitching, investment sources, innovation development)
- 2.3. Understanding social enterprises and how they can fix societal challenges
- 2.4. Practicalities and legislative context, understanding food cooperatives and community initiatives that handle food waste redistribution
- 2.5 Conclusion

Chapter 3: Motivating, inspiring and training the community to engage

- 3.1. Introduction
- 3.2. What is healthy consumption?
- 3.3. What is responsible consumption?
- 3.4. Sustainable and responsible food



Table of Contents

- 3.5. Measures related to the prevention and reduction of food waste
- 3.6. Healthy eating, responsible consumption and agroecology
- 3.7. Conclusion

Chapter 4: Shifting to digital solutions to reduce food waste

- 4.1. Introduction
- 4.2. Relying on technology that facilitates demand/supply
- 4.3. Learning how to use social media for food waste redistribution mechanisms
- 4.4. Training underprivileged groups to rely on technology to ensure food security
- 4.5. Engaging policymakers in fighting urban food waste via technology and enabling improved sustainable urban development
- 4.6 Conclusion





CHAPTER 1

**FROM A LINEAR TO A
CIRCULAR ECONOMY:
FINDING OPPORTUNITIES
FROM WASTE**



Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

1.1 Introduction

The world population is growing at an exponential rate as a result of low mortality rates and improvements in the quality of life. This situation is mainly attributable to major scientific and technological advances in health and prevention, as well as nutrition improvement.

The current food system is undoubtedly the safest in history, as it leads to a low probability of death or disease caused by poor nutrition. Nevertheless, the actual system has also turned into a major producer of food waste that is negatively affecting sustainability. According to FAO, more than one-third of the food produced annually is wasted, i.e., 2.96 Gigas tons/year (Priefer, Jörissen, and Bräutigam, 2013).

Nevertheless, waste is not the sole problem originating from our current food system, as it also causes an environmental footprint of about 3.3 Gigas of tons of CO₂, water loss of 250 km³, and loss of hectares of cultivable land. Additionally, these problems are exacerbated by the use of food packaging made with plastic, which generates more than 8.3 billion tons of waste, causing serious environmental disasters, especially in marine ecosystems.

The following sections will describe the concept of circular economy, the value of wasted food, the dynamic of supply and demand in the food context, the social and environmental impact of the food industry, and the role of alternative food systems.

1.2. Basics of circular economy

The Circular Economy (CE) model can be considered an alternative to the linear economic model of "take, make, consume and throw away" which is perceived as unsustainable (Ness, 2008). CE is a model of production and consumption that involves reusing, repairing, restoring, and recycling existing materials and products to conserve materials within the economy as much as possible. A circular economy implies that waste itself will become a valuable resource, reducing the actual amount of waste to a minimum. That is to say, circular economy allows to lengthen the lifespan of a product and gives products a second life.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

This model introduces concepts that include the **7Rs**:

Reduce

It entails reducing the number of products we consume and, therefore, the waste we generate. This action helps to avoid rapid and excessive consumption

Redesign

This first concept refers to the design of products considering the environment, i.e. based on eco-design. In this way, companies should focus not only on the functionality of the product but also on its sustainability

Recycling

This last concept refers to the reintroduction of waste that has already been used in the production process so that it can be used as raw material for new products. Recycling should be the last option since it is best for the environment that no waste is produced.



Reuse

This concept involves extending products' life, either by repurposing or reusing them

Repair

When a product breaks down, we tend to replace it instead of repairing it. Nevertheless, in most cases, repairing a product is cheaper than buying a new one

Renew

Involves updating older objects, with the aim of restoring them to the purpose for which they were created

Recover

Implies the collection of materials already used and their reintroduction into the production process

Consequently, the circular economy model has emerged to reduce the negative environmental impact of a system that is highly wasteful. It does not only focus on recycling but also on redesigning the entire production process to meet present needs more sustainably. Therefore, both concepts must be clearly understood before expanding our knowledge about the circular economy.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

Fundamentals of the linear and circular economy

- **Linear Economy Process:** A traditional model based on taking resources from nature (raw materials) to design products that satisfy consumer needs. In this model, products are manufactured, packaged, and transported for consumption, and once their life span is over, they are discarded, resulting in waste or garbage (**Figure 1**).
- **Circular economy process:** A renewed model of production and consumption that seeks to reduce pressure on natural resources and promote sustainable actions. In this model, raw materials can be either virgin or recycled. Furthermore, products are designed following the principles of eco-design, contributing to a longer product life, reducing energy consumption, and promoting an easy-to-repair design (e.g., household appliances). Once designed, these products are manufactured to contribute to a circular economy. Products, such as electronic items, can be rebuilt based on the manufacturer's original specifications using a combination of reused, repaired, and new parts. Subsequently, products are packaged and transported using packaging that can be reused as many times as possible before being discarded. The next phase is the use or consumption of the product, where the concept of sharing arises, prolonging and optimizing the use of the product. Besides, the ownership of the products in terms of their use changes (rental, shared use, or subscription models appear). Once products reach the end of their useful life, in this economy, they are repaired, reused, remanufactured, or recycled instead of being discarded. This results in a considerable reduction of waste from production (**Figure 2**).

Figure 1. Linear economy



Figure 2. Circular economy



Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

Some other concepts related to the circular economy are:



- **The collaborative economy**

The collaborative economy (also referred to as sharing economy, peer-to-peer economy, or collaborative consumption) is an economic system based on sharing resources. For consumers, this involves a shift from ownership to accessibility. The collaborative economy takes advantage of new technologies through the use of platforms, as well as ICTs, leveraging communities or crowds to rent, share, exchange, or sell access to products or services. The sharing economy is expanding in all sorts of niches, such as car sharing, home sharing, peer-to-peer lending, reselling, coworking, talent sharing, etc. Besides, it is argued that the sharing economy reduces the environmental impact of consumption by maximizing the use of products.

- **Planned obsolescence**

There is no general definition of the term "planned obsolescence", but it refers to the obsolescence of products or technologies. The term can be described as the intentional production of goods and services with a short economic life, which encourages consumers to repeat purchases in a shorter period of time or simply with excessive frequency. In this sense, the European Commission defines planned obsolescence as a commercial policy that consists in deliberately planning or designing a product with a limited useful life so that it becomes obsolete or does not function after a certain period of time.

- **Ecodesign**

The 2009 Ecodesign Directive sets EU standards for enhancing the environmental performance of energy-related products, such as household appliances, through eco-design. The directive sets mandatory minimum requirements for the energy efficiency of these products, helping to improve product quality and environmental protection. The 2010 Energy Labeling Directive complements eco-design requirements with mandatory labeling requirements.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

1.3. The value of wasted food

Until now, we have discussed the circular economy in a broad sense and taking into account all types of products. Nevertheless, in this section, we will focus on food products and the waste generated in this area.

The rise of the world population and the degradation of natural resources leads to the need to supply food for more people with less water, less arable land, and less rural labor. This situation creates an urgent need to change the traditional production and consumption approach to a more sustainable approach.

Currently, our society wastes nearly one-third of the food that is produced, yet almost 690 million people are suffering from hunger in the world. In order to achieve sustainable production and consumption, both producers and consumers must change their behavioral patterns. On the one hand, producers must reduce the environmental impact of their activity (loss of soil, water, nutrients, greenhouse gas emissions, degradation of ecosystems, etc.), while consumers should adopt a more sustainable and responsible approach to consumption to reduce their environmental footprint.

Additionally, several organizations are taking steps to promote these practices. A good example of this is the FAO (Food and Agriculture Organization) which is an organization of the UN in charge of coordinating global initiatives, activities and projects concerning food loss and waste mitigation in collaboration with other international and private entities.

However, before delving into these practices, we must understand what food waste constitutes. Below, some definitions related to this term are presented (Unep Food Waste Index Report, 2021):

- **Food** is defined as any substance, whether processed, semi-processed, or in its raw state, intended for human consumption. This concept includes beverages and any substance that has been used in the production, preparation, or processing of food, even if the material is damaged and, therefore, no longer fit for human consumption. Hence, it does not include cosmetics, tobacco, etc.
- **Food waste:** Includes both:
 - *"Edible parts"*: Those parts of the food that are intended for human consumption.
 - *"Inedible parts"*: Components associated with food that are not intended for human consumption. For example, bones, bark, hulls....

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

Food waste can be classified into four generating sectors:

- **Producers**
- **Households**
- **Retailers:** Such as stores and supermarkets.
- **Catering:** Such as restaurants, cafeterias, hotels, in brief, establishments or places where food is served.

In recent years, several initiatives have been presented to the UN to reduce waste with the objective of achieving more efficient use of food, as well as avoiding the pollution generated by the resources. However, to achieve this reduction, a change in the mindset of restaurants, supermarkets, producers, and consumers is required.

In general, many of the actions carried out by these collectives are sometimes unsustainable. For example, food services establishment generate a significant amount of waste. A clear example of this is when a restaurant needs pieces of vegetables cut into perfect squares for the design of a dish, and the rest of those vegetables are discarded because they do not fit with the specifications of the recipe. In these cases, these "wastes" can be used for other preparations or for other purposes. However, they are usually simply thrown away.

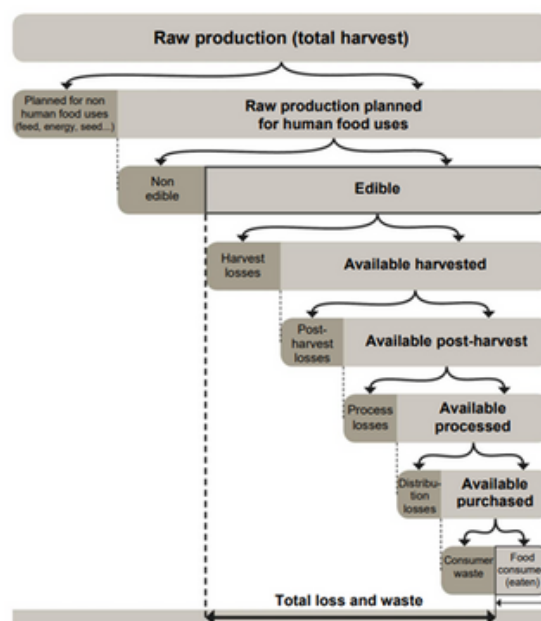
According to a FAO report, food loss and waste per capita in developed countries are concentrated in the production and post-harvest phases, which amounts to 280-300 kg per year (Europe and North America). Besides, in lower-income countries, waste amounts to 120-170 kg per year (Sub-Saharan Africa, South, and Sub-East Asia).

Figure 3 shows graphically how the majority of the total harvest is lost along the food supply chain.



Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

Figure 3. Diagram of food loss and waste along the food chain



Source: HLPE Reports (2014)

As a consequence of the large amount of edible food loss and waste, the need arises to implement a sustainable food system, which is defined by the HLPE report (2014) as: “A sustainable food system (SFS) is a food system that ensures food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised.”

One of the most relevant aspects that can be highlighted from this definition is the importance of ensuring food security and sufficient nutrition for future generations. If this is not guaranteed, then we can not talk about sustainability. Once accomplished, the sustainability of food systems will be determined by environmental, economic, and social factors.

Taking these into consideration, in this section, we will focus on the economic impact, followed in a subsequent section by the social and environmental impact.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

To date, few analyses of the economic impact of food losses and waste have been carried out considering global aspects. One study assessed the direct economic cost of these food losses and wastage, which amounted to 1.3 billion tons of losses and wastage, i.e. close to US\$ 1 trillion per year. Nevertheless, this figure does not include externalities and other social and environmental costs and damages, which FAO estimates at USD 900 billion and USD 700 billion, respectively (FAO, 2014a).

As for the economic impact on food chain actors and consumers, the economic impacts and net costs vary among the different actors according to their position in the food system. Apart from the economic cost, which has been put at USD 1 trillion per year, other analyses have underlined the fact that losses and waste contribute to an increase in demand and, thus, to higher prices (Stuart, 2009; HLPE, 2011). Any effect of price increases resulting from food losses and waste is different for net sellers compared to net buyers of food (similar analyses of the effect of food price increases on food security can be found in HLPE 2011). Also, depending on their market or purchasing power or their position and coordination capacity in the production chain, some agents may suffer less from the impact of food loss and waste and "pass on" the costs of inefficiency to agents in less favorable positions. In non-competitive markets, the consumer is most likely to ultimately pay for the inefficiency and economic losses of the production process. In markets where there is greater competition, economic losses may be borne by downstream agents who, by contract, must abide by the rules imposed by the "chain coordinator" (often a major supermarket company, a trader, or even a processing industry). However, even where competition exists, inefficient food systems always result in higher prices for consumers, all other things being equal. The existence of large amounts of food losses and waste leads, other things being equal, to a proportionately lower efficiency of the results of public resources spent on productive programs related to agriculture, capacity building, training, and grants.

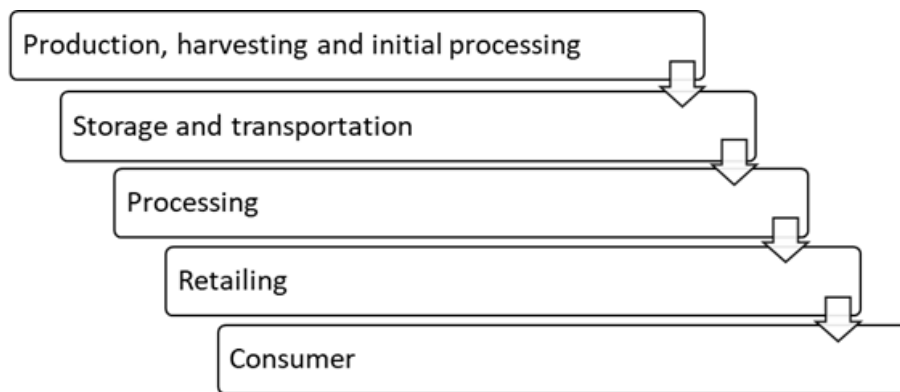
1.4. Supply/Demand in a food context

In this section, we will analyze the behavior of producers and consumers in the food context. For this purpose, it is necessary to understand the stages of the food chain, and to identify the causes of these food losses and wastes, since this knowledge will help us to find solutions to this problem.

The stages of the food chain are (**Figure 5**):

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

Figure 5. Food chain stages



Source: Own elaboration based on HLPE report, 2014

Damage caused by pests, diseases, weeds, etc., prior to harvesting is not considered loss and food waste. Nevertheless, the factors that are considered pre-harvest losses are divided into 4 groups:

- **The selection of crop varieties** according to the place of origin and destination market. The quality criteria and ripening times of the product depend on these factors. For example, in the case of cereals, if planted in windy areas, there may be a loss of the product before harvest. Or if, for example, it is cultivated in humid areas, it may contract fungal diseases before being harvested.
- **Agronomic practices** (fertilization, water management, pest control, disease control, pruning, etc.). For example, in fruits and vegetables, these practices can contribute greatly to their quality levels, both from a visual and nutritional point of view. This leads to the elimination of a high percentage of culls because they do not meet the desired quality standards.
- **Biological factors.**
- **Environmental factors.** In addition, weather conditions also have a negative impact on the loss of specimens caused by heavy rains, extreme temperatures, etc.

These factors impact the quality of production, and consequently, some products are not harvested because they do not meet the quality standards (shape, size, or weight) dictated by producers, retailers, and destination markets.

On other occasions, harvesting is not carried out because market prices are too low, and it does not compensate for the cost of harvesting since labor costs are higher.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

Moreover, producers tend to produce in excess in order to anticipate possible losses due to environmental issues, pests, etc. This generates a surplus that is either left unharvested or sold at lower prices, causing a drop in prices that further intensifies the abandonment of agricultural production.

Regarding the harvesting and initial handling phase, there are also many losses caused by non-compliance with a proper harvesting schedule and by abrupt and/or inadequate handling in the harvesting of the product. An example of these losses can be when the product is harvested too early or too late for various reasons (need for food, theft, etc). When fruits are picked too green, they are more likely to suffer injuries and lose nutritional properties. And in the case of overripeness, the shelf life of the product is reduced, and the flavor quality is reduced.

Another factor that influences the loss of food products is poor temperature control since it is essential to keep the product at low temperatures just after harvesting.

All of the above has repercussions in high discards or selective eliminations for not complying with quality standards, which despite being perfectly consumable by humans, are destined for other uses such as the production of animal feed. One study states that 20% of Swedish potatoes are discarded for not meeting quality standards (Mattsson et al., 2001). For fish, this percentage can reach 70 and 90 % in some trawl fisheries (HLPE, 2014). Losses also occur in the storage of food products. It is essential that the storage conditions have the ideal conditions, such as maintaining low temperatures of the containers, that the products are lined with rough materials that prevent shocks to food, and the reduction of large containers to smaller ones. All these could reduce food losses and damages, amounting to 35% of food (FAO, 2014).

Food transportation also increases food losses since it is important to have vehicles with adequate refrigeration, that loading and unloading are well coordinated to avoid failures in the cold chain of the product, and that the packaging is correct to avoid losses due to compression when putting some products on top of others. Another factor that affects is the state of the roads because if they are bad, the trucks can break down, and as a result, the transport time is extended, or worse, never arrives. In addition, at the place of destination, the product entries are usually verified, which generates a delay in the arrival, and what is even worse, the order is rejected for not meeting any requirements, which will lead to throwing away the entire product if an alternative buyer is not found.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

Retailing is another activity that leads to a high quantity of food being wasted. This is where the quality of the food to be supplied at the points of sale is decided, and in addition, at this stage, the consumer decides which food to buy and which not to buy. As a result, unsold food is often discarded. At these points of sale, the products are usually piled up, which means that the fresh food at the bottom tends to spoil more.

Another cause that leads to greater food waste is the demand for prepared products, as well as freshly cut products (fruit and vegetables), which causes the life of the product to be shortened, and if it is not sold quickly, it tends to be thrown away at the end of the day.

Finally, there is consumer waste. This waste occurs mainly in developed countries. The main causes of food losses and waste in households tend to be (WRAP, 2009; HISPACOO, 2012; Baptista et al., 2012):

- *Poor planning* in the purchase. We usually buy more food than we need immediately, which generates an excess of purchases that are not consumed in the ideal time and are thrown away. This poor planning is influenced by the impulsive buying behavior of consumers.
- Another important cause is not knowing *how to differentiate between the best-before and use-by dates*:
 - Best before date: This date indicates the date on which the product keeps all its properties intact, as long as it has not been opened. After this date, the product is still fit for consumption.
 - Expiration date: This date indicates that after this, the product is no longer safe from a sanitary point of view, and therefore, its consumption is not recommended.

Confusion between these two dates leads to the discarding of food when it is still good for consumption.

- Inadequate storage and administration of products.
- Excessive preparation of food that we finally do not consume.
- Lack of knowledge about reusing food for other recipes instead of discarding it.

Logically, the amount of food wasted depends on the income level of the household, the average age of the family, as well as the nationality and culture of the family. For example, families with higher incomes tend to waste more, as do smaller families, since they cook more food than they consume. Or for example, families dominated by teenagers also generate more waste.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

1.5. The social and environmental food impact

In the previous section, food loss and waste were evaluated from an economic point of view. This section will analyse the repercussions from a social and environmental point of view.

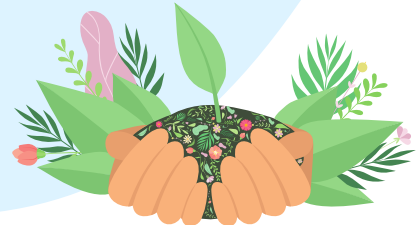
Social impact

In a context where nearly one billion people suffer from hunger, food wastage has a significant social and ethical impact. From a macroeconomic point of view, wastage leads to a reduced supply of products and, consequently, to an increase in food prices that directly impact the consumer. This increase in prices affects those sectors of the population with lower incomes, which leads to a rise in the number of people below the poverty line.

On the other hand, the losses that occur in the agricultural sector reduce productivity per worker in the field, which ends up affecting their salaries. This reduction in wages once again affects the poverty line, i.e., we are faced with a scenario in which some sectors of the population see their wages reduced and food prices rise, all caused mainly by food wastage. In addition, the reduction of salaries has a direct impact on the reduction of workers in the agricultural sector, attracted by other sectors that offer higher salaries. This leads to a reduction in production due to a lack of agricultural labor. This leads to a vicious circle that is difficult to break.



Chapter 1 - From a linear to a circular economy: Finding opportunities from waste



Environmental impact

The environmental impact of food loss and food waste can be classified into two main categories:

- Unnecessary use of resources destined to produce food that is subsequently wasted (land, water, energy, employees ...).
- The effect of the disposal of these wastes generates methane emissions that contribute to increasing the greenhouse effect.

Several studies have attempted to calculate the impact of different food waste treatment systems from households or industries to landfills, resulting in an estimate of "footprints". The carbon footprint of food produced and not consumed is estimated at 3.3 Gt of CO₂ equivalents. This amount does not take into account greenhouse gas emissions from land-use change, which is estimated to be between 6% and 10% of anthropogenic greenhouse gas emissions (Vermeulen, Campbell, and Ingram, 2012).

Another negative environmental effect of food waste is the amount of water needed for food production that is subsequently lost. It is estimated that more than a quarter of the total consumption of limited and vulnerable freshwater resources and more than 300 million liters of oil per year go to food that is lost and wasted globally. The Blue Water Footprint corresponding to the consumption of surface and groundwater resources for food loss and waste is 250 km³.

In terms of land used, an FAO study (2013a) estimates that food produced but not consumed occupies 1.4 billion hectares of land, i.e., it occupies 30% of the global agricultural land area.

So far, however, we have been talking about the environmental impact of the production of food that is not consumed. But, the environmental footprint is even larger when we consider the contamination from transportation, packaging, processing, distribution, home preparation of wasted food, etc. This results in an environmental footprint from the consumer's point of view. One study analyzed that, on average, consumer waste is up to 8 times greater than waste caused by post-harvest (Dobbs et al., 2011).

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

1.6. Leveraging alternative food networks

As discussed in previous sections, food loss and waste is increasing, making it necessary to change the habits of the different links in the supply chain and of consumers.

One of the possible solutions to reduce waste in the supply chain is the movement known as "alternative food networks". This system is defined as a local agri-food system, very different from the industrial one we are used to. These networks are based on building short production chains that connect the producer with the consumer, thereby reducing the carbon footprint of distribution. In the same way, these systems allow consumers to obtain fresher products, and consequently, the deterioration time since their acquisition is longer. They also reduce the use of fertilizers. Among the different alternative food networks, the following can be highlighted (Hernández, 2009):

- Community supported agriculture (community supported agriculture): Consists of an alliance of conscientious consumers and small farmers in the immediate environment, in which the former undertakes to purchase seasonal products supplied by the latter. It tends to have a constant frequency, and its delivery is usually at home.
- Box schemes: Similar to the previous one, but this initiative emphasizes the food production from environmentally friendly procedures.
- Farmers' markets: Consists of the direct sale of products by farmers to urban customers. Environmental concerns are also present in this channel.
- Direct sales: In this case it is the customer who travels directly to the rural area to purchase the product.
- Local sourcing from public institutions: This is a way of promoting the local agri-food sector and creating awareness of community and organic food.
- Buy Local Food: This is a way of promoting local food and convincing local people to buy local produce.
- Community food projects: Consists of the constitution of cooperatives promoted by local authorities to purchase and distribute fresh food in areas of social exclusion.
- Urban gardens: These are small plots of land cultivated by the neighborhood residents themselves for self-sufficiency. They are usually located in gardens, public land, or abandoned land.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

In addition to alternative food networks, there are other movements aimed at reducing food waste. An example of this is the apps created against food waste. In the following, we will explain what some of them consist of:

- Too Good To Go (TGTG): It is an app that allows establishments to sell their surplus food daily at lower prices. This prevents the surplus from ending up in the garbage and also helps people with lower purchasing power to obtain food at a lower price, and companies do not lose 100% of the cost of that food. This initiative is based on a Win-Win strategy, where all parties win. Companies such as Alcampo, Carrefour, NH Hotels, among others, have joined this initiative. According to company sources, this company has saved 2,700 tons of food since 2018 and has more than 34 million users in 15 different countries.
- Encantado de Comer: It is an app oriented to local commerce, currently established in Madrid and Zaragoza. Its objective is to give food to people with low-income levels. In this way, they help to reduce waste, reducing the environmental impact while doing social work.
- Yo no desperdicio: This app was born as a collaborative platform for citizens; that is to say, it is the citizens themselves who sell the products they are not going to consume. In addition, this organization aims to raise awareness of the population through recommendations to reduce waste, such as:
 - Make a shopping list
 - Use leftovers
 - Check expiration dates both at the time of purchase and consumption.
 - Share food or food that we are not going to use.

There are other types of initiatives besides apps that allow the use of food to achieve an actual circular economy:

- An example of this is the recipe book launched by Ikea, which offers more than 50 recipes for using the parts of food that we usually throw away, such as banana peels or broccoli stems, to turn them into conscientious and innovative dishes.
- Or the Rhodora restaurant in Brooklyn (New York), which bases its cuisine on gastronomic proposals based on food leftovers.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

1.7. Conclusion

It is fair to say that our waste gives us away and shows us what kind of society we have become. However, human history and our own evolution have taught us that we possess an enormous capacity to adapt to many different environments. Throughout this section, we have learned the concept of circular economy, as well as the importance of moving from a linear economy to a circular economy to reduce the loss and waste of food that consumes so many resources, as well as its negative impact on the carbon footprint. In addition, we have learned what is the loss and waste in each of the stages of the food chain from production to consumption. A possible solution to reduce this waste is to know where it is generated. The social, environmental, and economic impact of food waste and possible solutions for its reduction have also been presented.

The main conclusion of this booklet is the importance of changing our consumption habits and putting pressure on companies to change the way they produce towards more sustainable production. It is essential to reduce food loss and waste in order to preserve our ecosystem. Let's remember that the best thing for the environment is waste that is not produced.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

REFERENCES

- IBaptista, P., Campos, I., Pires, I., & Vaz, S. (2012). *Do Campo ao Garfo, Desperdício Alimentar em Portugal*. Lisboa: Cestras.
- Dobbs, R., Oppenheim, J., Thompson, F., Brinkman, M., & Zornes, M. (2011). *Resource Revolution: Meeting the world's energy, materials, food, and water needs*.
- FAO (2013a). *Toolkit: reducing the food wastage footprint*. Rome
- FAO. (2014). *The state of world fisheries and aquaculture 2014*. Rome: FAO.
- Hernández, J. L. S. (2009). *Redes alimentarias alternativas: concepto, tipología y adecuación a la realidad española*. Boletín de la Asociación de Geógrafos Españoles.
- High Level Panel of Experts (HLPE). (2011). *A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. Land tenure and international investments in agriculture*.
- High Level Panel of Experts. (2014). *Sustainable fisheries and aquaculture for food security and nutrition. A report by the high level panel of experts on food security and nutrition of the committee on world food security*. Rome: FAO.
- HISPA COOP (Confederación Española de Cooperativas de Consumidores y Usuarios), (2012). *Estudio sobre el desperdicio de alimentos en los hogares*.
- Mattsson, B., Wallén, E., Blom, A., & Stadig, M. (2001). *Livscykelanalys av matpotatis (Life cycle assessment of table potatoes)*. Internal report. The Swedish Institute for Food and Biotechnology (SIK), Gothenburg, Sweden.
- Ness, D. (2008). *Sustainable urban infrastructure in China: Towards a Factor 10 improvement in resource productivity through integrated infrastructure systems*. *The International Journal of Sustainable Development & World Ecology*, 15(4), 288-301.
- Stuart, T. (2009). *Waste: Uncovering the global food scandal*. WW Norton & Company.
- Underwood, E., Poláková, J., Berman, S., Dooley, E., Frelih-Larsen, A., Kretschmer, B., ... & van der Grijp, N. M. (2013). *Technology options for feeding 10 billion people. Interactions between climate change and agriculture and between biodiversity and agriculture*.
- Vermeulen, S. J., Campbell, B. M., & Ingram, J. S. (2012). *Climate change and food systems*. *Annual review of environment and resources*, 37, 195-222.

Chapter 1 - From a linear to a circular economy: Finding opportunities from waste

REFERENCES

WRAP (2009). Household food and drink waste in UK. Banbury, UK (<http://www.wrap.org.uk/sites/files/wrap/Household%20food%20and%20drink%20waste%20in%20the%20UK%20-%20report.pdf>).

Zhongming, Z., & Wei, L. (2021). UNEP Food Waste Index Report 2021.

Web:

- <https://www.ecoembes.com/es/reduce-reutiliza-y-recicla/economia-circular-en-espana>
- <https://www.europarl.europa.eu/thinktank/infographics/circulareconomy/public/index.htm>
- <https://www.fao.org/3/i3901s/i3901s.pdf>
- <https://www.fao.org/sustainable-development-goals/goals/goal-12/es/>
- <https://www.reasonwhy.es/actualidad/together-we-can-nuevo-posicionamiento-marca-vodafone>
- https://www.tuproyectodevida.es/economia-circular/?gclid=Cj0KCQjwl7qSBhD-ARIsACvV1X2pltTrj7sy-321Mcw3KNfgoDi4Vd8AkfmqulBNXCF8kmt-oWuGWTwaAk_NEALw_wcB



CHAPTER 2

**FOUNDATIONS OF
ENTERPRENEURSHIP AND
SOCIAL
ENTERPRENEURSHIP**



Chapter 2: Foundations of entrepreneurship and social entrepreneurship

2.1 Introduction

According to the World Bank, 3.4 billion tonnes of trash will be produced worldwide by 2050, an increase of more than 70%. Only 8.6% of this, according to the Circularity Gap Report 2020, is recycled back into the economy. In addition to being crucial for sustainability, waste reduction is essential for creating new economic prospects in the circular economy. From a capacity and cost standpoint, businesses are encouraged to maximize resource utilization and minimize waste output. The circular economy expands the range of possible uses for these leftover resources.

In the EU alone, 88 million tonnes of food are wasted each year. There will always be some surplus streams, even in highly optimized value chains. Since food spoils quickly, there are less opportunities for a "secondhand" market. This makes food unique. It is occasionally feasible to employ different routes of distribution, such as animal feed or, in the most extreme case, bio-energy, although doing so results in a decrease in the resource's value relative to the original distribution channel.

2.2 Entrepreneurship theories - (startup, scaleup, accounting, pitching, investment sources, innovation development)

Startups

Eric Ries, author of the best-selling book *Lean Startup*, defines a startup as:

"A structure designed to create a new product or service under conditions of extreme uncertainty."

Most often, a startup seeks to position itself in an underserved market segment. It needs to strike the right balance between niche targets and the ability to deploy its offer on a large scale. Finally, being a startup is a temporary status. Young innovative companies are not destined to remain startups forever. They evolve into scale-ups after reaching a certain stage of maturity. That being said, there is no fixed age for ceasing to be a startup.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

The term startup refers to a company in the first stages of operations. Startups are founded by one or more entrepreneurs who want to develop a product or service for which they believe there is demand. These companies generally start with high costs and limited revenue. Most of these companies are initially funded by their founders.

Startups are businesses or endeavors that are concentrated on a certain product or service that the founders seek to market. These businesses often lack a fully formed business plan and, more importantly, sufficient funding to advance to the next stage of development.

For additional funding, many entrepreneurs resort to friends, family, and venture capitalists. Silicon Valley is renowned for having a thriving venture capitalist community and is a well-liked location for entrepreneurs, but it is also regarded as the industry with the highest demands.

Startups might use seed money to finance their business planning and research expenditures. While a thorough business plan details the company's mission statement, vision, and goals, as well as management and marketing strategies, market research assists in determining the demand for a good or service.

One of the primary disadvantages of a startup is increased risk. This primarily applies to the success and longevity of a startup. New businesses need to prove themselves and raise capital before they can start turning a profit. Keeping investors happy with the startup's progress is critical. The risk of shutting down or not having enough capital to continue operations before turning a profit is ever-present.

Long hours are characteristic of startups as everyone is working towards the same goal—to see the startup succeed. This can lead to high-stress moments and sometimes compensation that isn't commensurate with the hours worked. Competition is also always high as there tend to be a handful of startups working on the same idea.

Scaleups

As the term implies, a scale-up is a startup that has grown, that has changed scale. To move to this next stage, the startup must have succeeded in stabilising its business model and industrialising its offer. It has therefore proven its viability.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

To qualify as a scale-up, it must meet certain criteria that have become the norm. The first of these concerns annual growth. A scale-up must register a team growth of more than 20% per year, with at least 10 employees on permanent contracts. In terms of turnover, a scale-up is expected to generate between \$1 million and \$3 million. It must also have already raised at least \$1 million. Once it has reached these milestones, it is no longer in the startup phase or in a situation of extreme uncertainty, as described by Eric Ries.

Simply put, a scale-up is nothing other than a successful startup. Since it will not remain a startup indefinitely, a young company's prospects are limited. It will either:

- Go bankrupt
- Complete an exit and/or merge with a large group or a scale-up
- Become a scale-up

A scale-up generally aims to continue its development and expand its market, notably by having strong international ambitions. Shift Technology is one example of a French startup rated by Early Metrics (ranked in the top 2% of most promising startups) that has become a scale-up. In fact, it is already active in North America and South-East Asia.

Scaleups are companies born to grow and expand beyond their own frontiers.

Many of the most highly-prized startups in the world in 2020 didn't even exist scarcely a decade ago. This list includes companies like Uber, WeWork, Epic Games and others which started from nothing, grew a lot in a short time and revolutionized the global economy with ground-breaking ideas, the opening of new markets and the creation of thousands of jobs. This dizzy growth is a result of a company strategy known in business jargon as scaling-up.

The secret to the exponential growth of a scaleup lies in its scalable business model, its non-conformist mentality and its long-term sustainability. These three characteristics are fundamental to attracting the eye of investors and getting finance, something essential for any of these companies at their inception. The scaleup format is becoming increasingly popular around the world and is proliferating especially in the US, Israel, China and the UK.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Top Characteristics of Startups and Scale-ups: What's the Difference?

1. Product-market Fit

The most obvious difference between tech startups and scale-ups is product-market fit: Scale-ups have perfected it, while startups are still experimenting with things like customer segmentation, customer acquisition costs, and product features. Scale-ups on the other hand, have already validated their assumptions by proving their units are economically sustainable.

In other words, scale-ups know if they put \$X into the business, they will get \$Y in return. That level of clarity allows them to confidently divert more funds into doing what they are already doing on an even bigger scale. Conversely, startups may still be unsure what kind of return they will get from their efforts. As such, most of their funds go toward experimentation in pursuit of "figuring out what works." The process of discovering that sweet spot takes about a year for most tech startups.

2. Stage of Funding

Since startups and scale-ups are at different stages of growth, it should come as no surprise that they are also at different stages of funding. Startups typically have either zero funding, a Seed Round, or sometimes, a Series A backing them. By the time the startup begins its second round, it will most often fall into the scale-up category. A rule of thumb: If your company can provide prospective investors with more validation than an MVP, a trustworthy team, and a great market opportunity, you can probably call yourself a scale-up.

3. Team Member Roles

During the early stages of company growth, it's not uncommon for team members to take on multiple roles. Most companies hire people with a specific skill set for a specific role, but they also expect those people to take on other challenges as they arise. You need that "jack of all trades" to develop strategies, systems, and processes from the ground up.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

As your startup transitions to a scale-up, however, it's important to narrow team roles. Whether that means turning your sales and marketing person into two separate departments or hiring specialists for each role within those departments, scale-ups focus on enhanced delegation in pursuit of growth.

4. Risk-aversion

The larger a company becomes, the greater its aversion to risk. Do you have a small customer base, an unproven product, and zero traction? You really don't have much to lose when confronted with the prospect of pursuing a new and unusual idea.

During the early days, a tech company's success was dependent on its ability to quickly pivot in response to incoming feedback, data, and ideas. Conversely, scale-ups are now expected by their investors, customers, and team members to quickly multiply results. The more money you make, the more careful you have to be when it comes to experimenting with new ideas.

5. Systems in Place

By nature, startups often have very loose systems in place. The process someone uses to draft an email marketing campaign, update an app, or answer customer emails might look different every time.

Team members are often given the freedom to experiment with various processes until they figure out what works best for them. Eventually, they are asked to document that process into a system that can be easily replicated. As startups transition into scale-ups, organized systems become imperative to maintaining quality control and completing projects on time.

6. Management Hierarchy

The leadership required for an early-stage company is entirely different from what's required for a late-stage company. Put simply, the more people you hire, the more people you have to manage. While directing a team of 10 is doable for a few co-founders, overseeing a team of 30 can be quite cumbersome.

For this reason, scale-ups typically onboard new leaders with corporate management experience. The more managers you have overseeing metrics, quotas, and processes, the more effective founders can be in scaling the company to greater heights.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

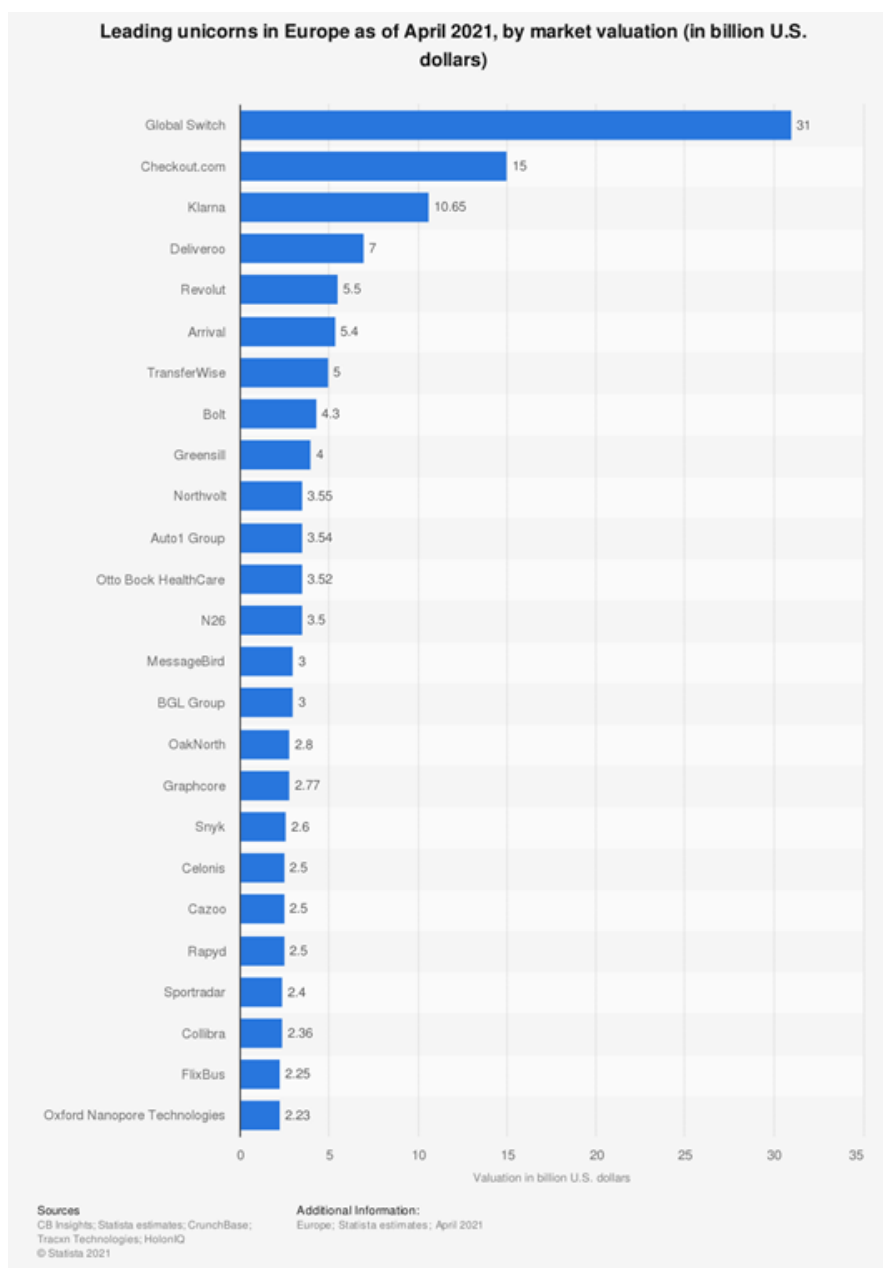
Unicorn scale-up

As its name suggests, the unicorn is a rare, even legendary creature. In economics, the term refers to an unlisted company valued at over \$1 billion. Aileen Lee coined the term in 2013. The venture capitalist was looking for a way to describe the 0.1% of companies with a valuation of over \$1 billion that venture capital funds invest in. These companies are also characterised by their business model which favours rapid growth financed by fundraising over profitability.

It is impossible to miss these unicorns today. Their names are now familiar, and the use of their services is widespread: Netflix, Blablacar, Dataiku, Deliveroo, etc. To sum up, a unicorn has to have been a scale-up, which itself had to be a startup initially. However, it is still difficult to get away from the name startup, a word still charged with connotations such as economic dynamism and entrepreneurial spirit.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Figure 1. Leading unicorns in Europe



Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Figure 2. Country of birth of unicorn founders



Business Model Canvas & Lean Startup

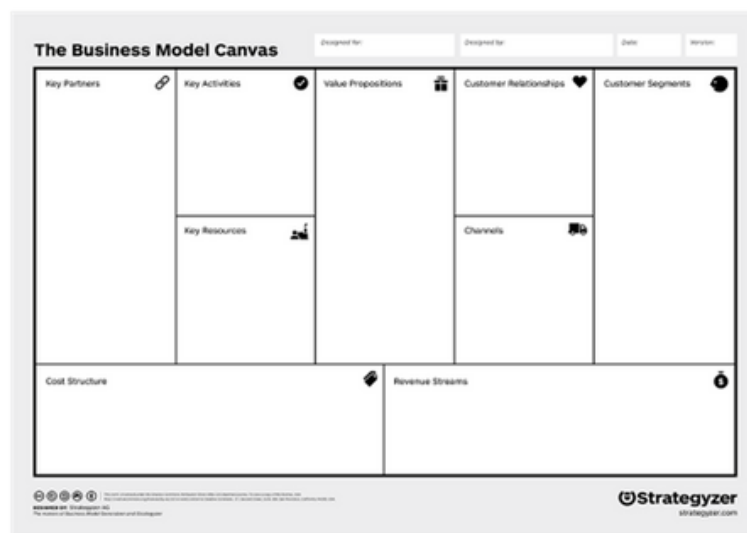
The Business Model Canvas (BMC) is a strategic management tool to quickly and easily define and communicate a business idea or concept. It is a hypothesis testing tool. Startups are organizations in search of a scalable model. Lean startups take advantage of reduced resources to search for their scalable model. The Business Model Canvas was created by Alexander Osterwalder, of Strategyzer.

The business model canvas is a great tool to help understand a business model in a straightforward, structured way. Using this canvas will lead to insights about the customers, what value propositions are offered through what channels, and how a company makes money.

It is a one-page document that works through the fundamental elements of a business or product, coherently structuring an idea.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Figure 3. Business model canvas (b)



The right side of the BMC focuses on the customer (external), while the left side of the canvas focuses on the business (internal). Both external and internal factors meet around the value proposition, which is the exchange of value between a business and its customer/clients.

Why we use it:

- To quickly draw a picture of what the idea entails.
- It allows us to get an understanding of a business and to go through the process of making connections between what the idea is and how to make it into a business.
- It looks at what kinds of customer decisions influence the use of its systems.
- It allows everyone to get a clear idea of what the business will likely be.

How we use it - Value Proposition:

The Value Proposition is foundational to any business/product. It is the fundamental concept of the exchange of value between a business and its customer/clients. Generally, value is exchanged from a customer for money when a problem is solved, or a pain is relieved for them by the business.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Lean Startup:

Lean startup is a methodology for developing businesses and products that aim to shorten product development cycles and rapidly discover if a proposed business model is viable; this is achieved by adopting a combination of business-hypothesis-driven experimentation, iterative product releases, and validated learning. Lean startup emphasizes customer feedback over intuition and flexibility over planning. This methodology enables recovery from failures more often than traditional ways of product development.

Central to the lean startup methodology is the assumption that when startup companies invest their time into iteratively building products or services to meet the needs of early customers, the company can reduce market risks and sidestep the need for large amounts of initial project funding and expensive product launches and financial failures.

Customer feedback during the development of products or services is integral to the lean startup process and ensures that the company does not invest time in designing features or services that consumers do not want. This is done primarily through two processes, using key performance indicators and a continuous deployment process.

When a startup company cannot afford to have its entire investment depend upon the success of a single product or service, the lean startup methodology proposes that by releasing a minimum viable product that is not yet finalized, the company can then make use of customer feedback to help further tailor the product or service to the specific needs of its customers.

"The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" is a book by Eric Ries describing his proposed lean startup strategy for startup companies. Ries developed the idea for the lean startup from his experiences as a startup advisor, employee, and founder. Ries attributes the failure of his first startup, Catalyst Recruiting, to not understanding the wants of their target customers and focusing too much time and energy on the initial product launch.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Investments, Financial, Accounting & Pitching

Startup investors are essentially buying a piece of the company with their investment. They are putting down capital, in exchange for equity: a portion of ownership in the startup and rights to its potential future profits. By doing so, investors are forming a partnership with the startups they choose to invest in – if the company turns a profit, investors make returns proportionate to their amount of equity in the startup; if the startup fails, the investors lose the money they've invested. By raising venture capital rather than taking out a loan, startups can raise money that they are under no obligation to repay. However, the potential cost of accepting that money is higher – while traditional loans have fixed interest rates, startup equity investors are buying a percentage of the company from the founders.

Early-stage startup investing offers potential for astronomical growth and outsized returns (relative to larger, more mature companies). This potential makes acquiring startup equity an attractive investment opportunity to prospective investors, despite the additional risk.

For the Founders, taking VC money can also come with huge benefits – startup investors can offer valuable support, guidance, and resources to new founders that can help to shape their company and increase its chances of success.

Venture Capital financing is also ideal for startups that can't get very far by bootstrapping. Although many founders self-fund their startups while operating out of a cramped apartment until they've reached profitability, bootstrapping doesn't work for companies that require a lot of capital up-front just to build and test their MVP (minimum viable product).

Here are some of the most common ways to get financing for a startup:

- Self-Funding / Bootstrapping
- Friends and Family Investors
- Crowdfunding
- Incubators / Accelerators
- Angel Investors
- Venture Capitalists
- Loans / Credit Cards / Debt
- Partnership / Licensing / Commitment to A Major Customer

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Things related to accounting every startup needs to track:

- Bank & Credit card statements - online
- Payroll - managing employee personnel records etc
- Invoices - If you want to get paid, this is the way
- Bills, Tax returns, Financial statements

Of course, when you're just starting, you can probably handle bookkeeping without too much extra work. As your team, sales, and profits grow it is a good idea to hire a professional.

What is Business pitching?

Business pitching is a common method for proposing new ideas and gaining support. As a working professional, you may encounter various opportunities to sell yourself and your ideas. Beyond advancing your career, knowing how to build and deliver a pitch can help you gain customers or investors for a business.

Pitching in business refers to presenting business ideas to another party. For example, you may pitch your startup business to potential investors or your products to potential customers. A business pitch needs to give your audience a clear understanding of your plan or goals to gain buy-in. To do this, you must gather and share relevant research or provide a compelling vision. When you pitch effectively, you can motivate and persuade your audience to follow your idea and make it a reality.

Sales pitch

A sales pitch is a brief message that attracts your audience's attention and outlines your business plan or the products and services you offer. The goal is to make the audience invest in your business or purchase your products or services. "Elevator pitch" is another term for sales pitch because it should last as long as an elevator ride.

Pitch deck

A pitch deck is a slide presentation that outlines your business plan to potential investors. This presentation should include research related to your product, competition, marketing plans and company finances. The founders need to provide a complete view of the company as it currently exists and the potential value it holds for investors to persuade their decision.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Skills required for business pitching:

- Communication - A business pitch requires delivering messages clearly and concisely, whether written or verbally
- Research - A pitch needs to provide supporting evidence for any claims made regarding the business or product
- Problem solving - A pitch will outline how an idea, business or product can solve the stakeholder's problem
- Public speaking - Being comfortable speaking in front of others is essential
- Creativity - Use creative skills to develop new or innovative solutions

How to develop and deliver a great pitch:

- Research - provide accurate data or research to support claims
- Understand the audience - Research the audience, try to learn their backgrounds and interests to understand what motivates them
- Build the pitch - Sales or pitch deck
- Win the audience - When presenting the pitch, getting straight to the main message is crucial
- Talk about success - Present revenue or sales (if any) that show the market interest
- Handle questions - Be prepared for everything!
- Read the audience reactions - assess next steps

Innovation development

Innovation is creating something new, a new solution, a new way of doing things, a new product, service or method, that is useful. Innovation is solving a problem for someone, somewhere. Every company needs to innovate in order to survive and thrive. All businesses need to stay relevant, be dynamic and respond to change.

An innovation process is a structured approach to growing a business by making sure that the founders capture all their best ideas, only invest in the most promising ones, and develop them through to launching them in the market. Having just the right amount of structure at the right times, without making the whole process overly burdened by red tape, helps to focus on better ideas and get more done, more quickly, at lower cost and with less risk.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

The key stages in the innovation process are:

- Having and collecting ideas
- Selecting the most promising ideas based on a combination of criteria, such as potential investment and return feasibility, customer and business impact
- Developing the most promising ideas
- Idea testing
- Implementation

In practice, projects will toggle between development and testing a few times before implementation. All businesses - from sole traders through to global corporations - benefit from using an innovation process to bring new ideas to market quickly and efficiently.

Do innovations fail?

Innovations fail principally because either they don't solve the right problem for customers in the right way, or the customer isn't aware of the benefits that the innovation will bring.

For innovations to succeed, they need to deliver clear value for target customers. This means that customers need to care enough about the innovation and be aware of it to be motivated to invest time, money, and effort in buying and using it.

Regarding innovation, we think of value as meaning three things:

- Worth, usefulness
- Values - needs to align with how people see themselves and their ethics
- A number - time, money

Innovations need to give customers value on all those three, or they won't buy it.

Innovations fail most of the time because they are not sufficiently tested and/or communicated well enough to customers.

Having an innovation development process helps reduce the risk of innovations failing because it prompts testing ideas with customers at key stages.

When start-ups are in the innovation process, they often think that they have got clarity about where this innovation is going. As new information comes up, they often realize that it's not as straightforward as they first thought, and the fog of uncertainty descends. The solution is to move through that fog. It is important to keep trying new angles and problem-solving. Eventually, clarity will emerge.

The innovation process describes the systematic conversion of existing and/or new findings into marketable solutions, from idea generation and idea evaluation to implementation and successful market launch. It is also important to discard ideas with little future potential in good time, in order to make targeted use of R&D resources and to focus innovation activities on promising innovations.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

2.3 Understanding social enterprises and how they can fix societal challenges

A social enterprise or social business is defined as a business with specific social objectives that serve its primary purpose. Social enterprises seek to maximize profits while maximizing benefits to society and the environment, and the profits are principally used to fund social programs.

Unlike a charity, social enterprises pursue endeavors that generate revenues, which fund their social causes. Regarding employment, preference is usually given to job-seekers from at-risk communities. Funding for a social enterprise is often obtained by selling services and goods.

The concept of a social enterprise was developed in the U.K. in the late 1970s to counter the traditional commercial enterprise. Social enterprises exist at the intersection of the private and volunteer sectors. They seek to balance activities that provide financial benefits with social goals, such as housing for low-income families or job training.

Funding is obtained primarily by selling goods and services to consumers, although some funding is obtained through grants. Because profit-maximization is not the primary goal, a social enterprise operates differently than a standard company.

While earning profits is not the primary motivation behind a social enterprise, revenue still plays an essential role in the venture's sustainability. Sustainable revenue differentiates a social enterprise from a traditional charity that relies on outside funding to fulfill its social mission. This goal does not mean social enterprises cannot be profitable. Instead, it's simply that their priority is to reinvest profits into their social mission rather than fund payouts to shareholders.

The Organisation for Economic Co-operation and Development (OECD) identifies social enterprises as being highly participatory, with stakeholders actively involved and a minimum number of paid employees.

A social enterprise is not to be confused with social entrepreneurship, which focuses on individuals who develop solutions to social and environmental problems using existing business techniques and strategies. Social entrepreneurs seek innovative ways to drive change, whereas social enterprises form to fulfill a business purpose and solve societal needs through their commercial activities.

Many social enterprises successfully maximize improvements in social well-being. For example, Warby Parker is an American eyeglass retailer that donates a pair of glasses to someone in need for every pair sold. TOMS, a California-based retailer, similarly has pledged to donate a pair of shoes or sunglasses for every pair sold. Also, Radicle trains businesses and gives them software tools to track and cut their greenhouse gas emissions.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Social enterprises are usually a blend of private and volunteer sectors. A credit union, a coffee shop that sells fair-trade beans and hires candidates from at-risk communities, or a neighborhood food co-op are all examples of social enterprises.

Employees of social enterprises come from many backgrounds, but priority is given to those from at-risk sections of the communities. These may include long-term underemployed workers, who have historically worked in jobs where they were informally paid.

Social enterprise opportunities may seek to provide a living wage, which is above the minimum wage in most cities. Some social enterprises may pointedly seek out employees from at-risk groups as a requirement for hire.

How can social enterprises fix societal challenges?

A social enterprise's purpose is to create social value for the greater public good, whereas a commercial enterprise seeks profit. Creating jobs, delivering innovative products and services, promoting sustainability, and giving hope for the future are all possible with social enterprises. As per the European Commission statistics, over 200 million volunteers worldwide are engaged in social entrepreneurship activities, and the numbers are growing steadily.

Problems such as those related to water shortages, education, health care, poverty, energy, forced migration, and global warming can be solved by social entrepreneurship when it creates innovative solutions that have a direct impact on people's lives.

As a means of generating economic and social value, social entrepreneurship is more responsive. It is a fast-growing sector with the ability to solve social problems and exploit local markets in a more responsive way than traditional business models.

The purpose of social enterprises is to solve global problems like poverty, unemployment, gender inequality, schooling and health policies that are inadequate, inefficient governance, etc. They create a global platform for like-minded people to work together to solve these problems.

A solution to a social issue can be exploited by social enterprises since they have the ability to solve this problem for society. As a result, consumers get a wider range of choices and jobs are created. It is well known that consumers have many choices, making it important for businesses to have a good public image.

Communities with a sense of purpose can be found in social enterprises. By partnering with locals, these enterprises can provide income for them while also addressing community needs.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Where can social enterprises focus:

- Ensure equality and inclusiveness
- Improve nutrition and sustainable agriculture in order to end hunger
- Encourage well-being among all age groups
- Assure that education is equitable and of high quality
- Equality for women and men
- Access to water and sanitation for all
- Access to modern energy for all

Problems of social entrepreneur/enterprises:

- Support for funding is lacking
- Scaling up is limited
- There are two missions at once
- Strategic approach to business

2.4 Practicalities and legislative context, understanding food cooperatives and community initiatives that handle food waste redistribution

The term “social enterprises” refers to a wide range of institutions that lie between not-for-profit and for-profit organisations. They are driven by social missions. We believe that cooperatives (co-ops) are an effective model of social entrepreneurship for development in rural areas.

A cooperative is an organisational structure in which all members receive a share of the profits and can vote on the future of the organisation. A membership in the cooperative therefore creates an incentive, as it is rewarded with a certain percentage of profit share, while the liability remains limited. The cooperative also allows ‘shares’ to be reallocated quickly, which guarantees flexibility when dealing with multiple partners, such as new residual resource providers. The terms of entry and exit can be managed with the membership agreement. All members have voting rights. The cooperative organisational form can be used to create a business model for its members around circular goals: such as using residual resources in new products.

Historically, cooperatives have been formed by organisations that want to collaborate on a similar product, i.e. horizontal integration of different parties with a similar business model that cooperate to strengthen their position. Stakeholders become shareholders in this cooperative structure; in fact, they become more than just stockholders. By participating in the cooperative's decision-making process and giving resources and knowledge, members actively contribute to its success. Around a product line, this involves a number of organizations, including manufacturers, distributors, logistics companies, and logo designers. Profits are distributed according to a distribution key among all members. As it makes it easier for new ways to create and retain the value of resources, the cooperative structure becomes more and more crucial.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Food cooperatives & circular economy

Cooperatives are set up with a specific goal. A well-known example from the Netherlands is the dairy cooperative FrieslandCampina U.A., which aims to provide price stability and guarantee sales for dairy suppliers. Some cooperatives focus on specific social goals, aptly named social cooperatives: strengthening farmers' positions to protect them against exploitation, for example.

The cooperative is able to connect different parties and production resources and to align interests. This way, win-win situations can be created for all members. On one hand, they contribute positively to the circular economy, and on the other, when the cooperative generates a profit, they will receive a profit share for the products that they helped to produce and sell. The general set-up of cooperatives can vary. Historically, cooperatives often aimed to cooperate horizontally, meaning that partners entered on equal terms to share infrastructure, for example expensive machinery, to create a similar product, for example tomatoes.

A food co-op is essentially a grocery store that's owned by the people who shop there. Members get to decide what foods and products are stocked on the shelves, where those items are purchased and what quality standards both products and vendors have to meet. Members also vote on standards for negotiating prices, and they choose how co-op employees are compensated.

Even though the circular economy is still in its infancy, more and more companies are beginning to incorporate these ideas into their business structures. Designing for longevity and disassembly, refurbishing products, and valuing resources that might otherwise go to waste or be downcycled into lower-value products are examples of circular principles. It's difficult to develop a circular business case. The playing field is not level for circular enterprises as they must compete with firms that are not held accountable for their pollution, CO2 emissions, or waste.

Moreover, circular businesses are enhanced by a broader and longer-term perspective for financial, ecological and societal benefits to prevail. In the meantime, transition costs (for example, the costs of inventing and structuring new products and services) are high and unevenly distributed. This way the linear economy can continue to privatise profits, while environmental costs are socialized. The circular frontrunners bear the costs, whereas the laggards can wait until the new ways of doing business are crystallised and de-risked.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Cooperatives have the ability to integrate more stakeholders in the value chain, creating benefits for all its members and the environment. This enables sharing risks and rewards for a common circular goal, in this case it's mitigating food waste.

Circular business models must fit within current legal and financial rule sets. In order to support circular businesses, we have to be smart in using and combining the existing linear frameworks with circular ones.

The problem of functioning inside the linear economy and adhering to its legal, financial, and accounting norms and regulations is one that businesses on the cutting edge of the circular economy frequently face. In order to overcome these obstacles, circular business models must adhere to current regulations while experimenting with new methods of conducting operations, gauging performance (ecological, social, and financial), and securing capital.

Twenty percent of the food produced in the European Union is thought to be wasted or lost. This puts undue strain on the ecosystem, the food chain, and the waste management system, in addition to contributing to the climate problem (if food waste were a nation, it would be the third GHG emitter). Additionally, it is a fundamental ethical problem that worsens food insecurity. As a result, there is an urgent need to address the issue of food waste in order to move toward a sustainable food system.

Since food waste is now a structural byproduct of our food system, combating it needs action throughout the whole supply chain. And it can only be successful if local governments, both urban and rural, collaborate with the farming communities and food producers in the rural and urban green belts. We will be able to permanently reduce (and eventually eliminate) food waste through a holistic approach to just, sustainable, and healthful food production. The European Union's (EU) current legal framework is still insufficient to take aggressive action in this area.

In the Waste Framework Directive, the 50 percent reduction goal for consumers and retail by 2030 is only mentioned; it is not a requirement. The recently approved Farm to Fork plan, however, paves the path for the adoption of mandatory targets that will be based on the measurement of food waste levels that Member States are required to record by 2022. To expedite the necessary change towards a waste-free food system, the EU and national governments will need to be ambitious in their proposals for legally enforceable pledges and specific actions.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

Local government also has a significant role to play if European and national legislation are to press for this change. Regions and municipalities are increasingly seen as crucial players in the circular economy and sustainable food system since they are the ones carrying out practical initiatives on the ground and represent the level of government closest to the general public and small companies. Cities also have the ability to stimulate both the direct (via green public procurement, public canteens, or municipal markets) and indirect (through peri-urban agriculture, citizen consumption) environments to establish a local food system that produces no waste.

High levels of food waste are a direct result of an unsustainable commercial food system that regards food as a commodity and is built on a mechanism of waste and overproduction. Food waste has various causes since it happens along the supply chain and at many different levels, from the farm to the table. Therefore, addressing the issue of food waste needs action at each of those steps, as well as action on both prevention and the reuse of inevitable food waste.

It takes a comprehensive strategy that considers the food system as a complex web of agricultural, economic, social, and cultural practices in order to prevent food waste. There is no single definition of what constitutes a sustainable food system, however it should support the following elements:

- Health: promoting wellbeing by considering the system's potential for contamination and its effects on human health;
- Ecological: preserving the planet's boundaries;
- Economic: ensuring economic viability, fair revenues, and job creation;
- Social: ensuring access to food that meets everyone's needs and avoids inequalities;
- Ethical: producing ethical food through transparency and producer's responsibility;
- Resilience: strengthening a system.

Any substance or product that is about to be discarded that is "designed to be, or reasonably expected to be consumed by humans" is referred to as "food waste" in EU legislation. The EU requires Member States to measure food waste and report on progress made at the following stages: primary production; processing and manufacturing; retail and other distribution of food; restaurants and food services; and households. This is done to ensure that national efforts to reduce food waste are supported by credible evidence.

In order to achieve Sustainable Development Goal 12.3, which calls for a 50% reduction in food waste at the retail and consumer level by 2030, Member States must also develop programs to avoid food waste and promote food donation and other forms of redistribution for human use. However, those clauses lack technical guidance on the kind of actions to take to effectively combat food waste and are not legally binding.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

In that regard, this strategy should be complemented by the application of the following food waste hierarchy, which aims to: 1. Prevent systemic food waste by addressing the cross-sectoral causes of food surplus; 2. Distribute and donate food when it cannot serve its intended purpose; and 3. Properly treat food that cannot be eaten by promoting recycling - composting or methanization - while avoiding any disposal option.



2.5 Conclusion

First and foremost, we have to change our mindset and embrace the hidden value of resources that are considered waste too early in their lifecycle. The negative terminology —'waste'—disincentivizes innovative approaches to maintain the value of the resources. Acting circular means involving more environmental factors, which can be ensured by including more stakeholders in the decision-making process. The cooperative is the vehicle for doing this within the linear economy, through sharing rewards and risks while contributing to circular goals like the mitigation of food waste.

Chapter 2: Foundations of entrepreneurship and social entrepreneurship

REFERENCES

Web:

- <https://earlymetrics.com/what-the-difference-between-startup-scale-up-tech-company/>
- <https://www.iberdrola.com/innovation/what-is-scaleup>
- <https://www.rocketpace.com/tech-startups/7-key-differences-between-startups-and-scale-ups>
- <https://www.slowfood.com/wp-content/uploads/2022/01/Guidance-on-food-waste-reduction-in-cities-EN.pdf>
- https://assets.website-files.com/5d26d80e8836af2d12ed1269/5fd0f7fa8c0198c24fc7e3e3_CCA%20%20Valorising%20residual%20resources%20-%20report%20-%20EN-compressed.pdf
- <https://www.icsid.org/uncategorized/how-social-entrepreneurship-can-help-resolve-wicked-problems-around-the-world/>
- <https://www.investopedia.com/terms/s/social-enterprise.asp>
- <https://startupsmagazine.co.uk/article-why-every-company-needs-innovation-process>
- <https://www.fool.com/the-ascent/small-business/accounting/articles/startup-accounting/>
- <http://theleanstartup.com>
- https://en.wikipedia.org/wiki/Business_Model_Canvas
- <https://www.strategyzer.com/canvas/business-model-canvas>
- <https://canvanizer.com/new/business-model-canvas>
- <https://www.businessmodelsinc.com/about-bmi/tools/business-model-canvas/>
- <https://medium.com/seed-digital/how-to-business-model-canvas-explained-ad3676b6fe4a>



CHAPTER 3

**MOTIVATING, INSPIRING
AND TRAINING THE
COMMUNITY TO
ENGAGE**



Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3.1 Introduction

Leisure education for children and young people, from the youngest learners to educators and families, encourages reflection and action on what is needed to be happy and live well and how to satisfy these needs, without mortgaging anyone's life (other people living elsewhere) or anything (the planet as a whole), taking into account both present and future generations. Questions such as what kind of world do we want to leave to those who succeed us, to the children who are growing up? What do we come into this world for? What did we come into this life for? What do we work and struggle for? What does this earth need us for?

For years numerous studies have provided scientific data and evidence on how human activity affects the survival of the planet as a whole. No one, with a minimum of scientific rigour, denies that we are in a systemic crisis (economic, ecological and social) that is unsustainable for the planet and that if we change our way of life and our development model, the world, as we know it now, will end up collapsing and disappearing.

Faced with the global system that invites us to unlimited consumption, scouting has a clear proposal, where less is better to live with less. The starting point is to opt for another lifestyle, in which austerity and care for the environment are rewarded.

1. All change needs motivation and an educational path. Education is fundamental for change to take place, and change begins with action, therefore, we must call for education by action, as is done in the scout movement.

2. We must not fall into the hands of today's consumerism: we are controlled by a system that only wants more production and more consumption, that only understands material happiness, but what about the other happiness, the happiness of small, everyday things? We must value sleeping under the stars in a camp, the joy of having a meal ready after work or school, looking with pride at the crowned peak on a march, etc.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3. We should be in contact with people from other cultures, who teach us other ways of seeing or relating to the world.

4. We must look for and learn from real proposals for change that are taking place in our cities and towns.

The world is not like this, but it is like this. The future is not written, it has not arrived, so we can face it and build it in many ways. Depending on our vision of the world, so will be our action on it.

In order to transmit all these values to children and young people, we are working on a series of concepts that we want to explore in more depth in the following sections.

3.2 What is healthy consumption?

We understand healthy consumption as an attitude on the part of consumers and users that implies conscious and critical consumption, which is demonstrated both when buying a product or contracting a service, and at home, using the available resources efficiently.

Responsible consumers and users are those who, in addition to knowing their rights, are guided by social and environmental criteria in order to contribute to a favourable environment for all, and to guarantee consumption with the least possible impact on the environment, with the aim of contributing to improving the quality of life of the people who inhabit this planet and of future generations. Responsible consumption is based on two maxims, which are to consume less and to make what we consume as sustainable and supportive as possible. The legal basis for responsible consumption and sustainable production can be found in articles 191 and 193 of the Treaty on the Functioning of the European Union.

Buying involves satisfying a need or a desire but also activating a whole series of economic, social and environmental processes. In this sense, doing it in a healthy way means questioning when buying what is dispensable and what is not; what our real economic availabilities are and then choosing products not only because of their price or quality, but also because they are environmentally friendly and because the companies that make them comply with human rights and the principles of social justice.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

Moreover, healthy consumption is an attitude that can also be exercised at home and in lifestyle habits. Citizens must internalise their share of responsibility as individuals in caring for and improving the environment. Simple gestures such as saving electricity, heating, water or fuel improve the quality of life of the community.

The characteristics of healthy consumption are:

- It is a **conscious act**, as it is premeditated and puts free choice before the pressure of advertising and imposed fashions.
- It is **critical** in that it questions the social and ecological conditions in which a product has been produced or a service has been provided.
- It is **ethical**, based on values such as responsibility, austerity as an alternative to waste and consumerism, and respect for the rights of producers and the environment.
- It is **ecological** by preventing the waste of natural resources, as mass production degrades the environment.
- It is **healthy** because it promotes a lifestyle based on healthy and balanced eating habits and the purchase of quality and environmentally friendly products.
- It is **sustainable** because reducing unnecessary consumption can improve the quality of life of the planet and the environmental balance and less waste would be generated.
- It is in **solidarity** with other peoples and with future generations, since the rights of the former are respected and the rights of the latter are ensured.
- It is **socially just** as it is based on the principles of non-discrimination and non-exploitation. It has the power of social transformation. Consumers have the power to transform a mere act of consumption into a true act of citizenship. In this way, through everyday gestures, they can contribute to a significant change in the rules and patterns of production and consumption in society.

The public authorities have the responsibility to dictate rules to ensure that the economy is sustainable, supportive and respectful of human rights, but it is individual consumers who do or do not opt for a responsible way of consuming.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3.3 What is responsible consumption?

Responsible consumption or conscious consumption is a model of purchasing goods and services advocated by various ecological, social and political organisations. Its central precept is the adoption, as consumers, of a commitment to the labour, ecological and moral conditions behind the production of what is consumed.

Put more simply, responsible consumption proposes that, when it comes to consumption, humanity should opt for goods and services whose manufacture complies with certain ethical parameters, and not simply for the cheapest product.

Broadly speaking, the idea is not to consume products whose manufacturers and marketers fail to meet minimum requirements in terms of environmental conservation, worker welfare and socio-economic equality. It is based on the idea that buyers are also jointly responsible for maintaining a specific production model. In other words, by consuming, we would be voluntarily or involuntarily perpetuating a way of doing things that harms people and the ecosystem.

Responsible consumption thus advocates a less passive attitude on the part of consumers, who could exert selective pressure on certain companies and industries by means of boycott strategies, i.e. by ceasing to buy their products and/or services. To this end, the slogan "buying is voting" is often used to tell consumers that they should not buy anything from unscrupulous people who would never vote to govern their own country.

The origins of responsible consumption

Responsible consumption arose as a counterpart to the consumerism unleashed during the 20th century, and the industrial transnationalisation that preceded globalisation; two phenomena that brought huge dividends to big capitalists, who privileged profitability over social justice and the preservation of the environment. The effects of this way of doing things became apparent after a certain period of time. On the one hand, economic, social and labour inequalities within countries increased. On the other hand, worldwide, climate change and the massive loss of biodiversity on planet Earth accelerated. As this happened, what were initially isolated and local demands by groups with little political and media power began to gain notoriety.

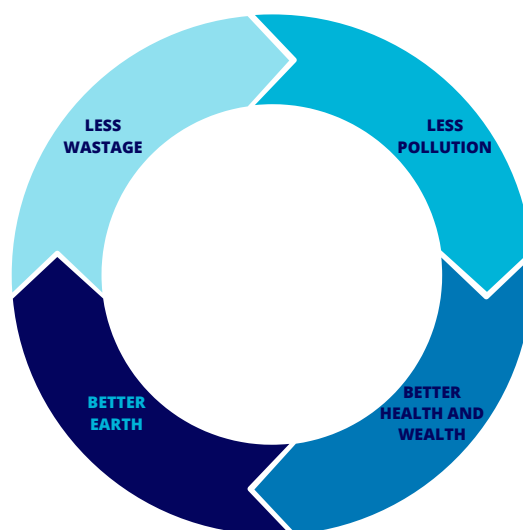
Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

The 1998 UNDP Human Development Report warned that the current model of industrial development is unsustainable over time, both in human and ecological terms. Moreover, the 1992 Rio Earth Summit had already agreed on the need to promote environmentally friendly consumption initiatives that would meet the basic needs of the majority of humanity. Since then, the concept of responsible consumption has continued to gain ground, although there are also those who oppose it or simply consider it utopian.

Benefits of responsible consumption

- Encourage a more equitable distribution of the world's wealth, given that currently 1% of the population accumulates 82% of the world's total wealth.
- Promote a work culture that sees workers as dignified human beings, endowed with rights, whose work should reward them and offer improvements in their quality of life, not simply subject them to exploitative conditions.
- Encourage respect for the delicate environmental balance, allowing renewable resources to be replenished at a sustainable rate, and managing within limits of pollution and exploitation that allow life to subsist and do not threaten global biodiversity.
- Force big transnational capital to review their business policies and to fight in ethical terms to win over their clientele, instead of applying monopolistic criteria or simply flooding the market with advertising and unfair competition.
- Enable the construction of a sustainable development model in the short, medium and long term.

Figure 1. Linkages of Responsible Consumption



Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

As an example of responsible consumption, let us cite some practical guidelines or principles from the point of view of an ordinary consumer:

1. Before consuming, question whether the product or service is really necessary or whether it is a superfluous expense whose benefits do not outweigh the global damage that its manufacture is likely to have entailed.
2. Inform yourself about companies, find out which ones make efforts to conduct their business in an environmentally and socially responsible way, and prefer their products to those of companies that do not.
3. Reject excess plastic: plastic bags, straws, cutlery, plates, cups, packaging, etc., to the minimum necessary, and opt for biodegradable substitutes if available. Also, reusable containers can be carried when shopping.
4. Where possible, apply the three R's of ecology: reduce, reuse and recycle.
5. Separate waste into biodegradable and recyclable, and prioritise returnable packaging over disposable.
6. Do not consume products that have been tested on animals or produced through human exploitation or animal abuse.

Irresponsible consumption

In contrast to responsible consumption, irresponsible consumption is the individual's choice not to be aware of or simply to ignore the ethical implications of buying a product or service, if not simply to resign oneself to the fact that the world is like this. It is a model of consumption that privileges the ephemeral welfare of consumption, without caring about what happens during the production chain of what they buy: how many human beings worked under inhumane conditions to make it, how many non-renewable natural resources were exploited to make it, and to what extent the environment was harmed in doing so. Irresponsible consumption may be a happier, more carefree form of consumption, but it is also an immoral, unsustainable form in the medium term.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3.4 Sustainable and responsible food

Responsible nutrition refers to healthy food, i.e. food that is suitable for disease prevention and environmentally friendly. Poor nutrition can reduce immunity, increase vulnerability to disease, impair physical and mental development and reduce productivity.

Food choices are very important for good health. A balanced diet is therefore essential for a healthier life, taking into account that we need a sufficiently varied diet that guarantees nutritional intake, adapting it to the characteristics of age, sex, physical exercise, possible illnesses, etc. To this end, it is vitally important:

- To consume foods rich in different nutrients, limiting the intake of saturated fats, cholesterol, sugar, salt and alcohol.
- Maintain an adequate weight, reducing calorie intake and increasing frequent physical exercise, limiting the consumption of sweet drinks, alcoholic beverages, sweet foods and foods rich in saturated fats and promoting the consumption of foods rich in fibre.
- Eating sufficient quantities of fish, consuming oily fish with some frequency.
- Consume sufficient quantities of fruit and vegetables, choosing them in a varied and seasonal way.
- Eat dishes made with pulses at least once a week.
- Be especially careful with the intake of saturated fats, cholesterol and the so-called trans-fatty acids, being important the sources of monounsaturated and polyunsaturated fatty acids such as fish, nuts, olive oil, etc.
- Prepare food with little salt, limiting sodium and promoting potassium in your diet (fruits and vegetables).
- If you consume alcohol, do so in moderation, although it should be noted that alcohol intake is not recommended, especially in minors, and in people who carry out risky activities or those that require attention or coordination..

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

Achieving a responsible and sustainable diet necessarily involves taking into account a number of aspects.

1. According to the WHO, a large part of illnesses are due to environmental causes, including eating habits. In addition, it points out five keys to safer food: **keep clean, separate raw and cooked, cook thoroughly, keep food at safe temperatures, use safe water and raw materials.**

Figure 2. Keys to safer food

Five keys to safer food

Keep clean

- Wash your hands before handling food and often during food preparation
- Wash your hands after going to the toilet
- Wash and sanitize all surfaces and equipment used for food preparation
- Protect kitchen areas and food from insects, pets and other animals

Why?
While most microorganisms do not cause disease, dangerous microorganisms are widely found in soil, water, animals and people. These microorganisms are carried on hands, wiping cloths and utensils, especially cutting boards and knives. The slightest contact can transfer them to food and cause foodborne disease.

Separate raw and cooked

- Separate raw meat, poultry and seafood from other foods
- Use separate equipment and utensils such as knives and cutting boards for handling raw foods
- Store food in containers to avoid contact between raw and prepared foods

Why?
Raw food, especially meat, poultry and seafood, and their juices, can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.

Cook thoroughly

- Cook food thoroughly especially meat, poultry, eggs and seafood
- Bring soups and stews to boiling to make sure that they have reached 70°C. For meat and poultry make sure that juices are clear, not pink. Ideally use a thermometer
- Reheat cooked food thoroughly

Why?
Proper cooking kills almost all dangerous microorganisms. Studies have shown that cooking to a temperature of 70°C can help ensure it is safe for consumption. Foods that require special attention (spices, red meat, seafood, large joints of meat and whole poultry).

Keep food at safe temperatures

- Do not leave cooked food at room temperature for more than 2 hours
- Refrigerate promptly all cooked and perishable food (preferably below 5°C)
- Keep cooked food piping hot (more than 60°C) prior to serving
- Do not store food too long even in the refrigerator
- Do not thaw frozen food at room temperature

Why?
Microorganisms can multiply very quickly if food is stored at room temperature. By heating at temperatures below 5°C or above 60°C, the growth of microorganisms is slowed down or stopped. Some dangerous microorganisms still grow below 5°C.

Use safe water and raw materials

- Use safe water or treat it to make it safe
- Select fresh and wholesome foods
- Choose foods processed for safety, such as pasteurized milk
- Wash fruits and vegetables, especially if eaten raw
- Do not use food beyond its expiry date

Why?
Raw materials, including water and soil, may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and mouldy foods. Care in selection of raw materials and simple measures such as washing and peeling may reduce the risk.

Food Safety World Health Organization

Knowledge = Prevention

Source: World Health Organization

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

2. By shortening the distance between the place of production of a product and the place of consumption, a number of benefits are brought to:

- **For the environment:** less packaging, lower environmental cost of transport, less pollution, etc.
- **For society:** boosting the local economy, promoting employment at regional level, investing in local infrastructure and preserving local culture and customs.

3. With regard to the establishments where the products are put on sale, the following should be borne in mind:

- Avoid those that do not comply with health regulations.
- The products should be kept in perfect condition (discard: dairy products and fish exposed to high temperatures, eggs with broken shells, etc.).
- Go to local shops, such as market squares or food markets, and carefully read the labelling of food products.
- Opt for seasonal products, avoiding processed food products. Also consider food products with designation of origin, as well as products from organic agriculture and livestock farming that restrict the use of fertilisers or pesticides, do not use genetically modified organisms, avoid pollution and respect animal and plant life in balance with the environment.
- Particular caution should be exercised with transgenic products (those that have been genetically modified). The label on these products should indicate this fact.
- Whenever possible, buy products from ***fair trade***, which guarantee, among other things:

- The practice of gender equality.
- The non-use of child labour.
- Equal and long-term contracts.
- The establishment of fair and equitable wages.
- Ensuring decent working conditions.
- The protection of the environment in their activity.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3.5 Measures related to the prevention and reduction of food waste

Food waste can be defined as those agricultural and food products discarded from the food chain that are still perfectly edible and suitable for human consumption and, in the absence of possible alternative uses, end up as waste.

Food waste has become a global concern and is generated at different stages along the entire food chain, from primary production to consumption. Tackling the problem therefore requires action at all these stages, both in prevention and in the reuse of those that are inevitably generated.

European Union countries have committed to meet the United Nations Sustainable Development Goal of halving per capita food waste at retail and consumer level by 2030. Food loss and waste is a global challenge. According to the Food and Agriculture Organisation of the United Nations (FAO), around one third of all food produced in the world is lost or wasted at some point in the agri-food chain, between the producer and the consumer. In the EU, this amounts to around 87.6 million tonnes of food every year.

The European Union and its Member States have taken concrete measures to prevent food loss and waste. Only when this is not possible do they take measures to reuse, recycle or use food for other purposes. The principles guiding this policy are enshrined in the EU Waste Framework Directive, which calls on Member States to:

- Reduce the amount of food lost during production and distribution,
- Reduce food waste in households,
- Encourage food donation,
- Monitor and evaluate the implementation of EU measures to prevent food waste.

In addition, the Council committed itself to a number of initiatives to:

1. Better monitor food waste.
2. Raise public awareness.
3. Improve the understanding and use of "best-before" and "best-before" labels.
4. Facilitate the donation of food products of unsold food products to charities.

Other measures to reduce food loss and waste include the re-use of surplus food, e.g. as feed or compost.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3.6 Healthy eating and Agroecology

Eating is not the same as feeding. What we eat determines our health or illness, but also our intelligence, resources and opportunities. The current industrialised and globalised food model makes it increasingly difficult to access fresh, healthy, seasonal, local food, grown in fertile soil and harvested at its optimum point of ripeness.

Essential nutrients are compounds that the body can not make, or can not make in sufficient quantity. According to the World Health Organization, these nutrients must come from food, and they're vital for disease prevention, growth, and good health. They are structured around two categories:

- **Macronutrients:** are eaten in large amounts and include the primary building blocks of your diet — protein, carbohydrates, and fat — which provide your body with energy.
- **Micronutrients:** Vitamins and minerals, eating in small doses go a long way.

There are six main groups of [essential nutrients](#):

1. **Protein:** 15 percent of daily food. Half of which are of vegetable origin. They help to build cells and organs. A startling 16 percent of the average person's body weight is from protein.

Healthy sources

While meat, fish, and eggs are good sources of essential amino acids, you can also get protein from plant sources like beans, soy, nuts, and some grains. Exactly how much protein you need daily depends on a variety of factors including how active you are, and your age.

2. **Carbohydrates:** should make up 45 to 65 percent of your total daily calories. They are necessary for a healthy body and provide energy for daily activity.

Healthy sources

Some carbs are healthier than others. Opt for whole grains, beans, and fiber-rich vegetables and fruits instead of refined grains and products with added sugar.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3. Fats preferably unsaturated and polyunsaturated: 25 percent of the daily food. They help the metabolism, the assimilation of vitamins and provide energy.

Healthy sources

The most famous unsaturated fats are omega-3 and omega-6 fatty acids. You can find these healthy fats in nuts, seeds, fish, and vegetable oils (like olive, avocado, and flaxseed).

Avoid trans fats and limit your intake of saturated animal-based fats like butter, cheese, red meat, and ice cream.

4. Vitamins: Necessary for the correct functioning of the organism and protection against diseases. There are 13 essential vitamins that the body needs to function properly, including vitamins A, C, B6, and D.

Healthy sources

If you eat a varied, well-balanced diet full of vegetables and fruits, and have a normal and healthy functioning digestive tract, you likely don't need to take vitamin supplements.

5. Minerals: They are the basis of bones, teeth and blood. They come mainly from fruits and vegetables. Some of the most common minerals are calcium, iron, and zinc.

6. Water: About 62% of our body weight is water. Improves our brain function and mood. It acts a shock absorber and a lubricant in the body. It also helps flush out toxins, carry nutrients to cells, hydrate the body, and prevent constipation.

Healthy sources

It is recommended to drink at least two litres of water a day.

Fruits and vegetables can also be a great source. Munch on some spinach or watermelon to stay hydrated.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

FOOD QUALITY

The quantity and quality of nutrients depend on the fertility of the soil, the way they are produced, the time they are harvested and the length of time they are stored. It is not the same to produce healthy food to feed local people (peasant agriculture) as it is to produce profitable food commodities for the world market.

- **LOW QUALITY NUTRIENTS AND UNHEALTHY DIETS**

White and refined HC without bran and germ. They do not provide B vitamins and fibre, but excess gluten. They provide empty calories that cause intolerances and autoimmune reactions.

Proteins from livestock farming with confined, overcrowded, mutilated and stressed animals. Rapid growth through high-yield transgenic feed, antibiotics and hormones.

Trans fats and trans fats. Meat from industrialised livestock has more fat and less protein because of the sedentary lifestyle and type of feeding and more toxins because of animal suffering.

- **HIGH QUALITY NUTRIENTS AND HEALTHY FOOD**

Plenty of organic, seasonal, freshly picked fruit and vegetables.

Wholegrain cereals fermented with mother yeast, lactic fermentation pre-digests the wholegrain parts, breaks down the long gluten chain and produces a more digestive bread that takes care of our intestinal flora.

Legumes combined with whole grains and vegetables. They provide high value vegetable protein, bioavailability and abundant fibre.

High-quality unsaturated fats from nuts, oily fish, seeds and cold-pressed extra virgin olive oil.

THE INTERNATIONAL FOOD (DIS)ORDER

The current food (dis)order is due to the commodification, industrialisation and globalisation of food. Multinationals control the food supply and condition the social regulation of food production, distribution and consumption, the Food Sovereignty of the people and the access to the fundamental right to healthy and sufficient food. Through advertising, the population's consumption habits are modified.

The Mediterranean diet - rich in seasonal fruit and vegetables, bread and wholegrain cereals, pulses, extra virgin olive oil, nuts and dried fruits and discrete amounts of dairy products, fish and meat - has been displaced by an industrialised and globalised diet, based on:

a) an excess of processed foods and drinks laden with sugar, refined flours, salt, meat, trans fats, preservatives, colourings, flavourings and alcohol.

b) a deficit in fresh fruit and vegetables, wholegrain cereals, pulses, nuts and dried fruits and water.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

WHAT IS AGROECOLOGY?

According to the definition of the Food and Agriculture Organization of the United Nations (FAO), agroecology is a scientific discipline, a set of practices and a social movement. As a **science**, agroecology studies how the different components of the system interact. On the other hand, it can draw on many of the **practices** of organic farming, permaculture or biodynamics for its implementation. And, as a **social movement**, it seeks to put into practice a series of social processes capable of generating positive synergies that achieve human development through the strengthening of the local economy.

It seeks to optimise the interactions between plants, animals, humans and the environment, while addressing the need for socially equitable food systems in which people can choose what they eat, how and where it is produced.

FAO developed the 10 Elements of Agroecology framework to help countries foster transformative change. The 10 elements are interrelated and interdependent and represent a simplified but holistic way of thinking about reality.

Figure 3. The 10 elements of Agroecology Framework



Source: FAO's Official images

- **Diversity:** Diversification is essential in agroecological transitions to ensure food security and nutrition while conserving, protecting and enhancing natural resources.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

- **Co-creation and sharing of knowledge:** Agricultural innovations respond better to local challenges when they are co-created through participatory processes.
- **Synergies:** Creating synergies enhances key functions of food systems, which supports production and multiple ecosystem services.
- **Efficiency:** Innovative agroecological practices produce more using fewer external resources.
- **Recycling:** recycling more means agricultural production with lower economic and environmental costs.
- **Resilience:** Improving the resilience of people, communities and ecosystems is fundamental to achieving sustainable food and agricultural systems.
- **Human and social values:** Protecting and enhancing livelihoods, equity and social well-being is fundamental to achieving sustainable food and agricultural systems.
- **Food culture and traditions:** By supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining healthy ecosystems.
- **Responsible governance:** Achieving sustainable food and agriculture requires the adoption of accountable and effective governance mechanisms at different scales, from local to national to global.
- **Circular and solidarity economy:** Circular and solidarity economies that reconnect producers and consumers offer innovative solutions for living within the limits of our planet and, at the same time, strengthen the social foundations for inclusive and sustainable development.

AGROECOLOGY AND SUSTAINABLE DEVELOPMENT GOALS

Agroecology is a key response to ensure healthy, nutritious and sufficient food that respects human rights and the environment, in line with the following goals of the 2030 Agenda for Sustainable Development:

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.



- **No Poverty:** helps boost the livelihoods of family farmers and reduces rural poverty by reducing farmers' dependence on external inputs, subsidies and volatile market prices.



- **Zero Hunger:** promotes local, stable and diverse diets with year-round integrated production of healthy and nutritious food.



- **Gender Equality:** applies solidarity practices through collective action to reduce gender inequality.



- **Decent Work and Economic Growth:** offers innovative solutions and decent employment for young people.



- **Reduced Inequalities:** contributes to the realisation of the right to food by advocating for a people-centred approach and for the most vulnerable.



- **Climate Action:** helps to protect, restore and enhance agricultural and food systems against climate shocks and stressors.



- **Life on land:** maintain and enhance natural functions and ecosystem services.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

3.7 Conclusion

In Spain, more than 60% of the energy consumed per inhabitant comes from foods laden with sugar, salt and preservatives, and malnutrition increases the risk of suffering from diseases such as overweight, obesity, heart disease, diabetes, metabolic syndrome, cancer, musculoskeletal disorders, immunodeficiencies and psychosocial disorders. Hunger and junk food compete for the first place in preventable diseases and deaths, either due to malnutrition or due to excess and toxicity of industrialised food.

Healthy food and agro-ecological food are one and the same thing.

Human food security and ecosystem health are interrelated and interact through soil microbiota, fermented foods and our gut flora. The health of people, society and nature depends on soil fertility, agro-ecological food production, responsible consumption and short distribution chains.

Food is a process whose stages (production, circulation and consumption) mutually engender each other. Agroecological production needs responsible consumption and vice versa. Likewise, Agroecology and Responsible Consumption need distribution, logistics and transport congruent with their principles. Agroecological Food requires cooperation - and not competition - between all links in the food chain.

Chapter 3: Motivating, inspiring and training the community to engage: motivating individuals and businesses to properly pre-select the waste.

REFERENCES

Fernández de Pinedo, C. (2001). Good environmental practices manuals. Government of Navarre (Spain).

Ministry of Agriculture, Fisheries and Food of Spain. (2020). Redistribution and Distribution of food entities in Spain.

Bringel, B. (2011). Food Sovereignty: The Practice of a Concept.

Närvänen, E., Mesiranta, N., Mattila, M., Heikkinen, A. (2020). Introduction: A Framework for Managing Food Waste. In: Närvänen, E., Mesiranta, N., Mattila, M., Heikkinen, A. (eds) Food Waste Management. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-20561-4_1

Bello, A., Jordá, C., Tello, J. (2010). Agroecology and organic production

Guzmán, G. I., Sevilla, E.; Gónzales, M. (2000). Introduction to Agroecology as sustainable rural development.

Web:

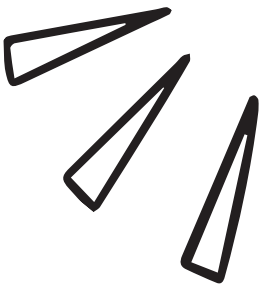
- www.fao.org/3/a-l6583.e.pdf
- <https://sostenibleosustentable.com/es/economia-verde/ejemplos-consumo-responsable-sostenible/#definicion-consumo-responsable-que-es>
- <https://concepto.de/consumo-responsable/#ixzz7UqoArkpG>
- [https://www20.gencat.cat/docs/arc/Home/LAgencia/Publicacions/Centre%20catala%20de%20reciclatge%20\(CCR\)/guia_consum_responsable_ES.pdf](https://www20.gencat.cat/docs/arc/Home/LAgencia/Publicacions/Centre%20catala%20de%20reciclatge%20(CCR)/guia_consum_responsable_ES.pdf)
- https://food.ec.europa.eu/safety/food-waste/eu-actions-against-food-waste_en
- https://ec.europa.eu/commission/presscorner/detail/es/MEMO_16_3989
- <https://www.fao.org/fao-stories/article/en/c/1309609/>
- <https://www.aesan.gob.es/AECOSAN/web/>
- <https://www.healthline.com/health/food-nutrition>
- <https://www.fao.org/agroecology/>



CHAPTER 4



**SHIFTING TO DIGITAL
SOLUTIONS TO REDUCE
FOOD WASTE**



Chapter 4: Shifting to digital solutions to reduce food waste

4.1 Introduction

Food waste is defined as “food which is fit for consumption but discarded by choice or because it has spoiled or expired” (Martin-Rios, Hofmann, & Mackenzie, 2020). In this definition, ‘food’ can refer to processed, semi-processed or raw products that are edible and are produced for human consumption (Martin-Rios et al., 2020). Currently, one-third of all food produced for human consumption is discarded as waste (International Telecommunication Union, 2021). Moreover, the amount of food wasted is increasing each year, and this increase is estimated to reach one-third (33%) by 2030. This will correspond to 2.1 billion tons of wasted food per year, equivalent to 66 tons per second. However, we do not need to look into the future to see the effects of food waste. In 2020, 26% of global greenhouse emissions resulted from the food industry alone, 6% of which resulted from food waste (Martin-Rios et al., 2020).

The problem of food waste raises serious ecological concerns as well as socio-economic ones. A paradox exists where more than 2 billion people on Earth do not have consistent access to safe, nutritious food, or food which is even enough for survival. This number includes 8% of the North American and European populations (Martin-Rios et al., 2020).

Meanwhile, vast amounts of food are wasted mainly as a result of overconsumption. It is predicted that by 2050 the world population will reach 9.9 billion. This increase will have to be met by a corresponding increase of 60% in agricultural production to meet the growing demand for food, and other needs (Martin-Rios et al., 2020). Therefore, the problem of food waste cannot be separated from the general problem of global food crises, given its paradoxical nature where “food scarcity coexists with excessive consumption” (Martin-Rios et al., 2020).

Chapter 4: Shifting to digital solutions to reduce food waste

4.2 Relying on technology that facilitates demand/supply

There are numerous techniques and technologies that can be used to facilitate food demand and supply across all stages of the food system. These are outlined in the table below.

	Production	Processing & Packaging	Distributing & Retailing	Consumption & Disposal
Techniques	<ul style="list-style-type: none"> • Fermentation of organic waste mixed with food waste (to produce fertilisers or insect repellents) • Hydroponics 	<ul style="list-style-type: none"> • Cold Chain 	<ul style="list-style-type: none"> • Cold Chain 	<ul style="list-style-type: none"> • Insulated bags or containers during transportation • Lowering refrigerator temperatures
Technologies	<ul style="list-style-type: none"> • Vertical and Urban Farming • Biogas technology • Genetic Modification and Cultured Meats • Applying 3D Printing Technology to Food • Internet of Things • Automation of skills and workforce • Data-driven farming • Chatbots • Drone technology • Blockchain technology • Nanotechnology 	<ul style="list-style-type: none"> • Sustainable Packaging: Bioplastics • Active Packaging • Smart Packaging (e.g. gas sensors) • Smart Labelling (e.g. dynamic pricing) 	<ul style="list-style-type: none"> • Web-based platforms (FoodSHare, EatCloud) • Vacuvita • Smart Bin • Smartphone apps enabling food-sharing and redistribution; NoFoodWasted, Too Good To Go, Imperfect Foods (sharing for money), FoodCloud, No Food Waste (sharing for charity), OLIO (sharing for the community) 	<ul style="list-style-type: none"> • Vacuvita (household vacuum storage system) • Community refrigerators • Smart Fridge • Modular Fridge (PRESENTA) • Smart Bin • Reminder and Food-Storage Apps (FoodTrek App, CozZo, MyKura) • Integrated Consumer Apps - Food Planning, Shopping, Storage, Recipes (Evocco, AnyList, Magic Fridge, Empty the Fridge, NoWaste) • Smartphone apps enabling food-sharing and redistribution; NoFoodWasted, Too Good To Go, Imperfect Foods (sharing for money), FoodCloud, No Food Waste (sharing for charity), OLIO (sharing for the community)

Chapter 4: Shifting to digital solutions to reduce food waste

Cold Chains

Cold chains refer to supply chains that make use of refrigeration to preserve or improve the shelf life of products. A cold chain in the food industry begins soon after a product is harvested and goes through all stages of the food system up until when the product is sold. Cold chains are essential, especially during the transport and distribution of fresh food, which is responsible for substantial food waste and food-borne illnesses (United Nations Environment Programme, 2021).



Figure 1. Cold Chain Management in the food industry. (Source: <https://www.thedailystar.net/cold-chain-can-save-food-supply-chain-41858>)

However, much of the cooling equipment used currently in cold-chain systems use chemicals or 'refrigerants', which contribute significantly to global warming, and depend on the generation of energy using fossil fuels (United Nations Environment Programme, 2021). This fact calls for a more sustainable and energy-efficient redesign of cooling equipment. The Kigali Amendment is providing such an opportunity of redesigning cooling equipment to the Montreal Protocol (United Nations Environment Programme, 2021). The Kigali Amendment aims to reduce the use of Hydrofluorocarbons (HFCs), which are used as refrigerants, with the goal of cutting the consumption of HFCs by 80% by 2047 (United Nations Environment Programme, 2021).

Chapter 4: Shifting to digital solutions to reduce food waste

Consumption and Disposal

Current food transportation and storage methods greatly reduce food life span and therefore increase food waste. Sometimes food can be wasted at the consumption stage during transportation by consumers. One study shows that temperatures for meat and yoghurt during this phase often increased above 6°C (Mercier et al., 2019). One suggestion to avoid the spoilage of fresh food during transportation by consumers is to use insulated bags or containers (Mercier et al., 2019). The temperature issue extends beyond transportation to storage as well. A study in the UK suggests that lowering the temperature of refrigerators from an average of 7°C to 4°C would save about 71,000 tons of food annually. This would amount to £162.9 million and 270,000 tonnes of CO₂e (carbon dioxide equivalent) emissions (Brown et al., 2014).

Within the household, a refrigerator dictates the size and frequency of grocery shopping and the foods' freshness and accessibility. It can influence the consumption of stored food and subsequently can allow for responsible budgeting (Waitt & Phillips, 2016). Therefore, a refrigerator's design plays an important role in how its contents are ordered and, subsequently, how much food will be discarded.

One technology, that is available but inaccessible for low-income and middle-income households, is the smart fridge. A smart fridge includes standalone cameras in its interior that enable the user to access images of the interior of the fridge to allow for better planning while shopping (United Nations Environment Programme, 2021). Similarly, though not yet commercially available, the smart bin is also equipped with cameras and scales that monitor the waste thrown inside the bin. By combining image or object recognition and machine learning, data on the amount and type of waste is recorded and displayed on a smartphone (United Nations Environment Programme, 2021). Additionally, off-grid-technology community refrigerators, for example, solar refrigerators, can lower costs per household and reduce food waste – as they sometimes act as food redistribution 'centres' – while preserving food in a sustainable manner (United Nations Environment Programme, 2021).

Though not a refrigerator, another technology, which is also less financially accessible for most households in low-income and middle-income countries, is the 'vacuvita' (United Nations Environment Programme, 2021). The 'vacuvita' is a vacuum storage system for household use which improves the lifespan of food by protecting it from moisture and oxygen. It also includes an app that informs the user of the remaining shelf-life of stored foods (United Nations Environment Programme, 2021).

Chapter 4: Shifting to digital solutions to reduce food waste

Finally, the modular fridge is another technology that is not yet commercially available, at least extensively. However, this could prove more useful for low-income and middle-income households than the smart technologies mentioned above. A prototype of this modular fridge, called 'PRESENTA', is comprised of detachable, folding, and rotating shelves that make up a modular storage system enabling the user to easily access all the contents of the fridge without having to remove anything (McNulty-Kowal, 2020). PRESENTA seeks to optimize storage and the ease of cleaning as well as to improve accessibility of contents. It also includes a color-coded signal which notifies the user when the contents have not been checked for longer than 24 hours (McNulty-Kowal, 2020).

The PRESENTA modular fridge prototype confirms the hypothesis proposed by some authors (Waitt & Phillips, 2016) (Dobernig & Schanes, 2019) that practices of placing, rotating, assessing, and cleaning of foods and leftovers in the refrigerator are essential in reducing food waste. According to Waitt and Phillips (2016), mundane practices, applied in the daily routine like ordering the contents in one's fridge, relate to people in "material, visceral, affective ways". This results in consumers treating food waste as more than a personal or structural problem (Waitt & Phillips, 2016). The 'PRESENTA' modular fridge prototype proves that technology and design can help overcome the possible lack of knowledge among consumers regarding the correct handling and storing of food (Dobernig & Schanes, 2019).

Farming

There are numerous techniques and technologies that can facilitate the demand and supply of food, and which can be used at the production level of the food system. The examples of such techniques and technologies discussed here include fermentation, hydroponics, vertical farming, genetic modification and cultured meats.

Firstly, fermentation is a type of biotechnology that combines organic matter with microorganisms to promote chemical reactions through decomposition releasing natural fertilisers and insect repellents (United Nations Environment Programme, 2021). An interesting case of implementing fermentation as a food waste solution can be seen in Bangkok. Local market operators in the city have introduced a reward system that incentivizes vendors to collect and return their waste. Through this process, food waste is reduced, as food that would be discarded, is turned into fertilizers and insect repellents instead (United Nations Environment Programme, 2021).

Chapter 4: Shifting to digital solutions to reduce food waste

Another farming technique that can facilitate the demand and supply of food is hydroponics. Using the hydroponics methods, plants are grown without soil. Instead, mineral nutrients are provided in an aqueous solution (a water solvent). This method does not rely on land, soil, or fossil fuels since it makes use of solar energy (De Clercq, Vats, & Biel, 2018). The purpose of this method is to use every possible nutrient that derives from the drip system's upper sector, as described in Figure 2.

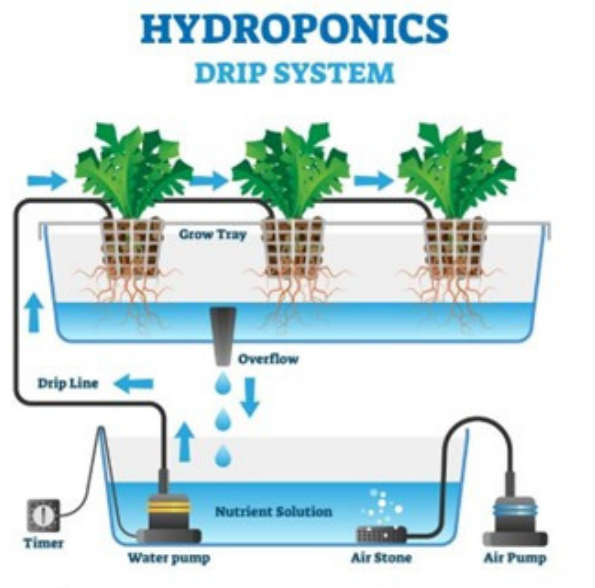


Figure 2. Hydroponics Drip System (Source: Aggarwal, 2021)

Furthermore, vertical farming is a relatively new technology/technique which is being implemented in urban settings. This method involves growing plants vertically, thus taking up less land surface. The method also uses 95% less water, fertilisers, and nutritional supplements compared to conventional methods, and no pesticides (De Clercq et al., 2018). This method uses controlled temperatures as plants are stored in large rooms so that they can remain fresh longer than imported food, making them a more beneficial source of food.

Various new and innovative technologies are used for food production. Many scientists are experimenting with 3D printing, trying to make meat from cow cells, Internet of Things (IoT) technologies and genetic modification, as all these methods can be applied to food production (De Clercq et al., 2018). Processing and correlating structured and unstructured data can provide useful and valuable insights into food production. This will likely result in the automation of skills and workforce where management, operations, and processes will be automated as it is projected that more than two thirds of the world

Chapter 4: Shifting to digital solutions to reduce food waste

population will live in urban areas by 2050 (United Nations, 2014), resulting in the reduction of workforce in rural areas.

These technologies point to the direction of traditional farming being replaced by data-driven farming, where a collection of data, including weather data, seed types, soil quality, the probability of plant diseases, historical data, marketplace trends, and pricing (De Clercq et al., 2018). Data-driven farming or smart farming helps farmers decide more informedly and thus accurately, while the outcome of this innovative method is beneficial for farmers and for the environment.

Blockchain technology can also be used in the production stage of the food system, specifically in agricultural transactions. This can reduce inefficiencies and the ease and likelihood of committing fraud, as well as improve farmers' pay and transaction times. Most importantly, however, blockchain technology provides improved traceability of products in supply chains, which allows regulators to identify the source of contaminated foods very quickly and determine the extent of further contamination of other products during such incidents (De Clercq et al., 2018). Moreover, this technology can identify and resolve disruptions or delays in the supply chain that contribute to food loss (De Clercq et al., 2018).

Finally, it is suggested that nanotechnology will, at some point, be used for precision farming (Duhan, Kumar, & Kumar, 2017). Conventional fertilisers, pesticides and herbicides will be delivered to plants via nanocapsules only in the precise amounts (dosages) needed, in slow, more sustainable processes (De Clercq et al., 2018).

Processing and Packaging

Several technologies and techniques are being explored and implemented in the processing and packaging stage of the food system too. These include bioplastics, sustainable, active, and smart packaging technologies, smart labelling technologies, gas sensors, and dynamic pricing techniques.

One sustainable packaging technology is bioplastics. A bioplastic is a compostable and recyclable type of plastic produced from renewable biomass material. This type of plastic is useful because when it will be disposed of, it can be decomposed without any toxic residue, and from it, a plant can grow (De Clercq et al., 2018). Additionally, active packaging refers to packaging systems that make use of materials that release active substances to preserve foods and ensure longer shelf life and better quality of food. (United Nations Environment Programme, 2021).

The active packaging result is less food waste, as described in Figure 2.

Chapter 4: Shifting to digital solutions to reduce food waste

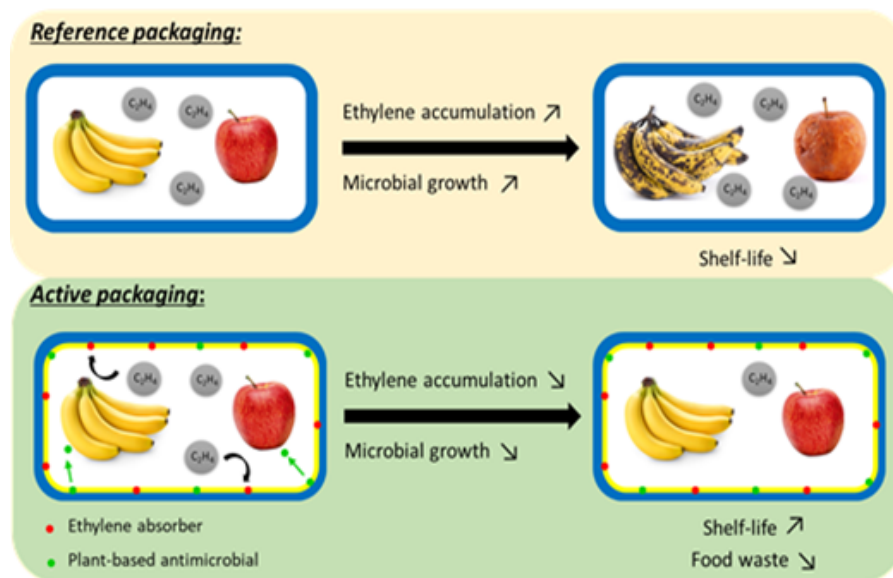


Figure 3. Active Packaging (Celabor, 2021)

Smart or intelligent packaging refers to packaging systems that monitor the quality of packaged products and share relevant and important information about the status of the packaged food with retailers or consumers (United Nations Environment Programme, 2021). Smart packaging makes use of

- sensors such as gas sensors detecting changes in CO_2 or H_2S due to biological reactions inside the packaging, and biosensors detecting living organisms such as pathogens,
 - indicators of factors such as time, temperature, gas, pH, and color, and
 - data carriers (e.g. barcode and QR code labels and radio frequency identification tags)
- to monitor, trace and communicate food quality (United Nations Environment Programme, 2021).

Similar to smart packaging, smart labelling technology includes a more detailed body of information that can be accessed by scanning the product's label using a smartphone. This information includes "shelf life, storage instructions, freshness, recipes, allergens and information on origin and sustainability" (United Nations Environment Programme, 2021). Therefore, by providing all this information, smart packaging and labelling provide useful insights to counter food waste by using data technologies to calculate and manage the issue.

Chapter 4: Shifting to digital solutions to reduce food waste

Fresh food transport and distribution

Some technologies mentioned before for the consumption and disposal stage of the food system, specifically, the 'vacuvita', the smart bin, and smartphone apps enabling food-sharing and redistribution can also be used to reduce food waste also at the distributing and retailing stage of the food market. Except for these technologies, however, web-based platforms can also be used to reduce food waste at the distribution and retail levels. Such web-based platforms include FoodSHare and EatCloud.

FoodSHare connects food donors like restaurants, hotels, hospitals, universities etc., and volunteers in order to distribute surplus food to disadvantaged groups. The platform matches donors to potential recipients based on "the type and quantity of food they donate or need, their proximity and timing" (United Nations Environment Programme, 2021).

EatCloud, on the other hand, "connects food manufacturers and retailers with food banks" (United Nations Environment Programme, 2021). Through artificial intelligence, the platform detects when and where food is being wasted so that food manufacturers and retailers can take the appropriate measures to ensure that the food is not discarded. EatCloud automatically identifies the most appropriate recipient for each kind of food ready to be distributed.

4.3 Learning how to use social media for food waste redistribution mechanisms

In all five of the cities examined in the 2021 Report by the United Nations Environment Programme (Bangkok, Belgrade, Bogotá, Doha and Kampala), an urgent need was identified to raise awareness about food waste among consumers and empower them to act towards food waste reduction. The Report includes awareness-raising campaigns on social media, among other actions in a list of effective approaches to educating the public, and kickstarting change in people's behaviors regarding food waste. The purpose of a campaign may not be limited to raising awareness, but also to encourage food donations and urban farming, to share and exchange surplus food and establish temporary food banks.

Such campaigns are often community-led grassroots initiatives advertised via popular social media networks (United Nations Environment Programme, 2021).

Simultaneously, private companies hold the power to inform their customers about food waste minimization via social media, newsletters and on-site messages relating to a given company's sector, including food processing, distribution, retail, and services. Such industry-led initiatives could inform consumers about the company's practices and could ultimately influence consumers' behavior (United Nations Environment Programme, 2021).

Chapter 4: Shifting to digital solutions to reduce food waste

Indeed, a 2018 study found a statistically significant decrease in food waste by consumers when they had been exposed to information by retailers on social media, as with other communication channels such as e-newsletters, in-store magazines and demonstrations, and stickers on food products (Young, Russel, Robinson, & Chintakayala, 2018).

Evidently, social media campaigns along with capacity-building programmes can be effectively applied on a large scale to improve consumers' understanding of food waste as a global crisis, allow them to share their experience and good practices, and thus, change their behaviour towards less food waste and more sustainable food consumption (United Nations Environment Programme, 2021)

Applications

Apart from these technologies, there are also smartphone (or web) applications that can facilitate food demand and/or supply and enable food-waste prevention in households. Smartphone/web applications that prevent food waste can have a range of functions, including

- reminder and food-storage apps,
- integrated consumer apps, and
- food-sharing and redistribution applications (United Nations Environment Programme, 2021).

Reminder and food-storage apps are called so as they alert the users regarding the expiration dates of the food items stored at their home as well as reminders to keep track of this stored food by scanning the product's name and the expiry or best-before date. Additionally, these apps also provide their users with information about the product's weight and price so that users can track their spending and the cost of food wasted in their household. A drawback of these applications is the lack of food product databases which forces the user to add the product's information manually, making these applications not very user-friendly. Some examples of reminder and food-storage apps include CozZo, MyKura, and FoodTrek (prototype) (United Nations Environment Programme, 2021).

Integrated consumer apps provide users with information on the expiry dates, nutritional value, and sometimes the carbon footprint of food products, as well as recipes and shopping lists based on these food products. In this way, consumers can better plan their grocery shopping and food storage and adopt healthier, more sustainable dietary habits (United Nations Environment Programme, 2021). Some of these applications include Evocco (Ireland), AnyList (US), Magic Fridge (France), Empty the Fridge (Belgium), and NoWaste (Denmark) (United Nations Environment Programme, 2021).

Lastly, there are apps and web platforms enabling the reuse of excess food from households, restaurants, and retail, thus decreasing food waste. These apps are, fittingly, called 'food-sharing and redistribution applications' and online platforms. Tools under this category fall under three models of food sharing: 'sharing for money', 'sharing for charity', and 'sharing for the community' (United Nations Environment Programme, 2021).

Chapter 4: Shifting to digital solutions to reduce food waste

The 'sharing for money' model involves businesses aiming to prevent food waste at the retail level while also generating profit. Smartphone apps under this model include NoFoodWasted, Too Good To Go, and Imperfect Foods. For example, Too Good To Go, which is available in a number of European countries, allows consumers to order and collect food from restaurants, cafes, bakeries, and other establishments, that would otherwise be discarded (United Nations Environment Programme, 2021).

Under the 'sharing for charity' model, independent charitable organisations, or companies trace, collect and store large amounts of food surplus from a variety of sources, including consumers, households, parties, retailers, and others, and then deliver the excess food to charities, NGOs, and others, to be redistributed. Apps falling under this model include FoodCloud (Ireland), a social enterprise, and No Food Waste (India), which is a charity organisation. Physical applications of the 'sharing for charity' model are food banks and social supermarkets, which sell food, that would originally be discarded, at discounted prices (United Nations Environment Programme, 2021).

The 'sharing for the community' model involves consumers sharing food with other consumers. The OLIO app, for example, based in the UK and used in 59 countries, allows residents in one area to connect with others in their neighbourhood and the local businesses to share food they have in excess, and that is still edible (United Nations Environment Programme, 2021). Research findings show that, across 19 months between 2017 and 2018, 60% of the 170,000 posts on OLIO about food surplus available for collections were effective. This amounted to approximately 91 tons of food with a retail value between £720,000 to £750,000 that was repurposed by secondary consumers instead of getting discarded as food waste (United Nations Environment Programme, 2021).

4.4 Training underprivileged groups to rely on technology to ensure food security

The first two targets of UN's Sustainable Development Goal 2 are to "[e]nd hunger, achieve food security and improved nutrition and promote sustainable agriculture" (United Nations, n.d.). The World Health Organization (WHO) defines food security as follows: "ensuring access to safe, nutritious and sufficient food for all people all year round, and (...) eradicating all forms of malnutrition" (FAO, IFAD, UNICEF, WFP and WHO, 2021).

According to Shuvo et al. (2022), the main factors widely affecting food security are availability, accessibility, utilization, and stability. Other factors that indirectly affect food security in households include occupation, monthly household income, level of education, family size, and others (Shuvo et al., 2022). Food insecurity can be framed into two categories: mild-to-moderate food insecurity (MMFI) and severe food insecurity (SFI) (Shuvo et al., 2022). According to Shuvo and others (2022), the three indicators determining the degree of food insecurity are anxiety and uncertainty about the household food supply, inadequate quality, and insufficient quantity of food intake.

Chapter 4: Shifting to digital solutions to reduce food waste

The 'sharing for money' model involves businesses aiming to prevent food waste at the retail level while also generating profit. Smartphone apps under this model include NoFoodWasted, Too Good To Go, and Imperfect Foods. For example, Too Good To Go, which is available in a number of European countries, allows consumers to order and collect food from restaurants, cafes, bakeries, and other establishments, that would otherwise be discarded (United Nations Environment Programme, 2021).

Under the 'sharing for charity' model, independent charitable organisations, or companies trace, collect and store large amounts of food surplus from a variety of sources, including consumers, households, parties, retailers, and others, and then deliver the excess food to charities, NGOs, and others, to be redistributed. Apps falling under this model include FoodCloud (Ireland), a social enterprise, and No Food Waste (India), which is a charity organisation. Physical applications of the 'sharing for charity' model are food banks and social supermarkets, which sell food, that would originally be discarded, at discounted prices (United Nations Environment Programme, 2021).

The 'sharing for the community' model involves consumers sharing food with other consumers. The OLIO app, for example, based in the UK and used in 59 countries, allows residents in one area to connect with others in their neighbourhood and the local businesses to share food they have in excess, and that is still edible (United Nations Environment Programme, 2021). Research findings show that, across 19 months between 2017 and 2018, 60% of the 170,000 posts on OLIO about food surplus available for collections were effective. This amounted to approximately 91 tons of food with a retail value between £720,000 to £750,000 that was repurposed by secondary consumers instead of getting discarded as food waste (United Nations Environment Programme, 2021).

Prior to the COVID-19 pandemic, the number of people who went to bed hungry exceeded 820 million, including 110 million people who were living in acute food insecurity (United Nations Department of Global Communications, 2020). The Covid-19 pandemic has further aggravated food insecurity globally, especially with regard to developing countries. The introduction of lockdown measures to mitigate the transmission of the virus led to "a global economic downturn, disruption of supply chains, interruption of social protection schemes, uneven food prices, changes in productivity, altered food environments, and increased economic inequalities" (Singh et al., 2021).

As a case study, Singh and others (2021) examined Nepal because of its socioeconomic problems that affect food insecurity. During their work in Nepal, the researchers noted several issues that cause food insecurity. The two primary reasons are unemployment and increased food prices, followed by household insecurity. Other factors resulting from the lockdown measures included border closure, disruption of transportation, and lack of food stock (Singh et al., 2021).

Chapter 4: Shifting to digital solutions to reduce food waste

Many farmers in Nepal had to resort to either destroying their food stock or selling it at cheaper prices due to disruptions in transportation that prevented these products from reaching the market, while other farmers resorted to selling these products through the black market (Singh et al., 2021). Apart from the aforementioned reasons, climate change is another main reason that causes insecurity (Karki et al., 2021), while coming from a marginal group can cause food insecurity as well (Adhikari et al., 2021).

Non-Technological initiatives

Following the impacts of the COVID-19 lockdown on food security, people in Bangladesh – mainly farmers – took some adaptation strategies to mitigate the severity of their household food insecurity. Some Nepalese who had left their villages to move to cities in Nepal or India, returned to start farming ginger and turmeric on their own (Adhikari et al., 2021).

Farmers in India's Alwar district, Rajasthan, joined groups with other farmers to invest in tube wells where their plots were located, which would have been unaffordable or inefficient for these farmers on an individual basis (Agarwal, 2014). Another similar initiative is machine cooperatives, which invest in large machines that can be hired by farmers (Agarwal, 2014). Similar to both of the above initiatives that have emerged in India is what Agarwal (2014) calls "multipurpose limited cooperation". This initiative involves the cooperation between farmers in crop planning as well as "pooling finances to buy inputs, machinery and crop insurance" (Agarwal, 2014).

An organization in India called 'Annakshetra' tackles food waste by targeting food waste resulting from weddings, parties, restaurants and temples (Agrawal & Nag, 2013). After the surplus food is collected from these donors/events, it is then distributed among disadvantaged communities in Jaipur and Allahabad (Agrawal & Nag, 2013). Annakshetra utilizes the 3R model (reduce, reuse, recycle/compost) to tackle food waste at the post-consumer stage (Agrawal & Nag, 2013). The organization employs a 24-hour helpline that is disseminated among party establishments, caterers and people-consumers of Jaipur, through newspapers, posters, banners and pamphlets. The helpline is intended to serve donors that want to donate high-quality surplus food from a catered event, and after calling the helpline, the Annakshetra van arrives at the specified venue to collect the surplus food as soon as the event ends (Agrawal & Nag, 2013). The surplus food is distributed to the beneficiaries the day after collection.

Chapter 4: Shifting to digital solutions to reduce food waste

Technological initiatives

Both governmental and private actors in Singapore are exploring and developing strategies involving the implementation of technological innovations aimed at enhancing food security. These strategies encompass three main areas: urban farming, processing technology and alternative food sources (Mok, Tan, & Chen, 2020).

Sky Greens, is the world's first commercial vertical farm (Siong 2012; Zimmer 2012). Its first prototype was conceived in 2009, and by 2012 the farm was fully operational (CNN Business, 2012). Sky Greens' vertical farms make use of an "A-Go-Gro" technology (Mok et al., 2020). "A-Go-Gro" technology is used in vertical farming to grow vegetables in six meters tall A-shaped modular towers, each of which consists of between 22 and 26 tiers of growing troughs, which rotate around the aluminium tower frame at a rate of 1mm per second to ensure uniform distribution of sunlight, as well as sufficient airflow and irrigation for all of the plants (Krishnamurthy, 2014). The towers are relatively easy to install and maintain (Krishnamurthy, 2014).

Furthermore, the rotation system is powered by "a unique gravity-aided water-pulley system", which uses only 1 litre of water, which is collected in a rainwater-fed overhead reservoir. The collected water is recycled and filtered before returning to the plants (Krishnamurthy, 2014). This technology has a very low carbon footprint as the energy required to rotate each A-frame is equal to the energy used by one 60-watt light bulb for the same amount of time (Krishnamurthy, 2014). Also, this method consumes fewer fossil fuels compared to traditional farming methods since the target consumers are living in close proximity to the farm, thus requiring much less long-distance transportation (Mok et al., 2020).

In addition, due to its vertical structure, the productivity per unit of cultivated land area is increased. It has been reported that lettuce production can reach 13.8 times higher when grown using vertical farming compared to traditional methods (Mok et al., 2020). Moreover, vertical farming protects crops against seasonal climate changes and natural disasters. Since plants are grown indoors, the ideal conditions necessary for optimal growth, such as heating, lighting, moisture content, humidity and nutrients, are controlled and customized for different crops (Mok et al., 2020). This controlled environment makes multiple harvests within a year possible, unlike traditional farming, which usually leads to only one harvest per year (Mok et al., 2020).

Chapter 4: Shifting to digital solutions to reduce food waste

The limit of traditional farming to only grow one crop at a time is also circumvented in vertical farming, where multiple types of crops can be grown simultaneously on different levels (Mok et al., 2020).

However, because vertical farming is situated inside buildings limiting the plants' access to sunlight, artificial lighting would be required to supplement the farming process. This would require higher energy consumption as well as higher capital and energy costs (Mok et al., 2020). Nevertheless, a solution to this challenge is already being explored by Sustenir Agriculture which also utilises modular towers for vertical farming but with the additional inclusion of light-emitting diodes (LED). LED bulbs consume less energy providing higher brightness suitable for greenhouse agriculture (Mok et al., 2020).

Another method of urban farming is aquaponics. Aquaponics capitalizes on “the symbiotic relationship between fish and plants in a unique combination of recirculating aquaculture system (RAS) and hydroponics in a closed-loop system” (Mok et al., 2020). Whereas conventional hydroponics requires the continuous addition of macro and micronutrients in a nutrient solution, aquaponics supplies fish excrement to plants (Mok et al., 2020).

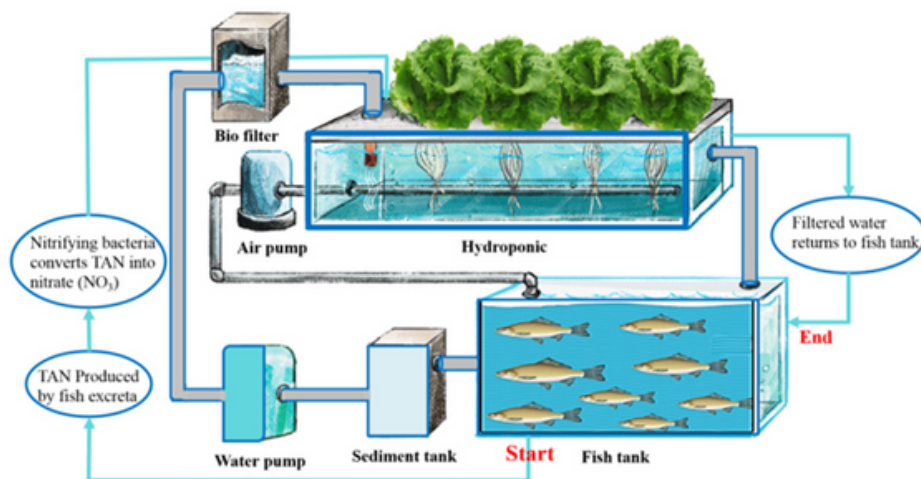


Figure 4. Aquaponics system diagram. (Source: Taha et al., 2022)

Chapter 4: Shifting to digital solutions to reduce food waste

4.5 Engaging policymakers in fighting urban food waste via technology and enabling improved sustainable urban development

One of the targets of the United Nations' Sustainable Development Goal 12 is 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” (United Nations, n.d.). The success of this target is measured using the Food Loss Index, in the food supply chain, and the Food Waste Index, at the retail and consumption stages (One Planet Network, n.d.). It is vital to realise that technologies alone cannot help in reaching the 12.3 target. They should be integrated into policies, regulations and infrastructure to be truly effective (United Nations Environment Programme, 2021).

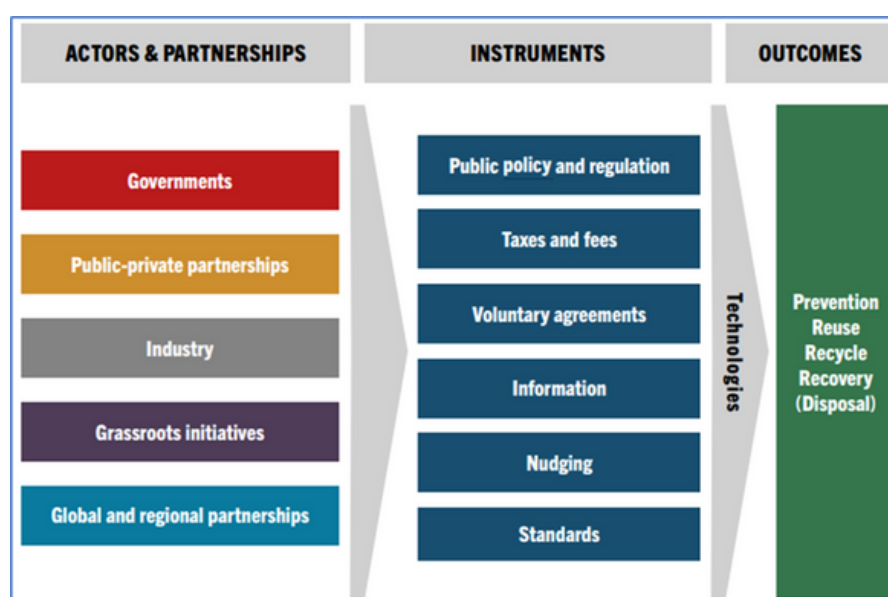


Figure 5. The main components of food-waste interventions: actors and partnerships, instruments, technology as an enabler and accelerator and outcomes. (Source: United Nations Environment Programme, 2021)

However, how can individual citizens, groups, organisations, and entrepreneurs engage policymakers in the fight against food waste via technology for sustainable urban development? Why are companies, especially small-medium enterprises, reluctant in adopting innovative, green technologies and practices? In reality, the adoption of these technologies is often perceived as high-cost and high-risk for individual companies.

Businesses do not recognise the true cost associated with the food waste created due to their products. They often focus on waste-disposal fees imposed by the given government rather than the costs of raw materials wasted, and costs of the production line such as water waste, electricity, and labour.

Chapter 4: Shifting to digital solutions to reduce food waste

Simultaneously, a number of enterprises, especially in the food production stage, find it difficult to recognise how their practices increase food waste at the consumption stage (United Nations Environment Programme, 2021).

Therefore, governments should assume responsibility to set up policies, infrastructure, and financial aid to enable the uptake of new technologies, especially by individual consumers (households), schools, hotels, restaurants, bars and cafes, and SMEs (producers and farmers, small retailers), and resist pressure from various big corporations in the food sector that want to hold on to their unsustainable practices (United Nations Environment Programme, 2021). One business model that should be encouraged via policy is that of 'loop entrepreneurship', which focuses on food re-distribution treating food waste as a resource to generate profit, in turn resulting in generating employment and income, and improving nutrition within the community (United Nations Environment Programme, 2021).

What technologies and practices should local and national governments encourage?

With the support and intervention of governments, there is a higher possibility that industry, public-private partnerships and grassroots initiatives can succeed in their efforts towards sustainable development of the urban food sector (Wunder, et al., 2019; WWF-WRAP, 2020; Uzea, Gooch, & Sparling, 2019). More specifically, public-private partnerships (PPPs) are collaborations between governmental bodies and private companies aimed to finance, develop, and execute projects on a large scale for the benefit of the public (Investopedia, 2022). In terms of food waste reduction initiatives between the public and private sectors have traditionally aimed at raising awareness of the food system and the factors increasing food waste among citizens (United Nations Environment Programme, 2021).

Food waste measurement standards

Food loss and waste measurement indicators are not only relevant for the overall monitoring of progress in attaining the UN's Sustainable Development Goals (SDGs) as previously explained. Research has shown that consumers themselves are not aware of the amount of food waste they generate (van der Werf, Seabrook, & Gilliland, 2020; Giordano, Piras, Boschini, & Falasconi, 2018). Measuring food waste accurately at the individual, local, and national levels requires building knowledge among citizens and policymakers, the latter of whom should be responsible for designing appropriate interventions that lead to the achievement of SDG 12 on the national and global levels (WWF-WRAP, 2020). Examples of successful measurement schemes that have been launched constitute those of the C40 initiative, where multiple large cities have committed and/or developed schemes to quantitatively follow their progress in decreasing food loss and waste (C40 Cities Climate Leadership Group, 2019).

Chapter 4: Shifting to digital solutions to reduce food waste

Food waste prevention

One technology that local and national governments and policymakers should focus on is active packaging (AP). Food products in active packaging have the potential to become popular and effective in food waste reduction among consumers in low- and middle-income countries who already often shop for packaged and treated food products from large supply chains. Manufacturers should also be encouraged through financial aid from governments and through PPPs to provide multiple package sizing options depending on the needs of various households in each country (United Nations Environment Programme, 2021).

Another, packaging-related practice that should be promoted by policy and regulation is the harmonization of date-labelling, differentiating between the use-by and best-before dates concerning safety and quality, respectively. Adding to this, manufacturers often underestimate the 'safe' period for their products to be consumed, resulting in further discarding of safe and good-quality food. Practices should not be limited to good-faith contracts between retailers and suppliers on the packaging and labelling, but to some extent, they should be imposed by policy (United Nations Environment Programme, 2021).

Recycling and Recovery

The hierarchy of food waste reduction management should be prevention and redistribution, followed by recycling and recovery. Recycling has traditionally included the use of food waste as livestock feed, however, waste-recycling and recovery infrastructure should continue to develop (United Nations Environment Programme, 2021). An example of such infrastructure has been South Korea's pay-as-you-throw food-waste recycling system established in 2013 which charges households according to the waste of the food waste they throw away, and the number of biodegradable bags they need for this waste. Smart bins are also utilised in the scheme, installed throughout the city of Seoul and equipped with scales and radio frequency identification technology which weighs the food waste and charges the citizens on a monthly payment using key cards. As landfilling of food has also been banned in the country since 2005, the food waste is recycled as compost in urban farms, animal feed and recovered energy through anaerobic digestion or incineration (United Nations Environment Programme, 2021).

Another important aspect of policy is the emergence of conflicts between food waste prevention and recycling practices. The Reduce-Reuse-Recycle approach lists the 3Rs in a hierarchal order of priority. Nevertheless, conflicts may arise between prevention and recycling actors. Recycling is implemented by the emerging organic waste management industry, which views food waste as a resource and focuses on the business opportunities that arise. Meanwhile, food waste prevention initiatives are sometimes viewed as a loss of opportunities to generate value. Policy frameworks that are created to address this, should be coherent to integrate the two approaches following the 3R hierarchy, so that prevention, reuse and recycling become complementary. Again, the example of South Korea's pay-as-you-throw scheme is one that balances prevention and reusing/recycling into animal feed and an energy source through incineration (United Nations Environment Programme, 2021).

Chapter 4: Shifting to digital solutions to reduce food waste

4.6 Conclusion

This chapter focused on the need to look for digital solutions to our food waste problems and went over various examples being implemented or that need to be implemented to find solutions to this problem.

Food waste has a significant global impact socially, economically and environmentally with over 200 billion people being affected every year because of it. Therefore, it is important to be aware of the various technological improvements we can begin to make to help change these issues raised. By improving our cold chains we can improve the shelf life of products while minimizing the food-borne illnesses that can arise from food transportation. Secondly, Focusing on making access to technologies, like the smart fridge and vacuvita, more widespread, will allow families to focus more on planning ahead on what groceries they need to buy while also keeping in mind their shelf life, reducing waste in the long-term.

Finally, as highlighted above, the need for educating underprivileged groups to rely on technology to ensure food security as well as engaging policy makers in fighting urban food waste through the use of technology, are both vital in promoting the sustainability of the food system.

Chapter 4: Shifting to digital solutions to reduce food waste

REFERENCES

- Adhikari, J., Timsina, J., Khadka, S. R., Ghale, Y., & Ojha, H. (2021). COVID-19 impacts on agriculture and food systems in Nepal: Implications for SDGs. *Agricultural Systems*, 186(102990), 1-7.
- Agarwal, B. (2014). Food sovereignty, food security and democratic choice: critical contradictions, difficult conciliations. *Journal of Peasant Studies*, 41(6), 1247–1268.
- Aggarwal, T. (2021). Hydroponic System: how to choose the ideal system for you?. Rise Hydroponics. Retrieved October 24, 2022, from <https://risehydroponics.in/what-are-the-different-hydroponic-systems/>
- Agrawal, V. S., & Nag, A. (2013). Sustainable Food Waste Prevention Strategies to Achieve Food Security in India. *International Journal of Agriculture and Food Science Technology*, 4(3), 189-194.
- Brown, T., Hipps, N., Easta, S., Parry, A., & Evans, J. (2014). Reducing domestic food waste by lowering home refrigerator temperatures. *International Journal of Refrigeration*, 40, 246-253.
- C40 Cities Climate Leadership Group. (2019). The C40 Good Food Cities Declaration: Planned actions to deliver commitments. Retrieved from https://www.c40knowledgehub.org/s/article/The-C40-Good-Food-Cities-Declaration-Planned-actions-to-deliver-commitments?language=en_US
- Celabor. (2021). FreshInPac – Celabor. Retrieved October 24, 2022, from <https://celabor.gcloud.be/nl/freshinpac/>
- CNN Business. (2012). Urban farming looking up in Singapore. Retrieved June 20, 2022, from <https://edition.cnn.com/2012/12/09/business/eco-singapore-vertical-farm/index.html>
- De Clercq, M., Vats, A., & Biel, A. (2018). Agriculture 4.0: The future of farming technology. Dubai: Proceedings of the World Government Summit.
- Dobernig, K., & Schanes, K. (2019). Domestic spaces and beyond: Consumer food waste in the context of shopping and storing routines. *International Journal of Consumer Studies*, 43(5), 480-489.
- Duhan, J. S., Kumar, R., & Kumar, N. (2017). Nanotechnology: The new perspective in precision agriculture. *Biotechnology Reports*, 15, 11-23. doi:<https://doi.org/10.1016/j.btre.2017.03.002>

Chapter 4: Shifting to digital solutions to reduce food waste

FAO, IFAD, UNICEF, WFP and WHO. (2022). The State of Food Security and Nutrition in the World 2022. Rome, FAO. <https://doi.org/10.4060/cc0639en>

Giordano, C., Piras, S., Boschini, M., & Falasconi, M. (2018). Are questionnaires a reliable method to measure food waste? A pilot study on Italian households. *British Food Journal*, 120(12), 2885-2897. Retrieved from <https://doi.org/10.1108/BFJ-02-2018-0081>

International Telecommunication Union. (2021). How technology can help avert food waste. Retrieved May 16, 2022, from <https://www.itu.int/hub/2021/09/how-technology-can-help-avert-food-waste/>

Investopedia. (2022). Public-Private Partnerships (PPPs): Definition, How They Work, and Examples. Retrieved September 13, 2022, from Investopedia: <https://www.investopedia.com/terms/p/public-private-partnerships.asp>

Karki, S., Burton, P., Mackey, B., & Alston Knox, C. (2021). Status and drivers of food insecurity and adaptation responses under a changing climate among smallholder. *Environment, Development and Sustainability*, 23(10), 14642-14665.

Krishnamurthy, R. (2014). Vertical Farming: Singapore's Solution to Feed the Local Urban Population. Retrieved June 10, 2022, from <https://www.permaculturenews.org/2014/07/25/vertical-farming-singapores-solution-feed-local-urban-population/>

Martin-Rios, C., Hofmann, A., & Mackenzie, N. (2020). Sustainability-Oriented Innovations in Food Waste Management Technology. *Sustainability*, 13(1), 210. Retrieved from <http://dx.doi.org/10.3390/su13010210>

McNulty-Kowal, S. (2020). This modular refrigerator uses an innovative shelving system to tackle food wastage. Retrieved October 17, 2022, from <https://www.yankodesign.com/2020/10/30/this-modular-refrigerator-uses-an-innovative-shelving-system-so-all-your-food-is-always-visible/>

Mercier, S., Mondor, M., McCarthy, U., Villeneuve, S., Alvarez, G., & Uysal, I. (2019). Optimized cold chain to save food. In C. M. Galanakis (Ed.), *Saving Food: Production, Supply Chain, Food Waste and Food Consumption* (pp. 203-226). London, United Kingdom ; San Diego, CA, United States: Academic Press.

Chapter 4: Shifting to digital solutions to reduce food waste

- Mok, W. K., Tan, Y. X., & Chen, W. N. (2020). Technology innovations for food security in Singapore: A case study of future food systems for an increasingly natural resource-scarce world. *Trends in Food Science & Technology*, 102, 155-168.
- One Planet Network. (n.d.). *Target 12.3 Food Loss & Waste*. SDG 12 Hub. Retrieved from <https://www.oneplanetnetwork.org/sdg-12-hub/see-progress-on-sdg-12-by-target/123-food-loss-waste>
- Rahman, S., & Pandey, M. S. (2015, March 7). *Cold chain can save food supply chain*. The Daily Star. <https://www.thedailystar.net/cold-chain-can-save-food-supply-chain-41858>
- Shuvo, S. D., Hossain, M., Riazuddin, M., Mazumdar, S., & Roy, D. (2022, May 10). Factors influencing low-income households' food insecurity in Bangladesh during the COVID-19 lockdown. *PLOS ONE*, 17(5), 1-20. Retrieved from <https://doi.org/10.1371/journal.pone.0267488>
- Singh, D. R., Sunuwar, D. R., Shah, S. K., Sah, L. K., Karki, K., & Sah, R. K. (2021). Food insecurity during COVID-19 pandemic: A genuine concern for people from disadvantaged community and low-income families in Province 2 of Nepal. *PLOS ONE*, 16(7), 1-20.
- Siong, O. (2012). *First commercial vertical farm opens in Singapore*. Retrieved June 20, 2022, from <https://web.archive.org/web/20121027232546/http://www.channelnewsasia.com/stories/singaporelocalnews/view/1233261/1/.html>
- Taha, M. F., ElMasry, G., Gouda, M., Zhou, L., Liang, N., Abdalla, A., Rousseau, D., & Qiu, Z. (2022). Recent Advances of Smart Systems and Internet of Things (IoT) for Aquaponics Automation: A Comprehensive Overview. *Chemosensors*, 10(8), 303. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/chemosensors10080303>
- United Nations. (2014). *World Urbanization Prospects: The 2014 Revision*. New York: United Nations.
- United Nations Environment Programme. (2021). *Reducing Consumer Food Waste Using Green and Digital Technologies*. Copenhagen and Nairobi: UNEP DTU Partnership.
- United Nations. (n.d.). *Goal 12*. Retrieved from Department of Economic and Social Affairs: <https://sdgs.un.org/goals/goal12>
- Uzea, N., Gooch, M., & Sparling, D. (2019). *Developing an Industry Led Approach to Addressing Food Waste in Canada*. Provision Coalition. Retrieved from <https://provisioncoalition.com/assets/website/pdfs/Provision-Addressing-Food-Waste-In-Canada-EN.pdf>
- van der Werf, P., Seabrook, J. A., & Gilliland, J. A. (2020). Food for thought: Comparing self-reported versus curbside measurements of household food wasting behavior and the predictive capacity of behavioral determinants. *Waste Management*, 101, 18-27. Retrieved from <https://doi.org/10.1016/j.wasman.2019.09.032>

Chapter 4: Shifting to digital solutions to reduce food waste

Waite, G., & Phillips, C. (2016). Food waste and domestic refrigeration: a visceral and material approach. *Social & Cultural Geography*, 17(3), 359-379.

Wunder, S., Van Herpen, E., McFarland, K., Ritter, A., van Geffen, L., Stenmarck, Å., & Hulten, J. (2019). *Policies against consumer food waste. Policy options for behaviour change including public campaigns. REFRESH Deliverable 3.4*. Retrieved from <https://eu-refresh.org/policies-against-consumer-food-waste>

WWF-WRAP. (2020). *Halving Food Loss and Waste in the EU by 2030: the major steps needed to accelerate progress*. Berlin (Germany). Retrieved from <https://wrap.org.uk/resources/report/halving-food-loss-and-waste-eu-2030-major-steps-needed-accelerate-progress>

Young, C. W., Russel, S. V., Robinson, C. A., & Chintakayala, P. K. (2018). Sustainable Retailing – Influencing Consumer Behaviour on Food Waste. *Business Strategy and the Environment*, 27(1), 1-15. Retrieved from <https://doi.org/10.1002/bse.1966>

Zimmer, L. (2012). *The World's First Commercial Vertical Farm Opens in Singapore*. Retrieved June 20, 2022, from <https://inhabitat.com/the-worlds-first-commercial-vertical-farm-opens-in-singapore/>

This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained.

Project Code: 2021-1-ES02-KA220-YOU-000028693

entre YOUTH



Funded by
the European Union



UNIVERSIDAD
DE ALMERÍA



CITIZENS
IN POWER



helixconnect
Consult. Finance. Grow.



ÍTACA
ASOCIACIÓN



Scouts Católicos
Andalucía



This work is licensed under Attribution-NonCommercial 4.0 International. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/4.0/>

