Prevention and reduction of food losses and food waste via appropriate packaging

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Today's world is facing enormous challenges. Principal amongst these are climate change, environmental destruction, scarce resources, globalisation, population growth as well as demographic change. This is in particular reflected in the topic of food safety and security.

For this reason, the present WPO (World Packaging Organisation) position paper aims at highlighting the issue of global food losses and food waste along the food supply chain and in particular packaging as a valuable solution to this challenge. In doing so, the paper builds up upon recently published data and reports in this research area as well as information and statements of previous WPO position papers. It then closes with the current and envisaged future role of the WPO in this topic.

Introduction

According to the Food and Agriculture Organisation of the United Nations (FAO), each year approximately one third of the food produced for human consumption is either lost or wasted globally. This does not only result in the fact that, despite sufficient world production, one in seven people in the world are starving but also means that the precious natural resources used in producing these goods are also lost.

While food wastage represents just the tip of the iceberg, the impacts on the environment are incredible. So, the carbon foot print of food wastage is the third biggest after USA and China, the blue water footprint is equivalent to the annual water discharge of the Zambezi or Volga River and approximately one third of the agricultural land area grows crops that will not be eaten, which accounts to the total land area of China, Mongolia and Kazakhstan. Besides this, biodiversity is reduced by the progressive intensification of agriculture and expansion thereof into wild areas. But that's not all. Additionally, food losses and food waste cause huge economic loss and at the moment incalculable costs to society.

Leading experts and organisations, therefore, emphasise that food wastage reduction is inevitably to reduce the pressure on the scare natural resources. This will not only have immediate effects but also decreases the need to drastically raise the global food production to meet the food demand of nine billion people in 2050.

Where food losses and food waste cannot be avoided, most reports and policies propose further measures of, in hierarchic order, redistribution of food, redirection of food to feed as well as composting and conversion to renewable energy. The least measure should be disposal.

Causes and Solutions

Along the food supply chain – ranging from pre-harvest, harvest and initial handling phase, storage, processing, distribution and storage, to retail outlets and consumption – the causes of food losses and waste are diverse. These range from biological, chemical, biochemical, mechanical, physical, physiological, technological, logistical, organizational, to psychological and behavioural causes – including those induced by marketing or other influencing factors. Examples include damage from pests and disease, unpredictable weather conditions, not meeting the quality specifications, inadequate packaging, spillage and degradation, trimmings and food preparation waste, batch mistakes, inadequate remaining shelf-life, poor management or handling, confusion over use-by and best-before dates, leftovers and many others.

In order to elaborate tailored solutions and to prioritize the actions to be taken, a careful identification of these causes is mandatory. Thereby, it is noteworthy that the causes strongly vary with the product, context and stage of the supply chain and that an integrated perspective is essential to distinguish between the point where food losses and food waste occur and the actual underlying cause, as these often can not be considered to be identical. Meaning that food losses or food waste appearing at one stage of the food supply chain may originate from more than just one specific cause up- or downstream the supply chain.

Despite different approaches, perspectives, scopes, methodologies or definitions used in the literature on food losses and food waste, which, to some extent, hamper the comparison of studies, systems and countries, a general trend can be observed. Hence, in less developed countries food tends to be lost at pre-harvest, harvest and initial handling phase due to inefficient harvest, storage, transport and processing. With increasing development, waste tends to move up the distribution chain to retail and consumption level. This is also where food is more likely to be thrown away when it is still edible.

When focusing on packaging, some underlying causes were already recognised and organized by stages in the food supply chain. At the harvest and initial handling phase, for example, inappropriate choice of containers and packaging materials is predominant. Moreover, sanitation and hygienic standards of the containers used to pack and transport the products are often insufficiently implemented. Moving forward the food supply chain to processing, lack of packaging poses one of the challenges to be overcome. During distribution and transport, however, rough handling during packaging and (un) loading of transport vehicles in the combination with the use of inappropriate packaging containers or packages pose a major challenge. Near the end of the supply chain, at the retail outlets, causes are mainly inadequate packaging but also factors like large pack sizes, which force consumers to purchase more than needed. Further, marketing strategies, product promotions and bulk discounts lead to more and larger purchases. Last but not least, packaging damage plays a crucial role.

The Role of Packaging in Minimising Food Losses and Food Waste

Packaging aims to contain preserve and protect. Basic traits, which allow satisfaction of the modern consumer's demand for fresh and processed foods, which are safe and convenient, independent from season or origin. Besides the basic functions, packaging also fulfils secondary functions like information about the product, convenience, presentation, brand communication, promotion, economy and environmental responsibility.

However, packaging is a highly polarizing topic and repeatedly subjected to heated environmental debates, mainly due to littering and recovery issues of used packaging. A circumstance that fuels the clamour for the general reduction of packaging among some not sufficiently informed parties.

While the reduction of packaging, indeed, could be an important element of general waste policies, it is easily forgotten that unaware omission or reduction of packaging could have the unintended consequence of dramatically increasing the amount of food losses and food waste along the food supply chain. When attempting to tackle the world's waste problem, it is therefore important to focus on packaging fit for purpose following the principle of "as little as possible, as much as necessary". Paradoxically, this may lead to

increased frequency or amount of packaging at some stages of the supply chain (Figure 1).

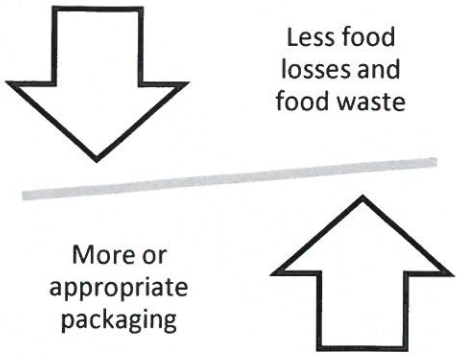

Figure 1: Trade-offs between food waste and packaging.

At the moment, however, primary, secondary and tertiary packaging together only account for approximately one tenth of the total energy inputs for one person's weekly consumptions of food and the protection offered by this packaging also ensures there is no further energy losses through possible food spoilage or wastage. This is why life cycle analysis should not be undertaken without taking packaging into account. Several studies have shown that packaging only accounts for two to five per cent of the total environmental impact in the food chain. In the specific case of beverages this accounts to up to 25 per cent. Against this background, it is of upmost importance to investigate the potential trade-offs between packaging consumption and food waste to achieve the best environmental outcome.

Technical solutions

It has been conclusively shown, that insufficient or inadequate packaging is a factor for food loses and food waste. As a consequence, using the appropriate packaging material is regarded to be a key element of a set of technologies to reduce these losses.

Often quite simple and inexpensive solutions can significantly reduce the level of losses and waste. Along with this, transport and processing need to be adapted to local situations, including infrastructure, economic and human resources as well as conditions along the supply chain. Solutions need to be affordable and adapted to local conditions, including human resources and to the scale of the operations in food chain.

In a packaging design and development process it is therefore of elementary importance to consider all aspects of the package's life cycle from production through distribution to consumption as well as waste management. In summary there are seven key areas to be considered:

(i) product needs,
(ii) distribution needs and wants,
(iii) packaging materials,
(iv) machinery and production process,
(v) consumer needs and wants,
(vi) market needs and wants, and
(vii) environmental performance.

There are now many modern and innovative food packaging innovations that are providing solutions in these seven areas. For example active and intelligent packaging, barrier materials, modified atmosphere packaging, portion sized packaging, breathable

polymer films, "easy to empty" packaging, aseptic technology, hermetic seals, re-sealable packaging and many more.

Even though these transport, processing or packaging solutions offer a range of advantages, they often encounter constraints to their acceptance or implementation. This is where further research and studies are required to better understand the food losses and food waste that occurs in this area.

In the context of food savings, two examples of successful food packaging are frequently mentioned: First, selling grapes in trays or bags can reduce the store waste of grapes by 20% and second, only 1.5 grams of wrapping plastic can keep cucumbers fresh for 14 days.

Current and envisaged future role of the WPO

In the effort to support a sustainable society and under the slogan "better quality of life through better packaging for more people", the WPO currently aims to globally promote:

- The positive economic, social and environmental impact of packaging on society
- A reduction of the negative environmental impact of packaging on society and the environment
- Development of packaging technology, sciences and engineering
- Communication concerning packaging technology and applications
- Advancement of packaging skills and expertise through education
- A forum for national and international organisations to further the state of the art of packaging
- Expansion of the international trade, not the least to support developing countries and economies

To support these actions, the envisaged future role of the WPO can increasingly be seen in:

- Putting all stakeholders together
- Awareness raising of the challenges and impact of food losses and food waste as well as pointing out possible solutions related to packaging
- Support to programmes, projects, research and education related to the packaging's role in food losses and food waste reduction
- Collaboration and coordination of packaging initiatives in the field of food losses and food waste
- Contribution to standards, laws and policies
- Encouraging for innovation (e.g. WorldStar Awards and WorldStar Student Awards)

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