Food packaging for better food systems

storaenso

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for better food systems

Stora Enso Packaging Materials
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About this paper

Food systems must undergo a radical transformation if the world is to achieve climate, nature, and health objectives. A growing number of governments, consumers, NGOs and businesses are mobilising to this effect. Last year, the United Nations Secretary-General convened a Food Systems Summit to launch bold new actions as part of the UN's Decade of Action to achieve the Sustainable Development Goals. At COP 26, countries participating agreed on the need to transition toward sustainable and climate-resilient food systems. We have reached a good understanding of what our food systems require, and this has triggered major commitments from organisations. Yet, action is not fast enough.

At Stora Enso, our purpose, "Do good for people and the planet," guides what we do. Our responsibility to "Do what's right" demands that we look at the needed food transition to understand what we can do to support the shift. Over the last decades, we have been providing our clients with renewable food packaging materials and solutions. We now want to accelerate our contribution to the required system transformations.

Food packaging is a critical enabler of food value chains, but we have seen a limited effort so far to rethink its role in the wider food system. With this white paper, we aim to initiate a discussion on the potential role of food packaging by mapping impact opportunities for the food industry. We are aware that the nature of the challenges requires the involvement of a large set of actors. For this reason, we are committed to engaging in discussions with businesses, governments, and civil society on how to move from ideas to action.

This document has been prepared by Stora Enso following interviews with actors from across the food system. We would like to thank Systemiq, the Food and Land Use Coalition, EAT Foundation, The Nature Conservancy, Unilever, Nestle, Danone, Pukka Herbs, Tomra, Compass, and Glovo for their contributions.

Executive Summary

Our food systems have brought prosperity and drastically reduced undernutrition and hunger, but they are generating large hidden socio-economic costs estimated at $12 trillion per year. Recent events have exposed the lack of resilience in our food systems. The COVID-19 pandemic and the war in Ukraine have increased food insecurity worldwide. Climate change and biodiversity loss pose an increasing threat to food production.

To address the shortfalls of our current food system, we need to radically change the way we produce and consume food. Government regulation is evolving rapidly to reduce the food system's environmental externalities, while new technologies and business models are opening opportunities to reduce costs and improve sustainability. Regulators, consumers, and investors are increasingly demanding more responsible actions from businesses, and there is a clear economic case for change that reduces the hidden costs of the food system.

Food packaging is a critical enabler of food value chains; the industry has an opportunity to support the food system transition and reduce the pressure on land-use and scarce resources. As a result of decarbonization and circularity targets, there is an expected shortage in biomass, that the food packaging industry can help address. Enabling closed loops for material use, including through circular business models, will be essential for the industry to reduce the pressure on resources.

We have identified 4 areas and 13 impact opportunities to unlock the potential contribution of food packaging for better food systems.

Healthy diets: We need to move toward the planetary health diets, which will require a radical shift towards producing and consuming more vegetables, legumes, and other healthy foods that are often highly perishable. Packaging solutions with optimized design and smart technologies can help keep food fresh for longer, limiting the use of preservatives with positive outcomes on human health. Clear and informative packaging labels can help consumers shift to healthier diets, while investments in the development of new food value chains, such as alternative proteins, are critical to developing novel food products that are healthy and sustainable.

Reduction of food loss and waste: Reducing food waste is critical to reduce GHG emissions and improving food security. Well-designed packaging, including that which is embedded smart sensors, can reduce food waste; packaging labels can help build awareness of consumers and shift their behaviour. Packaging models of optimized size and design can support consumers buying the amount of food they need and reduce potential waste. By investing in underdeveloped areas, the packaging industry can also support the development of local economies and generate local loops, reducing food loss and waste.

Protecting and restoring land: Land protection and restoration are critical to curb GHG emissions, increase resilience and reduce biodiversity loss. Sustainable sourcing of agriculture and forestry inputs can limit negative externalities of packaging solutions. At the same time, opportunities to increase recycling, reuse packaging and use alternative packaging materials, which leverage waste and by-products, can reduce resource gaps and land use competition. Innovative forestry production-protection models and regenerative value chains, including carbon sequestration through forest regrowth, can further protect and restore the land.

Protecting oceans: Protecting oceans improves climate, biodiversity, and food security outcomes. Through efficient and widespread collection, recycling technologies, and reuse packaging models, the food packaging industry can enable material circularity and reduce plastic waste flows into the ocean. New packaging materials derived from ocean biomass such as seaweed can absorb carbon dioxide and regenerate marine ecosystems, creating renewable feedstock for potentially biodegradable packaging.

At Stora Enso, we believe our industry has an opportunity to be a driver of the food system transformation by acting on these impact opportunities. This will require moving beyond responsible packaging to develop new solutions and drive the system transformation through a shift in behavior and business models. We know broad partnerships are required to catalyze system change and generate synergies. We believe we can build on our collective efforts so far to step up our ambition and accelerate the transition, and we seek perspectives from others in the system on how best to do so.

1. The need for food system transitions

Our food systems have greatly reduced hunger and generated prosperity, but they are currently generating large hidden socio-economic costs. Since the Green Revolution, agricultural innovations have created an abundance of low-cost food that helped to feed a fast-growing world. For example, food spending as a percentage of total household expenditure in the United States fell from 17% in 1960 to 10% in 2016.[1] However, compared to a market value of $10 trillion, the low retail cost of industrialized food has a very high price tag. The hidden health, environmental and economic costs are estimated at $12 trillion.[2] These costs can be attributed to GHG emissions, estimated up to 30% of the global total, biodiversity loss, malnutrition, including obesity, poverty and inequality.

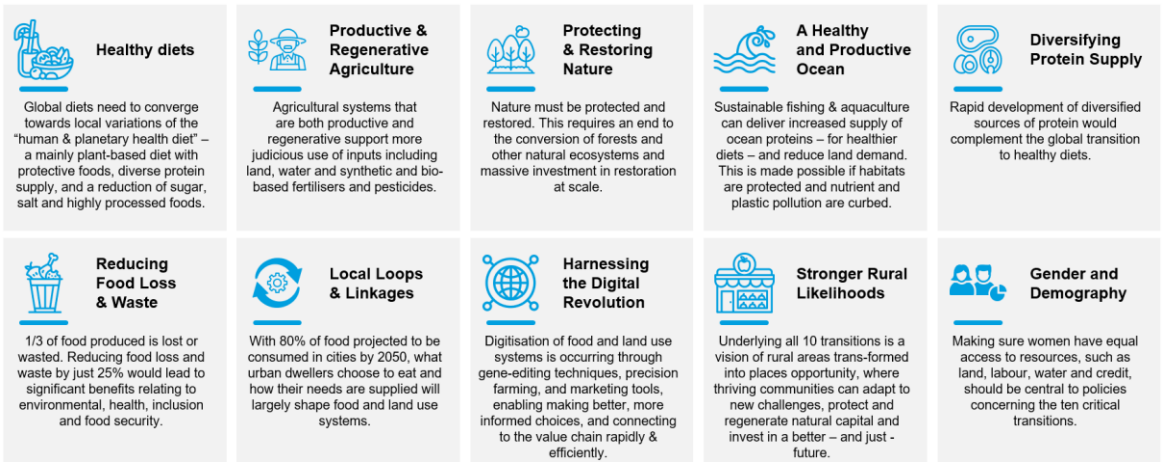
Recent external pressures have further exposed food systems failures. The COVID-19 pandemic increased global food insecurity by reducing incomes and disrupting food supply chains; post COVID-19, the number of food insecure people doubled to 276 million.[3] The pandemic also underscored the link between zoonotic diseases and environmental degradation, especially biodiversity loss, climate change and pollution.[4] More recently, the war in Ukraine has increased the price of wheat, sunflower oil and fossil fuels, with fallout for food security worldwide. The pressure on key commodities has led some countries like Algeria, Egypt, India, Indonesia and Turkey to adopt protectionist approaches resulting in restrictions on trading and worsening of the food market conditions[5].

Food systems, climate, and biodiversity are strongly interconnected. The food and land use system is responsible for one third of the global GHG emissions and in most regions of the world, 70% of freshwater is used for agriculture; food systems are the biggest driver of biodiversity loss, threatening 62% of animal and plant species.[6] At the same time, climate change and biodiversity loss pose a huge threat to food production. The near extinction of certain pollinators is threatening 5-8% percent of agricultural production[7], and extreme weather events such as floods, droughts, hurricanes and bushfires heavily disrupt food availability. Research predicts a reduction of global crop yields by up to 10% by mid-century due to climate change.[8] This pressure on ecosystems will grow with the global population expected to reach 9.8 billion in 2050[9], and people in the Global South increasing their consumption of animal proteins and processed food as a result of urbanization and economic growth.[10]

Rethinking our food production and consumption systems will promote food security and healthy diets, while addressing environmental and social pitfalls. The Food and Land Use (FOLU) coalition has identified 10 critical transitions that will enable the food systems to provide food security and healthy diets for a global population of over 9 billion by 2050 (Exhibit 1). These transitions tackle core environmental, health and poverty challenges by addressing climate change issues, safeguarding biological diversity and creating inclusive rural economies. There is a strong investment case for businesses to act and contribute to these transitions; FOLU calculated an annual business opportunity of $4.5 trillion associated with the 10 critical transitions by 2030. These transitions could also boost income growth for the bottom 20% of the rural population and create more than 120 million extra decent rural jobs.[11]

Technology and digitisation will play an important role in the future of food production. The digital transformation is affecting all aspects of food value chains, from farming to accelerating workflow optimisation, enabling traceability of products, and removing production bottlenecks.[12] Agricultural technologies including software, hardware, such as sensors, and contributions from the biotechnology sector can increase crop yields, and improve farming efficiency and resilience.[13] With digital precision tools, reductions in agricultural input requirements for a specific yield can be achieved by integrating data across the entire food production systems. Innovation in food processing technologies can also lead to the replacement of animal protein in our global diet[14] and digital technology may well be a positive multiplier of the other critical transitions.

Exhibit 1. The FOLU 10 critical transitions



Source: FOLU, 'Growing Better: Ten Critical Transitions to Transform Food and Land Use' (Food and Land Use Coalition, 2019).

Consumers' interest in healthy, sustainable yet convenient food has increased, especially in the Global North, with an impact on businesses. Interest in nutritious and healthy food has been increasing; almost 40% of high-income consumers plan to focus more on healthy eating in 2022, a trend that has been accelerated by COVID-19.[15] The pandemic has also sped up a movement from offline to online and convenience is becoming increasingly important. By 2030, online grocery is expected to make up 15-20% of the market.[16] Food delivery more than tripled since 2017 and became a $150bn global market.[17] The global ready meals market is expected to expand at a compound annual growth rate (CAGR) of 5% by 2030.[18] Additionally, consumers are increasingly buying more local products, preferring sustainable packaging options and looking at alternative proteins; the global meat substitute market for example is expected to more than double within the next decade.[19] Companies' commitment to climate and nature is affecting consumers' buying decisions, with a major impact on product demand.

Businesses in the food systems are exposed to increasing risks due to climate change and biodiversity loss. Direct physical risks of climate change due to extreme events such as droughts, bushfires, hurricanes, and floods, pose a massive threat; annual drought losses in Europe and the UK are currently estimated at €9bn per year and may rise to €65bn in 2100 in a 4 degrees Celsius warming scenario.[20] There is also considerable indirect risk for businesses, for example when climate change disrupts society or markets in which businesses operate.[21] Continuing to rely on carbon-intensive operations creates the risk of losing competitive advantage through higher carbon costs, reduced resilience and failure to keep up with innovation.[22] Committing to delivering a positive impact on climate and nature is proving critical for food companies' competitiveness, including in the food industry.

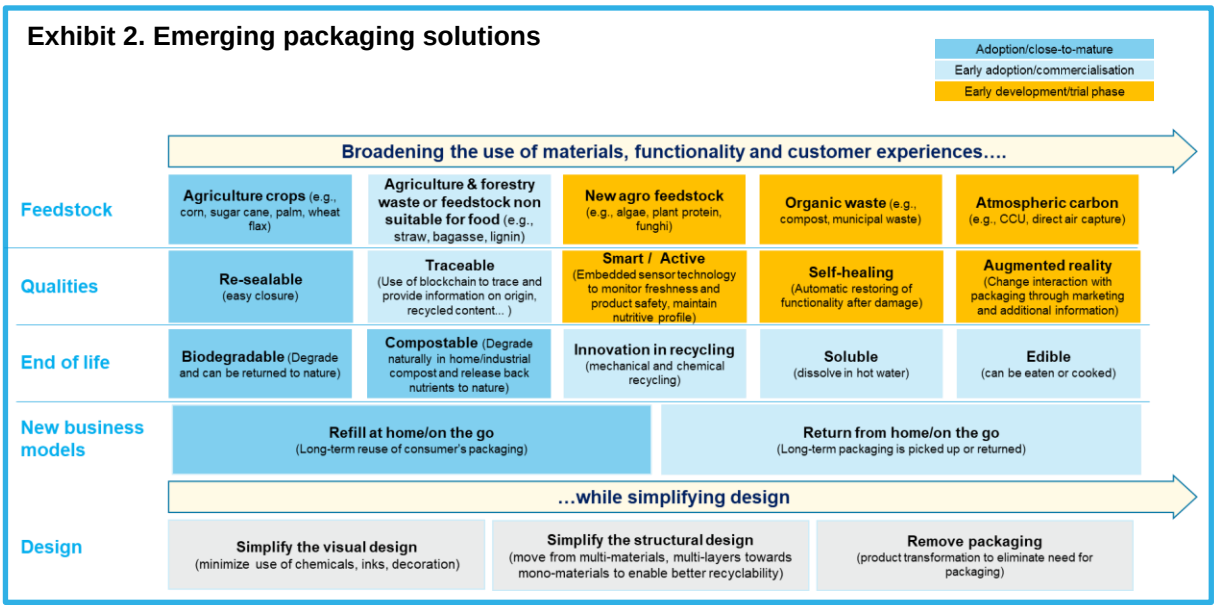
There is pressure from regulators and investors to increase transparency on businesses and address food systems challenges. Especially in Europe, governments are increasingly looking at ways to reduce the externalities of food systems. The EU Farm to Fork, EU Biodiversity strategy and EU Soil Strategy aim to deliver better climate and environmental results, increase climate resilience and optimise the use of agricultural inputs. Targets on nature protection and the use of pesticides are examples of measures with a direct impact on businesses. New legislations aligned with the Taskforce on Climate-related Financial Disclosure (TCFD) and the Taskforce on Nature-related Financial Disclosure (TNFD), are emerging, creating transparency on business risks associated with nature and climate. Access to finance is becoming more and more costly for companies with high environmental footprints and unhealthy food portfolios, as investors' decision-making is evolving. Supporting the food system transition is crucial to reduce regulatory and financial risks.

2. A systems perspective on food packaging

Packaging is a critical enabler of the food value-chain and its demand will continue to grow globally. Over the past two centuries with the invention of canning, food packaging has been developed hand-in-hand with food processing to provide safe food value added products accessible to people around the world. In many instances, food packaging protects and preserves food, increases its shelf-life and, therefore, reduces food loss and waste. The transport, protection and preservation, and food safety functions of packaging have supported the global effort to reduce hunger. More recently, food packaging models have evolved to provide critical information on food products and enable the traceability of their content. The expected growth in population and food demand will lead to increased global packaging consumption, driven by 4.5% growth in packaging consumption in emerging markets[23], despite the call to massively reduce packaging.

Packaging has been under the spotlight for its detrimental impact on the environment. Documentaries and campaigns have shown the impact of packaging, especially plastic based, on marine wildlife, as well as the limits of waste management and recycling. This has triggered an acute consumer response and regulatory pressures to move towards greater packaging sustainability through recyclability and circularity targets for all packaging[24] as well as measures specifically aimed preventing plastic leakage[25,26,27] and removing avoidable packaging. With increasing demand for packaging, the core challenge of the industry will be to continue guaranteeing the highest levels of food safety and functionality, while improving their products' circularity and environmental impact.

Exhibit 2. Emerging packaging solutions



New packaging solutions are emerging, offering new functionality and sustainability combinations. New solutions aim to overcome some of the challenges faced by the food and packaging industry (Exhibit 2). New feedstocks that can prevent land competition with food and reduce environmental impact are emerging; these range from agricultural and forestry residues to innovative sources such as algae, organic waste, or atmospheric carbon. New packaging properties can ensure longer food freshness, greater access to food, and better information on food and its packaging. While innovation is multiplying packaging options, there is a general push to simplify packaging design and, when possible, avoid packaging to reduce its externalities. WRAP's UK Plastic Pact members recently committed to having fruit & vegetables come unpackaged unless it's demonstrated the packaging is needed.

Competing uses for land and biomass will lead to pressure on resources. Land is a fixed and limited resource. A growing global population and increased sourcing of protein will lead to more land demand for food production, competing with a need for renewable resources to reach the commitment to net-zero pathways. Moving away from fossil resources means higher demand biomass for sustainable buildings, materials and chemicals, and energy. The growing demand for land both for food and for biomass will face an opposing regulatory force to protect and restore nature, directly reducing the availability of land for use. Although biomass resources are renewable, they are also functionally finite in that they need time to regrow or recover.[28] Trade-offs on resource access to prevent resource scarcity is critical to ensure demand is focused on uses for which biomass is the only viable option. Food packaging stands at the intersection of these tensions and has an opportunity to influence them (Exhibit 3).

Exhibit 3. Key drivers of pressure on natural resources

By supporting food system transitions, food packaging can reduce the pressure on land. Land use for the production of livestock proteins, including land used to grow feed for animals, stands at 62% of all agricultural land, but contributes only to 17% of calories. If we follow the current diets with the expected population growth, it is estimated that agricultural land will increase by 400 million hectares by 2050 to meet food demand.[29] By supporting the delivery of food transition, food packaging can help address the issue of land competition. By shifting to a planetary health diet,[30] 1.5 billion hectares of agricultural land, that would otherwise be used for farming and livestock grazing in 2050, could be preserved for restored land.[31] This creates the potential not only to protect forests and other ecosystems, but also to stabilize the climate and secure food production.

The demand for biomass for energy and materials will surge, driven by climate and circularity targets, directly affecting the packaging industry. If all sectors convert current demand for energy and materials to biomass globally, the biomass demand would be ~6 times larger than the maximum potential for supply by 2050.[32] In Europe, this will leave a 40–70%, potentially even 100%, gap in biomass.[33]

Policy action will be critical to prioritize biomass sources and usages. While growth in wood demand for sustainable buildings is irreplaceable,[34] materials will be expected to use a wider range of biomass feedstock (e.g., agricultural and forestry waste, industrial and organic waste, algae) and move away from the current primary focus on agricultural crops, directly competing with food. Harvested wood, however, is used comprehensively as sawn timber is purposed for construction and furniture, while branches and trimmings are collected for packaging material. Therefore, increased demand for wood in sustainable buildings creates additional side streams that are beneficial for packaging material production. Meanwhile, the use of biomass for energy should be restrained and limited to sectors with little-to-no possible alternatives.[35] In exploring energy transitions to limit biomass for energy, it will be important to consider different clean technologies and alternatives, such as hydrogen. For example, the

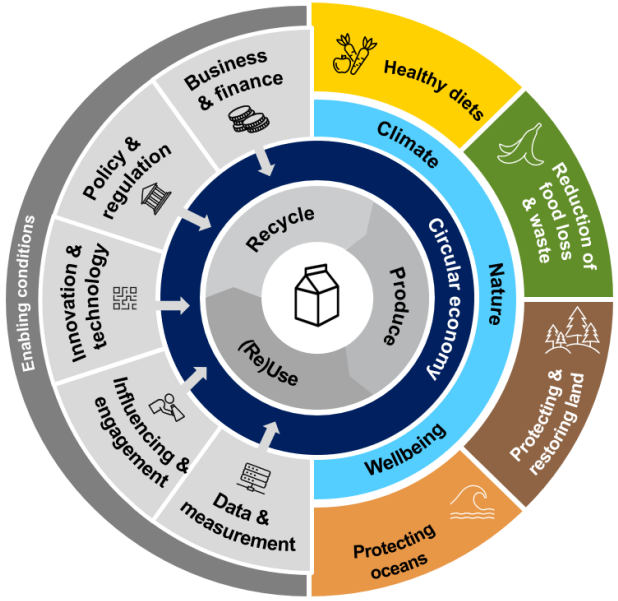
EU Forest Strategy has provided guidance on how to optimize their forestry biomass use based on 'the cascading principle' or the EU Waste Framework Directive created the "waste hierarchy" to set some prioritization within the waste management sector.

For the packaging industry, closing the material loops will be critical to alleviating pressure on the resource gap. While there is a clear focus today on upgrading collection, segregation, and improving recycling rates to minimize material impact and need, a large share of materials are still not being recycled and end up wasted. While paper and board packaging has a strong material loop with an 82% recycling rate in Europe,[36] plastic packaging have a weaker material loop with a 41% recycling rate[37] Meanwhile, opportunities to create organic waste loops remain largely untapped; less than 2% of valuable nutrients in food by-products and human waste in cities are being captured and recycled.[38] Waste can be used for packaging materials or chemicals, such as fertilizer, and energy for low-carbon transport fuels.[39] With urbanization in the Global South driving organic and packaging waste, establishing closed loops will be even more important.

3. Impact opportunities for the food packaging industry

Packaging can impact four main areas for the transition to better food systems. Looking at the critical transitions that need to happen to achieve better food systems, food packaging can play a critical role in enabling healthy and sustainable, reducing food loss and waste, protecting and restoring land and oceans (Exhibit 4). Across these four areas, we identified impact opportunities for the industry to drive system change.

Exhibit 4. Strategic framework for impact areas of food packaging



Healthy diets: plant-based, with more protective foods, diverse protein supply, and reduced consumption of sugar, salt and highly processed foods, which is good for humans and for the planet.

Reduction of food loss & waste: essential to reduce environmental and health impact, make more efficient use of resources and improve access to food.

Protecting & restoring land: critical to bring an end to the extinction of species and reduced biodiversity, restore nature and mitigate climate impact.

Protecting oceans: essential to protect marine habitats for better climate, biodiversity and food security outcomes

Healthy diets

Shifting toward a planetary healthy diet is critical for sustainable food consumption and production. 39% of the global population is overweight and 13% of adults globally are obese. It is estimated that one-fifth of all global deaths can be attributed to an unhealthy diet, including the 820 million people worldwide that face hunger and lack sufficient food.[40] In terms of food production, the main contributor to deforestation and GHG emissions is the production of animal protein. Shifting toward a human and planetary healthy diet consisting of a diversity of plant-based foods, low amounts of animal protein, limited saturated fats, refined grains, highly processed foods and added sugars (Exhibit 5) is the biggest lever to reduce social and environmental costs; a vegan diet could save up to 8 $GtCO_2eq$ emissions per year.[41]

Exhibit 5. The Planetary health diet

The planetary health diet has an optimal caloric intake and consists largely of a diversity of plant-based foods, low amounts of animal-based foods, containing unsaturated rather than saturated fats, and limited amounts of refined grains, highly processed foods and added sugars.

Source: EAT-Lancet Commission

Food packaging can support the transition toward healthy diets in different ways:

- **Optimized design**. Properly designed food packaging solutions can reduce the need for preservatives and keep food fresh and healthy for longer time, with positive outcomes on human health. Examples are packaging with better barrier properties or a modified atmosphere, maintaining the nutritive profile of food and ensuring food safety and longer shelf-life.[42,43] The use of resealable packaging, instead, helps preserve food for longer -- even after opening.
- **Smart technologies**. Release/absorption substance technology can help maintain food's nutritive profile and freshness longer.[44] For example, traceability technologies such as blockchain can ensure product safety by recalling a series of hazardous food products or can monitor product freshness through embedded sensor technologies.
- **Novelty food**. The food packaging industry can support the development of new value chains for healthy and sustainable food. This might include investing in food processing solutions that keep nutrients in food for a longer time, such as forward osmosis,[45] or developing new products which are healthy and sustainable (e.g., alternative protein) and enable their appropriate packaging. Meanwhile, leveraging packaging to provide the right amount of food, for example in ready prepared-meals, can help reduce overconsumption and unhealthy food consumption.[46]
- **Better consumer choices**. Packaging labels can foster the adoption of healthy and sustainable diets. This includes certifications for food health profiles, for example Nutri-score that push the food industry to improve food health and help communicate the food's nutritious value[47]. Digital recognition technology (e.g. QR-codes, augmented reality) can provide more information on the products' ingredients and sources of origin, for more conscious food choices.[48]

Reduction of food loss & waste

Reducing food loss and waste would deliver significant environmental benefits and greater food access and security. One-third of the food produced is lost in the production or wasted during the distribution or consumption stages; food loss and waste account for 4.4 Gt CO_2eq per year or 8% of the global emissions.[49] With fruits and vegetable losses as high as 50%, and being a large component of planetary healthy diets, the issue of food loss and waste will become even more prominent if not addressed. With 42% of food wasted at the consumption level in Europe, the European Commission has committed to reducing food waste per capita by 50% by 2030.[50] Meanwhile, in the Global South most food is lost during the production and storage phases.

Food packaging can support the reduction of food loss and waste in different ways:

- **Optimized design.** Food packaging can reduce food waste at the consumer level by extending product shelf-life, which might imply additional material layers to increase the permeability to oxygen and other gases[51] and improve the antimicrobial function.[52] However, innovation in this

area will need to consider the impact on packaging recyclability. To prevent consumer food waste, designs such as resealable packaging, better packaging emptying properties or adapted packaging size, especially with shrinking household sizes, can help reduce food waste.[53]

- **Smart technologies.** Smart/intelligent packaging can ensure longer shelf-life through release/absorption substance technology and modified atmosphere, and monitor real food freshness through sensors, potentially replacing the theoretical “best before” date with a realistic assessment of the food freshness, with positive impact on food waste.
- **Better consumer choices.** Packaging labels can shift industry and consumer behaviour to reduce food waste via educational information on the impact of food production or suggestion on how to use extra food to prevent food waste. The development of digital recognition technology can support packaging in communicating this additional information.[54]
- **Shorter supply chain.** Investing in the development of local food value chains generates jobs and improves livelihood, reduces food loss and waste, limits environmental externalities reduces food transport needs, and improves food system resilience. Investing in local food supply chains requires building the capacity of local actors and investing in infrastructure such as food refrigeration, storage, process, packaging and transport facilities.
- **Packaging reuse models.** Packaging models of optimized size and design can allow consumers reducing food waste. By not being bound to existing packaging sizes, consumers can refill their long-term packaging with the amount of food they need.

Protecting & restoring land

Land protection and restoration are critical for climate and nature targets, and for the future of our food systems. One-third of global GHG emissions[55] and 50% of anthropogenic methane emissions[56] are linked to our food systems. Food systems are responsible for deforestation, water scarcity, land degradation and biodiversity loss. Seventy percent of grassland, 45% of the temperate deciduous forest and 27% of tropical forests have been cleared by agriculture worldwide.[57] Nature protection and restoration are critical to curbing emissions, reducing biodiversity loss, improving the community's livelihood, and securing our future food systems.

Food packaging can support land protection and restoration in different ways:

- **Sustainable sourcing.** Source forestry and agricultural inputs that are sustainably produced (e.g. Forest Stewardship Council Certification) can contribute to regenerating soils and nature, supporting climate action, and improving the community's livelihood. Companies can commit to sourcing 100% of their inputs sustainably, but also help advance the development of new metrics, methodologies and certifications that can enable other organizations to take action for nature and climate.
- **Reduced input.** Design packaging to reduce the volume of resources needed such as biomass, water, and energy while not compromising functionality & recyclability, is an effective way to help achieve climate and nature targets. This might imply reducing packaging or simplifying its structure.
- **New materials.** Developing new packaging materials which leverage waste and by-products can reduce the pressure on land for biomass generation. Examples are agricultural and forestry by-products such as straw or bagasse, or recycled materials from industrial and consumer waste.
- **Collection, recycling and circularity enablers.** Delivering better waste collection and sorting systems as well as increased recycling capacity can foster materials circularity and reduce the need forf new biomass, alleviating the impact on land use and nature.
- **Production-protection models.** Develop new production models where land is utilised to achieve production and protection goals can be done by increasing productivity per hectare, protecting forest and restoring degraded land. There is an untapped opportunity in designing and implementing these types of models in forestry areas to simultaneously produce sustainable timber and restore adjacent degraded areas.[58]

- **Regenerative value chains.** Developing regenerative forest value chains connected to food products or packaging, in support of the livelihood of local communities and climate and nature targets (e.g., Brazilian nut or açaí berry, forest coffee in Ethiopia or wild forest honey in Indonesia).[59] This might imply establishing value chains and markets for forest positive commodities.

Protecting oceans

Packaging waste ending up in oceans, especially plastic, has a major impact on oceans, endangering wildlife and affecting food security. Every year, 13 million tonnes of plastic reach oceans affecting marine species and human health through microplastics.[60] Oceans have seen a decline in species by 39%[61] and coral reefs by 50%.[62] The economic damage created by plastic pollution, including clean-up and financial losses in fisheries, is estimated to be $13 billion per year.[63] Under current trends, 29 million tonnes of plastic per year is expected to leak into the ocean by 2040, 2.5 times more than today.[64]

Food packaging can support the protection of the oceans in different ways:

- **Collection, recycling and circularity enablers.** The packaging industry can deliver better waste collection and sorting systems, for instance through the development of Extended Producers' Responsibility, innovation in sorting and recycling technologies by colour and materials, fiber-sorting technologies, innovation in optical separation, and development of Deposit Return Schemes can prevent waste exports, litter, and wasting natural resources. Higher recycling capacity and the development of new technologies, including chemical recycling, and of a market for secondary raw materials are key enablers to establishing more circular materials systems.
- **Technologies for better recycling.** While technologies such as digital watermarks (e.g. HolyGrail 2.0) or AI/computer vision for automated waste analysis, or infrared pigment detectors can improve waste segregation, delamination technologies can further support the recycling of each material used in packaging and improve the recycling quality. Higher recycling can also contribute to the reduce the resource gap.
- **New materials.** Developing new packaging materials which are biodegradable, compostable, soluble, and edible can reduce packaging pollution in oceans. Marine biomass such as from algae can regenerate marine ecosystems and capture carbon dioxide, while creating new feedstock for packaging potentially biodegradable.
- **Packaging reuse models.** Developing packaging reuse models can reduce packaging leakage to the environment. Refill or return models based on long-term existing packaging at home or on the go prevent the production of single use packaging.[65]

An overview of all 13 impact opportunities can be found in the Appendix – Table 1.

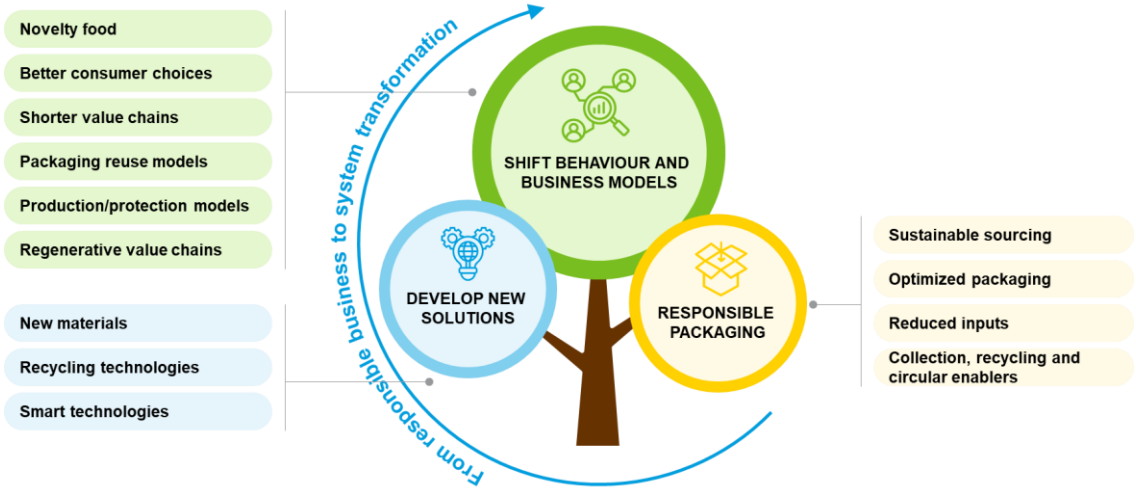
There is a strong social dimension to food systems. Despite food systems being key in reducing poverty, the value created in the food and land use economy is unevenly distributed, leading to growing rural poverty. Eighty percent of extremely impoverished people live in rural areas, of whom many make their living from agriculture, either as smallholders or wage labourer.[66] Many primary producers involved in international supply chains such as coffee and cocoa are also still living below the poverty line, as the value generated is unevenly distributed across value chain actors, with growers suffering the most. For example, from a $2.50 cup of coffee, less than $0.02 is earned by the grower.[67] Lack of financial opportunities to increase agricultural productivity, population growth and increased pressure on farm size and natural resources will put additional pressure on smallholders.

The food packaging industry can support better livelihoods. With targeted investments in less developed areas, food packaging companies can enable the creation of local food supply chains, with positive outcomes for livelihood and climate. By supporting skills building and improving access to

information and technology, for example, they can empower smaller producers. Furthermore, they can invest in training and development for women and equal payment schemes, to improve women's economical position. Improvements in livelihood have a direct impact on food affordability and security. It is important for businesses to define their ambition and their targets to improve socio-economic outcomes.

Taking action across these impact opportunities implies moving beyond responsible business. To deliver a meaningful contribution to better food systems**,** food packaging companies need to take action beyond sustainable packaging. Moving toward system transformation will require that businesses develop new solutions and enable a shift in behaviour of other food actors and the development of new business models aligned with and supporting better food systems. For companies this will mean gradually expanding their sphere of influence and widening the set of stakeholders they need to engage with (Exhibit 6).

Exhibit 6. Impact opportunities, from responsible business to system transformation



4. How to make it happen

Over the last years, businesses have come together to address the challenges of products' end-of-life. The recent pressure from consumers and regulators on packaging end of life, especially for plastic products, has triggered major commitments by the industry. Most of the largest food and beverage companies have set the target of achieving 100% reusable, recyclable or compostable

packaging by 2025 or 2030, sometimes with complementary recycled content targets. To overcome barriers and achieve those targets, businesses have come together and a large number of partnerships have emerged in the food packaging industry, involving a mix of food companies, producers, converters, recyclers, and research institutions. There are many cross-value chain associations and other industry bilateral collaboration, such as the Consumer Goods Forum, 4EverGreen, and the Circular Plastics Alliance.

Building on this experience, the industry can now widen the collaboration to support the transition to better food systems. The food packaging industry has an opportunity to move beyond its focus on sustainable packaging, looking at what goes inside its packaging and at the broader food system. To access the impact opportunities identified, sharing goals and adopting multi-stakeholder models will be needed. Collaboration outside of and along the value chain is needed to generate synergies and reduce current risks and costs. Depending on the area explored, we will need to engage not only with food companies, but also with research and innovators, the financial sector, government and regulators as well as civil society.

BOX 1: TETRA PAK AND STORA ENSO JOINING FORCES FOR BEVERAGE CARTON RECYCLING

Tetra Pak and Stora Enso joined forces to develop solutions for the recycling of all components of fiber-based packaging. In the Benelux region the two companies did a feasibility study for a comprehensive beverage carton recycling facility, where the processing of fibers would take place. These high-quality fresh fibers are excellent source material for producing recycled paper containerboard. Polymer and aluminium barrier materials were recycled by a partner company. In Poland, the two companies worked together to triple the recycling of beverage cartons throughout Central and Eastern Europe. Recycled fibers will be integrated into recycled board, and separated polymers and aluminium will be recycled into products such as pellets and foils. The collaboration aims to contribute to a circular economy development at a country level, and intends to be fully aligned with the EU Green Deal.

Sources: "Stora Enso and Tetra Pak join forces to triple the recycling capacity of beverage cartons in Poland" & "Stora Enso and Tetra Pak study a possible solution for beverage carton recycling in Benelux to advance circular paper-based packaging solutions"

At Stora Enso, we are ready to accelerate the required transformation of food systems. Over the last decades, we have been working to improve the sustainability of our packaging products. We believe we can build on our collective efforts to step up our ambition and we are open to collaborating to do so. We believe collaboration is essential to solve the bigger challenges and achieve faster system transformation, as generating multiplier effects on individual actor efforts. In writing this white paper, we have engaged with stakeholders across the food value chain to gather ideas and perspectives on how sustainable packaging can play a role in transitioning to a better food system. We are keen to move into action. We know this requires new commitments and working them into our exiting ambitions, and we are committed to do so. We will leverage our assets strategically, and keep building critical expertise and knowledge to enable system change.

Box 1 and Box 2 present two examples of collaborative efforts we have delivered with partners in the food value chains.

BOX 2: STORA ENSO AND SIG FOR NET POSITIVE PACKAGING SYSTEM

Since 2019, Stora Enso and SIG Combibloc have been working collaboratively to explore how to translate and adapt to the Net Positive Principles and apply these to establish a net positive food and drink packaging system. A pilot case study was established to explore the end-of- life of used packaging, its wider role in a circular economy and routes for systemic and transformative change. One of their findings shows that there are common tools for measuring and reducing footprints, but not yet a commonly used method to identify and measure companies' positive impacts (or "handprints"). The case study offers guiding principles that can help companies understand their impact from the perspective of their entire value chain. The goal is to create handprints with positive changes as a result which will benefit more of society and the environment.

Source: Approaching Systemic Transformation – Learnings from applying Net Positive Principles - The case of beverage carton (Stora Enso & SIG Combibloc, 2019)

We call for joint action by stakeholders to drive the transformation of food systems. We aim to translate the high-level impact opportunities into tangible targets and actions. We have mapped the required enablers (Appendix – Table 2) and we aim to use this analysis as our starting point for conversations with other stakeholders. As a first step, we need to build a perspective on what needs to happen and what other actors are doing. Ultimately, we hope to support our customers and the overall food systems in developing the next generation of business solutions to enable the necessary transitions. We welcome input from actors in the food systems on the impact opportunities and how to join forces to act on them. From large and established businesses to small and innovative start-ups, from research institutions to civil society, from governments to financial institutions, we invite organisations to get in touch with us to join forces.

Appendix

Appendix – Table 1. Overview of the 13 impact opportunities

		Opportunity	Details	Examples	Impact areas
Responsible packaging	*1*	**Sustainable sourcing**	Source forestry and agricultural inputs sustainably produced to contribute to regenerating soils and nature, supporting climate action, and improving communities' livelihood	1) Commit to sustainable sourcing, in line with climate, nature and livelihood goals (e.g., FSC certification) 2) Support the development of metrics, methodologies, certifications for nature and climate outcomes	
	2	**Reduced inputs**	Simplify packaging to reduce the volume of resources needed, such as woody biomass, agricultural inputs, water, energy, while not comprimising functionality and recyclability	1) Reducing overpackaging 2) Simplifying packaging structure and reduce inputs required 3) Reducing use of chemicals (e.g., bleaching) and decoration on the packaging	
	3	**Optimized design**	Design food packaging solutions which can keep food fresh for longer time periods, while reducing the need of preservative products, and/or reduce food waste at consumer level	1) Remove packaging when unnecessary 2) Better emptying properties 3) Re-sealable packaging 4) Better barrier properties 5) Adapted size for smaller households	
	4	**Collection, recycling and circularity enablers**	Deliver better waste collection and sorting, higher recycling capacity and establish a market for secondary raw materials, can prevent waste exports, litter, and reduce the need for natural resources	1) Development of Extended Producers Responsibility 2) Innovation in sorting and recycling technologies (e.g., sorting by colour and materials, innovation in optical separation, chemical recycling) 3) Development of deposit return schemes	
New solutions	*5*	**Smart technologies**	Develop smart / intelligent packaging supported by traceability technologies to ensure longer shelf-life, monitor freshness, increase product safety and nutritive profile	1) Blockchain to trace the origin of food / packaging materials, or to ensure safety by recalling hazardous products 2) Smart, intelligent, active packaging (e.g., embedded sensors and release/absorption substance technology, modified atmosphere)	
	6	**Technologies for better recycling**	Develop new packaging technologies to support higher quality segregation process and quality material recycling, improving material circularity and reducing gaps in resources and environmental externalities	1) Digital watermarks on packaging (e.g., Holygrail) 2) Packaging detection properties, sortation, and delamination (e.g., automated waste analysis and sorting through AI/computer vision, infrared pigment detectors, delamination technologies)	
	7	**New materials**	Develop new packaging materials with lower environmental impact and pollution potential, and reduce land competition with food demand leveraging alternative feedstock and recycling	1) Marine feedstock (e.g., algae) 2) Agricultural and forestry by-product (e.g., straw, bagasse) 3) Waste (e.g., industrial and consumer waste) 4) Carbon-based (e.g., CCU, direct air capture)	
Behaviour and business models shift	*8*	**Novelty food**	Support the development of new value chains of food products which are healthy and sustainable, by developing key enabling conditions required. This also includes innovation in processing and packaging solutions	1) Investments in food processing solutions to keep nutrients in food for longer-time without added-products (e.g., forward osmosis) 2) Packaging rightsizing the amount and nutritional balance of prepared-meals in line with the planetary diet 3) Innovation designs in packaging for new food products	
	9	**Better consumer choices**	Develop packaging labels that through targeted information can foster the adoption of healthy and sustainable diets and shift consumer behaviour to reduce food waste	1) Nutri-score and certifications, for less added products (e.g., salt, sugar, fat) and healthier food 2) Information on the impact of food production 3) Information on packaging disposal 4) Digital recognition technology (e.g., QR code, augmented reality) for information on food ingredients or source of origin	
	10	**Shorter supply chains**	Invest in the development of local food value chains to improve socio-economic conditions, reduce food loss and waste, reduce environmental externalities and improve resilience	1) Partnership models that empower local food actors 2) Investments in local packaging value chains	
	11	**Packaging reuse models**	Develop packaging reuse models to reduce pollution and need of raw materials for packaging as well as enable consumer purchasing the amount of food needed, reducing food waste	1) Refill models based on long-term packaging at home or on the go 2) Return existing long-term packaging at home or on the go	
	12	**Production-protection models**	Develop new production models where land is utilised to achieve production and protection goals by increasing productivity per hectare, protecting forest and restoring degraded land	1) Design and implement production-protection models in forestry areas to simultaneously produce sustainable timber and restore adjacent degraded areas	
	13	**Regenerative value chains**	Develop regenerative forest value chains, including through forest regrowth, in support of livelihood of local communities and climate and nature targets	1) Support the development of regenerative forestry value chains of food products 2) Regrow forests in degraded areas to sequester carbon	

Healthy diets
Reduction of food loss & waste
Protecting & restoring land
Protecting oceans

Appendix – Table 2. Key enablers required for the 13 impact opportunities

		Opportunity	Details	Enabling conditions
Responsible packaging	*1*	**Sustainable sourcing**	Source forestry and agricultural inputs sustainably produced to contribute to regenerating soils and nature, supporting climate action, and improving communities' livelihood	
	2	**Reduced inputs**	Simplify packaging to reduce the volume of resources needed, such as woody biomass, agricultural inputs, water, energy, while not comprimising functionality and recyclability	
	3	**Optimized design**	Design food packaging solutions which can keep food fresh for longer time periods, while reducing the need of preservative products, and/or reduce food waste at consumer level	
	4	**Collection, recycling and circularity enablers**	Deliver better waste collection and sorting, higher recycling capacity and establish a market for secondary raw materials, can prevent waste exports, litter, and reduce the need for natural resources	
New solutions	*5*	**Smart technologies**	Develop smart / intelligent packaging supported by traceability technologies to ensure longer shelf-life, monitor freshness, increase product safety and nutritive profile	
	6	**Technologies for better recycling**	Develop new packaging technologies to support higher quality segregation process and quality material recycling, improving material circularity and reducing gaps in resources and environmental externalities	
	7	**New materials**	Develop new packaging materials with lower environmental impact and pollution potential, and reduce land competition with food demand leveraging alternative feedstock and recycling	
Behavior and business models shift	*8*	**Novelty food**	Support the development of new value chains of food products which are healthy and sustainable, by developing key enabling conditions required. This also includes innovation in processing and packaging solutions	
	9	**Better consumer choices**	Develop packaging labels that through targeted information can foster the adoption of healthy and sustainable diets and shift consumer behaviour to reduce food waste	
	10	**Shorter supply chains**	Invest in the development of local food value chains to improve socio-economic conditions, reduce food loss and waste, reduce environmental externalities and improve resilience	
	11	**Packaging reuse models**	Develop packaging reuse models to reduce pollution and need of raw materials for packaging as well as enable consumer purchasing the amount of food needed, reducing food waste	
	12	**Production-protection models**	Develop new production models where land is utilised to achieve production and protection goals by increasing productivity per hectare, protecting forest and restoring degraded land	
	13	**Regenerative value chains**	Develop regenerative forest value chains, including through forest regrowth, in support of livelihood of local communities and climate and nature targets	

Business & finance
Policy & regulation
Innovation & technology
Influencing & engagement
Better data and measurement

Resources

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About Stora Enso

Part of the bioeconomy, Stora Enso is a leading global provider of renewable solutions in packaging, biomaterials, wooden constructions and paper.

We employ some 22,000 people and our low-carbon, fiber-based products offer solutions to climate change that enables our customers to become more eco-friendly.

We believe that everything that is made from fossil-based materials today can be made from a tree tomorrow.

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Stora Enso
Packaging Materials division
storaenso.com

THE RENEWABLE MATERIALS COMPANY