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Accelerating the transition towards a circular economy in the Economic Commission for Europe region: focus on reducing food loss and waste*

Submitted by the secretariat

Summary

The Economic Commission for Europe (ECE) has taken important steps to advance the transition to a more circular economy. At its sixty-ninth session in April 2021, ECE member States requested relevant sectoral committees and bodies to scale up their efforts to promote circular economy approaches and the sustainable use of natural resources. Member States also asked to consider how to enhance the impact of existing ECE instruments, including by proposing ways to identify, evaluate, and address gaps in governance and best practices (E/ECE/1494). In its more recent seventieth session, in April 2023, the Commission addressed progress made and invited to mainstream digital and green transformations for sustainable development as a cross-cutting priority (E/ECE/1504).

The ECE secretariat has since worked to integrate the circular economy approach in the full scope of its relevant activity streams. As part of the response, the Economic Cooperation and Trade Division has been implementing a United Nations Development Account project on "Accelerating the transition towards a circular economy and sustainable use of natural resources in the UNECE region" (2021–2024). The project aims to support the design and implementation of national policies, programmes, and strategies in key areas of intervention for the circular economy relating to waste management, public procurement, innovation, trade, and traceability of value chains.

This note summarizes key findings from a draft policy paper on reducing food loss and waste developed under the project. The document is presented to inform discussions at the ninth session of the Steering Committee.

* This document has not been formally edited by ECE.

I. Introduction

1. Global food demand is growing due to a confluence of factors such as population growth, prosperity, and changes in demographics. Population increases, alongside growing consumer expectations and societal changes, place significant pressure on humanity to meet escalating food demands within the constraints of finite natural resources and environmental considerations. To succeed, agri-food systems must become more resource-use efficient, with minimal losses and waste, and operate within a sustainable framework oriented to a circular bioeconomy.[1]

2. Modern agricultural production systems are energy- and resource-use intensive, accounting for approximately one-third of global energy consumption and relying heavily on fossil fuel-derived inputs, such as fertilizers, fuels, and agrochemicals. Globally, over 70 per cent of freshwater is used for agriculture, a proportion that is expected to increase with rising populations, increased wealth, and changing climates. Agriculture and food production also significantly contribute to greenhouse gas (GHG) emissions, with about a third of GHG emissions linked to the sector.[2]

3. The extent of the challenges facing the agri-food sector was reported in the Agricultural Outlook 2022-2031 of the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization (FAO), which found that to achieve the Sustainable Development Goal (SDG) 2 on zero hunger and the Paris Agreement, overall (total system) agricultural productivity would need to increase by 28 per cent.[3] This highlights the need for enhanced operational efficiency and sustainability within the agri-food sector.

4. Currently, about a third of all food produced globally goes to waste, accounting for some 8–10 per cent of global greenhouse gas emissions.[4] The challenge spans the entire food supply chain, from unharvested crops to consumer waste, and is associated with substantial costs. A significant portion of post-harvest agri-food waste in Western economies is avoidable. Preventing food waste is considered as the most effective way to improve resource use efficiency, and will require tackling losses throughout the full spectrum of value chains (i.e. from farms to food processing industries to household consumers). To address existing challenges, the circular economy model is particularly relevant. This model emphasizes (i) maximizing resource use efficiency; and (ii) promoting the recycling, reuse, and enhancement of resources. In the agri-food sector, this means ensuring efficient operations, minimal waste, and use of all by-products in so far as that is practicable, helping create a regenerative sustainable agri-food system.

II. Key trends and challenges

5. Two key narratives are driving the management of agri-food wastes: the food waste hierarchy, emphasizing waste prevention and reduction as the top priority, and the bioeconomy vision, highlighting the value in using unavoidable waste as feedstock (see below). Waste hierarchies outline a prioritized approach to preventing or managing food

[1] There are many definitions of what the bioeconomy entails. In this study the term is used broadly to refer to using renewable biological resources to produce food, materials and energy. For a similar approach see the European Union bioeconomy strategy available at: https://op.europa.eu/en/publication-detail/-/publication/edace3e3-e189-11e8-b690-01aa75ed71a1/language-en/format-PDF/source-149755478.

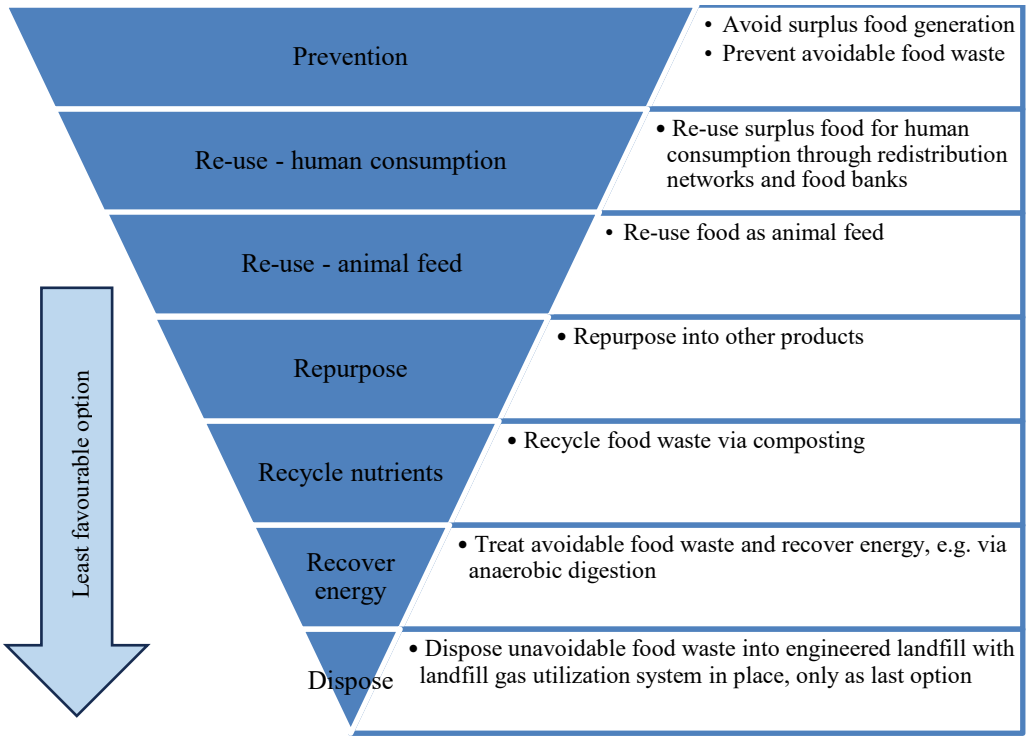
[2] See https://www.fao.org/newsroom/detail/Food-systems-account-for-more-than-one-third-of-global-greenhouse-gas-emissions/.

[3] OECD/FAO (2022), OECD-FAO Agricultural Outlook 2022-2031, OECD Publishing, Paris, https://doi.org/10.1787/f1b0b29c-en.

[4] United Nations Environment Programme (2024). Food Waste Index Report 2024. Nairobi, https://wedocs.unep.org/bitstream/handle/20.500.11822/45230/food_waste_index_report_2024.pdf?sequence=5&isAllowed=y.

waste,[5] as indicated in the figure below, while bioeconomy emphasizes the reuse of material into new products or services.

Food waste hierarchy



Source: Figure adapted in part from E. Papargyropoulou and others, "*The food waste hierarchy as a framework for the management of food surplus and food waste*," Journal of Cleaner Production, vol. 76 (2014), and from Zero Waste Europe, *Food Systems: a recipe for food waste prevention*, Policy Briefing (2019).

Circularity and food loss and waste reduction

6. The agri-food value chain comprises a complex interwoven network of steps (links), each dependent on others in the agri-food chain. No single step can operate in isolation from the market forces that ultimately drive the chain. Increasing circularity and addressing food losses and waste thus requires a systems-based approach, with emphasis on enhancing operational efficiency and working with all actors in the food chain (i.e. farmers, processors, retailers, food service providers, and consumers) to minimize the wastage that is currently embedded in the system.

Farms and food processors

7. Current farming practices lean towards maximizing yields for economic gain rather than optimizing resource use, posing a risk to soil health. To address these challenges, a transition to sustainable farming is required, involving the adoption of systems that enhance resource use efficiency, while focusing on minimizing losses and waste.

8. On-farm food losses arise due to numerous factors: inefficient production operation, inefficiently harvested crops, and discarded products due to damage or fluctuations in demand. Market dynamics, including demand and pricing, significantly influence farming. The misalignment between retail forecasting and crop production can result in overproduction to maintain high levels of in-stock fresh produce, making it economically

[5] For example, the European Union Waste Framework Directive (Directive 2008/98/EC) outlines a hierarchy for managing products and waste within the agri-food system, prioritizing waste prevention and aiming to utilize unavoidable waste streams as effectively as possible, with disposal as the last resort.

preferable to waste food rather than to risk under-delivering to customers.[6] As a consequence, a proportion of crops may go unharvested due to such market-driven losses.[7] However, overproduction does not necessarily lead to losses, as a substantial portion can and is used in food processing.

Retailers, food service providers and consumers

9. The relationship between food prices, household income, and food waste is complex. Low food prices in relation to income can lead to overconsumption and increased food waste. Research suggests that if food prices accurately reflect the real cost of natural resources and the societal costs of food waste, prices would rise, thereby encouraging waste prevention due to the higher cost of food.[8] However, policies that significantly raise food prices can compromise food security objectives and the achievement of other SDGs including SDG 2 on zero hunger, and are often politically unviable.

10. Food waste reduction requires behavioural changes among citizens, complemented by policy and infrastructural changes. Education on sustainable lifestyles, starting in primary schools, and measures such as mandatory product labelling are crucial.[9] For example, consumer demand and/or regulations may dictate that retailers discard out-of-date or imperfect stock (e.g. in many countries, consumers tend to perceive the "best before date" as a use-by date, discarding what may be perfectly safe and nutritious food), while in the Hotel, Restaurant, Cafe (HoReCa) sector, waste may be reduced through behavioural changes, although some food waste is inevitable (e.g., bookings cancellations that result on food servings that exceed customer demand, buffet waste).

11. Local authorities play a pivotal role in enabling the transition to a circular economy by providing essential services and infrastructure that encourage citizens to adopt sustainable lifestyles and support local businesses towards circular economy practices. Yet, many local authorities lack the necessary resources to enact significant change. To bridge this gap, targeted support and sharing of knowledge is essential.

Bioeconomy and the use of by-products

12. The classification of material streams as "waste" or "resource" impacts directly on how they are perceived and treated, where "resource" implies a potential value while "waste" implies little or no value. Reclassifying what may be considered "waste" into "resource"- by recognizing and valuing their characteristics - provides a basis for changing policies toward recognizing and managing agri-food wastes. Examples like animal manure, crop residues, and yeast from brewing demonstrate how materials traditionally viewed as waste can be valuable resources when recycled or repurposed within the farming system or into added-value products.

13. Many agri-food wastes can be re-used as raw materials (i.e., feedstocks) for processes that can result in new products, providing a major opportunity for the agri-food industry. The characteristics of agri-food wastes mean they can act as a source of renewable carbon. An agri-food-based bioeconomy describes an economic activity that involves using by-products (i.e. unavoidable wastes) of the agri-food sector (e.g. food and farm waste streams) and utilizing these as input feedstock for processing into a range of new products. In many cases, these feedstocks displace fossil-based feedstock, thus enhancing overall circularity.

14. The waste-to-resource transition under the circular bioeconomy offers clear benefits to society from an economic, social, and environmental perspective. The creation of bio-based chemicals and fertilizers from such feedstock can offset traditional mineral-based

[6] Lillywhite, R.D., McCosker, C., and Sheane, R. (2016). *The embedded resource and environmental burden of deliberately wasted lettuce.* 10th International Conference on Life Cycle Assessment of Food.

[7] Johnson, L.K. and others (2018). *Estimating on-farm food loss at the field level: A methodology and applied case study on a North Carolina farm. Resources, Conservation and Recycling* volume 137, October 2018, 243-250.

[8] Willet and others (2019). *Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems*.

[9] Friant, M., Vermuelen, W. and Salomone (2021). *Analysing European Union circular economy policies: words versus actions. Sustainable Production and Consumption*, 27:337-353.

products and provide more renewable feedstocks for the industry. This will enable more resilient agri-food systems, reducing environmental impacts and reliance on finite resources. Enabling this transition to a sustainable bioeconomy will require strategic policy and financial intervention by governments to support a progressive and just transition to a fully integrated circular economy, underpinned by resource use efficiency at all stages.

15. Understanding the provenance and quality of waste used as feedstock is crucial for maintaining the sustainability of the supply chain and its compliance with circular economy principles. The establishment of "raw material passports" could provide information on the origin and method of production of input materials (e.g., distinguishing between avoidable and unavoidable wastes) to ensure that recycled and recovered products can compete (on cost, societal, and environmental levels) with fossil-based alternatives. This requires the establishment of a tamper-proof data capture, storage, and verification system delivering full traceability of the waste - in effect, a complementary feature of a fully integrated food chain traceability system.[10]

16. Collaboration across stakeholders in different supply chains is essential for identifying and securing suitable feedstocks, such as unavoidable agri-food waste, and developing efficient waste collection systems. Governments can complement these initiatives with clear policies to increase the collection and recycling of unavoidable agri-food waste while continuing to incentivize the reduction of avoidable agri-food waste.

17. Trading platforms are emerging as potential marketplaces for agri-food waste, particularly for unavoidable waste streams, which are by-products of the system. Currently, there is no economically viable global market for agri-food waste, but nascent trading platforms are being developed to facilitate efficient trade and sustainable utilization of these waste streams. However, for these platforms to contribute to sustainability and gain widespread adoption, they must incorporate systems that verify the origin of the materials (e.g., a "waste passport" system) and secure financial payment system to enable seamless trade. Such mechanisms are fundamental to achieving a circular agri-food bioeconomy, as circular compliance is contingent upon knowing the feedstock's origin.

18. Circular business models, pivotal in driving the circular economy, often disrupt traditional business practices but are key to reducing environmental impacts and changing the pattern of product and material flows through the economy. "First adopter" businesses play a critical role in demonstrating the commercial viability of these models, influencing the willingness of other businesses to engage. As businesses navigate the transition to a circular economy, they face inherent uncertainties and risks, necessitating support mechanisms that mitigate these challenges and provide financial backing. It is crucial for financial institutions to collaborate with governments in crafting financial solutions that aid "first adopter" businesses.

III. Conclusions and recommendations

19. Effective food waste prevention and reuse is a complex issue. There is a need for a systems-based approach and integrated policies targeting the formation of sustainable food systems as part of a circular economy. The complexity of the food chain, influenced by market forces and interdependencies among stages (e.g. on farms, in value chains, at retail, food service, and consumer levels), requires careful policy design and implementation. The overall emphasis must be on enhancing full-chain operational efficiency and increasing consumer awareness, leading to reduced food losses and waste.

20. International experience indicates that there are various ways in which policymakers can promote the reduction and reuse of waste in the agri-food sector, thus supporting a transition towards a circular economy. Recent studies suggest that the following elements of such an integrated policy approach are central:

- Stimulate transparency and data sharing to improve supply chain collaboration, through baseline and impact measurements at the business, sector, and national levels.

[10] For more information on digital product passports, see document ECE/CTCS/2024/10.

- Invest in awareness raising and consumer empowerment. Consumer habits are key to reducing practices that generate high quantities of edible food waste.
- Set prevention targets aimed at environmental improvements and sustainability performance along the food supply chains. Targets for food waste prevention should be set and implemented in quantitative, measurable terms.
- Use fiscal tools to incentivize food waste prevention measures along value chains. Measures could include the introduction of green taxation on food waste and the establishment of benchmarks for food waste avoidance.
- Consider modifications to food labelling aimed at extending the shelf life of packaged food, differentiating the labels depending on whether the date given refers to a health risk or "best before" dates that only refer to organoleptic characteristics.
- Reform food redistribution policies to simplify donations while ensuring food safety.
- Review public procurement regulations, for example by including technical specifications, requirements, and clauses that favour the reduction of food waste in public procurement contracts.
- Establish a food system waste prevention board, constituting an organizational and knowledge-sharing instrument to promote stakeholder collaboration in setting out agreements, joint actions, sharing of good practices, and promoting awareness-raising campaigns on the prevention of food waste.

21. The policy options applied in different countries and contexts must be calibrated and customized to the specific roles of value chain stakeholders, starting from the farmers to processors and retailers, to the bioeconomy businesses. The following are some key considerations:

Aimed at farmers, processors, and retailers:

- Incentivize the implementation of multi-faceted farming systems and practices that optimize resource use efficiency, including plant and animal genetics, digital agriculture, and eco-compatible and economically sustainable husbandry practices, among others.
- Promote the implementation of mandatory resource flow audits facilitated by a national food loss and waste digital platform.
- Support public-private cooperation for research and innovation in the modelling, prediction, and risk assessment of supply and demand across the full agri-food chain, including the implementation of systems that recycle unavoidable farming waste.
- Provide support to supply-demand modelling as part of an overall full-chain agri-food systems initiative minimizing waste and conducting reviews and regulate the structure of supply contracts with farmers.
- Review food packaging practices to strike the appropriate balance between packaging as a food hygiene and shelf-life extender.

Aimed at bioeconomy businesses:

- Support collaboration within agri-food chains on supply-demand modelling work (as feedstock availability is dependent upon agri-food chain dynamics) and incentivize the implementation of "waste passport" systems whereby the provenance of wastes used as bioeconomy feedstock can be verified, to enable its efficient use.
- Build collaborative ventures with complementary feedstock sources such as municipal wastes, including through public-private partnerships.
- Incentivise scaling up and replicating business models that facilitate product recycling back into farming, and address local waste disposal issues while also delivering high-value products for wider society.

22. The ECE Economic Cooperation and Trade Division stands ready to assist its member States in leveraging the potential of reducing food loss and waste for a circular economy transition. It provides a variety of tools that can support digital transformation, including

norms, standards, legal instruments, and policy advice. For example, it has issued a measuring methodology for fresh produce value chains and a code of good practice for ensuring optimum handling of fresh fruit and vegetables along the value chain. Support by ECE to its member States on capacity building for the circular economy transition depends on extrabudgetary funding. Delegations to the Steering Committee are invited to consider making funding pledges in line with available ECE instruments for resource mobilization.