



Ministry of Foreign Affairs

Systems analysis and strategic plan on the circularity of packaging in the agro-food and flower value chains in Kenya

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Systems mapping and design report

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Systems mapping and design report

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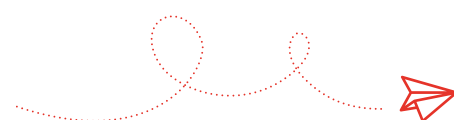


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List of abbreviations

ACEN	African Circular Economy Network
APML	Advanced Packaging Manufacturers Limited
BOPP	Biaxially Oriented Polypropylene
CA	Controlled Atmosphere
CE	Circular Economy
CEFLEX	Circular Economy for Flexible Packaging
CGGCC	Centre for Green Growth and Climate Change
CO ₂	Carbon Dioxide
DRS	Deposit Return Scheme
EMCA	Environmental Management and Coordination Act
EPR	Extended Producer Responsibility
EU	European Union
FPEAK	Fresh Produce Exporters Association of Kenya
GDP	Gross Domestic Product
GHG	Greenhouse Gases
HDPE	High-Density Polyethylene
INDC	Intended Nationally Determined Contribution
KAM	Kenya Association of Manufacturers
KEPRO	Kenya Extended Producer Responsible Organisation
KEPSA	Kenya Private Sector Alliance
KES	Kenyan Shilling
KIDV	Knowledge Institute for Sustainable Packaging
KPP	Kenya Plastics Pact
LCA	Life Cycle Analysis
LDPE	Low-Density Polyethylene
MAP	Modified Atmosphere packaging
MoEF	Ministry of Environment and Forestry
MoITED	Ministry of Industrialization, Trade and Enterprise Development
NCCAP	National Climate Change Action Plan
NEMA	National Environmental Management Agency
NGO	Non-governmental Organization
NMS	Nairobi Metropolitan Services
OHAS	Ornamental Horticulture Packhouse Standard
OT	Oxygen Transmission
PADEO	Programmatic Approach for Sustainable Economic Development
PBAT	Polybutylene adipate terephthalate
PBS	Polybutylene succinate
PE	Polyethylene
PET	Polyethylene Terephthalate
PHA	Polyhydroxyalkanoates
PLA	Polylactic acid
PP	Polypropylene
PPE	Personal Protective Equipment
PRO	Producer Responsibility Organisations
PTT	Polytrimethylene Terephthalate

RPET	Recycled Polyethylene Terephthalate
RVO	Netherlands Enterprise Agency
SDG	Sustainable Development Goal
SFK	Single Faced Kraft
SIB-K	Sustainable Inclusive Business – Kenya
TPC-ET	Thermoplastic Polyester Elastomer Polylactic Acid
UK	United Kingdom
UN	United Nations
USD	United States Dolla

1. Introduction

1.1 Background and context

Background of the packaging industry

Packaging is essential to food quality preservation during transport and storage. It is also essential in preventing food safety issues (food-borne diseases and food chemical contamination) and extending food shelf-life to prevent wastage. To mitigate food loss, globally manufacturers have focused on small size single-use packaging. As result, 36 percent of all plastics produced worldwide is used for packaging. This includes single-use plastic products for packaging fruits, vegetables, flowers, and beverages. When the product is used, the packaging gets discarded and when not managed properly, this leads to a huge environmental burden. Besides the lack of waste management resulting in littering, the use of single-use packaging promotes a take-make-waste (linear) economy, rather than a circular economy, in which resources are being used again in the system.

To prevent further environmental damage there is a need to view the agro-food packaging system as a whole, and not in silos. It is necessary to consider the environmental impact of the packaging material as well as its role in the reduction of the environmental impact of food waste and loss. There is a need for innovative sustainable packaging that reduces food waste and loss by preserving food quality, addresses food safety issues by preventing food-borne diseases and limits the risk of food chemical contamination while also minimising the environmental footprint of packed food.

In Kenya, food packaging is essential, as it protects products against heat, humidity, and in transit. As Kenya is a significant exporter of fresh produce, packaging is essential in preserving produce quality. Currently, most Kenyan plastic and paper packaging material is imported, packed in Kenya, and exported to other markets, like the Netherlands. This transport-heavy market for fresh produce, requires a high quality of packaging materials. However, with a growing level of environmentally conscious governments, companies, and consumers, there is a need for sustainable packaging that can reduce food waste and loss by preserving food quality while also minimising the environmental footprint of the packaging. Moreover, sustainable packaging also has the potential to create opportunities for local economic development in the form of job creation.

Context of the circular economy

Circular economy is a concept that does not have one commonly accepted definition. According to the Ellen MacArthur Foundation, circular economy is defined as a system solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution.¹ Generally, it is accepted as a counter reaction to the linear economy, where resources are abundant, easy to retrieve, and cheap to dispose. This linear economy is not future-proof, since we know that resources are limited, and regular disposal methods are energy intensive and environmentally harmful.² A circular economy is thus needed to take better care of our limited resources, and ensure the ecologic balance of the earth stays within

¹ Ellen MacArthur Foundation, 2022. Circular economy overview. <https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview>

² R. Denise, S. Witjes, 2018. The circular economy: New or Refurbished as CE 3.0?. <https://www.sciencedirect.com/science/article/pii/S0921344917302756>

certain boundaries. Beyond environmental reasons, the economic effects of resource depletion are also beginning to have a noticeable effect. The rising prices of resources and insecurity of supply result in disruptive value chains for many products.

The linear economy is still very much the structure of the system in agro-food. Virgin materials are extracted, (single-use) packaging is made, wrapped around products, and transported to the retailer. After use, the consumer typically disposes of the packaging by directly throwing it in the bin – if there is a bin at all. From the United Nations (UN) circularity steps (Figure 1), follows the recommendation no packaging, less packaging, reused packaging, repaired/remanufactured packaging, repurposed packaging, recycled packaging.

The design of the packaging is very important in this sense, as this determines the technical possibility to reduce, reuse, or recycle the product. In a circular economy, waste does not exist – products are designed to be reassembled and reused. Even recycling can be challenged within such a system, since it is a highly energy intensive process. However, it does keep the materials in the same system (apart for some losses during the process).³ Increasing circular packaging can for example be measured by preventing the use of virgin materials, preventing the incineration of virgin materials, or producing packaging from renewable sources.

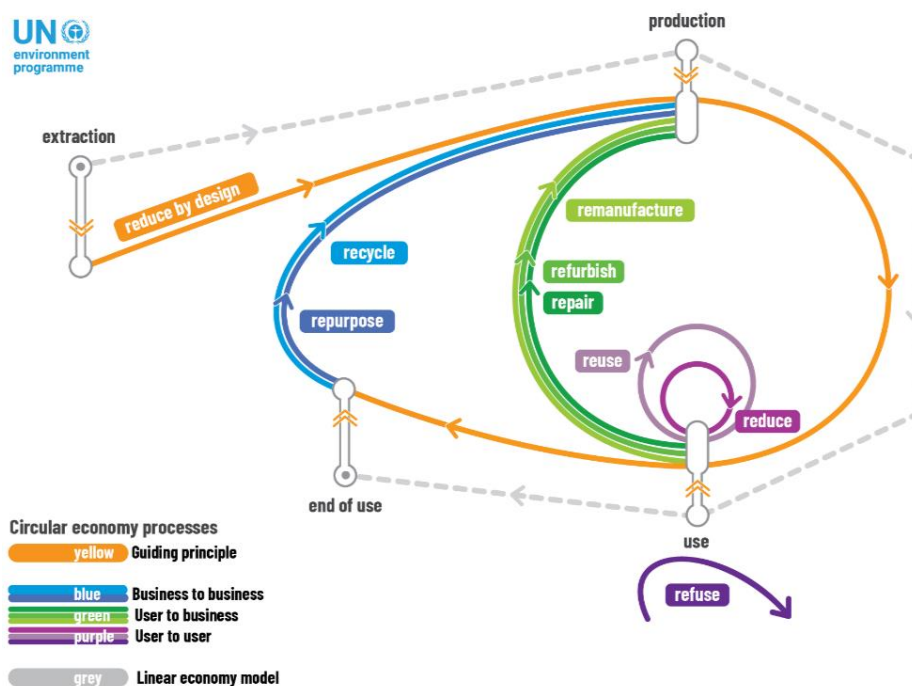


Figure 1 UN circularity steps (source: <https://buildingcircularity.org/>)

Circular economy is not a goal in itself, but a means to reduce the environmental impact by improving resource-use efficiency.

³ World Economic Forum, 2013. Towards the circular economy. <https://www.weforum.org/reports/towards-circular-economy-accelerating-scale-across-global-supply-chains/>

1.2 Objective of this study

The overall objective of this project is to give insights in the Kenyan packaging system and design interventions that positively impact economic activities on circularity for packaging in the agro-food and flower value chains in Kenya while spurring sustainable job creation. The sub-objectives are:

- Develop a clear and practical understanding of how the agro-food and flower value chains function in relation to more economic activities on circularity in packaging and the complexities that underly the success of possible interventions for impact on economic inclusive growth, circularity, and job creation;
- Design possible interventions that trigger key leverage points and address the identified local needs and crucial bottlenecks. Also, provide insights into the possible impact on economic growth, circularity and job creation of the interventions that are selected. In addition, the report will provide an understanding of the added value of (Dutch) interventions or companies.

The strong relationship between the Netherlands and Kenya is transitioning from aid to trade. The Netherlands, in the period of 2019 – 2022, is focusing on promoting sustainable trade and investment and has a focus on water, food security and climate. The embassy will continue to develop and strengthen sustainable and climate resilient agricultural value chains and have prioritised circular economy as a cross-sector theme to match Kenya's ambitions to put circular economy into practice. The embassy aims to promote sustainable projects in the agricultural value chains together with the Dutch diamond (i.e. collaboration between government parties, business communities, knowledge institutes and NGOs), positioning Dutch expertise and knowledge as strategic elements in the transformation towards circular and more sustainable agriculture in Kenya. A strategic approach to defining interventions on circular possibilities in agro-food value chains for more sustainable packaging solutions is the focus of the embassy, linking the Kenyan agriculture sector with sustainability, innovation, economic growth models, emphasis on the role of women and youth, alongside Dutch expertise and technologies.

Box 1 Royal Dutch Embassy Policy Focus

1.3 Approach

The world of agro-food and flower packaging is complex, with a constant balancing act between the amount of packaging and product loss. To get a nuanced understanding of the complexities, specific value chains will be selected for a deep dive. The lessons will eventually also be used for systemic recommendations. The packaging value chains of three products were selected for further analysis. See for an elaboration on this Chapter 3 - Selection of packaging value chains.

The Embassy, together with the Ministry of Foreign Affairs of the Netherlands has asked the consultants to follow a systematic approach to designing interventions under the new Programmatic Approach for Sustainable Economic Development (PADEO). The aim is to pilot with this systematic approach for achieving more progress on Sustainable Development Goal (SDG) 8.⁴

The aspects of applying the systems thinking approach are crucial for this project. Rather than trying to understand the world by reducing it to its individual elements and looking at them in isolation, systems-

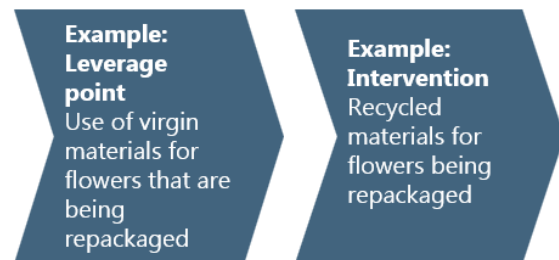
⁴ Terms of Reference

thinking focuses on the relationships between elements and how these result in emergent outcomes over time.⁵

The three main steps that led to this report are described below.

1. The desktop review signalled the start of the systems mapping. Literature specifically on Kenya and literature more broadly on circular economy has been used.
2. Stakeholder interviews, which were grounded on the root cause analysis framework where mental models, structures, patterns and events were uncovered; through which causal loop inputs were identified to help detect leverage points and areas of interventions.
3. A workshop with key stakeholders was conducted to validate and complement the findings of the previous steps. In the first part of the workshop, the root cause analysis has been validated. The identified leverage points were the basis for break-out groups around four different themes. See below the framework for thinking for the break-out groups and the four themes. The workshop concluded with a discussion on potential interventions.

- ▶ Leverage points → **Where can a small shift produce big changes?**
- ▶ Intervention → **Which actions can impact a leverage point?**
- ▶ Rules:
 - ▶ Focus on what is **realistic** (impact vs. effort)
 - ▶ Indicate the kind of **support** that would contribute to the shift (from Kenyan & Dutch stakeholders)
- ▶ Output of breakouts:
 1. Find leverage points
 2. Determine interventions



Themes:

1. Production of packaging
2. Use of packaging for the local market
3. Use of packaging for the export market
4. Disposal of packaging

Box 2 Framework for the workshop break-out sessions

1.4 Reader's guide

In the next chapter, Chapter 2, this report will describe the state of packaging in Kenya. It will explain the role of packaging in the agro-food sector in general before narrowing into the local context, focusing on the quality of packaging, imports of inputs, technology for packaging production and waste system collection. The chapter also explores the regulatory environment, and social perspective in terms of lack of standards and awareness. The final section elaborates on the financial incentives to produce, dispose and how this could encourage job creation in the packaging industry.

⁵ Metabolic, 2022. www.metabolic.nl

Chapter 3 will explain the selection of the packing value chains. It first explores the selection rationale of the three value chains, the packaging material used for the selected products, and how the packaging moves i.e., where the raw materials are sourced from and to which markets they are exported.

Chapter 4 provides a deep dive into the packaging value chains. It concentrates on the value chains of both plastic and paper to unpack the system complexities from production, use/transport, and disposal.

Chapter 5 focuses on leverage points. It explains the leverage points that play a role in the production, use/transport, and disposal of packaging. Leverage points are specific areas where small changes can have a significant impact.

In the next chapter, Chapter 6 identifies interventions and explores their potential implementation. The identified interventions are expounded on through their categorisation into technical, social, regulatory, and financial sections. After this, there will be a feasibility scan looking at the potential implementation and impact of various interventions.

Finally, Chapter 7 will conclude. The chapter begins by exposing the root causes and leverage points, delves into existing circularity practices and potential opportunities for job creation.

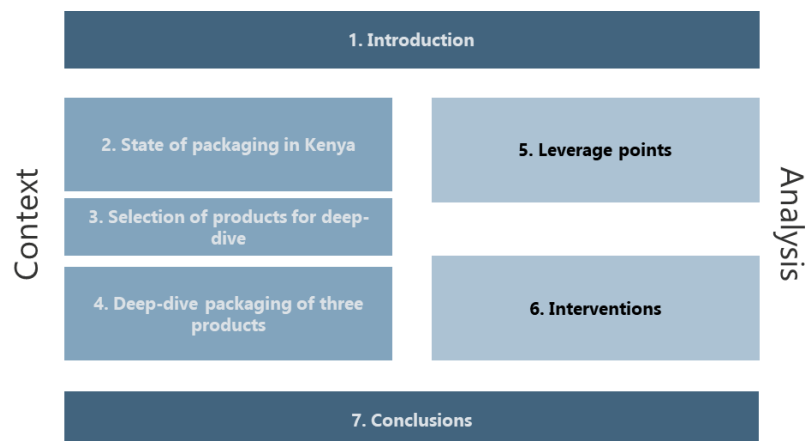


Figure 2 Simplified structure of the report

2. The state of (circular) packaging in the Kenyan agro-food sector

2.1 Introduction

This chapter explains the current state of packaging in the Kenyan agro-food and flower sector. First, we introduce the packaging types of the agro-food and flower products, and explain the circular economy status in Kenya. Then, the agro-food sector in Kenya is explained based on four perspectives: the technical, regulatory, social, and financial perspective. For each perspective, we will elaborate on the current achievements and remaining challenges.

2.2 Packaging of flowers and agro-food products

Using adequate packaging to avoid product losses and food wastage is essential and benefits the environment more than if no packaging was used at all.⁶ The most used packaging materials in the flower and agro-food industry are plastic and cardboard. The main reasons for these packaging materials are the functionalities of weight, strength, repellentness (of plastic), and cost effectiveness.

Paper packaging is usually made from wood, which is a renewable material. Because it can get contaminated quickly, it is usually combined with other materials like plastic or metal. If the packaging is not contaminated with moisture or waste and it does not stick to other materials (which is often what happens in drink cartons), it can be recycled into new reusable paper or carton. Plastic packaging is made of plastic polymers, which is a petro-chemical material. Commonly used plastic types for agro-food and flower products are Polyethylene Terephthalate (PET), High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE), and Polypropylene (PP).⁷

Circular packaging is related to sustainable packaging. Sustainable packaging has limited impact on the environment, without compromising on the quality of the packaged product. This can however still result in a linear process, for example via incineration for energy recovery. Circular packaging is about optimising the utility and value of materials at all times, and thus keeping products and materials in the system.¹ A common thought about circular (or 'sustainable') packaging is that plastics should not play a role. However, plastics have great functions relative to food safety and increasing the shelf-life of products. The assumption that using paper or biodegradable plastic is better than plastic is therefore not always correct. This also depends on whether the material is prone to littering or not. Namely, plastic does have a necessarily larger negative effect than paper, when ending up as litter in the environment. One should therefore take into account the whole value chain of the packaging material for deciding on the most sustainable packaging material. The life cycle of plastic packaging is visualised in Figure 3. In Appendix 1, the environmental advantages and disadvantages of different packaging materials are further explained.

⁶ World Economic Forum, 2016. The New Plastics Economy Rethinking the future of plastics.

⁷ Petro packaging company inc, 2021. Different types of plastic packaging explained.

<https://www.petropackaging.com/different-types-of-plastic-packaging/>

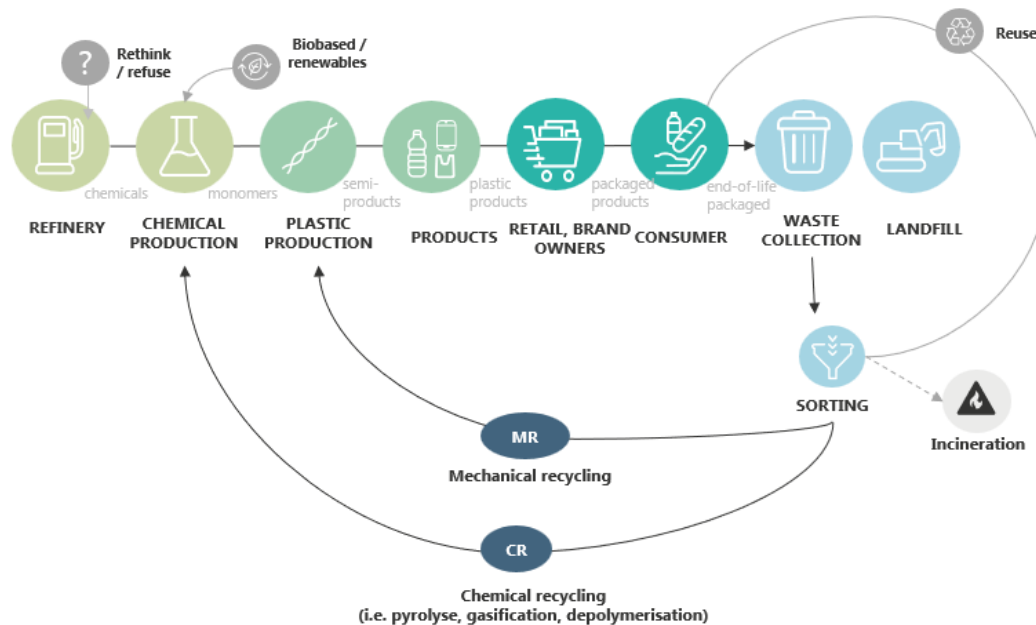
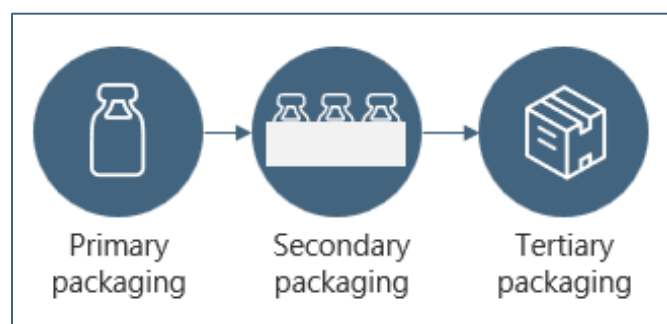


Figure 3 Value chain of plastic packaging (source: Rebel)

When packaging and exporting fresh produce of the agro-food and flower sector, there are several layers of packaging; usually primary, secondary, and sometimes also tertiary packaging. Using Figure 4 for illustration, primary packaging is in direct contact with the product itself (like a glass bottle); secondary packaging combines different products and their primary packaging (a small plastic or carton crate); and tertiary packaging, contains products with multiple secondary packaging. For food safety, primary packaging is most important. This packaging therefore is most strictly regulated.

Figure 4 Types of packaging



Using different packaging also has the benefit of being able to separate different materials better, which improves the reuse and recyclability of the materials. Looking at the total amount of packaging also has the benefit of being able to see where improvements can be made: increasing the strength of for example the tertiary packaging, could eliminate or reduce the need for secondary packaging.⁸

A circular approach on packaging that focuses on a reduce-reuse-recycle approach is key. This includes minimising single-use plastic, encouraging the reuse and recycling of materials and improving the economics and quality of recycled plastic materials. Due to their low weight, low cost and high

⁸ KIDV, 2022. Packaging systems. <https://kidv.nl/verpakkingssystemen>

functionality, plastic flexible packaging is used for everything from fresh fruit, to meat, dry foods, drinks, flowers and much more. However, a large portion of food packaging is multi-layer plastic which is technically very difficult to recycle and also cost-intensive. There are currently limited viable packaging alternatives that offer the same level of protection.¹⁰

2.3 Technical context

Quality of packaging is crucial for food quality and safety, locally and for the exports of Kenya.

Packaging plays an important role in agro-food products by keeping food fresh and retaining quality, to ensure safety and by extending shelf-life which reduces food loss and wastage.⁹ Active packaging systems, for example modified atmosphere packaging (MAP), modify the food or environment it is held in.¹⁰

Plastic is the most common in primary packaging due to it being lightweight, flexible, and relatively affordable. However, not all plastics are easily recycled or reused.¹⁰ Primary plastic packaging that comes in direct contact with food can usually not be reused due to the high safety standards required of food packaging. Furthermore, the primary packaging used has multiple layers made from several different plastic polymer types which only further increase the complexities of the recycling process.

Multi-layered packaging offers alternative benefits such as oxygen barriers. These packaging solutions keep packaging volume to a minimum, reducing raw material use and lower CO₂ emissions while offering maximum protection to the food, extending shelf-life and reducing food waste.¹¹ Multi-layer plastics pose significant challenges for recycling, with high associated costs, the technological difficulty of separating different plastic polymers, and the inability of current waste processes to recycle mixed polymers.¹² Multi-layered packaging combines different polymeric and non-polymeric materials such as paper or aluminium, to enable customised property profiles with low material consumption. Multi-layers can reduce the cost of existing film structures, e.g., by replacing expensive polymers with less costly ones, reducing film thickness, or using recycled materials. Furthermore, the combination of different layers achieves a functionality that is not possible through the use of a single layer. Product protection is the central criterion for sustainable packaging in horticulture. Savings in packaging, which lead to higher levels of food waste, significantly worsen the environmental impacts of the integrated product packaging system.

Most packaging inputs are imported

The plastic used for packaging is imported from oil-producing countries, where plastic by-products are competitively priced, e.g. Saudi Arabia, Turkey, China, and India. Equally, the paper used in packaging is also imported as Kenya has a paper deficit with few craft mill factories. Within East Africa, Tanzania is the only country to have a paper mill, yet the quality is still not up to the export market standard. Virgin

⁹ Matthews C., Moran F., Jaiswal A.K, 2021. A review on European Union's strategy for plastics in a circular economy and its impact on food safety. *Journal of Cleaner Production*.

¹⁰ Gontard, Nathalie & Guillaume, Carole, 2009. Packaging and the Shelf Life of Fruits and Vegetables.

¹¹ Schmidt, J, Grau,L, Auer,M, Maletz,R, Woidasky,J,2022. Multilayer Packaging in a Circular Economy

¹² FAO, 2011.Appropriate food packaging solutions for developing countries.

paper is typically imported into Kenya from countries such as India, Sweden and Tanzania (even though the quality of paper from Tanzania is not up to standard).

Technology for packaging production can be further improved

In most Sub-Saharan African countries, suitable packaging, particularly for the small and medium agro-enterprise sector, is often lacking. The poor level of access to quality packaging for both fresh and processed foods is among the main reasons for the failure of locally manufactured food products to compete with imported ones. Strengthening food packaging systems is one of the most appropriate solutions for tackling food losses and waste reduction. In terms of packaging production, there are several materials that are especially hard to recycle. This includes plastics which contain varied resins that ensure sufficient quality by improving the strength of the packaging. Paper packaging, sourced from either virgin or recycled wood fibre, is far easier to recycle.

Using recycled plastic for food contact material may pose a food safety risk as there is possibility of hazardous chemicals migrating into the food. However, recycled material could be utilised in food packaging in conjunction with a layer manufactured from virgin materials.¹³ Active food contact materials absorb or release substances in order to improve the quality of packaged food or to extend its shelf life. Intelligent food contact materials either monitor the condition of packaged food or the surrounding environment e.g., measuring the freshness of the food.¹⁴ Although ambitious, the use of recycled plastics to create food-grade packaging may be achieved in the near future. Currently, such advancements are still in the experimental/ pilot stage in Europe. In the meantime, it would be prudent for Africa to depart from a linear economy, by finding other useful applications of recycled plastics.

¹³ B. Geueke, K. Groh, J. Muncke. Food packaging in the circular economy: overview of chemical safety aspects for commonly used materials. *J. Clean. Prod.*, 193 (2018), pp. 491-505, [10.1016/j.jclepro.2018.05.005](https://doi.org/10.1016/j.jclepro.2018.05.005)

¹⁴ European Food Safety Authority, 2022. Active and intelligent packaging substances. [Active and intelligent packaging substances | EFSA \(europa.eu\)](https://www.efsa.europa.eu/en/active-intelligent-packaging-substances)

A plastic can be defined as a bioplastic if it is either bio-based, which means that the material is (partly) derived from plants, or if the material itself is biodegradable. Biodegradable means that microorganisms found in the environment convert the material into natural organic substances. Any natural polymers utilised for packaging solutions should meet the same performance standards as synthetic polymers, including physical requirements, sealing properties and barrier release compounds.

Polylactic Acid (PLA) is the most versatile bioplastic on the market, because it is compostable and recyclable. However, PLA's limitations such as brittleness, poor heat resistance and hydrolytic instability have limited its use primarily to single-use disposable applications. Currently PLA is not composted or sorted for recycling. As such it often ends up with other plastics diverted for sorting and recycling where it contaminates the high-value plastics stream and affects its recyclability.

One successful example of biodegradable packaging is the ecovative mushroom packaging made from hemp hurd and mycelium that is home compostable, contains zero man-made chemicals, and is an earth-friendly alternative to styrofoam. Ecovative uses mycelium - mushroom roots and low value agricultural feedstock (part of the plants that cannot be used for food) to make their packaging.

Categories of bioplastics are:

- Bio-based or partly bio-based; non-biodegradable plastics such as PE, PP, or PET;
- bio-based technical performance polymers such as PTT or TPC-ET;
- both bio-based and biodegradable plastics such as PLA and PHA or PBS;
- Biodegradable fossil-based plastics such as PBAT.

Box 3 Bioplastics and circularity

Limited effective and scalable waste collection systems

The recycling system is inadequately managed in Kenya. More often than not waste is not sorted at the source. Thus, recyclable waste is contaminated with other waste affecting its sorting and recyclability and usually ending up dumped in landfills. Current waste collection systems are limited and not scalable. Waste management in the country is not prioritised with lacking regulations for the multiple actors involved, particularly in the private sector (around 150 operators).¹⁵ Moreover, the problems surrounding the scalability of the existing waste collection system are due to the lack of formal organisation by waste collectors and the stakeholders in the value chain. These low waste collection rates across the country amount to approximately 2,400 tonnes of waste in the environment with around 44 percent of the waste ending up in streams and landfills.

¹⁵ L. Oyake-Ombis, 2018. How Nairobi can fix its serious waste problem. <https://qz.com/africa/1237034/how-nairobi-kenya-fixes-its-waste-management-problem>



Figure 5 Polluted Stream in Kenya¹⁶

Technology for recycling can be further improved and scaled up

In Kenya, there exist limited recyclers relative to the high daily waste generation. The quality of waste inputs are relatively low, given the high contamination rate. Other than volume and quality of inputs in waste, another barrier to the scaling up of recycling capacity is the low value chain efficiency due to limited capacity and quality of equipment. Equipment is not able to process all types of plastics, and the output is very dependent on machinery quality, which requires large capital investment for which there is no enabling environment in Kenya (e.g., long-term certainty and financing).

2.4 Regulatory environment

Kenya has made solid progress towards circular economy via government such as partnerships with the Ministry of Environment and Forestry (MoEF), Ministry of Industrialization, Trade and Enterprise Development (MoITED), and via multilateral agencies which have established policy frameworks to spur evolution from a linear economy. Despite the strides accomplished towards a more circular economy, Kenya still has a long way to go in ensuring policies are prioritised and accurately enforced, and budgeted for the economy to adopt circularity.¹⁷

For instance, Kenya Extended Producer Responsibility Organisation (KEPRO), through the establishment of Producer Responsibility Organisations (PROs), charges packaging users Extended Producer Responsibility (EPR) fees. This includes fees on consumer packaged goods, packers and re-packers, and

¹⁶ African Development Choices, 2021. Tackling Kenya's water pollution crisis. <https://africandevdevelopmentchoices.org/water-pollution-in-kenya/>

¹⁷ RVO, 2021. Kenyan Circular Economy trends opportunities. <https://www.rvo.nl/sites/default/files/2021/06/Kenyan-Circular-Economy-trends-opportunities.pdf>

importers.¹⁸ These funds are intended to be used to support the growth, efficiency, and viability of the waste collection, sorting, and recycling sector.

At the end of 2020, Kenya committed to reducing its GHG by 30 percent by 2030, building on the National Climate Change Action Plan (NCCAP) actions. This move is underpinned by the Intended Nationally Determined Contribution (INDC), contingent on receiving international finance, technology, investment and capacity building support. Due to the plastic ban in Kenya, the majority of fruits and vegetables sold locally are plastic-free. Kenya has enforced notable circular economy related policies (listed below are the ones relevant for this study);¹⁹

- **The ban on single-use plastic bags (2017).** On the 28th of February 2017, the Cabinet Secretary, Ministry of Environment and Natural Resources gazetted the ban on single-use plastic bags that would take effect in six months after that date.²⁰ The ban has had far-reaching implications for production and use of packaging.
- **The Sustainable Waste Management Bill (2021).** This act establishes the legal and institutional framework for the sustainable management of waste. Additionally, this act ensures the realisation of the constitutional provision on the right to a clean and healthy environment.²¹ Sustainable waste management is also set to address the separated collection of waste and its importance during the recycling process. The separated collection of waste allows for feedstock that is less contaminated with materials that obstruct the recycling process.
- The **Extended Producer Responsibility (EPR 2020)** regulations for packaging are currently under design in Kenya. EPR refers to the obligation of a producer to reduce pollution through environmentally sound practices in all phases of a product lifecycle including the post-consumer phase and end of life stage. The regulations include but are not limited to the design for reuse and recyclability, creation of take-back schemes, recycling, composting and other suitable recovery and disposal measures. In the context of this study EPR covers; packaging materials, composites and agricultural film. Currently, in Kenya EPR fees are not compulsory and run based on the ethics and company values of plastic consumers. Without such guiding policies, it is impossible to achieve a strong recycling economy. The EPR Bill is expected to pass within 2 months (by February 2023). This will for example require flower packaging users (in this case the exporters) to most likely pay an EPR fees (Box 4).

¹⁸ KEPRO, 2022. Kenya's path to a clean natural environment. <https://www.kepro.co.ke/>

¹⁹ RVO, 2022. Kenya and the Netherlands, Working together towards circular agriculture in Kenya. <https://www.agroberichtenbuitenland.nl/actueel/nieuws/2022/03/09/kenya-and-the-netherlands-working->

²⁰ National Environment Management Authority, 2017. *NEMA News: A Quarterly Publication*. [www.nema.go.ke. https://www.nema.go.ke/images/Docs/Awarness%20Materials/NEAPS/NEMA%20Quarterly%20Magazine-Jan-March%202017.pdf?_ga=2.36692640.1002122023.1663920219-1022497380.1663920219](http://www.nema.go.ke/images/Docs/Awarness%20Materials/NEAPS/NEMA%20Quarterly%20Magazine-Jan-March%202017.pdf?_ga=2.36692640.1002122023.1663920219-1022497380.1663920219)

²¹ The Sustainable Waste Management Bill, no. Bill No. 22 of 2021, Parliament, 2021. <http://www.parliament.go.ke/sites/default/files/2022-05/The%20Sustainable%20Waste%20Management%20Bill%20%28%20National%20Assembly%20Bills%20No.%2022%29%202021.pdf>

- **The ban on the use of single-use plastics in parks and nature areas (2020).** Nature areas in Kenya noticed an increase in the plastic litter left by the public. This litter was polluting the ecosystems in those areas and poses a great risk to the planet. On the 5th of June 2020, the ban was placed on single-use plastics in protected natural areas, including beaches, forests and conservation areas.²²
- The **Kenya Plastics Pact (KPP) 2021**, a collaborative multi-stakeholder platform that aims to create a circular economy for plastics. It aims to eliminate problematic or unnecessary single-use packaging items through redesign, innovation or reuse delivery models; ensure 100 percent of plastic packaging to be reusable or recyclable; ensure 40 percent of plastic packaging is effectively recycled and 15 percent average recycled content across all plastic packaging.
- **'Horticulture Code of Conduct', KS1758** is the standard that covers horticulture standards, along the value chains. It gives guidance on how production should be done, and how crops should be handled from production, processing to the market. KS1758 is divided into two parts; the first covers floriculture, and the second covers fruits, vegetables, herbs and spices. The code of conduct requires the produce to be packaged in clean, well labelled boxes. Relevant barcodes should be attached such that the produce is easily traceable should there be a need to trace it back. The packaging containers should be sealable. The packaged products should be maintained in a cool environment, to keep them fresh.

To make plastic producers more responsible for their plastic waste, the Extended producer responsibility law was established. In this law, producer responsibility organisations (PROs) are held responsible for the collection and disposal of different types of plastics, to ensure they do not end up in the environment.

The law however, has multiple shortcomings. Currently, it is not compulsory for each producer to join a PRO, it purely depends on the companies ambitions and willingness to partake in the scheme. Additionally, there is a lack of importance on the Deposit Return Scheme (DRS). DRS is an efficient method for handling packaging pollution because they give consumers a tangible incentive to recycle. The introduction of DRS can also be a critical influencer for reuse, an important mechanism to help companies achieve recycled content targets, and a key to spurring a circular economy.²³

Yet there is a fine balancing act. If more companies subscribe to the scheme, they may pass on the EPR fees to the consumer, reducing their purchasing power. More companies paying EPR fees increases fees collected by PROs to fund circular activities i.e., wages for waste pickers, investing waste sorting and in recycling plants etc. On the flip side, if it does become mandatory, a high number of free riders could eventually lead to bankruptcy of the system as few ordinary participants finance a high portion of non-billed packaging.

Box 4 Extended Producer Responsibility

²² UNEP, 2020. Kenya bans single-use plastics in protected areas. <https://www.unep.org/news-and-stories/story/kenya-bans-single-use-plastics-protected-areas>

²³ Clean up Kenya, 2021. Here is why the proposed Kenya Extended Producer Responsibility law is likely to fail. <https://cleanupkenya.org/here-is-why-the-proposed-kenya-extended-producer-responsibility-law-is-likely-to-fail/>

Enforcing regulations and subsidiary regulations are needed

Regulatory frameworks in Kenya are established on different levels, with the overarching 'Regulatory Framework on Plastics' on the highest level. Thereafter fall the 'County Laws and Regulations', the 'National Laws and Regulations' and the 'Licenses and Compliances' on the same level. In Kenya, there are existing acts for this industry within the constitution, namely the Environmental Management and Coordination Act (EMCA). This is the main National Law regulating waste management. To enforce and maintain these regulations, The National Environment Management Authority (NEMA) was established. EMCA did not explicitly address the management of plastic waste until recently, and addressed it in largely broad terms. However, there are still significant loopholes in the regulation of waste collection. Particularly with the enforcement of The National Sustainable Waste Management Policy. This policy is expected to incentivise action from national and county levels on waste recycling and the available disposable facilities in the country and has consequences for the EPR scheme.²⁴ Mandating EPR fees is possible, but enforcement is a major issue given the complicated monitoring and collection system.²⁵

For exporting markets, the regulations from other countries and continents are relevant for packaging

An important regulation for the exporting sector is the regulation around plastics in Europe. Under the "European Strategy for Plastics in a Circular Economy 2018", the key requirement is that by 2030, all plastic packaging placed on the EU market is either reusable or can be recycled in a cost-effective manner.

As the European market is the most important export market for Kenya, emphasis is placed on European regulations surrounding packaging (see Box 5). Similar regulations also apply to other countries that Kenya exports to. Imports into the EU of packaging that are in direct contact with food and are designed to ensure that food placed on the market is safe and remain uncontaminated (i.e., primary packaging) must comply with EU legislation. The risk of contaminant presence in food (including fruits and vegetables, meat, fish, cereals, spices, dairy products, etc.) is present across all the various stages of its production, packaging, transport and holding.

During the workshop, a participant mentioned that some United Kingdom importers require specific packaging for a product. This packaging is only produced in the United Kingdom (UK), and requires transportation from the UK to Kenya, where the product is packed, before being re-exported with the product to the UK again.

Box 5 Transportation of packaging

²⁴ Njoroge, G., Nikam, J., & Ddiba, D., 2022 Plastic waste management and recycling in Mombasa, Kenya A scoping study of the value chain and its institutional, policy and regulatory frameworks. Stockholm Environment Institute. <https://www.sei.org/wp-content/uploads/2022/04/plasticwastemanagementmombasa-sei2022.013.pdf>

²⁵ UNIDO, 2022. Plastic values chain Kenya. https://www.unido.org/sites/default/files/files/2022-01/Plastic_value_chain_in_Kenya.pdf

The safety of food contact packaging materials requires stringent evaluations due to the risk of chemicals migrating from the materials into the food. EU regulations require these materials to be produced using strict manufacturing practices that mitigate against any change in the composition or quality of the food (for instance, taste and/or odour).²⁶

The EU promotes circular economy design principles for packaging, as prescribed by the Circular Economy for Flexible Packaging (CEFLEX), that focus on upstream design requirements to enable efficient end-of-life phase disposal.²⁷

2.5 Social perspective

Many people lack awareness of the importance of good waste management and their role in this

Recycled products are often associated with waste. Many people believe that using recycled plastic lowers the quality and value of their product. Awareness of end-of-life products is pertinent in evoking more circular behaviours where community based initiatives can also be effective.

In Kenya, the abundance of waste pickers is a result of lack of employment opportunities which have increased circular economic activities. Nevertheless, gaps in awareness are evident in view of the visible litter on streets and the fact that commitments to circularity by producers is still deficient.



Figure 6 Plastic nets that consumers use in-store for fruits and vegetables

Following-on from the plastic ban in Kenya, many supermarkets now allow consumers the option to pack their fruits and vegetables in difficult-to-recycle plastic nets with limited instruction on reuse. (Figure 6).²⁸ There has also been a steady increase in the frequency of sold vegetables in plastic trays with a clear film (see Figure 8 on page 31). This has been attributed to the growing middle class who increasingly demand greater convenience.

Many packing producers and consumers do not know what happens to the packaging after consumption. The lack of data/ transparency means value players are not being incentivised to move to more sustainable packaging alternatives.

²⁶ EEA, 2020. Plastics, the circular economy and Europe's environment - A priority for action 2020. <https://www.eea.europa.eu/publications/plastics-the-circular-economy-and>

²⁷ Ceflex, 2022. Designing for circular economy. <https://guidelines.ceflex.eu/>

²⁸ Kenya Association of Manufacturers, 2019. Kenya Plastic Action Plan.

Lack of standards and lack of information sharing

The packaging industry lacks standards; for most products, there are no specific restrictions on the use of multi-layered plastics. In addition, there is asymmetric information on the definition of plastic and the nature of plastics used in different value chains. This ultimately affects recycling - one can for example not distinguish between Polythiophenes (PTs) and other polymers used in the plastic punnets (trays) of French beans (see Figure 8 on page 31).

In the informal economy, reforms are sometimes difficult to realise due to lack of organisation, but there are recent initiatives

There is a large informal economy in the waste management and recycling sector in Kenya. People pick valuable waste like PET, glass, metal, paper, from the streets or landfills (they are called scavengers, or waste pickers), which they sell to middle men. They aggregate waste to sell recyclable materials in larger quantities to recyclers. These waste pickers (and middle men sometimes too), work in poor health and environment conditions, and are often not officially registered. This means they do not have steady work or health insurance, and are difficult to reach and collect data on. Several waste picker organisations have formed such as KenyaWastepickers.org and WastepickersKenya.net.

Initiatives from private organisations are leading, particularly towards the informal economy. However, there are certain drawbacks to these interventions. Firstly, it is difficult to formalise waste picking jobs. Additionally, larger recycling companies often use those in the bottom of the pyramid to collect certain types of materials to bring to the companies. However, the fees that are often pushed down to pickers for them to collect the materials is often absorbed by the aggregators. In the recycling value chain, aggregators are often small businesses who serve as a focal point for the informal waste pickers.²⁹ These aggregators usually provide transport vehicles or the necessary bailing equipment which the collectors often do not have. Some organisations are trying to direct a greater portion of collection fees directly through to the bottom of the pyramid with the use of technology but this will take some time.^{30,31} There also exists some hesitancy in formalising these jobs as there is no structural improvement for those in the informal economy which limits this particular model.

²⁹ KAM, 2019. Kenya plastic action plan. https://kam.co.ke/kam/wp-content/uploads/2019/12/KPAP_Document-pages.pdf

³⁰ Kiunguyu, K, 2022. Mr Green Africa is changing that by purchasing directly from their sourcing agents or waste pickers (<https://allafrica.com/stories/202206210252.html>)

³¹ Next Billion, 2022. Households can connect directly with wastepickers through apps and apps can give accurate information about prices, avoiding access margins for the middle man (<https://nextbillion.net/from-trash-to-resource-how-technology-can-help-informal-waste-pickers-solve-indias-recycling-problem/>)

2.6 Financial incentives

Plastic is light, cheap and effective

In 2018, it was estimated that the amount of plastic being imported for trade and manufacturing in Kenya amounted to 240,000 tonnes per year.³² Compared to paper packaging, plastic is the cheapest material to acquire. Plastic packaging can be used for every kind of food thus making it a versatile packaging material. The durability of plastic material provides the ultimate protection for food products, especially during transportation when goods are usually stacked on top of each other. The durability of plastic, in terms of how long it can resist damage also prevents the food from deteriorating fast and improves the shelf life of these goods which leads to a reduction in food waste.³³ Additionally, as the material is lightweight, costs incurred during the transportation of food products with plastic packaging are reduced significantly.³⁴ Both from a financial perspective as from an environmental perspective (as measured in an Life Cycle Analysis (LCA)) plastic packaging is often the better choice.

The price of recyclate is lower in Kenya than some other countries

Around 60 percent of recycled Polyethylene Terephthalate (PET) plastic, commonly used in beverage bottles, is used for the production of synthetic fibres of which recyclers generate plastic flakes, 98 percent of which is exported to Europe or South Africa. The ERP charged in Kenya is significantly lower than the amount charged in Europe resulting in recyclers preferring to export the recycled plastic flakes instead of selling them to local manufacturers who pay less due to attitudes around recycled plastics being of lower quality and regarded as waste. Recycled plastics, including Recycled Polyethylene Terephthalate (RPET), is in high demand in Europe. Multinational companies such as Coca-Cola and Unilever are willing to pay high prices for RPET to meet company commitments to reducing plastic waste by incorporating recyclable packing. As a result of increased demand in Europe, the price of recycled plastic is higher compared to virgin plastic.

The income generating activities of waste sorting coupled with the current risks at the dumpsite impede the development of waste management organisations and working conditions.

In Kenya, the majority of material that gets recycled is collected and sorted by the informal waste sector. Dandora dumpsite, which covers over 30 acres, is one of Africa's largest unregulated waste disposal sites. It is the destination for around 2,400 tons of solid waste generated daily in Nairobi which has a population of about 6.5 m people.³⁵ Dumping waste in Dandora is unrestricted and includes industrial, agricultural, domestic and medical waste. In July 2021, Nairobi Metropolitan Services (NMS) were

³² Elliot, T., Ettlinger, S., Blacklaws, K., Kibara, S., Ndirangu, E. and Chege, W., 2018. Plastic Packaging Waste Flow in Kenya. http://eng.mst.dk/media/189822/kenya-plastic-packaging-report_final.pdf

³³ BPF, 2022. The benefits of using plastic packaging. https://www.bpf.co.uk/plastipedia/applications/about_plastics_packaging.aspx

³⁴ Swiftpak, 2021. Plastic vs Paper Packaging: The Pros and Cons. <https://www.swiftpak.co.uk/insights/plastic-vs-paper-packaging-the-pros-and-cons>

³⁵ UNEP, 2007. Environmental Pollution and Impacts on Public Health: Implications of the Dandora Municipal Dumping Site in Nairobi. [file:///C:/Users/Alisha.Crasto/Downloads/Report%20UNEP%20Dandora%20Environmental%20Pollution%20and%20Impact%20to%20Public%20Health%20\(2007\).pdf](file:///C:/Users/Alisha.Crasto/Downloads/Report%20UNEP%20Dandora%20Environmental%20Pollution%20and%20Impact%20to%20Public%20Health%20(2007).pdf)

ordered by the environment and land court to close the Dandora dumpsite and relocate it within 6 months.

Residents of surrounding informal settlements and those living on the fringes of Nairobi society make a living from rummaging the waste, putting themselves at significant health risk. Waste pickers do not have the necessary skills or tools required to carry out the work safely, often working without Personal Protective Equipment (PPE). Working conditions remain unsolved in part due to the low market price for recyclables in Kenya and high price of transportation, leaving little room for investment in workers.³⁶

An estimated average of 3000 Kenyans per day, from neighbouring informal sectors, make a living from collecting waste for recycling at Dandora. They collect plastics, glass bottles, waste papers, and the recently introduced non-woven bags under a performance-based arrangement of informal employment. Other traders also tap this emergent micro-market, selling diverse products from food, water, groundnuts and even protective clothing such as the PPE to waste pickers.

According to an interview by RFI-France, one can collect as much as 8,000 tonnes of waste glass bottles in a month, earning a revenue of up to 36,000 Kenyan shillings (USD 311). A waste picker can collect between 100-200 kilogrammes of plastic waste per day with a kilo of plastic waste expected to sell for 17 Kenya shillings (USD 0.15). In an economy where unemployment is high and higher education graduates struggling to find work, the earnings are in many cases more than what would be typically earned by a diploma graduate.

The Dandora dumpsite, although hazardous, has contributed to reduced crime by providing additional employment opportunities for the informal sector. As the site generates millions of Kenyan Shillings in earnings from waste, there are fears that the main beneficiaries are limited to an oligopoly of cartels who control both the workers and supply of garbage collection and sorting at the government-owned site. These powerful cartels are opposed to any idea of improvement or organisation in recycling that would affect their income generating activities. Thus, all these risks at the dumpsite are a barrier to improving waste management organisations and working conditions.

³⁶ UN-Habitat, 2022. Improve municipal solid Waste management in Kenya's coastal area (2022). <https://unhabitat.org/news/14-jun-2022/un-habitat-project-to-improve-municipal-solid-waste-management-in-kenyas-coastal>

3. Selection of packaging value chains

3.1 Introduction

This chapter will describe the report's methodology for selecting three products used in the analysis of Chapter 4. The chapter will analyse product packaging and illustrate the lifecycle or 'movement of packaging' from material sourcing to product export.

3.2 Selection of three value chains

In 2020, Kenya exported nearly 314 thousand metric tonnes of fresh horticultural products and 146 thousand metric tonnes of flowers.³⁷ Agriculture in Kenya contributes to 24 percent of GDP, of this a significant portion of which comes from horticulture. Kenya's primary horticulture exports include French beans, avocados, mangoes, and Asian vegetables. It mainly exports to the UK (USD 125.16 m, 2021), Netherlands (USD 80.96 m, 2021), and France (USD 69.88 m, 2021). In comparison, the Kenyan flower industry is viewed as the oldest and largest in Africa generating approximately 1.29 percent of the country's GDP. In 2020, Kenya mainly exported flowers to – the Netherlands (USD 269 m), United Kingdom (USD 108 m), and Germany (USD 32.2 m). Given the large Kenyan agro-food and flower market, a multi variable criterion selection method using the following criteria was used to conduct the product selection:

- Volume of product produced in Kenya;
- Volume exported to Netherlands;
- Complexity / volume of packaging.

Volume of product includes both horticulture and floriculture grown in Kenya. Volume exported to Netherlands was selected because the local Kenyan market consumes less plastic after the plastic ban was enforced, and for ease of Dutch value add in partnership with RVO and the Embassy would have greater impact. The complexity and amount of packaging includes the quantity of material needed to preserve produce quality during transportation until end consumption.

Based on the first two criteria, the top seven flowers, vegetables, and fruits were identified by volume produced in Kenya and total export value to the Netherlands.

³⁷ Statista, 2022. Export volume of cut flowers from Kenya between January 2019 and December 2021.

<https://www.statista.com/statistics/1130798/monthly-export-volume-of-cut-flowers-in-kenya/>

Table 1 Selection of value chains for in-depth analysis³⁸

Product	TOP 7	Tonnes Produced 2019	Export volume to NL 2019	Export Value to NL 2018
Fruits	<ol style="list-style-type: none"> Bananas Mango Pineapples Avocado Citrus fruits Berries Apples 	<ol style="list-style-type: none"> 1,715,77 806,066 335,353 264,032 91,987 504 261 	<ol style="list-style-type: none"> Unidentified Unidentified 3,437,420 kg 23,371,000 kg 9,681 kg 19,385 kg Unidentified 	<ol style="list-style-type: none"> Unidentified Unidentified USD 3,949,920 USD 42,468,520 USD 27,530 USD 110,830 Unidentified
Vegetables	<ol style="list-style-type: none"> Irish Potatoes Cabbages and other brassicas Tomatoes Spinach Snow peas French beans Broccoli and cauliflower 	<ol style="list-style-type: none"> 1,978,952 829,331 567,941 180,343 73,118 43,389 1,162 	<ol style="list-style-type: none"> Unidentified Unidentified 7,548 kg 571 kg 752,270 kg 4,400,620 kg 275,822 kg 	<ol style="list-style-type: none"> Unidentified Unidentified USD 23,750 USD 2,900 USD 2,859,120 USD 10,328,320 USD 1,118,420
Flowers	<ol style="list-style-type: none"> Roses Carnations, Alstromeria, Gypsophilla, Lilies Eryngiums, Arabicum, 	1. 4,700 ha	1. 3.3 bn roses (2013)	1. USD 404,991,040

Based on the final criterion, the type of packaging used by the three identified products was assessed. Only the products with significant plastic and other non-reusable packaging were considered for further analysis (1-3=from limited/ non-complicated packaging to more complicated packaging;

Table 2).

Table 2 Packaging type was analysed for the three product categories

Product	TOP 7	Packaging type	Deep dive on packaging for selected products (see next slide)
Fruits	<ol style="list-style-type: none"> Bananas Mango Pineapples Avocado Citrus fruits Berries Apples 	<ol style="list-style-type: none"> Fiberboard cartons with soft lining Netted polystyrene sleeve on each mango & Insect-proof boxes Fiberboard or wood boxes Plastic packets or cardboard packets Cardboard trays or plastic bags Plastic clamshells Plastic bags and Corrugated carboard 	Avocados: <ul style="list-style-type: none"> Recyclable Laminated 4kg cartons Each 4 kg carton at a cost of US\$ 4.10 Pallet with 276 (4kg) cartons Plastic packets (per two) 40 cubic feet container holds 20 such pallets
Vegetables	<ol style="list-style-type: none"> Irish Potatoes Cabbages and other brassicas Tomatoes Spinach Snow peas French beans Broccoli and cauliflower 	<ol style="list-style-type: none"> Bags and net sacks Crates Cartons or cardboard boxes Perforated plastic bags Plastic wrappers, trays or punnets Plastic pre-packs or corrugated fiberboard carton Crates 	French Beans: <ul style="list-style-type: none"> 3 kg corrugated fiberboard cartons which are recyclable 250, 500 or 1,000 gm plastic pre-packs which are non-recyclable.
Flowers	<ol style="list-style-type: none"> Roses Due to low exports of other flowers, only roses will be considered 	1. Plastic sleeves and Single Faced Kraft (SFK) corrugated Boards	Roses: <ul style="list-style-type: none"> Non recyclable/waxy feel Flower sleeves and Rubber bands which are non recyclable Recyclable Cardboard and cargo lite cartons Carton separator which are recyclable, Bob Nets which are non recyclable and Cardboard bunching protection (non recyclable/recyclable)

³⁸ Websites used: World Integrated Trade Solution, 2022. <https://wits.worldbank.org/>

FAO, 2022. <https://www.fao.org/faostat/en/>

CBI Ministry of foreign Affairs, 2022. <https://www.cbi.eu/>

The three criteria were combined and given a weighting from 1 (least quantity of packaging) to 3 (highest quantity of packaging), specifically for fruits and vegetables. Roses were not included in Table 3 as their selection was confirmed in the previous step, depicted in Table 3.

Table 3 Combination of Three criteria weightings for fruits and vegetables

Fruits	Production in Kenya	Export to NL	Type of packaging	Total
1 Bananas	3	1	1	5
2 Mango	3	1	2	6
3 Pineapples	2	2	1	5
4 Avocado	2	3	2	7
5 Citrus fruits	1	2	2	5
6 Berries	1	2	3	6
7 Apples	1	1	2	4

Vegetables	Production in Kenya	Export to NL	Type of packaging	Total
1 Irish Potatoes	3	1	1	5
2 Cabbages and other brassicas	3	1	1	5
3 Tomatoes	2	2	1	5
4 Spinach	2	1	3	6
5 Snow peas	1	2	3	6
6 French beans	1	3	3	7
7 Broccoli and cauliflower	1	2	1	4

LEGEND:
1= Least
2= Moderate
3= Highest

The multi variable criterion established the value chains worth further exploring are those of avocados, French beans, and roses. High volumes of each are produced in Kenya, they are exported in high volumes to the Netherlands, and they use a significant amount of packaging. To ensure the entire packaging value chain was covered for each product, paper packaging i.e., corrugated boxes, cardboard trays were also included in the analysis.

An in-depth analysis of the packaging value chains of these products is conducted in the next chapter informed by desk research and key stakeholder engagements.

3.3 Packaging materials for selected products

For the three selected products, we have identified the current packaging and their details. Table 4 provides a snapshot on the specifics on the packaging materials for roses, French beans and avocados.

Table 4 Packaging of the three value chains

Produce	Packaging material	Packaging details
Roses	Plastic sleeves and Single Faced Kraft (SFK) corrugated Boards	<ul style="list-style-type: none"> Non-recyclable waxy flower sleeves and rubber bands Recyclable cardboard and cargo lite cartons Carton separators which are recyclable, bob nets which are non-recyclable and cardboard bunching protection (non-recyclable/recyclable)
French beans	Plastic pre-packs or corrugated fibreboard carton	<ul style="list-style-type: none"> 3 kilograms corrugated fibreboard cartons which are recyclable 250, 500 or 1,000 grams plastic pre-packs which are non-recyclable
Avocado	Sometimes plastics packets, cardboard boxes, plastic crates	<ul style="list-style-type: none"> Recyclable laminated 4 kilograms cartons Each 4 kilograms carton at a cost of USD 4.10 Pallet with 276 (4 kilograms) cartons

Produce	Packaging material	Packaging details
		<ul style="list-style-type: none"> Plastic packets (per two) 40 cubic feet container holds 20 such pallets

Roses are mostly packed in plastic sleeves, corrugated cardboard boxes, or both. This decision ultimately lies with the buyer, whose specifications and needs are relayed to the packing manufacturer. The rose packaging industry is dynamic with no one-size-fits-all approach. All rose growers package their roses depending on the market they supply their roses to.

Plastic packaging for roses are mostly for aesthetic quality (unless when it rains to avoid Botrytis).³⁹ Fully recycled cardboard is not used, as an element of virgin material is needed to retain quality of roses and give the boxes their strength. The percentage of virgin material is largely dictated by the use and ultimate quality requirements. For example, 3 ply carton packaging (mostly used for flowers) would have 60 percent virgin material and 5 ply (for avocado) would have 53 percent.

Rose packaging includes various components, some are recyclable, non-recyclable or, have aspects of both depending on the nature of the material. The recyclable components comprise of corrugated cardboard and cargo lite cartons with separators to bunch the roses. The non-recyclable components include; waxy-feel rose sleeves, rubber bands for bunching (bobnets/sponge), and foil packaging for each barrel unit (some companies use this when roses are exported via airfreight in bunches of 10 to 20 stems; see Figure 7).

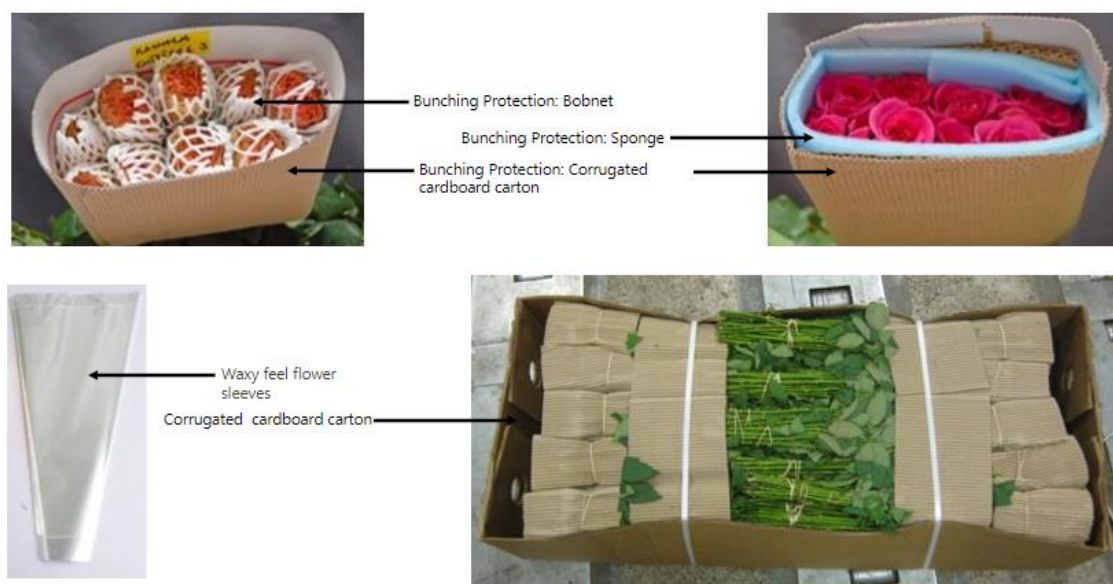


Figure 7 Packaging used for roses.⁴⁰

³⁹ Botrytis definition: A fungus that can reduce a blooming rose bush to a mass of dry, brown, dead flowers.

⁴⁰ Pictures from - Eagle link flowers, 2022. <https://www.eagle-linkflowers.com/blog/packaging-of-roses/> and CBI, 2022. <https://www.cbi.eu/market-information/cut-flowers-foilage/roses/europe>

French beans are usually packaged in virgin plastic material which helps preserve the quality of the vegetable and reduces food loss. The packaging size for French beans differ according to the customer's request. However, small packaging is more convenient for the consumer and better for maintaining shelf life and product quality. French beans are packed in two, three, four or five kilogram corrugated fibreboard cartons which are recyclable (Figure 8). Common retail packaging in supermarkets includes flow packs, trays and plastic wrappers, and plastic punnets (non-recyclable but reusable) of 250, 500 or 1,000 grams which are non-recyclable. Some packaging is also microwave safe. Other types of packing include carton, plastic bag, crates and plastic nets (local use).

As more European countries increase their commitments to reducing plastic consumption, Kenyan growers are also looking for plastic alternatives to package French beans, such as the use of biodegradable cardboard boxes where the inner lining is made from virgin material to ensure food safety. However, biodegradability is often criticised as it is almost never biodegradable in nature, and is more expensive than non-biodegradable alternatives due to limited production. There are high requirements in the circumstances to biodegrade the material, see Box 3 and Appendix 1 for more information.



Figure 8 Packaging for French beans

Avocados are traditionally packed in corrugated boxes and sometimes packed in plastic packages of two depending on the specifications provided by the clients (Figure 9). The corrugated box has a recyclable laminated packing of 4 kilograms cartons (35cm x 28.5cm x 9cm). The boxes comply with all the necessary standards for export including being cold and weight resistant. Each 4 kilograms box holds between 9 and 26 pieces of fruit depending on the size. The 4 kilograms boxes are packed into pallets which hold 276 boxes each. Every 40 cubic feet container holds 20 such pallets (276 boxes*20 pallets =5520 boxes of 4 kilograms each / 40 foot container). During harvest and transport to pack house, the avocados are stored in reusable plastic crates. Most of the fresh avocados are shipped in Controlled

Atmosphere (CA) containers to Mombasa port on route to Europe and the Middle East by sea. The shipments take 12–15 days to reach Marseilles and 21 days to reach Rotterdam / Amsterdam. To reach Dubai, for Middle East clients, the shipments take around 8 days. With a growing need for circularity, global commitments from large retailers have encouraged Kenyan plastics manufacturers to innovate and produce reusable and recyclable carton crates which not only have the same functionality as corrugated boxes but require less energy and water to recycle.

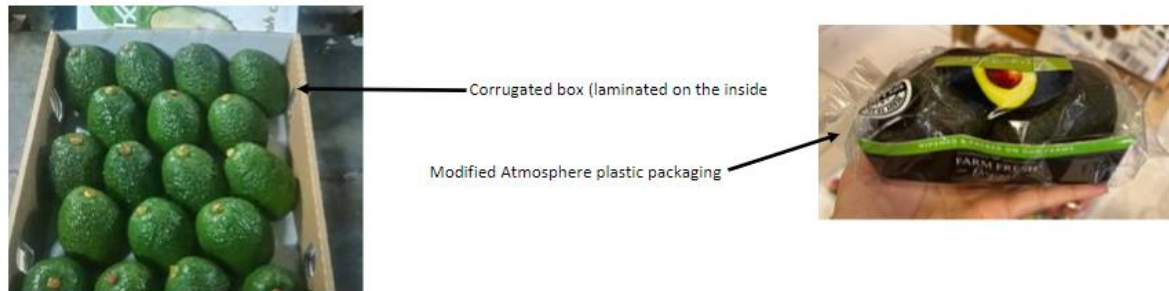


Figure 9 Packaging of avocados

3.4 Movement of the packaging

As highlighted in the sections above, the plastic and paper packaging used for roses, French beans and avocados is often imported into Kenya and once the goods are packed, they are exported to other countries. In the figures below, the movement of packaging for each of the selected value chains is highlighted. Given there are few local Kenyan producers of packaging material, reducing the dependency on foreign manufacturers and increasing local production will have additional ripple effects on local levels of employment with the creation of new jobs and opportunities for Kenyans. Additionally, the figures below illustrate the movement of imports and exports from several countries. Increasing local production will reduce the carbon emissions borne from international transit, while also lowering the Kenya's vulnerability to sudden supply shocks of plastic and paper.

Roses

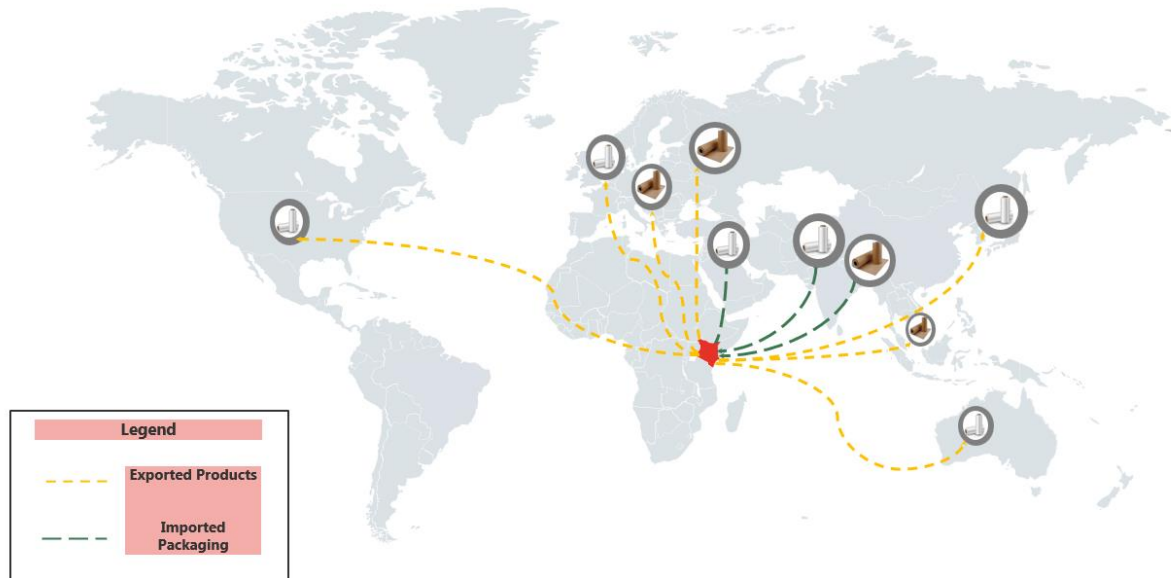


Figure 10 Movement of packaging for Roses

For **roses**, plastic and paper packaging is imported from countries such as Saudi Arabia, India, and China. Once the material has been processed and moulded to the packaging requested by the importing country, the packaged roses are prepared for export. The **roses**, with the requested packaging, are then shipped to countries including The United Kingdom, The Netherlands, Germany, Norway, The United States of America, United Arab Emirates, Japan, Australia and Singapore (Figure 10).

French Beans



Figure 11 Movement of packaging for French Beans

For **French beans**, plastic and paper packaging is imported from China, India and Saudi Arabia. Similarly to **roses**, once the packaging has been processed and meets the requirements of the importing countries it is cleared for export from Kenya. **French beans** are exported to The Netherlands, United Kingdom, Belgium, China, India, The United States of America and Zimbabwe (Figure 11).

Avocados



Figure 12 Movement of packaging for Avocados

For **avocados**, the movement of packaging is very similar to that of **roses** and **French beans**. As Kenya imports all its virgin paper, the imported paper is mainly from The United States of America, Canada, Brazil, South Africa, China, India and Eastern Europe. From the virgin paper, the avocados are packaged in cardboard boxes and/or plastic covers before being exported to The United Kingdom, Western Europe, China, India, Egypt and the Middle East (Figure 12).

4. Packaging value chain description

4.1 Introduction

This chapter provides a deep-dive into the packaging of avocados, French beans and roses. It will analyse the current packaging materials used, and explore which packaging materials are recyclable and non-recyclable.

In the value chain of packaging material, three steps are observed. Firstly, the production of packaging which describes the acquiring and manufacturing of plastic and paper packaging material in Kenya. Secondly, the use of packaging, this mainly describes the role packaging plays in preserving and transporting avocados, French beans and roses. Lastly, the disposal of packaging, this step in the value chain describes the manner in which paper and plastic is disposed in the local context and in final destinations. These three steps are described in detail in this chapter for avocados, French beans and roses.



Figure 13 The value chain of packaging material

4.2 Production

Table 5 Main take-aways for production

Main take-aways	
Generic	<ul style="list-style-type: none"> Kenya is an importer of raw material (virgin plastic and cardboard) for packaging leading to dependencies and risks (e.g., global shocks, FX exposure) The type of plastic and paper packaging used for the selected exported goods depends on the specifications provided by the off-taker and regulator(s) (e.g., flower auction/ supermarkets/ Kenyan and recipient country), but for secondary packaging (mainly carton boxes) and the local market there are limited standards
Plastic	<ul style="list-style-type: none"> Virgin plastic is required to produce food grade packaging, affecting the value chain of avocados and French beans Recycled plastics are more expensive and price volatile than virgin plastics in Kenya
Paper	<ul style="list-style-type: none"> Kenya imports most of the paper due to an existing wood deficit and few paper mills The quality of the recycled paper is inferior to the quality of virgin paper, exacerbated in Kenya because of limited high-quality machinery and the low quality of inputs The market for boxes is relatively small in Kenya, which could be contributing to limited innovation (other factors like pressure from off-takers and access to financing could also play a role) Some carton is used as primary packaging due to UK import tariffs on plastics

Main take-aways

- Cardboard boxes are more expensive than plastic crates, but are the norm
- An element of virgin paper is required to produce food grade packaging in the value chain of avocados and French beans



As mentioned in section 3.3 plastics used to package **roses**, **avocados**, and **French beans** are imported in roll form, usually 5,000-7,000 meters long, and is stored in the factory repository. For **roses**, the plastic roll composition used to package roses are Biaxially Oriented Polypropylene (BOPP), virgin plastic material where the polypropylene film can be stretched in both directions during manufacturing to create a biaxially stretched material which increases stiffness, high tensile strength, excellent optics (high clarity display of products), and good water vapor barrier properties. BOPP comes in two forms heat sealable and non-heat sealable, whereas in the case of roses heat sealable is used to mould the package into the desired shape. In 2021, Kenya imported roughly 3,400 shipments of BOPP film.⁴¹ BOPP film is made from plastic pellets which can only be sourced from oil producing countries.

The grower/ exporter provides specifications to the plastic packaging manufacturer, highlighting the length, cut, and design of the sleeve. The manufacturer then creates samples to ensure that the sleeves meet the client's requirements before starting the order, this helps eliminate unnecessary waste of plastic material. Growers conduct tests, to ensure that the roses reach the end customers in the desired state. This is done by placing the packaged roses in simulations similar to the export journey, after which some export small batches to test the durability of the packaging and monitor the quality of the **roses**.

After approval, the rolls are taken into production where they are slit and sent to the printer for design. The printing stage is skipped if the client wants clear sleeves with no branding (note that for recycling non-branded film is strongly preferred). Thereafter, the roll goes into the folding sleeve machine where bullet holes of either 2, 6, or 8 are introduced into the plastic sleeve to regulate the moisture and respiration of the roses. The sleeves are then packed in boxes that carry 2,000-3,000 sleeves per box. This depends on size specifications provided by the growers and is sent to the growers' packhouse facilities at the airport.

For **French beans** and **avocados** the grower provides a breakdown of the type of vegetable including size, how many grams they want to be packed per bag, and export destination. The grower also provides the plastics bag manufacturer with some of the produce for shelf life testing. Sample bags are filled with produce and are placed in simulation environments to understand how the quality of the **French beans/ avocado** will change through their journey from packaging, export, and to the end consumer. Different vegetables have varying Oxygen Transmission (OT) rates, the shelf life testing ensures that the micro holes on the bags are the optimal size to ensure quality preservation.

The plastic rolls imported for packing **French beans** and **avocados** are of Modified Atmosphere Material (MAP) which, in packaging, involves modifying or controlling the makeup of gases contained within each package to provide optimal conditions for increasing the shelf life and reducing oxidation and spoilage

⁴¹ Volza grow global, 2021. Overview. <https://www.volza.com/p/bopp-film/import/import-in-kenya>

of perishable food and beverage products. When it comes to consumables, especially in the area that is in direct contact with the produce, only virgin plastic material can be used to uphold the quality and reduce food wastage.

Initially, a number of **French beans** and other vegetable growers in Kenya imported their plastic packaging from the UK. However, there has been a shift in this trend as many local manufacturers are now adding innovative solutions, such as anti-mist coating, which increases the shelf life of the produce and reduces the need to import expensive finished packaging.

Once the sample bags are approved, the rolls are slit or taken directly to printing (this step can also be avoided if plain bags are required). Next, the rolls are sent to laser perforation machines, where a laser puts micro holes into the bag to help with the breathability of the fruits and vegetables to increase their shelf life of the produce. The holes allow carbon dioxide to go out and allow the vegetable to absorb oxygen. After this, the rolls are taken to the bag-making machine, where they are turned into small pouches. The completed MAP plastic bags are packed in boxes that hold 2,000-3,000 bags and are either sent to packhouses at the airport or exported as empty bags to countries like India and Zimbabwe who then pack and distribute their finished product.

Last year, Kenya started exporting **avocados** in plastic reusable crates. The plastic crates are produced in Kenya using imported plastic pellets created from the waste of rose sleeves. The plastic foldable crates provide the same functionality as cardboard board boxes, they are lighter and carry the same amount of avocados. They replace corrugated carton which has less ventilation and requires more water and energy to recycle. The crates are sent directly to the farm, where producers pick their **avocados**, place them into the crates, and send them directly to the supermarket display shelves due to their aesthetic qualities. This reduces the handling of the **avocados** in the supply chain, therefore reducing food loss in the value chain.



Roses; As mentioned previously, due to the paper deficit, the paper material that is used to package **roses** and **French beans** and **avocados** is imported in the form of virgin paper also known as unbleached kraft paper and it is shipped in the form of rolls. These rolls, are used to make several different box types for each product and one example of these is the **rose** box which is 'Telescopic Box'. From this box, **roses** are exported without compromising on the quality from when they are plucked and exported to The Netherlands and other countries.

French beans are usually exported in carton boxes with a capacity of four to five kilograms. These boxes will need to be lined with film so as to absorb the sweat from the French beans and to ensure that the quality of the **French beans** for consumption is kept.

Some companies pack **French beans** in carton boxes also made from virgin paper for export, instead of in plastics as primary packaging. The **French beans** are stacked and laid in boxes. Furthermore, a standard box costs around 350 KES (around EUR 3), which are included in the full export costs. Some export markets such as the UK, have placed high taxes on the import of plastic of certain weight, thus several companies are making the shift towards paper packaging for French beans to diminish this cost. However, the purchase of a box is around five times more expensive than the plastic excluding import taxes. **Avocados** and **French beans** are primarily packaged in solid cardboard boxes which hold around 8-12 kilograms. For avocados, from conversations with several manufacturers, the importance of preserving the quality and delicate structure of avocados results in their packaging in a high-density

material known as solid boards or corrugated boxes. The boxes need to have proper ventilation in order to allow for effective cooling and proper air circulation. However it is important to note that corrugated cardboard boxes require far much more energy to recycle and thus is not the most environmentally friendly packaging type.

4.3 Use/ Transport

Table 6 Main take-aways for use/ transport

Main take-aways	
Cross-cutting	<ul style="list-style-type: none"> • Being the quickest form of transport, roses and French beans (perishable goods) are mostly transported by airfreight. • Sea freight is emerging as a (financially) viable alternative for flowers as it is reliable in terms of maintaining temperature for fruits and vegetables and more recently for flowers due to a new special treatment. This trend is increasing, further stimulated by high airfreight costs. • The lack of cooling logistics at the airport creates a need for packaging that can resist high levels of condensation • The current charging structures of airfreight does not necessarily incentivise decreasing weight (priced mainly on volume)
Plastic	<ul style="list-style-type: none"> • Plastic sleeves of flowers are sometimes disposed after transport, meaning that less aesthetically appealing alternatives (e.g. paper or mix of virgin and recycled plastics) can be considered as replacements. There is an increasing amount of unnecessary packaging of avocados and French beans in the local Kenyan market
Paper	<ul style="list-style-type: none"> • Paper packaging should be designed in a way that there is enough ventilation and that it protects products from temperature fluctuations • French bean producers are trying to move to higher use of paper instead of plastics in their packaging, but paper is more expensive and the total environmental footprint tends to increase • There is no standard cardboard box size in the market for transportation of roses, avocados and French beans. Cardboard boxes are heavier than plastic and are often more expensive to export (costs for the transporter, not costs charged to exporter) • The quality of the recycled paper is low, meaning higher volumes are needed for boxes (more weight for airfreight, which has CO2 consequences, and higher costs for the extra volume)



Once the **roses**, **French beans** and **avocados** are sleeved/boxed, they are placed in cold storage rooms before being transferred to the plane/ship. The majority of the roses are exported by air freight as it offers rapid turnaround times for flowers; however, sea freight is emerging as a viable alternative as capacity concerns have emerged, one of the reasons being the reliable nature of sea freight in terms of maintaining temperature. For flowers, transport is moving

to rely on sea freight in order to reduce carbon footprint and costs. Covid-19 had temporarily compounded the complications of airfreight. One of the major issues with airfreight is the charging mechanism. Airfreight is charged by pivot weight, based on the assumption that the main deck pellet (unit load device (ULD) has a weight of 2,700 – 2,800 kilograms. The current way of charging does not decrease weight (priced by volume and not actual weight), this issue is intensified with the varying standard box sizes in the market which do not fit in the aircraft thus transporting fewer **roses** compared to the air transport price paid. The lack of cooling logistics at the airport causes condensation and packaging of roses needs to be able to absorb this.

There is a similar push for **French beans**, although they are traditionally transported using air freight some companies are now piloting exports using sea freight to cut down costs. **Avocados** are mostly exported through sea freight. Once they leave the farm they are transported in temperature-controlled trucks to the port where they are placed in cold room containers that have ethylene scrubbers to artificially ripen the **avocados** upon arrival.

The use of transparent sleeves is done for both preservation of the roses, and aesthetic reasons. Plastic sleeves of flowers are sometimes disposed after transport, meaning that less aesthetically appealing alternatives (e.g., paper or mix of virgin and recycled plastics) can be considered. Paper packaging for avocados, roses and French beans are designed in a way that there is enough ventilation and that it protects products from temperature fluctuations. There is no standard cardboard box size in the market for transportation of roses, avocados and French beans. French bean producers are also trying to use more paper instead of plastics in their packaging, but paper is more expensive and the total environmental footprint tends to increase.

There is increasingly unnecessary packaging of avocados and French beans in the local Kenyan market. Kenya follows a trend seen in other countries where an emerging middle class demands the convenience of more packaging.

4.4 Disposal

Table 7 Main take-aways for disposal

Main take-aways	
Plastic	<ul style="list-style-type: none"> • Both Modified Atmosphere Packaging (MAP) and Biaxially Oriented Polypropylene (BOPP) / Ornamental Horticulture Packhouse Standard (OHAS) can be reused and recycled many times, while still maintaining its value. However, this often does not happen due to the need for separated collection and the lack of technology needed to do so • Local consumption: Plastic waste is not collected separately at households. Because sorting takes place after collection, plastics are contaminated and recycling becomes difficult. Limited to mostly downcycling • Export: in theory the plastics should be recycled in export markets, but in practice this is difficult because of use of multi-layers and small size of the products • Plastic packaging exported does not come back to Kenya: <ul style="list-style-type: none"> ○ Not economically viable to send back ○ Demand for recycled plastic is high in Europe

Main take-aways	
	<ul style="list-style-type: none"> ○ It is likely that a large portion of the packaging is not recycled, despite the ambition to recycle all plastics larger than one A4 size ○ Can be recycled but in Kenya there is mostly downcycling where the recycled material is of lower quality and functionality
Paper	<ul style="list-style-type: none"> • There are some smaller initiatives in Kenya for sorting waste at the source • Locally, the recycling market for paper is more mature and larger than the plastics market • Implementation of proper waste management system is still lacking across different value chains • Paper requires a lot of water and energy to recycle which leads to a relatively large environmental footprint for high-quality boxes that are only being used once



Locally; for roses most of the waste from the plastic sleeve manufacturing value chain comes from the slitting machine and from the rejected sleeves after the sleeve folding stage. Biaxially Oriented Polypropylene (BOPP) plastic is environmentally friendly even though it is not biodegradable. The Modified Atmosphere Packaging (MAP) waste material when making French beans packaging is collected at the printing, slitting, and bag-making stage where rejected bags are collected and sent for recycling and reuse. Both MAP and BOPP can be reused and recycled many times over while still maintaining their value. These rejected sleeves/ waste plastics are sent to the recycling plant to be reconverted into granules and extruded (granules are melted into sheets for packaging). When it comes to local consumption, there are no established plastic management systems to sort waste at the source which contaminates the plastic. Both avocados and French beans consumed locally are sold without plastic packaging, sometimes consumers have the option pack the fruits and vegetables they wish to purchase in plastic nets which are difficult-to-recycle. Thus low plastic consumption and one-way supply chains minimise the local input capacity to recycle.

Roses that are exported to the flower auction market are often unpacked, recut, and regraded. The people in charge of unpacking collect the packing and sell it to recycling plants for high prices. Due to global commitments to reduce plastic packaging, demand for recycled plastic is high in Europe. This encouraged a one-way supply chain of packing, unable to close the loop on the circularity of packing in the Kenyan market. Similarly, once the **French beans** and **avocados** are packaged, they are usually opened by the end consumer who then discards the waste in their neighbourhoods. Waste collectors then separate and recycle the plastic in their countries or export the segregated plastic to neighbouring countries within the EU that have machines to upcycle the packaging. The smaller the size of plastic waste, the lower the chance that it will be recycled. With regards to the introduction of reusable foldable plastic crates for **avocados**, the value chain has been a one-way route. Sending crates back to individual growers and plastic manufacturers has been a logistical issue in terms of tracking the crates, and finding partners to collect fold/ store the crates due to the high air and sea transport costs. As a result, the crates remain in Europe where they are used for the local transport of fruits and after 6-7 rounds are upcycled using local modern recycling plants. The one-way supply chain further constricts the plastic recycling market in Kenya. Compared to paper, plastic is easier to recycle but all recycling processes undertaken

in Kenya for materials sourced from post-consumer waste – do not allow for food grade use of resulting recyclates.⁴²



Locally, there are initiatives for sorting paper at the source. However, implementation of proper waste management system is still lacking across different value chains. **Avocados** and **French beans** are often sold without paper boxes, each supermarket has their own crates in which they present the fresh **avocados** and **French beans** to the consumers.

The use of recycled paper to make boxes for **roses**, **avocados**, and **French beans** is low in Kenya. This has been attributed to many reasons i.e., carton manufacturers advise clients that virgin material is needed to preserve the quality of the **roses**, which may be true if the paper was recycled using outdated machinery, but is largely for personal gain as virgin boxes generate higher revenues. There also exists a significant lack of knowledge sharing in the industry. Boxes that carry food-grade commodities such as **avocados** and **French beans** are packed using virgin material due to food safety concerns recycled boxes. Locally in Kenya, there are only five mills that are capable of recycling paper to make quality boxes, however, the scale and production of such factories does not meet the quality and output standard set by foreign markets.

⁴² UNIDO, 2021. Plastic value chain in Kenya. https://www.unido.org/sites/default/files/files/2022-01/Plastic_value_chain_in_Kenya.pdf

5. Root causes and leverage points

During the project, desk review, interviews and a workshop were used to explore the packaging value chains of three selected products. The interviews were also used to find root causes of the limited upscaling in initiatives for circularity in packaging. This chapter shows the identified root causes of this lack, building on previous sections. The most important elements were used in a causal map,⁴³ to identify leverage points that can influence the system. We have categorised them in production, use, and disposal.

5.1 Root causes

During the interviews, the questions focused on the root causes of the question “Why is there limited circularity of packaging in Kenya and in particular for the selected products?”. The root causes have been categorised in three phases: production, use and disposal. In the workshop, we validated and added onto the causes to create a more thorough overview.

5.1.1 Production

This section describes the root causes that play a role in the production of packaging.

Table 8 Root causes in production of packaging

Root cause	Explanation
Food-grade packaging requirements (in primary packaging)	There are strict packaging requirements for food-grade products. Specifically for the packaging that comes into contact with the product (primary packaging). Strict safety requirements hinder the use of recycle in primary packaging
Perception and knowledge of the quality of recycled material	Recycled material is perceived as low quality for the transportation of agri-food products. Although the quality is lower than virgin material, there are still opportunities to use more recycle in packaging
Quality and price of virgin packaging	The quality and price of virgin packaging are favourable and mostly used by producers of packaging to ensure the safety of the (food) products
Only some plastic producers and users are committed to innovation to safeguard and attract more multi-national organizations	Only some producers of packaging in Kenya have explicitly committed to circular economy by reducing or eliminating plastic waste ⁴⁴

⁴³ Kumu.io

⁴⁴ See for example; Silafrica, 2022. Silafrica Joins Ellen MacArthur Foundation Global Commitment to Create a Circular Economy. <https://silafrica.com/news/silafrica-joins-ellen-macarthur-foundation-global-commitment-to-create-a-circular-economy-for-plastic?s=1634190187891x815067821606174700>

Root cause	Explanation
Limited volume of recyclate available	The volume of recyclate available is limited which reduces the amount of packaging made from recycled material
No regulations on packaging requirements	There are limited clear or standardised regulations on packaging requirements in Kenya and in export markets, especially for secondary packaging
Lack of EPR legislation	There is no mandatory Extended Producer Registration (EPR) legislation in Kenya yet. There are several voluntary EPR organisations causing overlap and competition

5.1.2 Use

This section describes the root causes that play a role in the use of packaging.

Table 9 Root causes in use of packaging

Root cause	Explanation
Increasing use of unnecessary packaging for agri-food	This refers to packaging for aesthetic and/or convenience purposes
Air freight priced by volume or weight, whichever one is lowest	Current air freight pricing method limits the incentive to reduce the amount of packaging on a product
Plastic regulations in Europe	The plastic regulations in Europe hinder producers as the import of products with plastic packaging increase taxes incurred
The complexities in acquiring licenses for sustainable packing	Applications for different licenses from government institutions are complex. This discourages agri-food producers to venture into more sustainable packaging
Price sensitivity of buyers of packaging	Buyers of packaging are sensitive to price changes, often accepting the more price-friendly virgin material instead of costly sustainable packaging
Temperature volatility during transport	Increased complexities due to additional requirements for packaging to maintain the quality of the products

5.1.3 Disposal

This section describes the root causes that play a role in the disposal of packaging.

Table 10 Root causes in the disposal of packaging

Root cause	Explanation
Exporting products leading to circularity challenges	Packaging fails to complete the circularity loop as it is not clear for the producers what happens to the packaging once it has arrived at the destination country
Limited understanding of the negative effects of waste	There is limited knowledge of the negative effects of waste on the environment
Low incentives/budget to enforce standards and laws i.e., waste management	A low budget coupled with low incentives limits the enforcement of laws and standards such as waste management
Economic well-being <ul style="list-style-type: none"> Spatial capacity in homes for waste bins/ sorting capacity The need to earn (informal income), through waste picking and sorting 	There are limited spaces for waste sorting in homes and in public areas. Thus residents do not separate their waste at source, further contaminating potential recyclable material. Additionally, there is an avenue for those living in vulnerable areas to earn an income through the picking and sorting of waste and providing feedstock to recyclers
Limited information sharing/data on the availability or composition of plastic	Availability of data on plastic composition is very limited in Kenya. Plastic producers/users do not openly share numbers, even with national platforms such as the Kenya National Bureau of Statistics (KNBS)
Access to information on benefits of waste management, sorting at source and recycled materials	The access to information on waste management, sorting and the benefits of using recycled material is very limited. Hence, there is limited waste sorting at the source

5.2 Leverage points

Leverage points are specific areas where small changes can have a significant impact. The leverage points are ranked based on the importance indicated by the Kumu analysis⁴⁵ as well as the discussion in the Rebel workshop session. In general, the disposal leverage points were assessed as more important in the Kumu analysis than use-focused leverage points. However, disposal leverage points seem more focused on the local market (except the first leverage point in this category, see Table 13), whereas the production and use phase leverage points are local as well as export related. In Appendix 2 all the leverage points can be found, in the sub sections below, the top-five ranked leverage points are explained.

⁴⁵ Kumu.io

5.2.1 Production

This section describes the top-5 leverage points that play a role in the production of packaging.

Table 11 Leverage points in production of packaging

Ranking	Leverage points in production	Explanation
1	Function of packaging (affecting food quality)	The primary function of the packaging is to preserve the quality and safety of the packaged product. In the case of avocados, green beans, and roses, the product needs to be preserved for the duration of the transport, to both the immediate export client and the end consumer.
2	Standards or regulations for packaging materials Type of packaging affects food quality	Standards in packaging requirements can increase the effectiveness of packaging production; <ol style="list-style-type: none"> 1) The more packaging requirements there are, the less repackaging of products will take place which often requires additional packaging material. 2) Less variations in packaging will make sorting and recycling more viable. <p>Furthermore, regulations for packaging materials may encourage greater usage of recycled content.</p>
3	Price of virgin material packaging vs. more sustainable alternatives	Price is a major aspect in the decision-making process of users of packaging given the competitive nature of the markets they work in.
4	Reusability of plastic crates (compared to boxes that are disposable)	This refers to the possibility to reuse the secondary packaging crates, instead of disposing them directly when they reach the destination. They could be reused in the destination export market, or sent back to Kenya and be reused domestically.
5	Client specifications are leading in packaging production	One of the main reasons certain packaging is being imported, is because the client requires this type of packaging or a specific packager. The users are then bound to these producers of packaging. If these packagers are not located in Kenya, or do not have the option to provide recycled or reusable packaging, the producers do not have the flexibility to change to a more sustainable packaging solution.

5.2.2 Use

This section describes the top-5 leverage points that play a role in the use of packaging.

Table 12 Leverage points in use of packaging

Ranking	Leverage points in Use	Explanation
1	Access to information on benefits and quality of sustainable packaging	Sharing of information on the benefits of sustainable packaging can have a large impact on the system. Many people are not aware of this, and are therefore reluctant to change their behaviour. This is the case for producers, but also for consumers that have the option between different packaging types.
2	Use of virgin materials for flowers that are being repackaged	There is a leverage point at the point of repacking flowers (or other products) when they are being repacked into other sleeves that are more appealing for the consumer. This provides opportunities to use recycled material for the first transport leg (even when less aesthetically appealing).
3	Secondary packaging does not have to be made from virgin material (and for flowers primary packaging also not)	Virgin material is used to provide food-grade quality. This is only applicable for primary packaging, that is directly in contact with the food. Secondary (and tertiary if applicable) packaging does not need to be food-grade, and thus provides an opportunity to use recycled materials in their production.
4	Access to information on consequences of unnecessary packaging	Just as there is little awareness of the benefits of using sustainable packaging, there is also little awareness of the negatives of resource depletion, in the case of unnecessary packaging. Besides a financial incentive, an environmental incentive can also be proposed to change mindsets around (unnecessary) packaging.
5	Regulations to promote recycled materials	Regulation that encourages the use of recycled material among both producers and users of packaging.

5.2.3 Disposal

This section describes the top-5 leverage points that play a role in the disposal of packaging.

Table 13 Leverage points in disposal of packaging

Ranking	Leverage points in Disposal	Explanation
1	Disposal method of packaging in export markets	Since packaging is exported, it is usually disposed of in the destination export country. Knowing whether it is reused, recycled, or incinerated determines the best design for the

Ranking	Leverage points in Disposal	Explanation
		packaging. Stronger packaging can, for example, be reused and mono materials can be easier recycled (a product which is only composed of a single type of material).
2	Availability of more (non-polluted) paper and plastic (feedstock)	Recyclers are very dependent on the quality of the input they get for their recycling machines. Having non-polluted materials benefits the quality of the recycle.
3	Sorting at source	Sorting waste at source reduces the contamination of different waste streams, which benefits the quality of the feedstock for recyclers.
4	Involvement of communities or local government in waste collection	Waste management is a collective task. Communities and local governments should also take responsibility and contribute in a valuable way.
5	Responsibility for private sector on collection of packaging	Since brand owners put packaging on the market, private parties should lead in taking responsibility in waste management. This could be achieved through financially supporting the government or communities to invest in waste management systems. An EPR scheme is one of the options to implement this.

6. Identified interventions and potential for implementation

6.1 Introduction

The leverage points from the previous section have been used to formulate interventions. In this section, we will explain and analyse the interventions that have been identified. The interventions are based on three types of inputs.

- Stakeholder interviews with new ideas as output;
- Leverage points for interventions;
- Discussions during stakeholder workshop leading to interventions.

These led to a list of interventions that can affect the Kenyan packaging industry in a positive way. Aligning these in our analysis, overlap was found and four main categories were noted: technical, regulatory, social and financial interventions. Predictably, many of the interventions are related – e.g., if certain technical interventions will be implemented, they will likely be more effective if supported by regulations. Our analysis will indicate where there are dependencies. In Section 6.3, several of the interventions will be selected for further explanation.

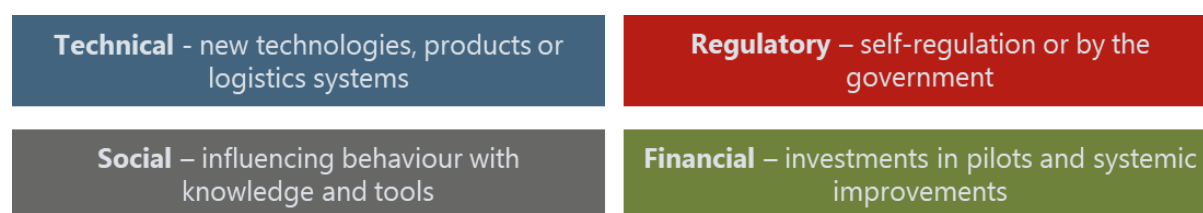


Figure 14 Four categories of interventions

6.2 Identified interventions

6.2.1 Technical

This category refers to interventions for which the starting point is that new technologies, products or logistics systems are being utilised, investigated or developed.

Table 14 Technical interventions

Number	Intervention
T1	Start research on the production of biobased polymer (e.g. cassava starch) in Kenya for packaging. From research, more information will become available on the price, end-of-life effects and the consequences for the quality of the subject that will be packaged.
T2	Start a pilot for reusable and returnable crates for flowers for export. The reason to start with flowers is that they are being shipped mainly to one location (the auction) and this is mostly done by consolidating both Dutch and Kenyan traders who can collectively leverage group coordination.

Number	Intervention
T3	Investigate the market for crates in the Netherlands, to determine whether there is demand for reusing plastic crates in NL (think of specs of Dutch companies/recyclers). This would lead to more employment in Kenya.
T4	Promote local deposit systems where growers and retailers work together to limit the use of cardboard for secondary packaging.
T5	Redesigning packaging – aiming for the production of packaging material that is recyclable without compromising food quality and safety.
T6	Investigate the options for more eco-coating of food which could lead to 'lighter specifications' for food packaging, because eco-coating makes the food more resilient.

6.2.2 Regulatory

This category refers to interventions that lead to standards or other changes in regulations. These can either be imposed by the government or by the sector (self-regulation) and these usually require more coordination.

Table 15 Regulatory Interventions

Number	Intervention
R1	Change customer specs for export products in cooperation with governments of export markets, to make it possible to produce more packaging in Kenya (and to avoid import dependence on UK packaging).
R2	Regulate the use of virgin material for secondary packaging, because secondary packaging does not have to be food-grade.
R3	Establish PRO council with all packaging PROs involved. There are currently multiple PROs which can be aligned better to improve effectiveness.
R4	Establish standards of packaging for the aviation sector and in both markets (domestic and export) across all sectors. This leads to more efficient use of inputs for packaging (encourage more recycling).
R5	Provide tax benefits for recycled products and remove import levies for returned packaging.
R6	Engage with the logistics sector with the aim to introduce a pricing system that provides incentives to keep both weight and volume down.

6.2.3 Social

The interventions in this category aim to influence behaviour with knowledge or other tools, like financial incentives for communities.

Table 16 Social Interventions

Number	Intervention
S1	Create open source networks and forums where information can be shared that will help to create consumer awareness on the importance of returning packaging and avoiding littering. Take steps to change public perceptions around the quality of recycled packaging.
S2	Broader sensitisation of the problem (and opportunities!) of waste – through education and updated school curriculums.
S3	Engage the informal sector more for waste collection.
S4	Provide access to information for practitioners on the benefits of waste management, source sorting, recycled materials (and what can be recycled).

6.2.4 Financial

The most tangible investments that should lead to more circularity in packaging have been described in this category.

Table 17 Financial Interventions

Number	Intervention
F1	Invest in PET recycling facilities in Kenya. Currently, there is the risk of insufficient quality feedstock, which should also be tackled and any potential investment de-risked.
F2	Provide financial support for innovations and pilot programs, like deposit systems and bio-degradable packaging.
F3	Invest in cold-chain logistics to make value chains more efficient which will limit the technical requirements for packaging.
F4	Provide incentives to the informal sector to collect / separate waste streams.

6.3 Potential for implementation

Some interventions will have more impact than others, and some are more feasible than others. Below, **Figure 15** illustrates the interventions and provides a high-level assessment of the feasibility and potential impact of each intervention. Based on this, we have identified groups of interventions that combine individual interventions. These groups aim to stimulate circularity as well as to boost job potential.

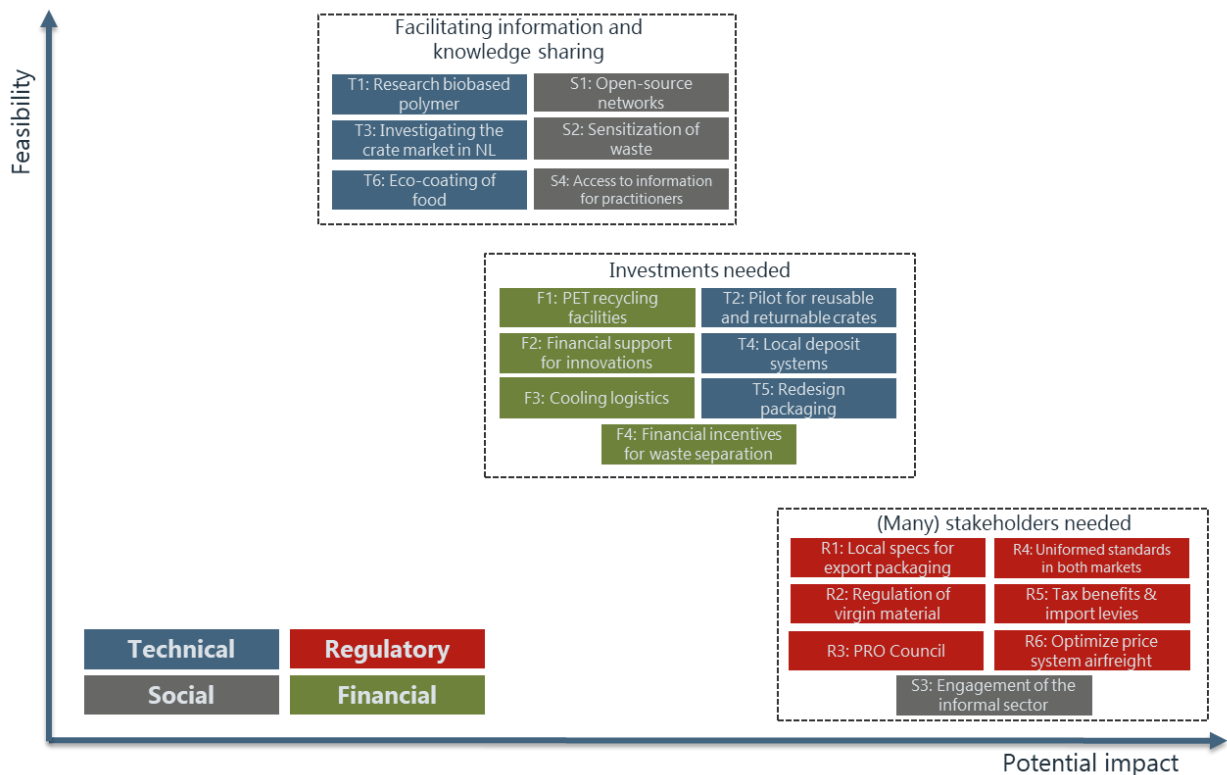


Figure 15 Feasibility and potential impact of interventions

The visual in Figure 15 has been used to carve out intervention groups. For each group, there will be an explanation of what the current initiatives are and which stakeholders play a role. This gives the starting point for future interventions.

6.3.1 Intervention area one: formulating and implementing standards (R1/ R4/ R6/ T5)

One of the major issues identified is the lack of standards. This affects the value chain in at least two ways: for recycling and the efficiency of transport. When specifications are not set or remain unknown, this makes it difficult to design packaging for recycling.

Use of leverage points

The intervention area builds on the following leverage points (the numbers refer to the leverage points as formulated at the beginning of Chapter 5 – from the categories **P**roduction, **U**se and **D**isposal):

- Price of virgin material vs. recycled material (P2);
- Standards and regulations for packaging (P1);
- Client specifications are leading in packaging production (P4);
- Demand for recycled material for packaging (P7);
- Production of easily recyclable packaging (P8).

The standards of packaging in place are outdated or non-existent i.e., there are different 'standard-sized' carton boxes being manufactured in Kenya. In addition, the review of standards is not keeping pace with

the new innovations in packaging. Some of the current boxes do not fit in the aircraft ballot or the auction trolleys, causing inefficiencies during transport.

The overarching intervention here is that the Dutch government can work with the industry on developing standards for packaging of exports. This is a form of self-regulation which can be applied to both plastics and paper. The unique position that the Dutch government/embassy has, is that it can connect exporters and importers (in particular from Kenya and The Netherlands) to work on standards for plastic packaging and paper boxes (applicable for exports to The Netherlands). The suggestions have been elaborated upon in the tables in this section. The first one is around producing recyclable flower sleeves. Another one focuses on boxes of a standard size (secondary and tertiary packaging) to enable efficient transport (efficient use of space both in air freight and sea freight). In addition, we also recommend working towards the use of recycled paper in boxes without compromising the quality of the boxes. The ambition here – verified with producers – should be 30-40 percent of recycled paper.

Table 18 Implementation actions for flower sleeves

Implementation of actions around flower sleeves	
Working around current root causes	
Usually, the aesthetics and quality of virgin have led to users preferring virgin plastics. However, since we know that some flowers are being re-packaged and flowers do not need food-grade packaging, we can propose using less visually appealing recycled plastics. Currently there is not a lot of recyclate available, but demand will create supply.	
Step 0	Map current sustainability initiatives around flower sleeves <ul style="list-style-type: none"> • Timaflo has started using 100 percent recycled flower sleeves as alternative to non-recyclable plastic packaging. The features of the foil both in aesthetics and preserving the flowers have not changed. It is not clear what the potential is for scaling this up, but that can be explored as part of next steps. • Broekhof Holland packaging company with offices in Kenya, sells recycled flower sleeves made from plastic waste. The back cover is made of 100 percent recycled plastic which is collected at and via the Dutch flower auctions. The front cover remains transparent to preserve the aesthetic value of the flowers. The flower sleeve consists of mono-material and is widely recyclable after use. Broekhof is also enroute to offering 100 percent FSC certified paper, cardboard and wood items.
Step 1	Identify and liaise with stakeholders to define roles and gauge appetite. <ul style="list-style-type: none"> • Mr. Green Africa; a recycling company that recycles multiple types of plastics, including PP. Their intention is to serve and create value and close the circularity loop within local and regional markets. They are exploring producing pellets for non-transparent sleeves from recyclate using their current equipment, yet this will require further investigation (also in relation to pricing compared to the current virgin sleeves). Other local flexible plastic recyclers include Vintz Plastics Ltd, December Waste Services, Go Green Granulars Ltd and Sigma Industrial who recycle and sell approximately 600 tons of pellets per month. The figure is higher for recovered volumes (both

Implementation of actions around flower sleeves	
	<p>post-consumer and industrial) (more organisations listed in the implementation plan stakeholder contacts list).</p> <ul style="list-style-type: none"> • Royal FloraHolland; since roses are to a certain extent repackaged in the NL, it needs to be analysed how much re-packaging is actually done. Of those that are repackaged – Royal FloraHolland could help identify rose growers who are keen to cooperate given that sustainability is an important pillar in their strategy. In doing so, rose suppliers from Kenya can sleeve their roses in non-transparent recycled sleeves to encourage the use of recycled plastic. • Dutch traders (e.g., DFG Africa); play a key role in consolidating flower producers and offering supply chain efficiencies. They speak on behalf of the supermarkets especially on technical compliance issues that include packaging. For example Albert Heijn repackages flowers, which means that other (less aesthetically appealing) wraps could be an alternative. • FlowerWatch; could leverage their industry knowledge and research to educate their client base of new methods of sleeving the roses, moving away from virgin sleeves. Their clients include flower producers, forwarders, importers and supermarkets. • Advance Packaging Manufacturers Limited (APML); they currently produce clear flower sleeves made of virgin plastic material. The company is willing to explore producing non-transparent sleeves made from recycled plastics.
<p>What is now needed?</p> <ul style="list-style-type: none"> • Opening up dialogue with Dutch companies that have the scale to influence and prevent the use of virgin plastic sleeves in Kenya. • Financial assistance for research and for recycling companies to start producing non-transparent/ recycled inputs for sleeves and to plastic sleeve manufacturers to cover capital costs. 	
Step 2	<p>Build business models to determine viability for the plan and the impact on SDG 8.</p> <p>Given that Kenya is not an oil-producing country, using more recycle for packaging creates jobs and reduces dependencies and vulnerability to sudden shocks and distortions in the supply of plastic and paper. Increasing local production will also reduce the carbon emissions borne from international transport. With this, it is important to engage with Dutch importers, as they play a role in determining the requirements for packaging.</p> <p>As recycled material can be more expensive than virgin material, (small) price incentives might be needed to start the transition.</p>
Step 3	<p>First steps</p> <ul style="list-style-type: none"> • RVO should reach out to companies such as Royal FloraHolland and/or DFG Africa to identify Kenyan growers who are willing to cooperate. The intent is to collectively find a solution for influencing Kenyan growers to disincentivise exporting roses in virgin sleeves which are only further repackaged in the Netherlands.

Implementation of actions around flower sleeves	
	<ul style="list-style-type: none"> • A pilot collaboration between Mr. Green (or other recyclers), APML, Royal FloraHolland and companies like Timaflo and/ or Broekhof facilitated by RVO. <ul style="list-style-type: none"> ○ Mr. Green Africa would need to confirm whether the granulate that is needed can be produced by them locally (first impression is that this is possible). If they can, Mr. Green might be able to create more employment opportunities among waste pickers to increase feedstock. After the pilot, Mr. Green might have to make additional investments in equipment to be able to serve the market with non-transparent pallets for rose sleeves. ○ APML will use the grant to convert the recycle pellet to roll form which will then be cut into sleeves. Although their current machines can input recycle materials, a (one-off) financial incentive will be needed to pilot demand for non-transparent sleeves as it will be limited to small scale. ○ All the information gathered during the pilot can be used to build a sustainable business case that will show whether financial incentives are needed in the long-run or whether a financially sound transition can already exist. For data collection, business case development and learnings, the participation of an industry knowledge organisation is needed (e.g., FlowerWatch).

Table 19 Implementation of actions around production of standard size box

Implementation of actions around production of standard size box	
Working around current root causes	
There is limited coordination / knowledge sharing. Increasing that will lead to more buy-in for the standard box. There is no regulation in this area. However, the market can probably pick this up without the government (self-regulation).	
Step 0	Map current sustainability initiatives around boxes <ul style="list-style-type: none"> • Based on market consultations, there are limited standard size box specifications implemented in Kenya. Although one notable example is XPOL, a rose supply chain service provider has invented the XPOL BOXX - a clean recyclable carton which can carry 8 percent more products, uses 15 percent less paper per airplane pallet and can be customisable for private label use.⁴⁶
Step 1	Identify and liaise with stakeholders to define roles and gauge appetite <ul style="list-style-type: none"> • Royal FloraHolland; could play a pivotal role in enforcing standard box standards, especially for flowers being sent to the Netherlands (worth a total of USD 269m in 2020). Royal FloraHolland is committed to optimising pricing. The company can inch closer to the ambition of packing roses in standard

⁴⁶ <https://xpolplatform.com/xpolboxx/>

Implementation of actions around production of standard size box	
	<p>boxes to reduce unnecessary packing, decrease air freight costs, and ultimately the price of the roses.</p> <ul style="list-style-type: none"> • Engagement of the Kenya Flower Council and its members; the members have an appetite for new ideas especially on sustainability matters e.g., Maginpar, Tambuzi and other farms. • Airflo (the second largest freight forwarder after Kuehne+Nagel) has an increasing focus on sustainability in their operations. In consultation with their packaging materials suppliers, their specialists are starting to look for ways of packing more items per unit of packaging material. They are exploring working together with organisations like Royal FloraHolland. • A knowledge organisation with specific industry knowledge (e.g., FlowerWatch) could help with analysing the optimal size of the flower box to ensure the quality of the rose is not compromised.
<p>What is now needed?</p> <ul style="list-style-type: none"> • Identify Kenyan rose growers and off-takers (large supermarkets in the NL) who are willing to cooperate, possibly with the help of Royal FloraHolland. This is because there are currently two boxes used between production and the supermarket/ buyer, causing unnecessary wastage. • Consultations with logistic companies and other stakeholders (Kenya Flower Council, Carton Manufacturers LTD) to set a standard box (size and other specifications). The ambition should be to produce this with between 30-40 percent recycled paper – the percentage that can be reached without compromising on quality. • Financial incentives might be needed – but that is not clear at this moment and should follow from the first steps. Support to get the processes going might be important at this stage. In the supply chain, there will also be more efficiencies in transport, so overall this should not lead to price increases of flowers. Box manufactures (plastic and carton) may require financing to make adjustments in their manufacturing processes to ensure the boxes created are of the new agreed standard size. 	
Step 2	<p>Build business model to determine viability for the plan and the impact on SDG 8</p> <p>Encouraging the use of standard size boxes will allow the manufacturer to scale up their production to the new standard boxes. In the short run, there will be some (small) investments in adjustment of the equipment, which leads to (limited, short-term) employment. Furthermore, the organisation managing the standards will also need time to implement, monitor and evaluate the standards, which leads to employment.</p>
Step 3	<p>First steps</p> <ul style="list-style-type: none"> • RVO can decide to carve out a budget to facilitate meetings among stakeholders to collaborate and agree on a standard box size. • Roses packed in boxes are often re-packed in another box (two boxes between production and supermarket/ buyer). The first step is to identify growers and large supermarkets who are willing to cooperate (possibly with

Implementation of actions around production of standard size box	
	<p>help from the Royal FloraHolland). To explore the possibility of having one box - it is important to connect the end user and grower.</p> <ul style="list-style-type: none"> • Once this is agreed upon, stakeholders identified in the previous step along with Kuehne+Nagel and Airflo can hold meetings to determine the ideal size of a standard box. A box that can hold an optimal amount of produce but also ideal for stacking during transportation. • Next, engage with the Kenya Flower Council and its members to ensure their buy-in before holding consultations with individual box producers such as Carton Manufacturers LTD to determine the financial implications of changing the size. • Roses would be the best sector to start in and later expand the concept to other sectors (French beans/ avocados), because the flower sector is less fragmented than other sectors (with relatively few growers and still a lot of the produce being channelled through the Dutch Flower Auction).

6.3.2 Intervention area two: investments in cooling logistics & sustainable secondary packaging (F3/ T2/ T3)

Multiple organisations are exploring the option to work with reusable crates made from recycled plastics. They could be returned to the producer of avocados, flowers and French beans, or stay in the country of export. So far, there have been financial and logistical obstacles preventing this from happening at a larger scale. Another less explored option is to produce crates that have potential off-takers in export markets. The crates can be locally produced from locally available recycle.

Investments in cold chain logistics add value for both the air freight and the sea freight routes. Obviously, where investments stimulate the trend towards more sea freight, there is a multiplied sustainability effect entailing less food loss, less packaging needed and a lower transport footprint. Temperature volatility limits the durability of packaging which has to be capable of absorbing more moisture.

Use of leverage points

The intervention builds on the following leverage points (the numbers refer to the leverage points as formulated at the beginning of Chapter 5 – from the categories **P**roduction, **U**se and **D**isposal):

- Reusability of plastic crates (compared to boxes that are disposable; P3);
- Demand for recycled material for secondary packaging (P7);
- Temperature management of fresh produce during export (U7);
- Disposal method of packaging in export markets (D1).

Table 20 Implementation of actions around production of reusable crates

Implementation of actions around production and use of reusable crates	
Working around root causes	
One of the challenges around this intervention has been setting up the logistics pool for the crates. This will be avoided if demand for crates can be created in The Netherlands.	
Step 0	Map current sustainability initiatives around boxes

Implementation of actions around production and use of reusable crates	
	<ul style="list-style-type: none"> • Silafrica (packaging company) and the Avocado Society of Kenya have agreed to enter into a long-term partnership aimed at increasing the Kenyan avocado market share in global trade. Silafrica have developed hard-plastic crates for the export of avocados, as a substitute for cardboard boxes. These are exported globally. In terms of the Dutch market, Pro Organic (a Dutch company in Tanzania) buys Silafrica's avocado crates. • Silafrica has also identified a technology that can convert flower sleeve waste recycle pellets into flat pack 100% recycled crates (Silafrica recycled flatpack circular returnable carton) that function in the same way as corrugated cartons/boxes, and do not require standardisation of sizes. They company has conducted the research and development but will only invest if there are identified off-taker contracts in place. This is a \$7m investment which could be funded via a combination of grant, soft loan, commercial loan and investment from Silafrica. • Flamingo group international originally used plastic foldable crates to export roses, the boxes are flattened in the UK/NL and sent back to Kenya. The company has not rolled out the use of plastic reusable crates. • Bloemenkrat.nl has developed a standard size crate for flowers.
Step 1	<p>Identify and liaise with stakeholders to define roles and gauge appetite</p> <ul style="list-style-type: none"> • Silafrica; is currently making reusable, foldable plastic crates which provide the same functionality as cardboard boxes. They are lighter and carry the same amount of avocados. They replace corrugated carton which has less ventilation and requires more water and energy to recycle. The net saving of the foldable plastic crate has been positive, allowing Silafrica to already scale this innovation. The company is now trying to identify secondary use applications for these crates in export countries. They are keen to meet Dutch fruit (avocado) and vegetable importers from East Africa. Additionally, Silafrica is also ready to introduce the Silafrica recycled flatpack circular returnable carton, contingent on the number of predetermined offtake contracts. • Airflo / Kuehne+Nagel; Having long term freight handling contracts with Airflo/ Kuehne+Nagel could be beneficial for the introduction of crates. The crates should lead to efficiencies in transport. The agreement could also open opportunities for Kenya to import back the reusable crates. • Food importers/ distributors; may create demand for reusable and foldable plastic crates in The Netherlands. If the crates are made in consultation with the supermarket, this could open a market in The Netherlands (exporting the empty crates back to Kenya may not financially feasible in the long run – and is complex from a logistical point of view). • Bloemenkrat: Utilising their knowledge and industry experience they could help with brainstorming specifications of a new potential reusable crate.

Implementation of actions around production and use of reusable crates	
<p>What is now needed?</p> <ul style="list-style-type: none"> • Hold consultation meetings with distributors / importers to gauge their interest in using the reusable plastic crates produced in Kenya. The crates can be used as displays in the supermarkets (instead of being transported back to Kenya). • Alternatively, negotiating logistic rates with (mentioned) logistics players to explore exporting back empty crates to Kenya for reuse. • Providing subsidies i.e., for the setup of a system for collection and storage in The Netherlands to ensure that empty crates can be exported back to Kenya for reuse in a potential pilot project. • Conducting a Life Cycle Analysis (LCA) to assess what the exact environmental benefits (or losses) are of returning and reusing the crates in Kenya. 	
Step 2	<p>Build a business model to determine viability for the plan and impact on SDG 8.</p> <p>Producing crates from recycled plastics as secondary packaging, and selling them in export markets without the logistical complexities of returning them to Kenya, is the preferred option. This creates jobs in Kenya as it creates off-takers for recyclers. Potentially, some jobs in cardboard box manufacturing would be lost, but this would be compensated by jobs created for the production of the new crates. Note that while this intervention focuses on avocados because there is already an initiative in that market, it could be expanded to flowers using the specifications of 'bloemenkrat'.⁴⁷ For the crates of 'bloemenkrat' there is a proven market in The Netherlands.</p>
Step 3	<p>First steps.</p> <ul style="list-style-type: none"> • Explore how to serve the Dutch market of crates. Identify distributors in The Netherlands that can help in estimating the demand. This limits the need for them to be transported back to Kenya. • Once there is an indication of demand, the distributors could play a role in determining the specs of the crate to suit their logistics and brand image. This could be done in consultation with Silafrica. • The rollout can start with avocados (to ferry off the existing partnership with the Avocado Society and Silafrica), then later expand to French beans and roses.

Investments in cold supply chain logistics also has the potential to create direct jobs for Kenya and, as it increases the export potential, also leads to indirect job creation. A strong multiplier sustainability effect (less packaging, lower packaging volumes/weight for transport, lower transport footprint and most significantly less food waste).

6.3.3 Intervention area three: knowledge and information (S1/ S3/ S4)

Open source networks, especially in Kenya but also in The Netherlands, could increase consumer awareness on packaging for both practitioners as well as consumers. There still remain a number of

⁴⁷ Bloemenkrat, 2022. The crate. <https://www.bloemenkrat.nl/en/the-crate>

unknowns about the environmental impact of packaging, waste management and recycling. The Dutch embassy can stimulate knowledge sharing on these topics, for example, by creating a knowledge exchange platform. Workshop participants indicated that they do not always know the most sustainable option and are interested in follow-up from the Dutch government in further networking events. Examples often mentioned are:

- The expanding middle-class in Kenya increasingly buys pre-packaged fruits and vegetables, which are primarily reliant on the use of plastics which are unnecessary and difficult to recycle. Additionally, some growers package their produce in less sustainable packaging, despite alternatives being available, due to a lack of knowledge sharing initiatives within the market.
- In The Netherlands, consumers buy roses which are wrapped in clear plastic sleeves, for aesthetics. There is limited awareness on the availability of more sustainable alternatives.

Since there is small plastic market in Kenya, it leads to a less critical attitude of value chain players i.e., buyer of packaging is less critical of the producer of packaging because of limited knowledge of alternatives in the market. The lack of knowledge on alternatives further compounds this.

Also in the informal waste sector, building more knowledge and improving the link between the informal and formal service providers could generate more jobs and/or higher incomes.

The Dutch embassy could aim to play a role in knowledge sharing within the industry in Kenya and The Netherlands, the informal sector in Kenya, and potentially consumers in both countries.

Use of leverage points

The intervention area builds on the following leverage points (the numbers refer to the leverage points as formulated at the beginning of (Chapter 5 – from the categories **P**roduction, **U**se and **D**isposal):

- Access to information on benefits and quality of sustainable packaging (U1);
- Access to information on consequences of unnecessary packaging (U4);
- Involvement of communities or local government in waste collection (D4);
- Access to information on negative effects of littering, dumpsites, and home incineration (D6).

Table 21 Implementation of actions around knowledge and information

Implementation of actions around knowledge and information	
Work around current root causes	
This intervention provides a solution for several root causes, e.g. no regulations on packaging requirements and wrong perception of the quality of recycle.	
Step 0	Map current sustainability initiatives around knowledge and information <ul style="list-style-type: none"> • Kenya Association of Manufacturers (KAM), releases a policy and sustainability report annually, to demonstrate how they use fact-based policy to advocate for its members within government on various issues including trade and regulations. They have also have a Centre for Green Growth and Climate Change (CGGCC), which aims to deepen industry level interventions, promote circular economy, climate change actions, and financial linkages that prioritise people and planet. The CGGCC is set to host their first circularity exposition slated for 23 February 2023.

Implementation of actions around knowledge and information	
	<ul style="list-style-type: none"> Sustainable Inclusive Business Kenya (SIB-K), is a knowledge sharing centre. They hold a number of events which enable the participation of members and the wider audience. Events include the annual private sector conference on sustainable inclusive business, frequent workshops, and a number of relevant articles published on their website. SIB plays an important role as the secretariat of the Kenya Plastic Pact. As part of the activities under the pact, SIB maps problematic and unnecessary packaging.
Step 1	<p>Identify and liaise with stakeholders to define roles and gauge appetite</p> <ul style="list-style-type: none"> The Netherlands Enterprise Agency (RVO) could leverage Dutch expertise and knowledge to bring in strategic elements in the transformation towards circular and more sustainable agriculture in Kenya (and use other (African) countries as example). The aim of Kenya Extended Producer Responsible Organization (KEPRO) is to help increase national awareness and protect Kenya's natural environment from waste and pollution. They play a vital role in educating and encouraging new organisations to pay EPR fees. Currently, KEPRO has an agreement with Danish Industries where they share best practices in Denmark around their EPR schemes and could benefit from a similar arrangement with RVO. KAM represents multiple manufacturing organisations including plastic packaging manufacturers, horti- and floriculture producers and could provide a platform for knowledge sharing among members. Kenya Private Sector Alliance (KEPSA) is a private sector umbrella body, they have the power to influence how private manufacturing organisations conduct business and can provide a learning base for information sharing. SIB-K; has had experience hosting conferences. Once every year they explore multiple thematic areas and one of the topics includes the circularity of plastic.
Step 2	<p>Build business models to determine viability for the plan and the impact on SDG 8.</p> <p>There is a lack of knowledge and knowledge sharing in the market. Most of the interviewees are convinced that this hampers innovations that could lead to more sustainability and scalable models that support job creation. Knowledge about circular business models can stimulate businesses to hire people for R&D and sustainable operations.</p>
Step 3	<p>First steps</p> <ul style="list-style-type: none"> Conduct a meeting with KAM to identify how RVO can assist CGGCC in the long run but also explore how RVO can be involved in the circularity exposition. Some of the services that the CGGCC offers are resource efficiency services (energy, water & wastewater audits, waste and circular economy resource mapping), capacity building and green financing. They also provide technology and financial linkages to enable members to

Implementation of actions around knowledge and information	
	<p>implement the recommendations from assessments. RVO can augment these existing services by leveraging Dutch expertise.</p> <ul style="list-style-type: none">• Reach out to KEPSA on the best approach to offer the educational material and platform.• Reach out to SIB – K to delve into the possibility of a circular economy trade mission to Kenya.• Liaise with KEPRO for a strategic collaboration focusing on sustainability. This could entail bi-annual meetings where RVO can share best practices and help KEPRO realise context specific solutions, especially around EPR fees uptake and enforcement.

7. Conclusions

7.1 Exposing the root causes and leverage points...

The systems analysis has exposed root causes like lack of awareness and lack of knowledge. These root causes have a relation to different parts of the packaging value chain. They lead to other elements, like limited access to high-quality feedstock and limited production of recycled packaging (see Figure 16).

Some of the important root causes relate to the fact that two of the three selected products need food-grade packaging and have limited possibilities for recycling. Other root causes relate to perception of recycled packaging, a lack of knowledge and (relatively) favourable pricing of virgin material. Although a lot of progress is visible in Kenya, the market for circular packaging is still relatively immature. The products selected are export products, leading to logistical complexities for recycling.

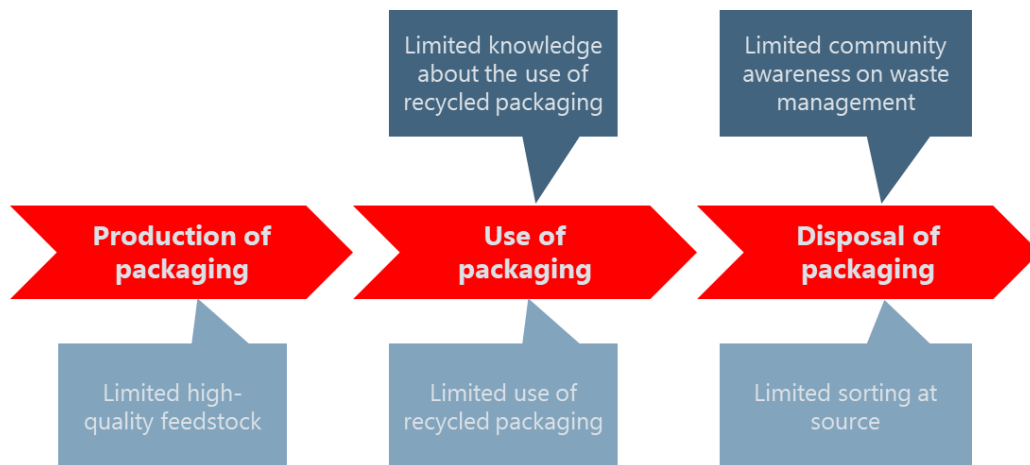


Figure 16 The relation between root causes (top) and outcomes (bottom) in the packaging value chain

The identified root causes need to be tackled, to be able to realise more circularity. The leverage points play an important role in this. The leverage points show where a small shift can have a big impact and have been identified and categorised into production, use and disposal.

- In production, it has been observed that the specifications of the buyer is prominent and that introducing standards can stimulate change. Reusability and availability of quality equipment are other variables playing a role;
- In use, regulations for the use of recycle is an area where change can be realised, as well as different structuring of the price of freight and temperature management;
- Involvement of communities and private sector and an enabling environment for investments in recycling are some factors that can influence change in the disposal lifecycle of plastic.

7.2 .. can show there are opportunities for more circularity...

Some important interventions on different levels have been implemented. Examples are the ban on single-use plastic bags (2017), the introduction of the Sustainable Waste Management Bill (2021), and Extended Producer Responsibility (EPR, 2020), which is anticipated to become mandatory within the next year. Companies and other organisations have also made important efforts on different levels.

This study has identified practical opportunities to increase circularity. The focus has been on suggestions that can practically be realised with the support of the Dutch government (including the embassy in Nairobi).

Intervention area one focuses on the formulation of standards that can lead to standards being implemented by market leaders and eventually most of the sector. Also presents an opportunity to strengthen the sustainability of Dutch-Kenyan trade and inform best practice elsewhere. The lack of standards (regulations for packaging materials, waste management, etc) has been mentioned as a root cause by many interviewees. Practical interventions that have been elaborated on include the development of a standard size box with up to 40 percent recycled paper, and the introduction of sleeves produced from recycled plastics to be used for flowers being re-packaged in The Netherlands.

Intervention area two focuses on practical interventions that have already partly been explored and implemented by stakeholders, like investments in cooling and cold supply chain logistics and reusable/returnable packaging (see previous Section).⁴⁸ Introduction of a plastic crate made from recycled plastics for which there is a market in The Netherlands may also improve sustainability and could lead to more circular economy jobs in Kenya.

Intervention area three has indirect effects, by increasing the knowledge base in Kenya and The Netherlands on production, use and recycling of packaging. This would indirectly lead to more traction for circular economy and eventually lead to more circular economy related jobs.

7.3 ...and job creation

After the plastic ban was enforced in Kenya, many fruits and vegetables are sold without packing. This limits the amount of plastic and paper packaging in circulation within the Kenyan market. From the agro-food and flowers that are packaged for local consumption or for export, most raw packaging materials are imported. Since plastic is the by-product of oil, plastic is mostly sourced from oil-producing countries making it cheaper to import. Kenya currently has a timber deficit, forcing cardboard manufacturers to import paper from abroad due to the limited local supply. The production of the packaging is limited by aging machines that affect quality, especially when using recycled material which distresses the durability of the packaging and eventually the quality of the products that use it.

There are opportunities for local sourcing to curb the high costs of importing raw materials through recovering waste and prevention. Finding local solutions in the packing value chain will have cascading benefits, from environmental preservation, technological innovation, job creation, and economic growth.

⁴⁸ BCS, 2022. Home Page. www.bcskenya.co.ke. BCS is one of the companies, supported by the Dutch government, active in cooling logistics in Kenya. Currently the Dutch investment bank Invest International is developing a project on cold chain logistics with partners, in the port of Mombasa. Recently large investments in cold chain solutions have been done by private equity companies, like ARCH Emerging Markets Partners Limited

Appendix 1 Environmental effects of packaging materials

To be able to say something about the environmental impact of packaging, you need to take into account its whole life cycle: the production, the transportation, and the end-of-life phase. The production phase gives insights into the impact of the extraction of raw packaging material. The weight of the packaging has environmental effects deriving from transportation (the heavier, the more negative the environmental impact in terms of GHG emissions). The disposal of the product determines how the end-of-life material is being processed. This usually differs per geographical location, but in the case of exporting agro-food and flower products to the Netherlands, the most common disposal methods in the Netherlands will be explained. Since this type of packaging is not litter-prone (as it's mainly consumed within households), the effect of the end-of-life product will include the product ending up in the environment. Besides the value chain of the packaging itself, it is also important to take into account its functionality for the product it covers. This can have a large environmental impact in terms of food waste. As this effect vastly differs by product, it is not included in the table below.

To provide insights in the environmental effects of packaging, the table explains the pros and cons of four different packaging materials that are most commonly used for packaging of fresh produce. Those are plastic (low density for primary packaging and high density for secondary packaging), paper, and the biodegradable material (Table 22).⁴⁹ If a more detailed analysis for the impact of specific packaging is desired, a full impact-assessment of packaging materials can be conducted in a next phase of the PADEO project.

Table 22 Environmental effects of packaging materials

Life cycle stage Packaging type	Production ⁵¹	Transport	Disposal (sorting and reuse/recycling)
Plastic (flexible, low density)	The environmental impact in terms of global warming potential and water use of low density plastic is usually lower than paper, since paper packaging requires more material than plastic.	Light-weight	Difficult to sort and reuse, but theoretical possible to recycle, and many ongoing innovations

⁴⁹ Biodegradable material is heavily criticized due to the many requirements of the circumstances in which the material can be biodegraded. This usually requires high temperatures, special installations, and large timespans. The speed of degradation is dependent on factors like material and amount of oxygen and/or water. The material can be degraded in industrial circumstances, soil, or water.⁴⁷

⁵⁰ KIDV, 2021. Biologisch afbreekbare verpakkingen. https://kidv.nl/media/factsheets/bio_2021/20211028_factsheet_biologisch_

⁵¹ Based on the globally used life cycle assessment database Ecoinvent (Ecoinvent.org).

Life cycle stage Packaging type	Production ⁵¹	Transport	Disposal (sorting and reuse/recycling)
Plastic (rigid, high density)	The environmental impact in terms of global warming potential and water use of high density plastic is usually higher than cardboard boxes. It requires more weight of the plastic material and the assembly steps for HDPE have a higher impact than for paper.	Heavier than low density plastic and heavier than cardboard	Easier to reuse due to more strength than low density plastic; usually well-recyclable
Paper (for primary packaging), cardboard (for secondary)	See above. This does however not take into account the effect that the tree could also absorb CO ₂ when it would not have been cut down (substitute effect).	Relatively heavier than low density plastic, and a bit less than high density plastic	Reusable when strong enough; if dry and not contaminated, very easy to recycle.
Bio-degradable material (PLA)	The environmental impact in terms of global warming potential and water use of PLA is much higher than for low-density plastics.	Relatively light, like low density plastic	Cannot be recycled at consumer; costs a lot of energy to degrade; pollutes the plastic stream if not sorted correctly

Appendix 2 All identified leverage points

In the Kumu environment, three analyses have been conducted that led to the identification of leverage points. For our analysis, interviews, desk research, and workshop outcomes have been combined. The identified leverage points can be found in Table 23 - Table 25. Within their category of production, use and disposal, they are ranked based on the Kumu tool and workshop discussions.

Table 23 Leverage points in the production of packaging

Ranking	Leverage points in production	Explanation
1	Function of packaging (affecting food quality)	The primary function of the packaging is to preserve the quality and safety of the packaged product. In the case of avocados, green beans, and roses, the product needs to be preserved for the duration of the transport, to both the immediate export client and the end consumer.
2	Standards or regulations for packaging materials Type of packaging affects food quality	Standards in packaging requirements can increase the effectiveness of packaging production. 3) The more packaging requirements there are, the less repacking of products will take place which often requires additional packaging material. 4) Less variations in packaging will make sorting and recycling more viable. Furthermore, regulations for packaging materials may encourage greater usage of recycled content.
3	Price of virgin material packaging vs. more sustainable alternatives	Price is a major aspect in the decision-making process of users of packaging given the competitive nature of the markets they work in.
4	Reusability of plastic crates (compared to boxes that are disposable)	This refers to the possibility to reuse the secondary packaging crates, instead of disposing them directly when they reach the destination. They could be reused in the destination export market, or sent back to Kenya and be reused domestically.
5	Client specifications are leading in packaging production	One of the main reasons certain packaging is being imported, is because the client requires this type of packaging or a specific packager. The users are then bound to these producers of packaging. If these packagers are not located in Kenya, or do not have the option to provide recycled or reusable packaging, the producers do not have the flexibility to change to a more sustainable packaging solution.

Ranking	Leverage points in production	Explanation
6	Quality machinery to produce packaging	The quality of machinery that produces packaging is of great importance for the quality of the output of the machine. The higher the quality of the packaging, the less material needed, and the higher the potential for reuse.
7	Demand for recycled material for secondary packaging (and flowers primary packaging)	The demand for recycled material can stimulate the market to produce recycled products.
8	Production of packaging with high potential for recycling	The production of easily recyclable material can result in better feedstock (inputs) for recyclers.

This table describes the leverage points that play a role in the **use** of packaging.

Table 24 Leverage points in the use of packaging

Ranking	Leverage points in Use	Explanation
1	Access to information on benefits and quality of sustainable packaging	Sharing of information on the benefits of sustainable packaging can have a large impact on the system. Many people are not aware of this, and are therefore reluctant to change their behaviour. This is the case for producers, but also for consumers that have the option between different packaging types.
2	Use of virgin materials for flowers that are being repackaged	There is a leverage point at the point of repacking flowers (or other products) when they are being repacked into other sleeves that are more appealing for the consumer. This provides opportunities to use recycled material for the first transport leg (even when less aesthetically appealing).
3	Secondary packaging does not have to be made from virgin material (and for flowers primary packaging also not)	Virgin material is used to provide food-grade quality. This is only applicable for primary packaging, that is directly in contact with the food. Secondary (and tertiary if applicable) packaging does not need to be food-grade, and thus provides an opportunity to use recycled materials in their production.
4	Access to information on consequences of unnecessary packaging	Just as there is little awareness of the benefits of using sustainable packaging, there is also little awareness of the negatives of resource depletion, in the case of unnecessary packaging. Besides a financial incentive, an environmental incentive can also be proposed to change mindsets around

Ranking	Leverage points in Use	Explanation
		(unnecessary) packaging.
5	Regulations to promote recycled materials	Regulation that encourages the use of recycled material among both producers and users of packaging.
6	Air freight fees incentives taking into account weight and volume	To reduce environmental impact, weight allowance on air transport should be limited. Having an incentive to reduce the weight (of packaging), will translate into weight reductions in the plane.
7	Temperature management of fresh produce during export	When the temperature of transported products is well controlled, there are less constraints on and requirements for packaging material.
8	Use of (reusable) packaging in local markets	Since within the local Kenyan market transportation is less crucial (no need to pack and repack into ships or planes and less temperature volatility), it is more viable to use less packaging, reusable packaging or packaging made from recycled material.

This table describes the leverage points that play a role in the **disposal** of packaging.

Table 25 Leverage points in the disposal of packaging

Ranking	Leverage points in Disposal	Explanation
1	Disposal method of packaging in export markets	Since packaging is exported, it is usually disposed of in the destination export country. Knowing whether it is reused, recycled, or incinerated determines the best design for the packaging. Stronger packaging can, for example, be reused and monomaterials can be easier recycled (a product which is only composed of a single type of material).
2	Availability of more (non-polluted) paper and plastic (feedstock)	Recyclers are very dependent on the quality of the input they get for their recycling machines. Having non-polluted materials benefits the quality of the recycle.
3	Sorting at source	Sorting waste at source reduces the contamination of different waste streams, which benefits the quality of the feedstock for recyclers.
4	Involvement of communities or local government in waste collection	Waste management is a collective task. Communities and local governments should also take responsibility and contribute in a valuable way.

Ranking	Leverage points in Disposal	Explanation
5	Responsibility for private sector on collection of packaging	Since brand owners put packaging on the market, private parties should lead in taking responsibility in waste management. This could be achieved through financially supporting the government or communities to invest in waste management systems. An EPR scheme is one of the options to implement this.
6	Access to information on negative effects of littering, dumpsites, and home incineration	There is little awareness of the downsides of waste in the environment. Putting more emphasis on these effects, can motivate public and private stakeholders to take action.
7	Higher/ mandatory EPR fees (European Plastic Pact incentivizes import countries to also have EPR)	In Western countries, Extended Producer Responsibility (EPR) fees can support a business model for waste management. Implementing this regulation creates more possibilities to invest.
8	Waste Management bill: biological waste and non-biological waste has to be sorted at source and can only be given to regulated collection companies and recyclers.	The Waste Management bill that will be implemented in Kenya mandates counties as responsible for sorting waste at households. This can limit the contamination of waste streams, and increase the quality of feedstock (inputs) for recyclers.
9	Enabling environment for investments in recycling (stable and enforced regulations)	A regulatory framework that promotes recycling can stimulate businesses to invest in this sector.
10	Recycling facilities in Kenya (not possible for PET)	Facilities needed to recycle PET into high-end new products are very expensive. Currently they are not available in Kenya, which forces the recyclers to export the PET flakes to other countries like Greece, Turkey, and Vietnam.

The leverage points are ranked based on the importance indicated by the Kumu analysis as well as the discussion in the workshop. In general, the disposal leverage points came out as more important in the Kumu analyses than the use-focused leverage points. However, the disposal leverage points seem to be more focused on the local market (except the first), whereas the production and use phase leverage points are local as well as export related.

Appendix 3 Stakeholder overview

This section highlights a broad range of stakeholders involved in the packaging value chain. These stakeholders include packaging producers, vegetable growers, flower growers, logistic companies, government institutions, knowledge institutes, retailers and recyclers.

This list of stakeholders is inclusive of consulted stakeholders and overarching stakeholders. Those stakeholders with (*) have been interviewed, those with (*) have attended the workshop held on the 29th of September 2022 and those with (**) were interviewed and attended the workshop

Packaging Producers

Table 26 List of packaging producers

Organization	Website
Advanced Packaging Limited**	http://apml.co.ke/
Broekhof	https://www.broekhof.nl/
Cargolite	https://www.cargo-lite.com/
Carton Manufacturers Ltd**	https://carton.co.ke/
DPL – The Packaging Experts	https://dplkenya.com/
East African Packaging Industries	https://eapi.co.ke/
Elgon Kenya	https://www.elgonkenya.com/
Fresco Flowers	https://www.frescoflowers.nl/
Packaging Industries Limited**	https://www.pil.co.ke/
RD Plastic Producer*	https://www.rdplastics.nl/
Sanpac Africa	https://sanpac.com/
Silafrica**	https://silafrika.com/
Vintz Plastics**	https://vintzplastics.com/

Vegetable Growers

Table 27 List of vegetable growers

Organization	Website
AAA Growers**	https://www.aaagrowers.co.ke/
Biofarms	https://www.biofarms.co.ke/
East African Growers Fresh Produce Limited*	https://www.eaga.co.ke/
Instaveg Ltd*	https://www.instaveg.co.ke/
Kakuzi	https://www.kakuzi.co.ke/
Kenya Horticultural Exporters	https://khekenya.com/
Sigrut Farms*	https://sigrutfarmsinternational.com/
Solfruit Kenya*	https://www.solfruitkenya.com/
Sunripe	https://www.sunripe.co.ke/index.html
The Mara Farm Group*	http://www.marafarmgroup.com/
Veg Pro**	https://www.vegpro-group.com/

Flower Growers

Table 28 List of Flower Growers

Organization	Website
Aquila Flower Farm	https://aquilaflowers.com/home
Bilashaka	https://zuurbier.com/bilashaka-flowers/
Branan Flowers	https://brananflowers.com/
Credible Blooms	https://www.credibleblooms.co.ke/
Dutch Flower Group	https://dfg.nl/en/
Flamingo	https://flamingo.net/
Florensis	https://www.florensis.com/nl-nl

Organization	Website
Flower Hub	https://theflowerhub.net/
Karen Roses**	https://www.karenroses.com/
Oserian	https://www.bloomquestusa.com/oserian-farms.html
Penta Flowers*	https://theflowerhub.net/our-flowers/our-growers/penta-flowers/
Royal Flora Holland**	https://www.royalfloraholland.com/
Sian Flowers*	https://sianflowers.co.ke/
Subati Group*	https://www.subatigroup.com/

Logistics

Table 29 List of logistic companies

Organization	Website
FlowerWatch*	https://www.flowerwatch.com/en/supply-chain
AirFlo	https://airflo.nl/
Kuehne +Nagel International AG	https://nl.kuehne-nagel.com/
Will Freight*	https://www.willfreight.com/

Policies and Regulation

Table 30 List of regulatory organizations

Organization	Website
Avocado Society*	https://kenyaavocados.co.ke/
Fresh Produce Exporters Association of Kenya (FPEAK)	https://fpeak.org/
Kenya Association of Manufacturers (KAM)**	https://kam.co.ke/

Organization	Website
Kenya Extended Producer Responsible Organization (KEPRO)**	https://www.kepro.co.ke/
Kenya Private Sector Alliance (KEPSA)	https://kepsa.or.ke/
PETCO**	https://www.petco.co.ke/

Government Institutions

Table 31 List of government institutions

Organization	Website
Ministry of Agriculture	https://kilimo.go.ke/
Ministry of Environment and Forestry	http://www.environment.go.ke/
Ministry of Industrialization, Entrepreneurship and Trade	https://msea.go.ke/ministry-of-industry-trade-and-enterprise-development/

Others: (inclusive of retailers recyclers and knowledge institutions)

Table 32 List of knowledge institutes, retailers and recyclers

Organization	Website
African Circular Economy Network (ACEN)	https://www.acen.africa/kenya
Albert Heijn*	https://www.ah.nl/
Carrefour Supermarket	https://www.carrefour.com/en
Flower Council Holland	https://www.flowercouncil.co.uk/
Kenya Flower Council	https://kenyaflowercouncil.org/
Knowledge Institute for Sustainable Packaging (KIDV)*	https://kidv.nl/diensten
Mr. Green Africa**	https://www.mrgreenafrica.com/

Organization	Website
Naivas Limited	https://www.naivas.co.ke/
Now New Next*	https://www.nownewnext.nl/en/
Sustainable Inclusive Business – Kenya – Knowledge center**	https://sustainableinclusivebusiness.org/
Taka Taka Solutions	https://takatakasolutions.com/

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