UNEP Latin America and the Caribbean Food Waste Working Group 2023
Workshop 3: Circular Food System Transitions

[DATE]

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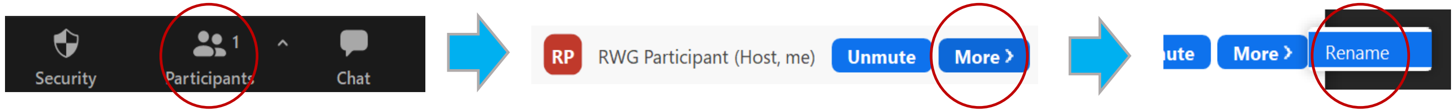
WRAP

Agenda

Section
Introduction & housekeeping
Framework: What is a circular food system?
Solutions deep dive: Upcycling
Solutions deep dive: Animal feed diversion
Solutions deep dive: Food waste recycling
Applying this in a city/region
Workshop close
Guest speakers will be presenting throughout

PAUTAS PARA LA REUNIÓN

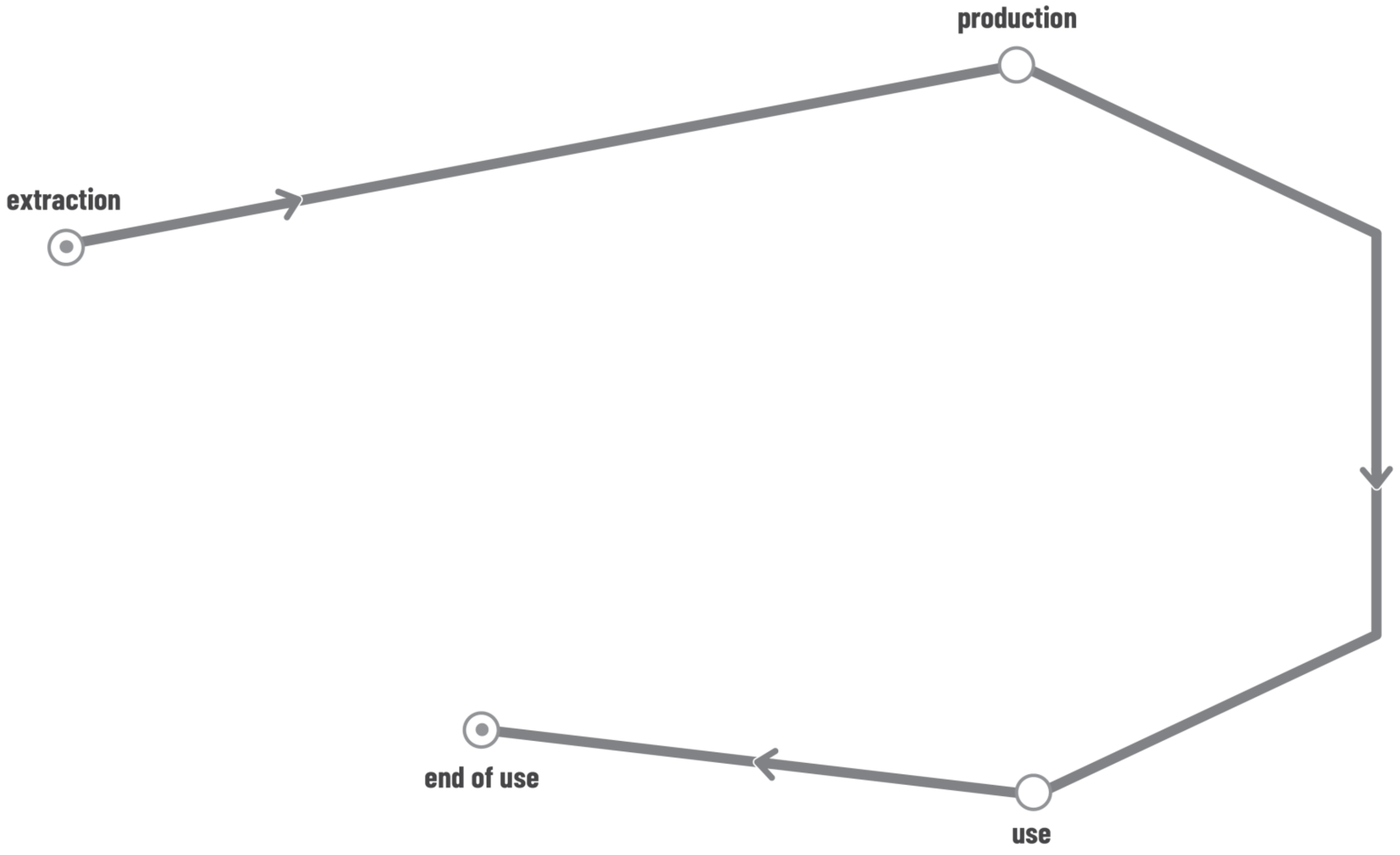
- Por favor, silencie el micrófono cuando alguien más esté presentando o hablando. Por favor, ¡reactive su micrófono para discusiones y preguntas!
- Cambie su nombre en Zoom para incluir su **país** (por ejemplo, Joe Bloggs – Reino Unido)



- Estamos grabando
- Si tiene dificultades técnicas, póngase en contacto con Project Admin Team
- Para la traducción, haga clic en 'Interpretación'

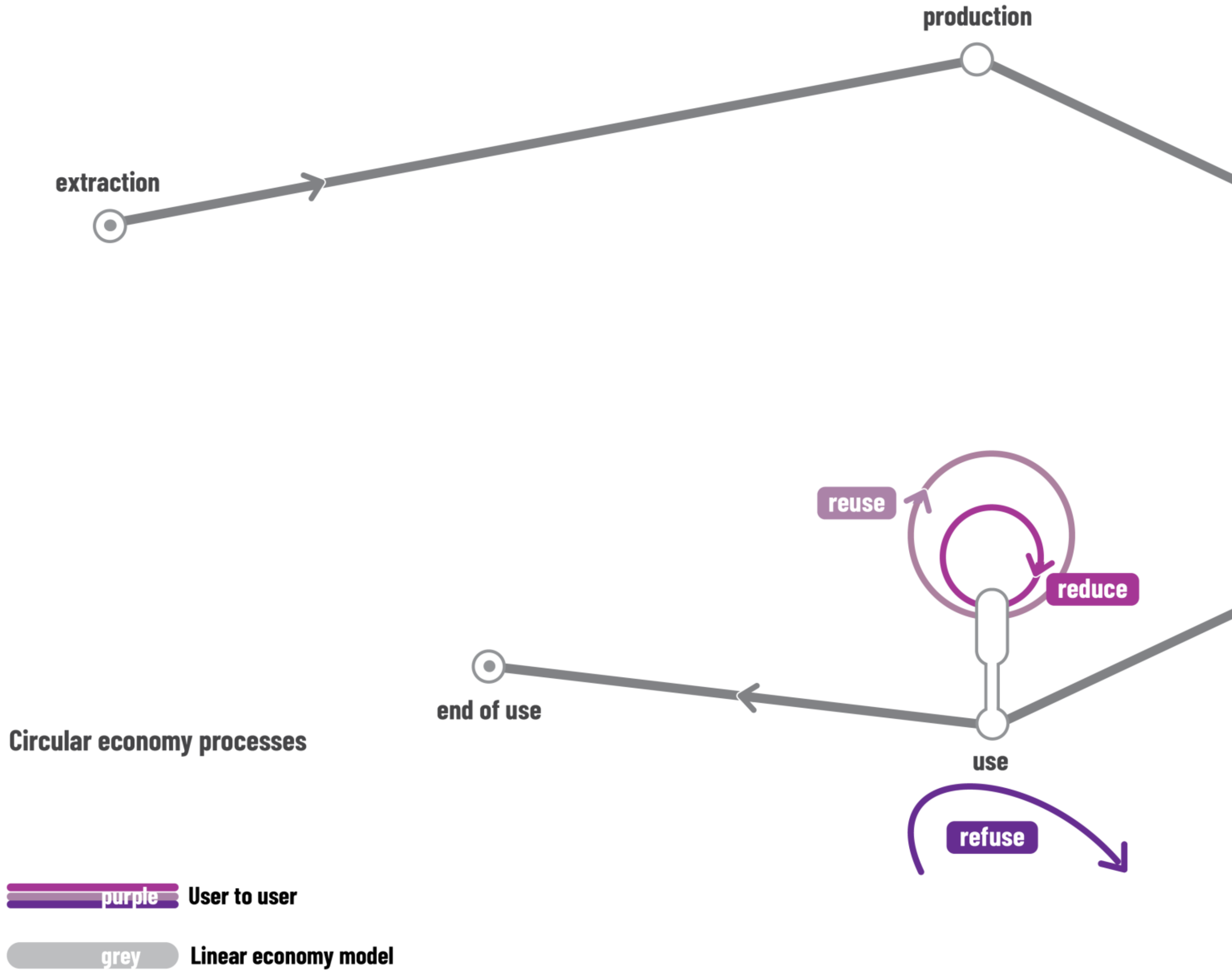
Circular Economy: a framework

Circular economy

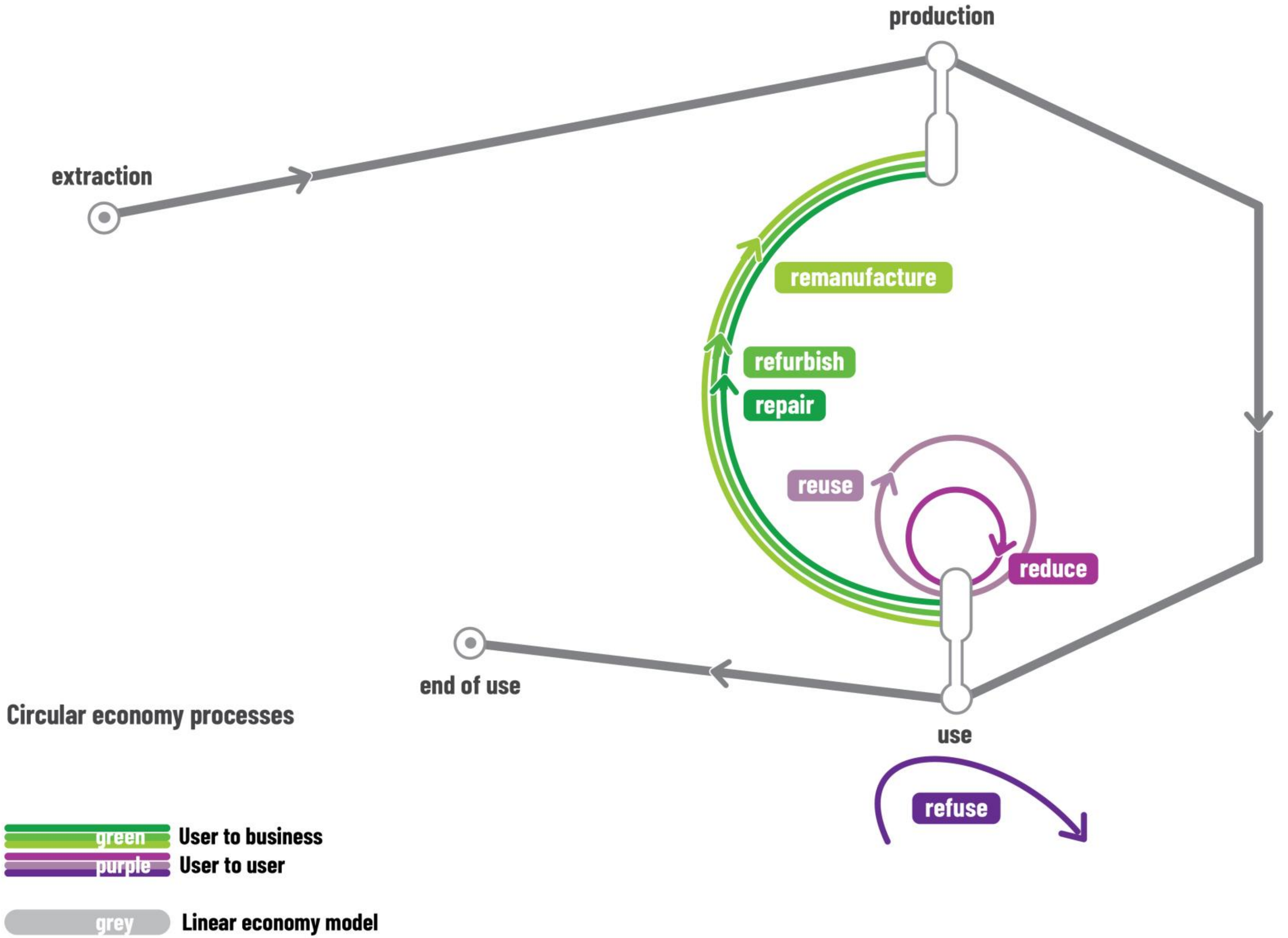


grey Linear economy model

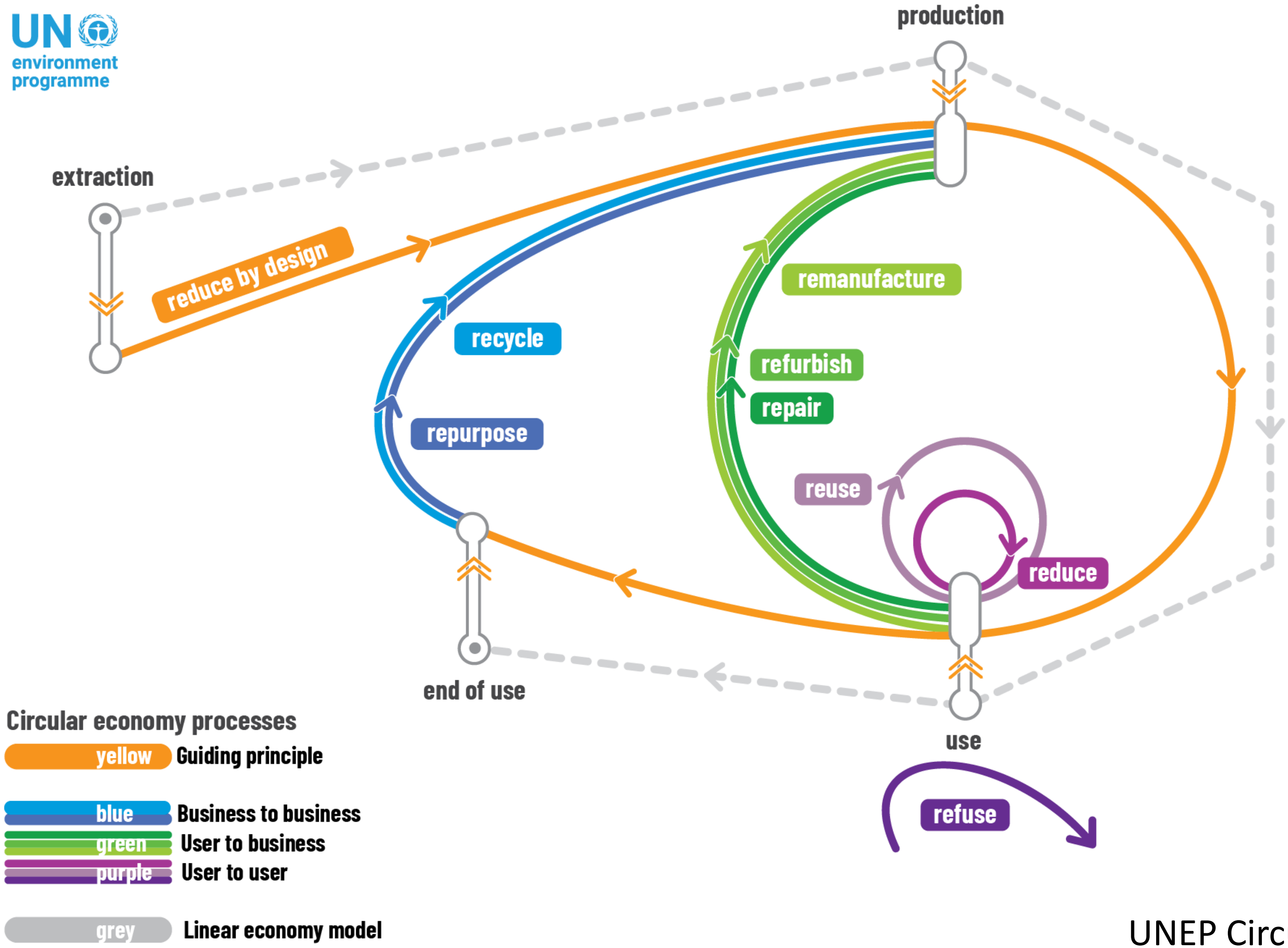
Circular economy



Circular economy

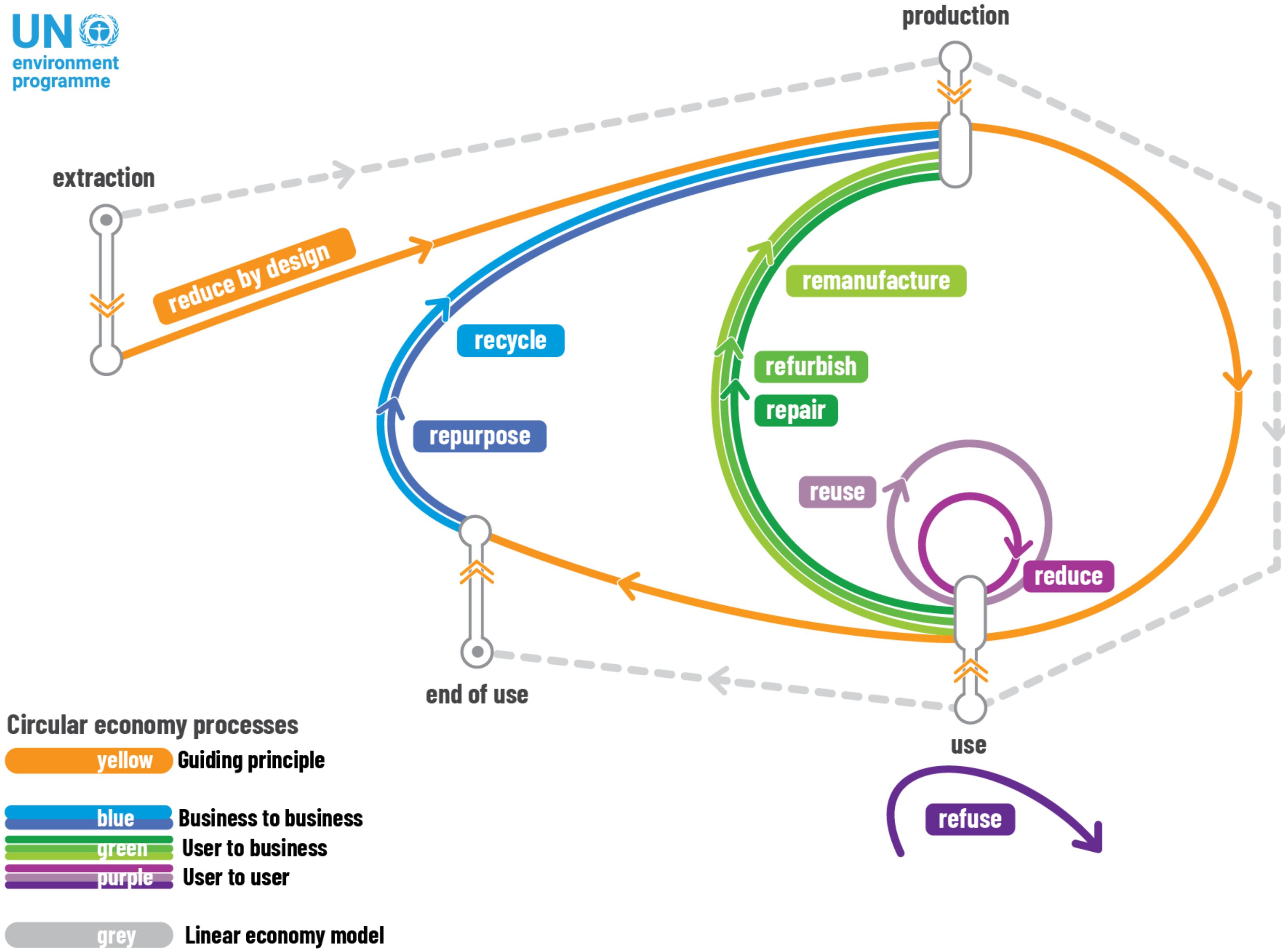


Circular economy



UNEP Circularity Platform 2019

Circular economy



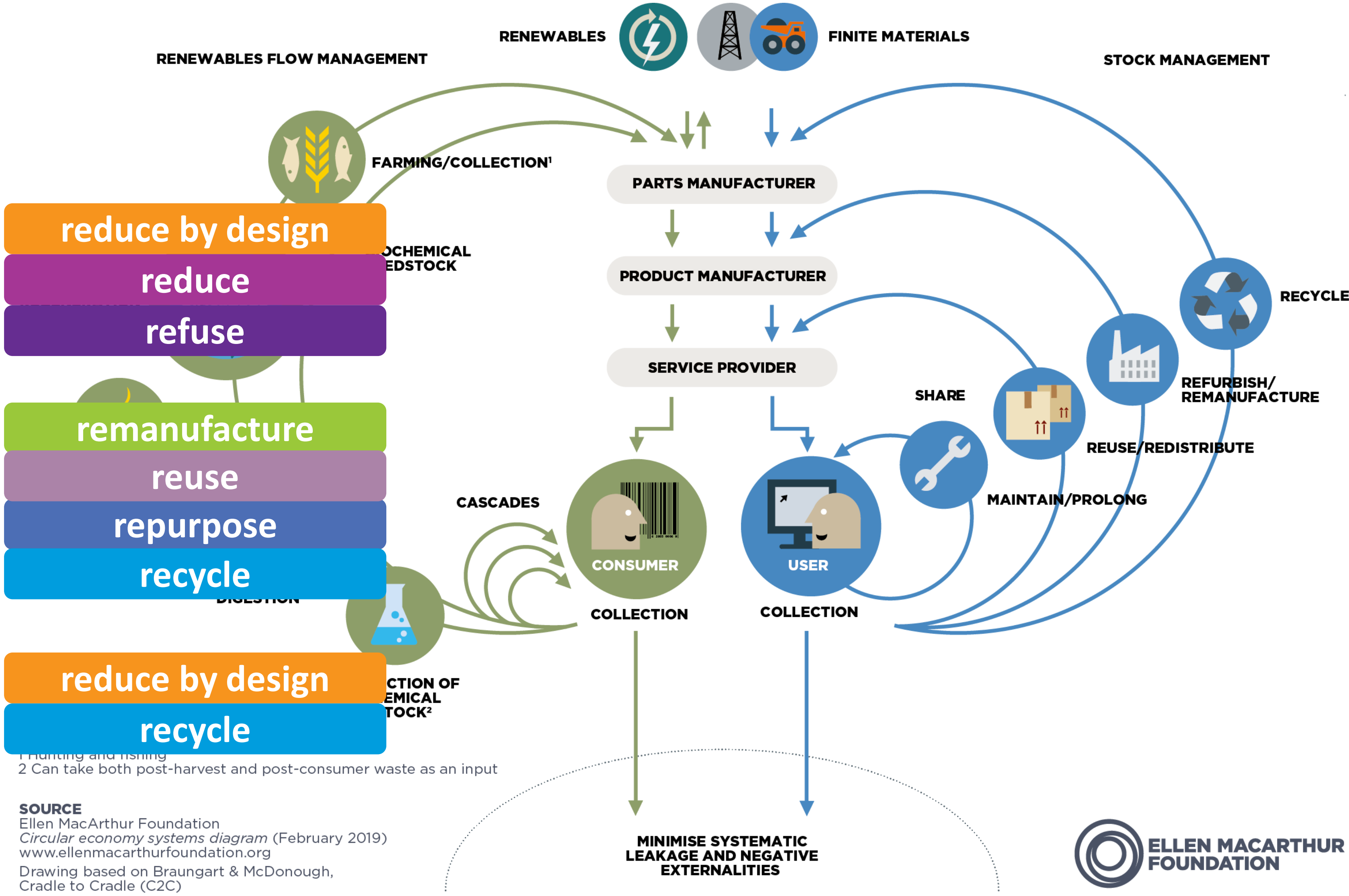
Some key points for **food**

- **Reduce by design:**
  - Food producers designing products to reduce consumer waste
  - Identifying products and applications for byproducts/side streams
- **Refuse and reuse:**
  - User (consumer or business) reducing their own waste and buying less
- **Repurpose and reuse:**
  - Developing and facilitating markets for byproducts
- **Recycle** anything remaining to close nutrient loops

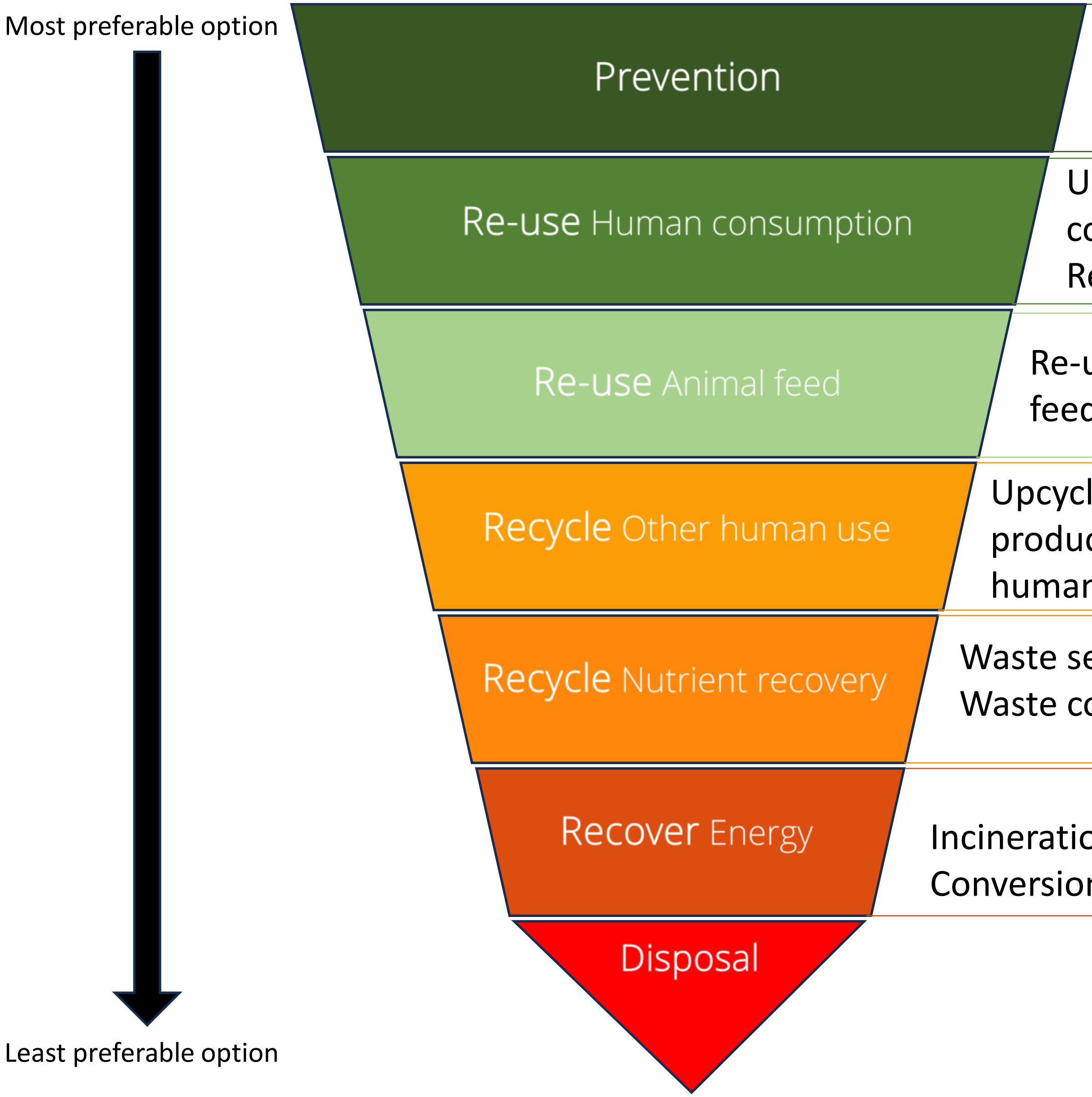
Ellen MacArthur Foundation – Circular Economy

Circular economy principles:

- Eliminate waste and pollution
- Circulate Products and Materials
- Regenerate Nature



Linking the food waste hierarchy and circular food systems



Reduce by design

Upcycle: Repurpose/remanufacture surpluses for human consumption
Redistribute for human consumption

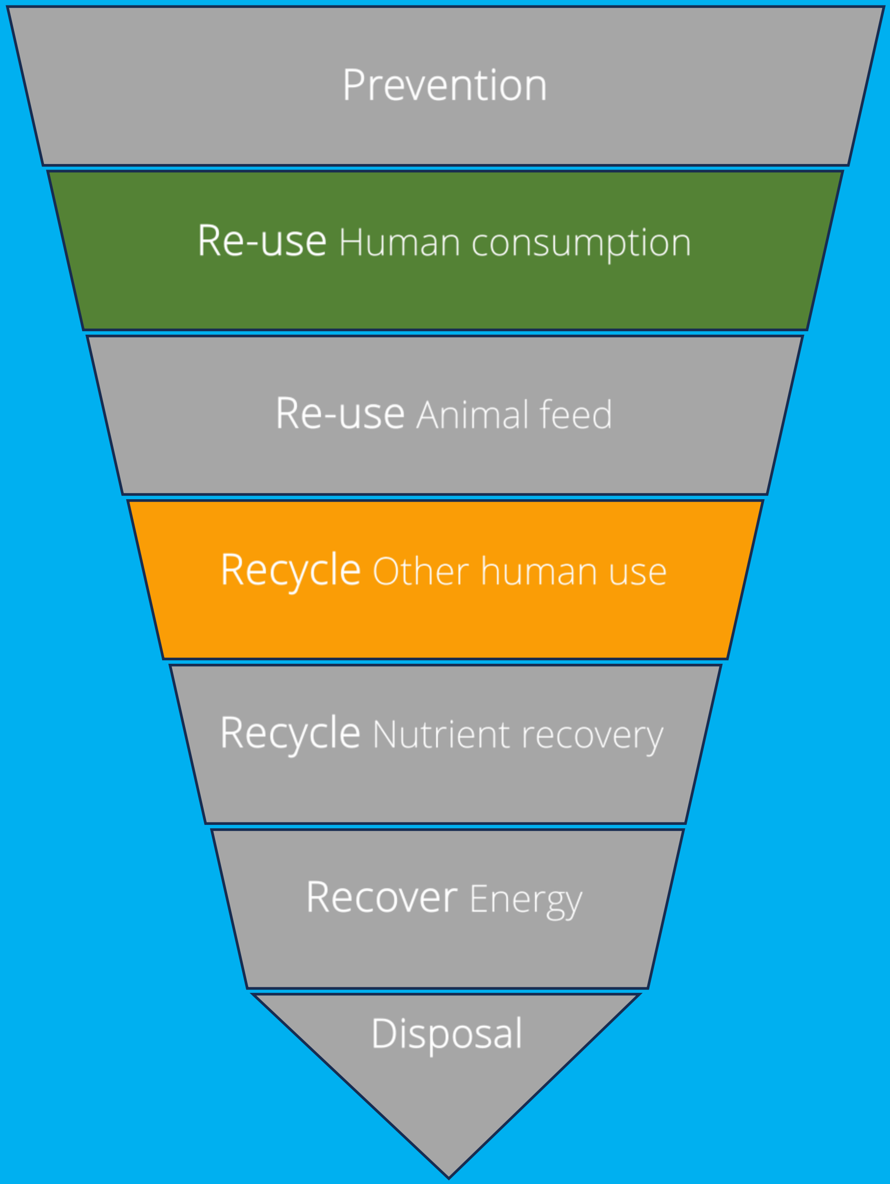
Re-use: Repurpose/remanufacture surpluses for animal feed

Upcycle: By-products from processing into other products, bio-based chemicals or other compounds for human use

Waste sent to anaerobic digestion
Waste composted

Incineration of waste with energy recovery
Conversion to biofuels

Solutions deep dive: Upcycling



reduce by design
remanufacture
repurpose
reuse

Upcycling

- **Upcycling** denotes "a process of converting materials into new materials of higher quality and increased functionality" (EMF)
- Upcycling food surplus/waste can involve creating new **food**, or other products (e.g. **pharmaceuticals, textiles, feed, bioplastics**)
- Sometimes termed 'valorisation'

Upcycled food

Upcycled Food Association defines it as: *'Upcycled foods use ingredients that otherwise would not have gone to human consumption, are procured and produced using verifiable supply chains, and have a positive impact on the environment'*

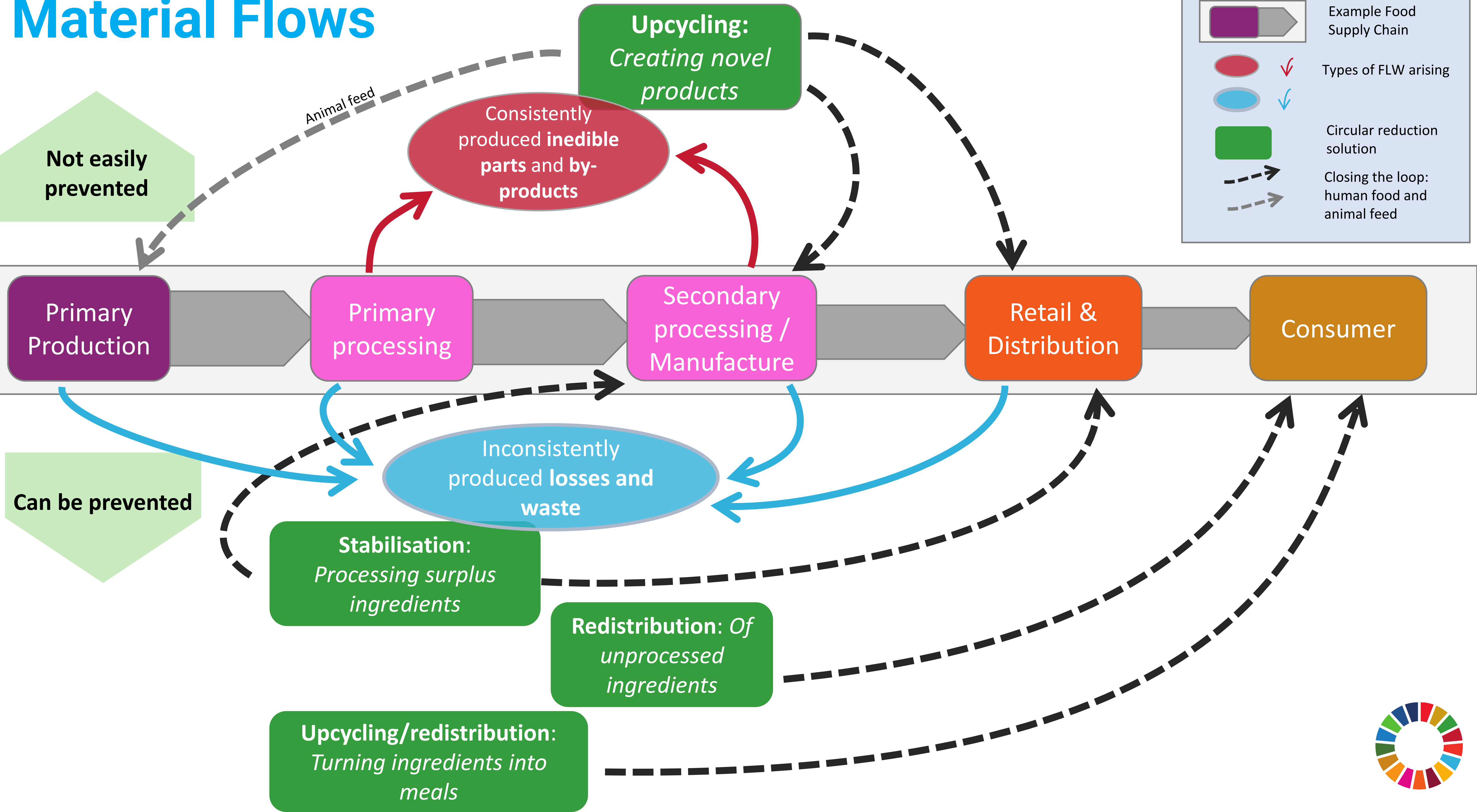
1. Upcycled foods are made from ingredients **that would otherwise have ended up in any food waste destination**
2. Upcycled foods are **value-added products**
3. Upcycled foods are **for human consumption**
4. Upcycled foods **have an auditable supply chain**
5. Upcycled foods **indicate which ingredients are upcycled on their labels**

Framework to approach upcycling

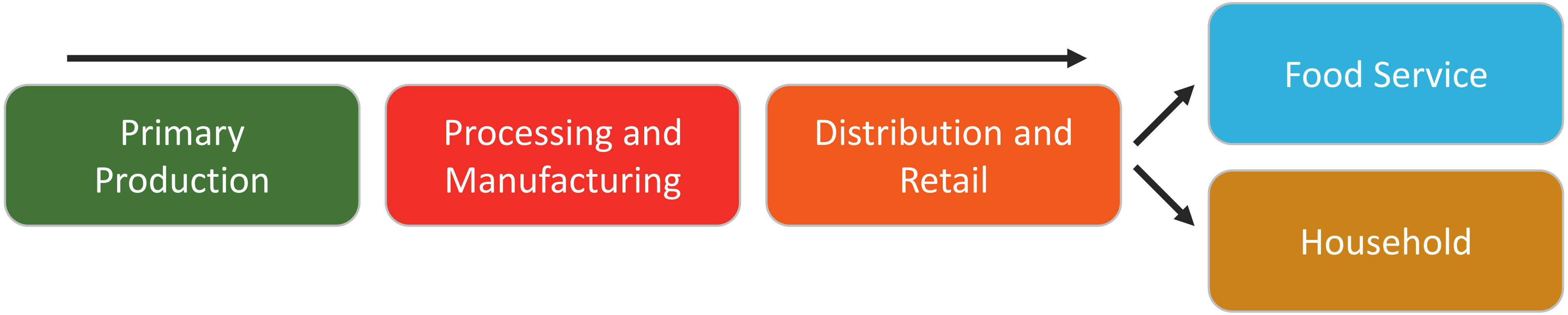
Key initial questions:

- **What** resources do we have available? In what quantities?
- **What** can be achieved with those resources?
- **Where/when** are those resources available?
- **How accessible?** Competing use for resources? When available?
- Do end markets exist? Do they need creation? What role for policy in supporting them?

Material Flows



Food supply chain



Edible and inedible parts of food waste in a circular food system

INEDIBLE

Processing by-products
- Plant stalks
- Fruit and vegetable peels/stems/cores
- Mash/residues from drink production
- Inedible animal parts

- Feeding animals
- Processing to improve digestibility/extract nutrient/flavour
-Changing preferences

Processing by-products
- Purposefully removed fruit and veg peels/stems/cores
- Inedible animal parts

Primary Production → Processing and Manufacturing → Distribution and Retail → Food Service / Household

Processing
- Stabilisation/freezing/ chilling
- Cooking
- Fermenting

Redistribution
- Processed or unprocessed

- 'Pausing' a product for use later
- Redistributing edible food to those who need it

Processing
- Stabilisation/freezing/ chilling
- Cooking
- Fermenting

EDIBLE

Level of processing options

Minimal processing	**Heat treatment/ chilling**	**Stabilisation**	**Size reduction**	**Advanced processing**
Chopping, trimming	Cooking, blending, pureeing (soup, smoothie, juice)	Drying (freeze dry, airdry, spray dry), Freezing	Milling/grinding	Extraction
Second grade (surplus) produce chopped for use in kitchens 	Second/ third grade (surplus) produce prepared in cooked meals 	Freeze dried strawberry snacks from third grade (surplus) produce 	Spent grain flour from brewers grain (byproduct) 	Grapeseed extract from grape marc (byproduct) 

Source: Fight Food waste CRC

Framework to approach upcycling

Key initial questions:

- **What** resources -> Inedible co-products and losses upstream likely to be biggest opportunity
- **What** can be achieved with those resources?
- **Where** are those resources available?
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LAC Region – Identifying Hotspots

Production across whole region

Product	Production (million tonnes)
Sugar cane	931.93
Soya beans	197.23
Maize (corn)	194.43
Raw milk of cattle	85.55
Wheat	32.58
Bananas	31.63
Rice	29.04

Losses, for products/countries with estimates

Product	**Production (million tonnes)**	**Estimated loss**
Raw milk of cattle	12.85	4.77
Maize (corn)	34.81	3.10
Oranges	20.81	2.12
Rice	12.98	2.02
Tomatoes	8.25	1.78

Production data from: https://www.fao.org/faostat/
Loss data by product from: https://www.fao.org/platform-food-loss-waste/flw-data/en/

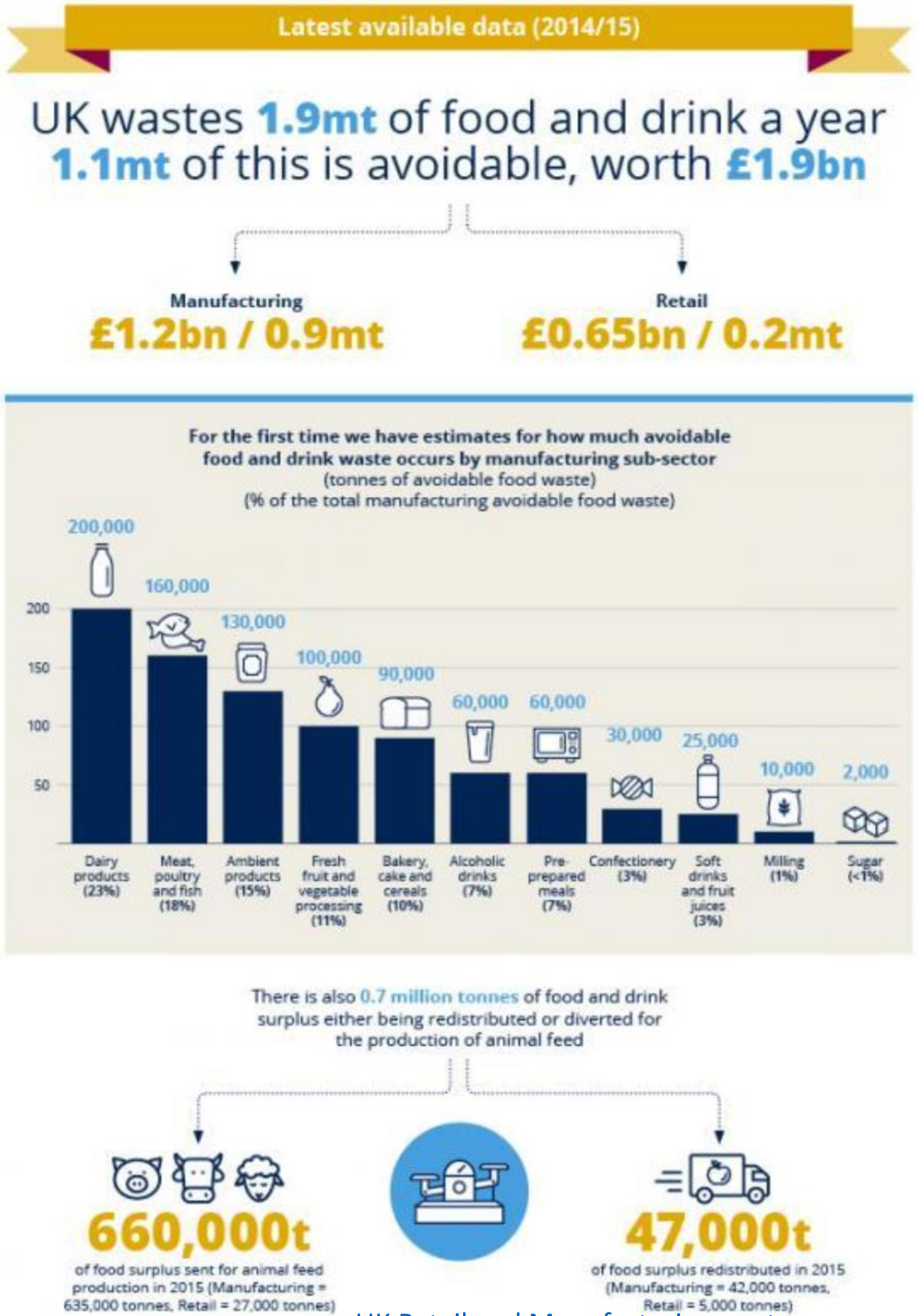
Identifying hotspots in a country

- Food waste baseline and sector measurement data is crucial to identify biggest hotspots
- Opportunities could be identified by tonnes, by environmental impact, by cost (or other metrics)

Table 5 Distribution of warm and hotspots across all indicators.

	Primary	Processing	Distribution	Retail	Household consumption	Hospitality consumption	Institutional consumption
Waste	Warm	Cold	Cold	Cold	Warm	Hot	Warm
Climate change	Cold	Cold	Cold	Cold	Hot	Hot	Hot
Water scarcity	Cold	Cold	Cold	Cold	Hot	Hot	Hot
Land occupation	Cold	Cold	Cold	Cold	Hot	Hot	Hot
Cost	Cold	Cold	Cold	Cold	Hot	Hot	Hot

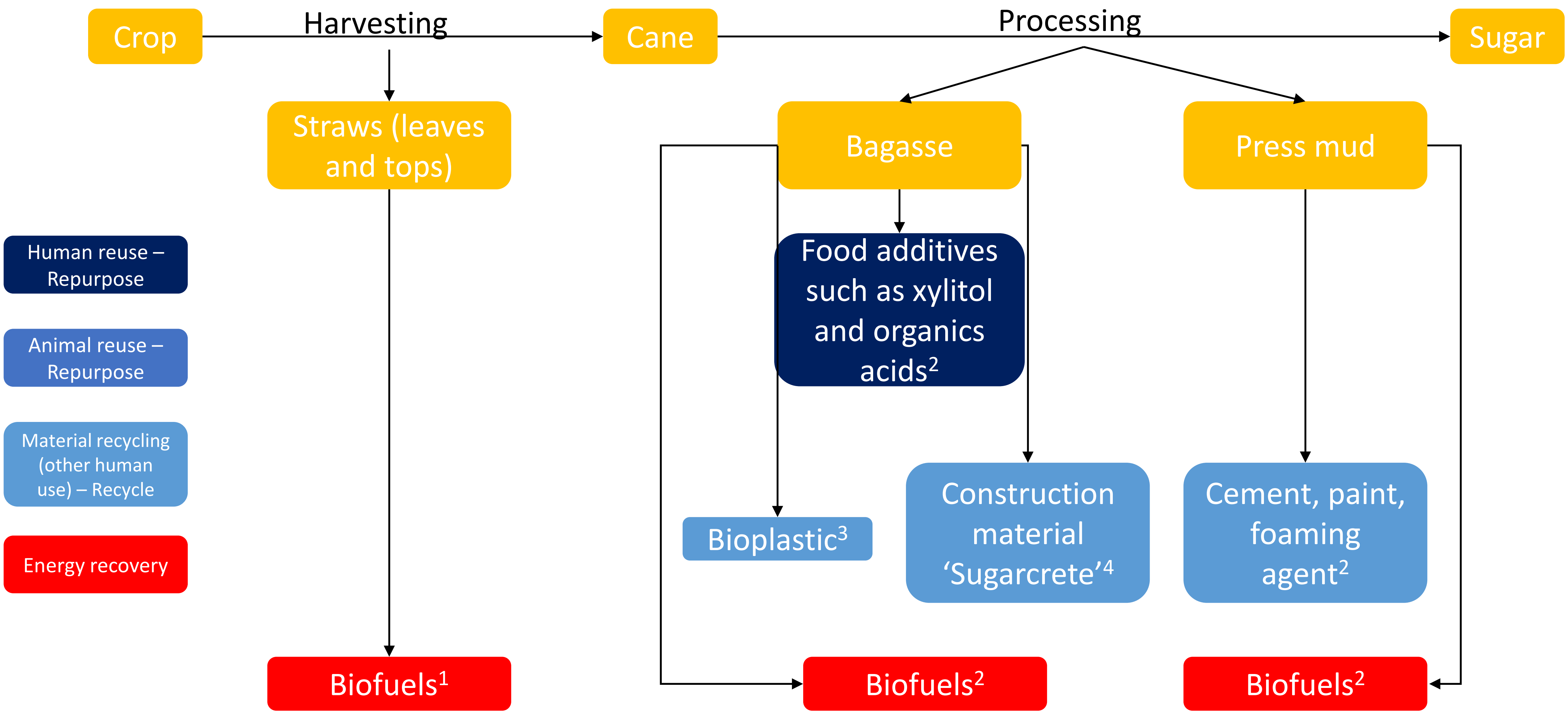
[Australia whole chain hotspot analysis]



[UK Retail and Manufacturing waste]

Consistently produced **inedible parts** and **by-products**

Sugar Cane Valorisation Process Flow



Other examples

Inconsistently produced **losses and waste**

Consistently produced **inedible parts** and **by-products**

Tomatoes

- Upcycling bruised or over ripe fruit into new soups and sauces: https://www.foodfellows.nl/en/who-are-the-food-fellows

- Processing by products such as skin and seeds have been upcycled by extracting functional additives such as carotenoids and dietary fibre. These can be used in food applications as seen in https://doi.org/10.3389/frfst.2022.893795

Maize

- Upcycling ethanol by-products and corncobs through fermentation into feed for pigs https://www.sciencedirect.com/science/article/pii/S0961953422003312

- Processing (e.g. milling) of surplus grain
- Diverting excess to animal feed
- But most importantly, prevention of losses in the first place: loss rates can be reduced to as low as 1-2% https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5296677/

Consistently produced **inedible parts** and **by-products**

Inconsistently produced **losses and waste**

Other examples

Bananas

- Banana stems in Uganda are being upcycled through small holder farmers collaborating with the non-formal engineering sector to transform banana stems into fibres for sustainable textile and handicraft products. Start-up, TEXFAD, work with farmers to upcycle waste to create rugs (over 30,000 square feet each year). https://www.weforum.org/agenda/2023/05/how-banana-waste-is-transforming-uganda-s-circular-economy/

Papayas

- Extraction of the protease enzyme, papain, for a variety of uses https://doi.org/10.1016/j.tifs.2017.08.017:
  - Meat tenderisation
  - Biocatalyst for milk clotting in cheese manufacturing
  - Baking industry to produce a hypoallergenic flour by removing gliadins
  - Beer and wine clarification
  - Nutritional supplement and pharmaceutical ingredients
- Processing byproducts (skins and seeds) have been used as aquafeed: https://www.feedandadditive.com/papaya-by-products-application-in-aquafeeds/

Pineapples

- Removing the pineapple leaves/'crown' can increase the shipping efficiency (https://tobymyers.substack.com/p/how-to-reduce-a-pineapples-carbon?r=a4h3d&utm_campaign=post&utm_medium=web). Crown uses include:
  - Leaf waste has been utilised for animal feed, this paper finds pineapple leaf feed can increase milk production in dairy cows (https://doi.org/10.1063/1.5117108)
  - Fibre cellulose obtained from acid pretreatment and alkaline treatment of crown residues to produce a food container (https://doi.org/10.3390/recycling5040024)

Framework to approach upcycling

Key initial questions:

- **What** resources -> Inedible co-products and losses upstream likely to be biggest opportunity
- **What** uses -> Varies by region/product: use national/regional data to inform
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Mapping bio-resources

- **Mapping is key step to inform approach:**
  - Business can map their internal processes/waste flows
  - Cities/Regions/Countries can map their resources – data likely national & inconsistent

Materials Arising	x	Bioresource Content	=	**Bioresource Arising**
Bioresource Arising	-	Accessibility Constraints	=	**Bioresource Available**

Toowoomba (Australia)

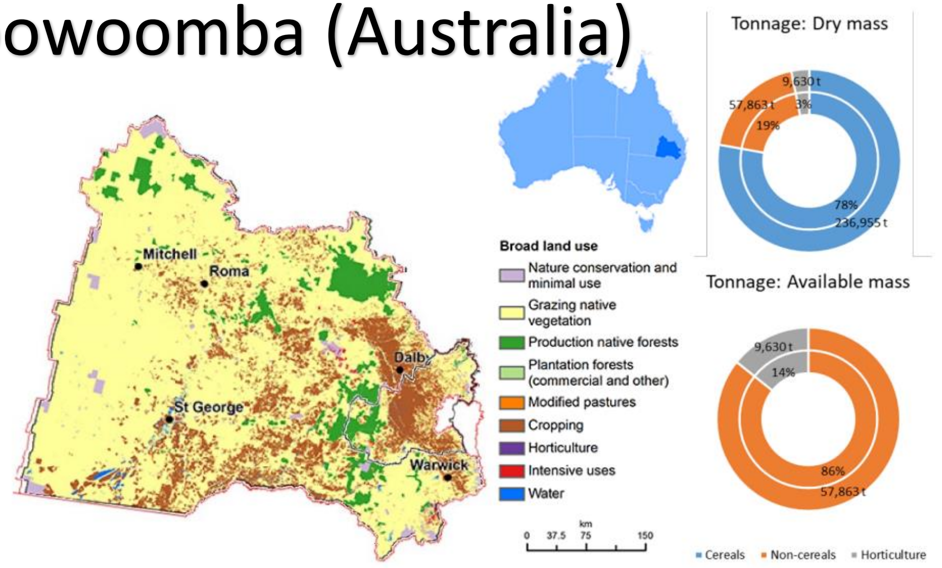


Figure 6: Agricultural map of the Darling Downs - Maranoa SA4 region with Toowoomba LGA overlay, altered from Farmbuy real estate (2023), and relative residue masses in the Toowoomba LGA.

FFW CRC paper

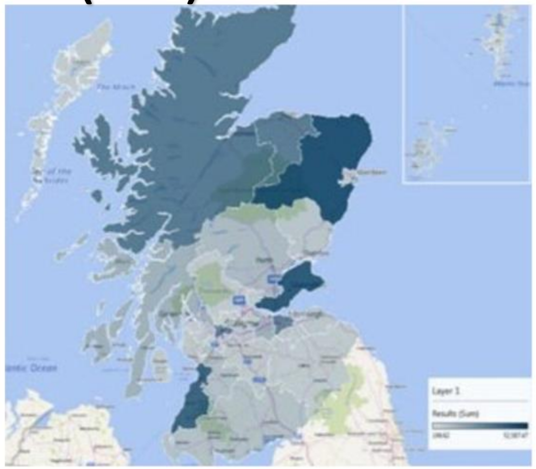
Scotland (UK)

The Scottish Bioresource Mapping Tool

The Scottish Bioresource Mapping Tool is a pioneering approach to developing value chains in the bio- and circular economies. The Tool maps raw material and bioresource arisings across Scotland down to the local authority level, which allows us to provide companies, investors, and stakeholders uniquely detailed insights and visuals related to the >27 million tonnes of bioresources arising in Scotland every year.

The Bioresource Mapping Tool is the result of analysis undertaken in preparation of the Biorefining Potential for Scotland Report by Zero Waste Scotland; it compiles and models data from four key material groupings:

- Waste streams (municipal solid wastes, commercial and industrial wastes)
- Food & drink production by-products
- Agricultural residues
- Waste waters and sludges



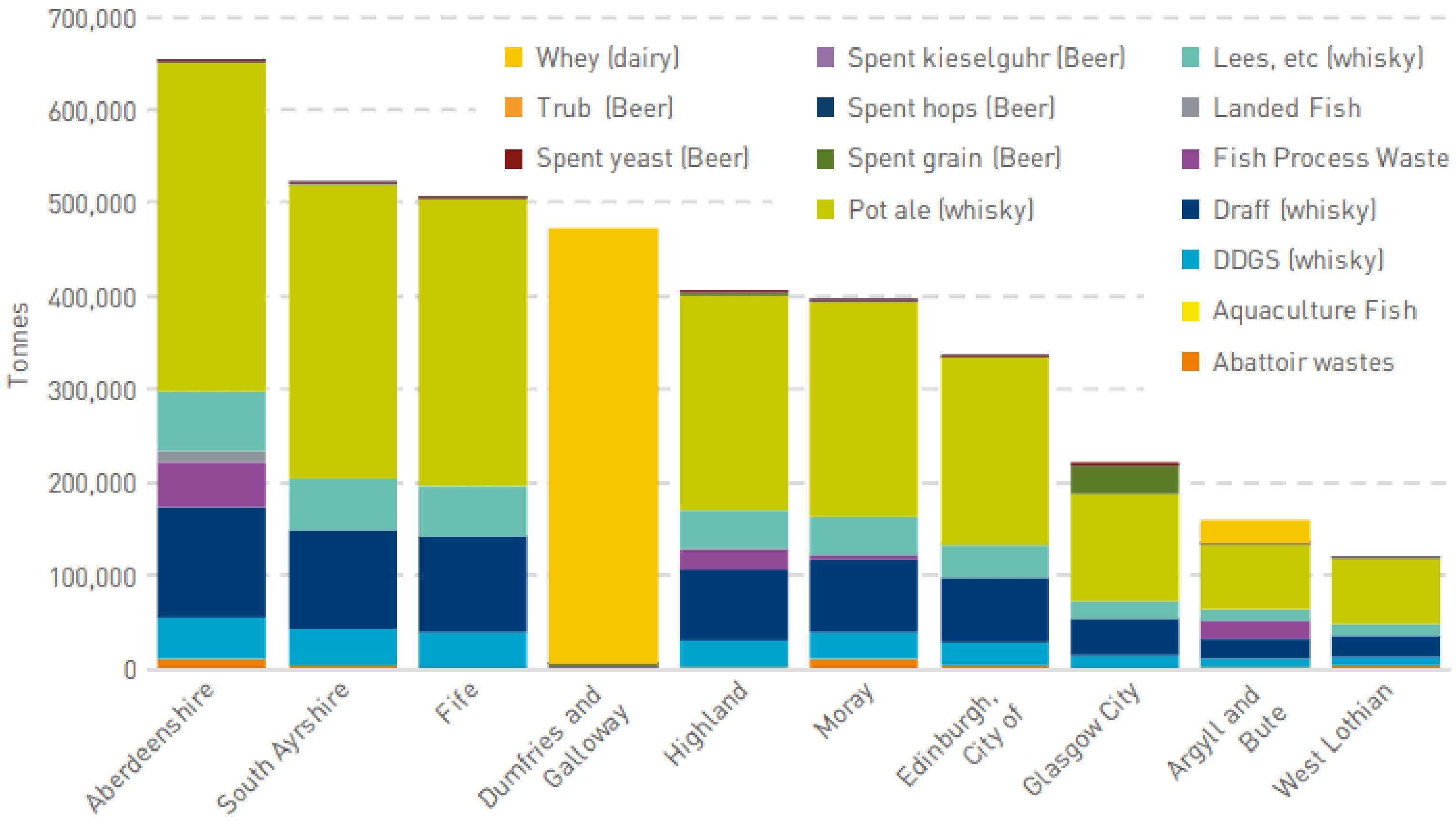
Scottish mapping report

See also: Wales;

Example: Scotland

- **Mapping:**
  - Waste arisings from households and businesses
  - By-products from major industries (beer, whisky, fish, livestock), agriculture and other industries (bakery, coffee grounds, macro-algae)
  - Identifies big opportunities from whisky by-products (& other sources)

Figure 12: By-product feedstocks by local authority (focus on the top ten authorities)



Data is key!

https://www.zerowastescotland.org.uk/resources/report-biorefining-potential-scotland

Framework to approach upcycling

Key initial questions:

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- **What** uses -> Varies by region/product: use national/regional data to inform
- **Where/when** -> Likely major production & manufacturing hubs – map in a country
- **How accessible?** Competing use for resources? When available?
- Do end markets exist? Do they need creation? What role for policy in supporting them?

Competing/accessible resources

- **Does the material already have a market?**
  - Does the material command a *revenue* through sale or does it incur a *cost* for disposal?
  - If a market exists, data may exist. If it doesn't, businesses can be asked.
  - How much will an upcycler be willing to pay/be paid for the feedstock?
- **Is the material geographically and temporally accessible?**
  - Is it stable, consistent through the year, or emerges in short seasons?
  - Is it cost-effective to transport material? Or can upcycling be co-situated to production clusters?

Framework to approach upcycling

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- **What** uses -> Varies by region/product: use national/regional data to inform
- **Where/when** -> Likely major production & manufacturing hubs – map in a country
- **How accessible?** -> Gather/create data on existing uses, distances, costs, seasons
- Do end markets exist? Do they need creation? What role for policy in supporting them?

Creating markets & reducing costs

- **Most upcycling activities will only scale if there is a commercial opportunity – policy can play a supportive role**

Approaches	**Example measures**
Reduce costs of innovation	• Research & Development funding for universities/scientific experiments • Providing regulatory advice to innovators & lower compliance costs • Running challenges / competitions
Reduce (relative) costs of solution	• Increase costs of alternative scenario (e.g. fees/bans for organic waste to landfill; Extended Producer Responsibility) • Reduce costs of solution (e.g. subsidies, grants, favourable finance arrangements for companies providing solutions to social problems) – noting relevant rules on subsidies etc.
Protected markets to support demand	• Support demand for particular (upcyled) products, such as through government procurement schemes
Incentivise consumer demand or higher returns	• Public communication about benefits of approach • Certification / labelling scheme to identify products and add consumer value

Framework to approach upcycling

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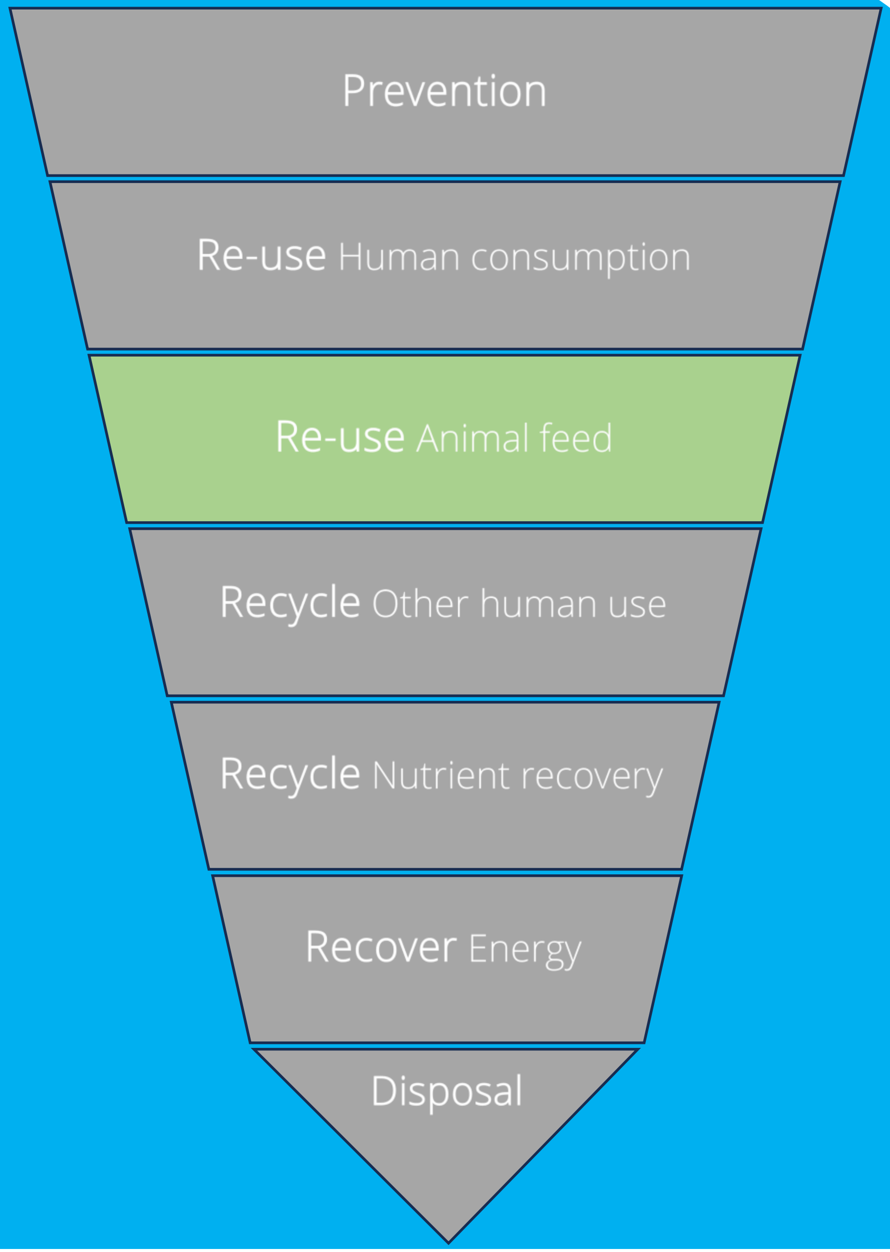
- **Where/when** -> Likely major production & manufacturing hubs – map in a country
- **How accessible?** -> Gather/create data on existing uses, distances, costs, seasons
- End markets? -> Consider innovation policy environment to support new approaches

Solutions deep dive: Animal feed

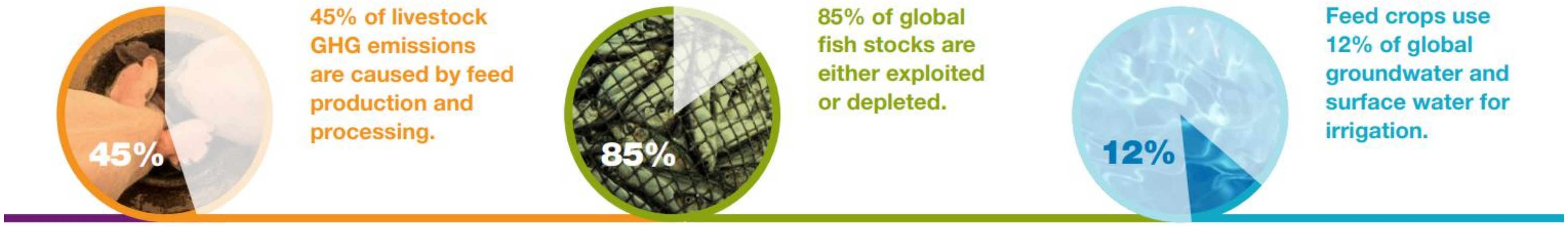


Animal feed diversion

remanufacture

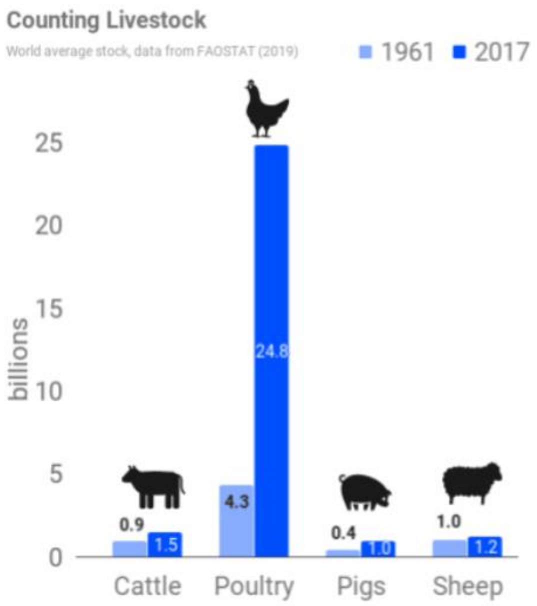
repurpose

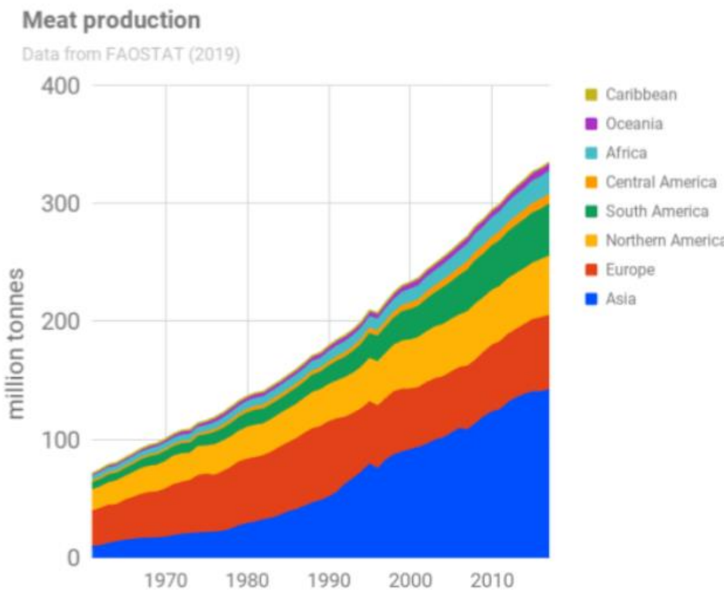
- **Animal feed production** has huge environmental impacts



Source: Forum for the Future 'the Feed Behind Our Food' report

- **Demand for meat** is growing, notably for poultry which accounts nearly ½ of all non-forage feed





Two approaches to improve feed sustainability systems (1)

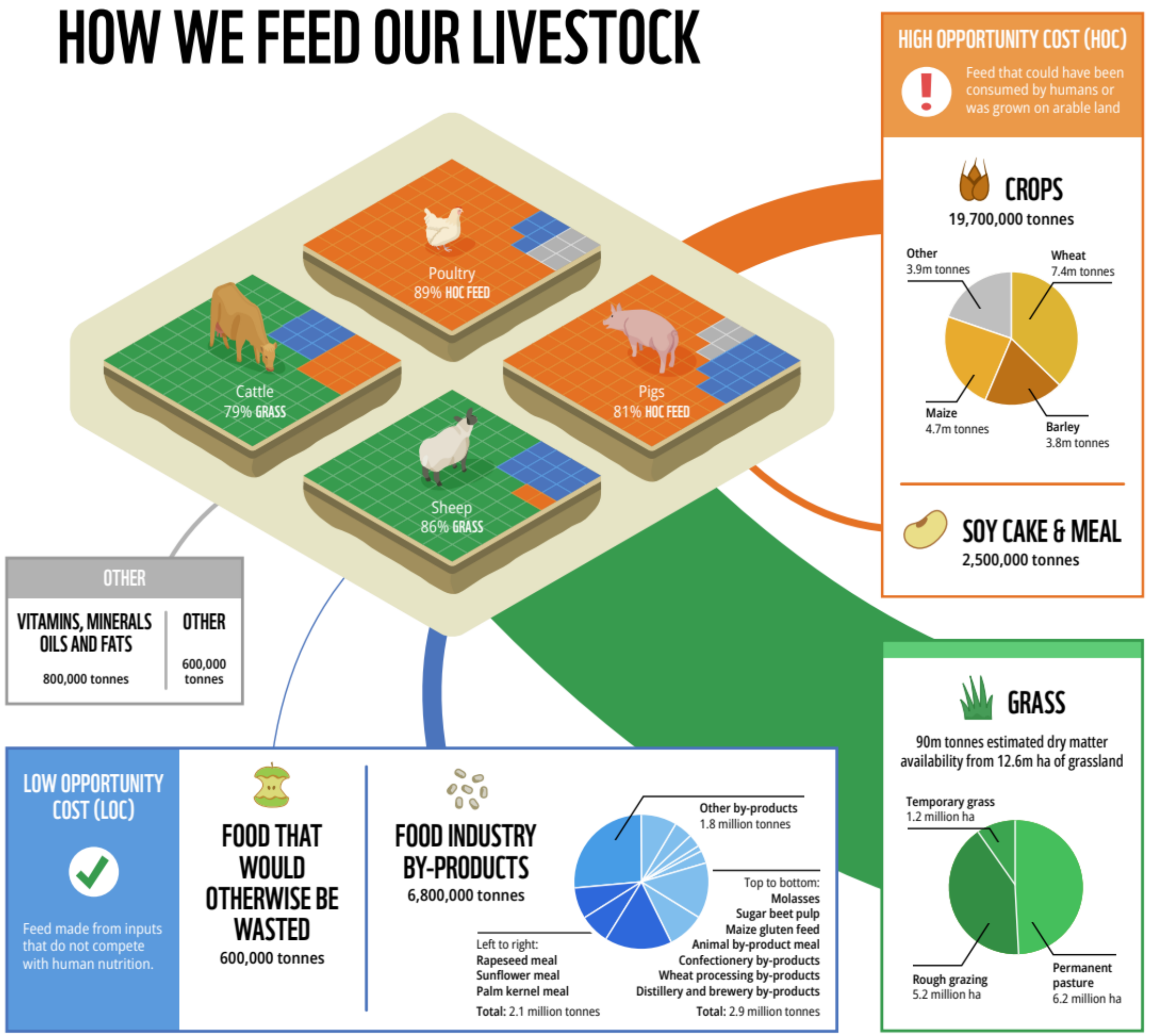
- **From Forum for the Future:**
  - Changes to farming practices & human diets ('less but better' meat);
  - Novel & 'circular' feed
  - Improving the production and sustainability of feed crops

SourceL Forum for the Future 'the Feed Behind Our Food' report

Two approaches to improve feed sustainability systems (2)

Taken from WWF-UK 'The Future of Feed'

- **Low Opportunity Cost (LOC) and High Opportunity Cost (HOC) feed**
  - In other words, "feed resources unsuitable or undesired for human consumption"
- **Poultry and pigs in particular**
  - Globally, poultry and pigs and consume c. 70% of manufactured feed



Circular feed

- However we analyse the problem, *‘**circular feed**’* is a solution
- So, what is circular feed?
  - **Direct feeding of scraps**: may be common in some places (e.g. smallholder farms), but may carry disease risks – and food safety is a food waste issue;
  - **Crop residues & food industry byproducts:** important avenue for reducing waste of inedible parts, in some cases already common;
  - **Processing of segregated surplus:** particularly relevant for high-energy products in manufacturing and retail;
  - **Insect protein fed on food surplus:** more novel in many parts of the world but growing in significance

Byproducts and surplus to feed

- **Criteria to determine if surplus can be used for feed:**
  - Is it nutritious on its own or as a component of feed mixture?
  - Is it safe for animal feed?
  - Are there Animal By-Product risks?

Energy/nutritional value

	LOW	Intermediate	HIGH
Example food surplus	• Vegetable processing waste (wet) • Highly dilute sources that require dewatering	• Vegetables and residues thereof • Wheat bran	• Cake & cake products (not containing ruminant gelatine) • Bread • Chocolate bars & crisps • Biscuits • Dairy • Cereals • Soft drinks
Characteristics	Food surplus that is eligible but have low nutritional value to the feed sector i.e. may be diluted or less palatable. Nutritional value varies by type of livestock.	Food surplus that contain intermediate nutritional value. Will need supplementing with other feedstock.	Ideal characteristics: Highly concentrated source of nutritious value.
Revenue	May not be revenue generating, but may be a saving on alternative routes e.g. AD, landfill		Easy to make a business case, depending on how scalable. Large scale and high nutritional value

From WRAP 2016

- **Diversion to feed can reduce waste management costs and lead to new revenue-generating opportunities**

- **Heat-treated swill pig feed common in Japan and South Korea, but swill is banned in the EU. Regulation may shape opportunities in your country/region**

21 認証第 6 号

ecofeed

食品循環資源利用率：100%

Insect processing

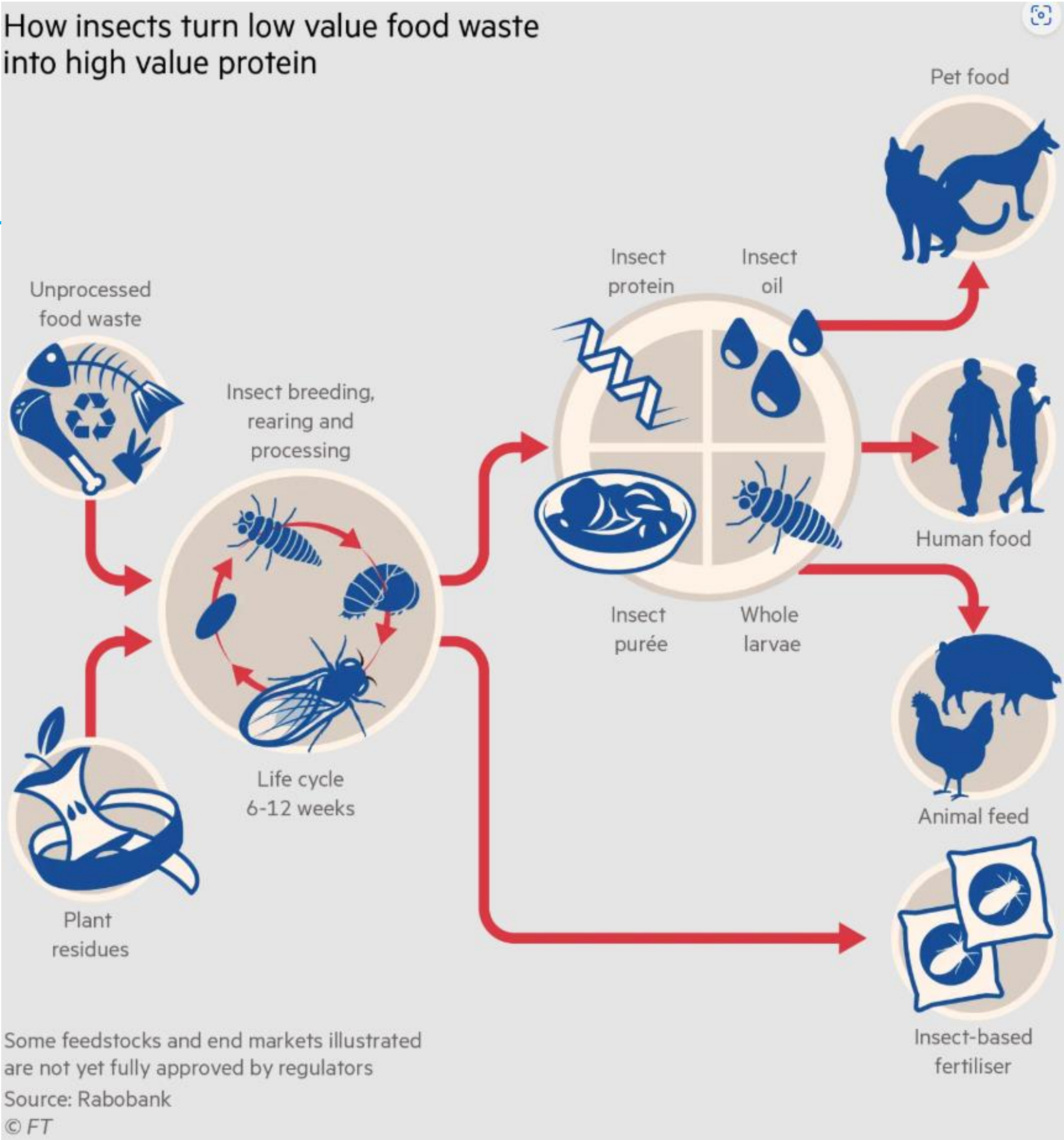
- **Insects are part of the natural diets of many livestock animals**
- **As natural waste processors, insects can be reared from feedstock substrates otherwise inedible / waste and contribute to compound feed**
- **Insects can be healthy, yielding 56-82% protein content after defatting (higher than soymeal)**
  - Insect meal and oil are both high-value product
  - Amino acid profile varies by species, life stage, feedstock diet and rearing system

Photo by James Tiono on Unsplash

Insect processing

- Numerous byproducts including frass (fertiliser), chitin (pharmaceuticals, textiles, agriculture)

- Examples exist of both industrial and small, on-farm units



Some commonly farmed insects

- **Banded cricket** *(gryllodes sigillatus)*
- **Jamaican field cricket** *(Gryllus assimilis)*
- **House cricket** *(Acheta domesticus)*
- **Mealworm** *(Tenebrio molitor)*
- **House fly** *(Musca domestica)*
- **Black soldier fly** *(Hermetia illucens)*

Challenges for scaling

Legislation and regulation:

- What can be fed to insects?
- What permitted uses of insect meal?
- What retailer requirements for feed? Can they be met?
- Are there restrictions on the use of insect by-products?

Financial and research challenges:

- Finance and investment for the industry
- Research on risks of contaminants flowing up the food chain via substrates
- Access to low-cost farming and processing technology

Adapted from WWF (2021)

Some considerations

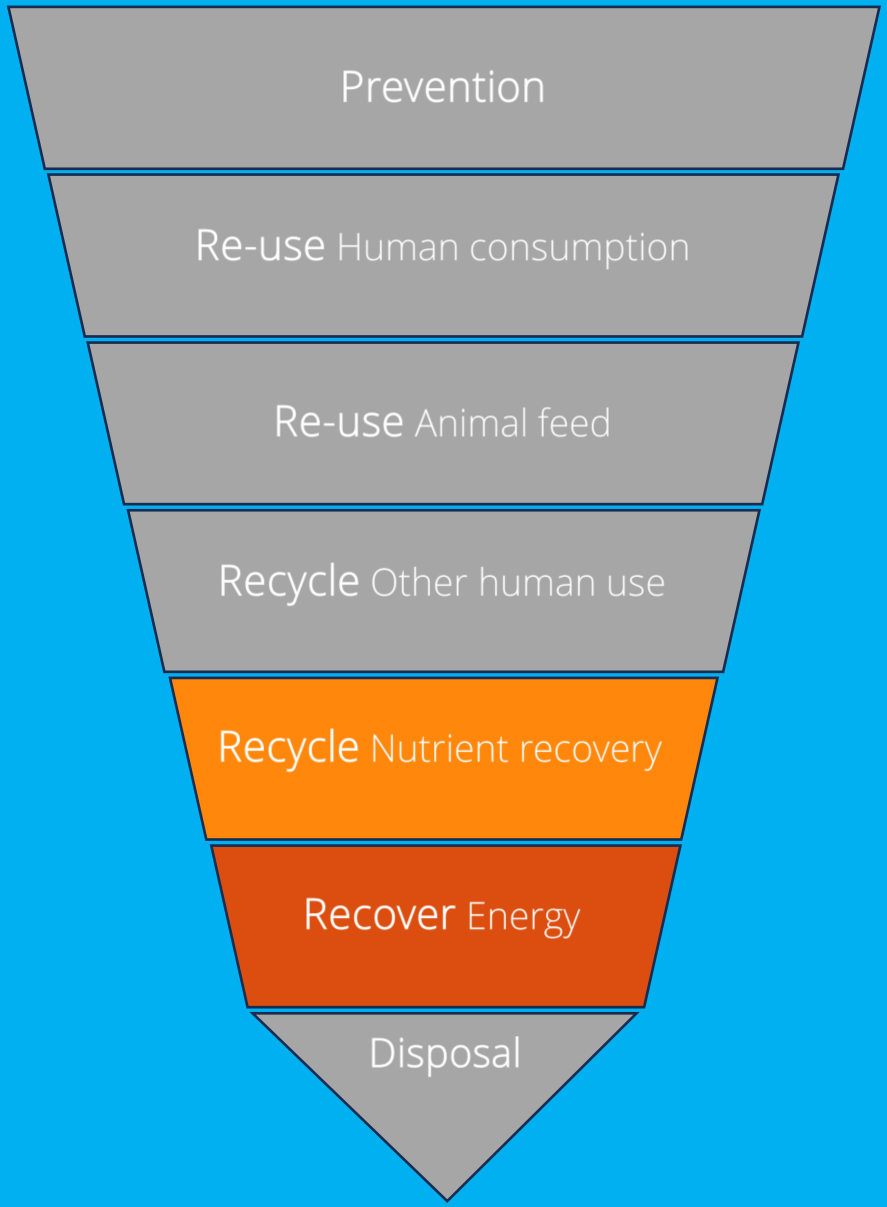
- **Understand your regulatory environment – is changing it a possibility?**
  - Confidence in the growth of the sector can attract investment
- **Fund appropriate research and development**
  - Researching most efficient feedstocks
  - Identifying and managing any risks associated (diseases, toxins etc.)
- **What competing industries? How to manage stakeholders?**
  - E.g. biogas industry receiving green energy subsidies? Are feed crops currently produced domestically – what impact on producers?

Jobs and financial impact – upcycling & animal feed

Solution	Financial benefit per ton diverted	Job potential (jobs per thousand tonnes FW treated)
Upcycling	**Net:** $1,440 Gross financial benefit: $2,460 Investment: $-1,020	c. 1.52
Livestock feed	**Net:** $140 Gros financial benefit: $320 Investment: $180	c. 1.51
Insect farming	*Not yet estimated by ReFED*	

All based on figures from the US, taken from ReFED Solutions Database

Solutions deep dive: Food waste recycling

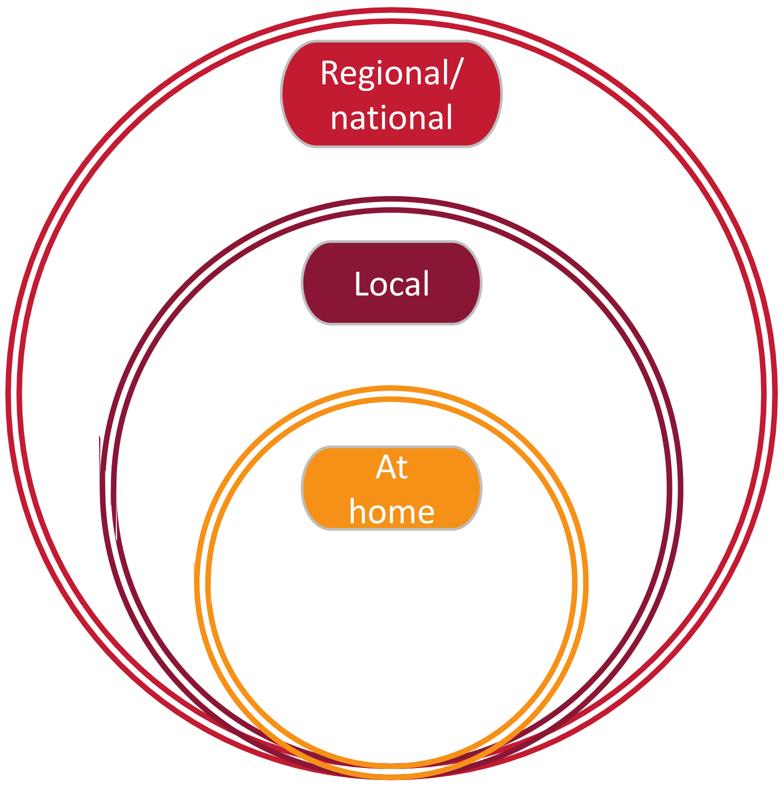


reuse

recycle

Food waste recycling

- **Different approaches to recycling at different scales**
- **Likely to be shaped by available co-products and the need in an area: how can we benefit the most?**
- **Choices to be made around:**
  - Food waste recycling technology
  - Type of service



Food waste recycling technologies

- If not collecting food waste separately from other wastes, **energy production** is the main opportunity
- If collecting food waste separately there are opportunities for co-benefits:
    - Nutrient recycling & soil amendment
    - Energy generation
    - Easier measurement of food waste

TECHNOLOGY	SUPPORTS FOOD WASTE REDUCTION	COST SCALE 1-5 (LOW-TO-HIGH)	ENERGY PRODUCTION	NUTRIENT RECOVERY	CAN BUILD SOIL ORGANIC MATTER
FOOD WASTE SEPARATELY COLLECTED					
Anaerobic digestion	✓	4	✓	✓	✓
In-vessel composting	✓	3	x	✓	✓
Windrow composting	✓	2	x	✓	✓
Liquefaction	✓		Dependent on context		x
Rendering	✓		Dependent on context		x
FOOD WASTE COLLECTED IN RESIDUAL WASTE					
Gasification	x	5	✓	x	x
Incineration and energy recovery	x	4	✓	x	x
Landfill without gas extraction	x	1	x	x	x
LFG extraction	x	2	✓	x	x
MBT	x	2	✓(with AD)	x	x
Pyrolysis	x	5	✓	x	x

Source: World Biogas Association 'Global food waste management: an implementation guide for cities'

Food waste recycling technologies

- **Windrow composting**
  - *Piling organic matter in long rows in open air*
  - More traditional method, can deal with large quantities
  - Requires large amounts of land and labour to maintain
  - Risks of leachate, bad odours or vermin
- **In-vessel composting**
  - *Confining composting to within a controlled environment*
  - Controlled method, varies hugely in size
  - Less land than Windrow, but may be more costly/require more technical expertise
  - Can accommodate virtually any type of organic waste

TECHNOLOGY	SUPPORTS FOOD WASTE REDUCTION	COST SCALE 1-5 (LOW-TO-HIGH)	ENERGY PRODUCTION	NUTRIENT RECOVERY	CAN BUILD SOIL ORGANIC MATTER
FOOD WASTE SEPARATELY COLLECTED					
Anaerobic digestion	✓	4	✓	✓	✓
In-vessel composting	✓	3	x	✓	✓
Windrow composting	✓	2	x	✓	✓

- **Anaerobic digestion**
  - *Microorganisms breaking down biodegradable material in absence of oxygen*
  - Produces biogas for electricity, heat, gas and fuel which can be off-grid/local
  - Digestate (fertiliser) is a co-product and can be applied to soils

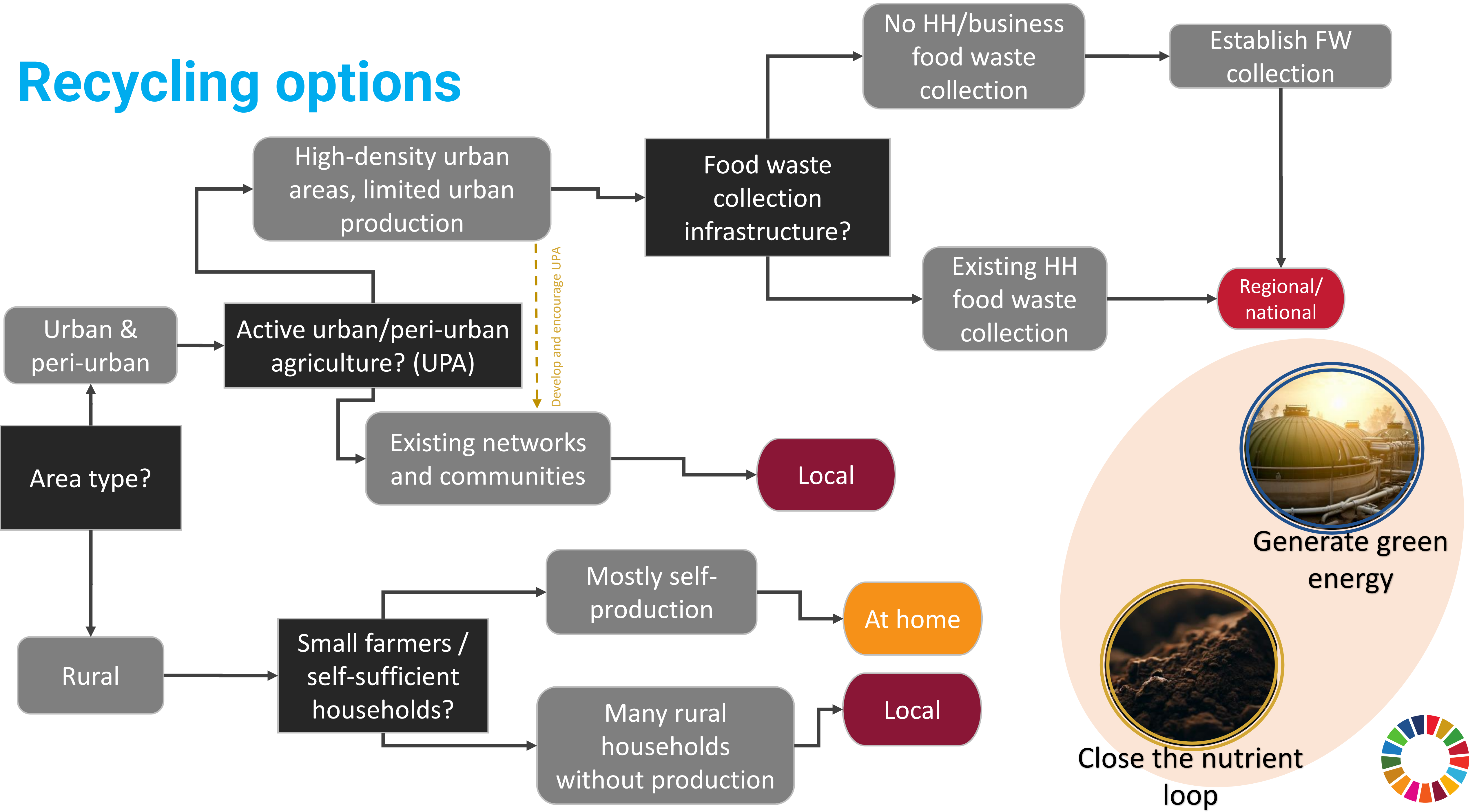
Source: World Biogas Association 'Global food waste management: an implementation guide for cities'
See also:
https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process

Recycling options

Area type?

- Urban & peri-urban
- Rural → Small farmers / self-sufficient households?
  - Mostly self-production → At home
  - Many rural households without production → Local

Close the nutrient loop


Recycling options
Area type?
Urban & peri-urban
Active urban/peri-urban agriculture? (UPA)
High-density urban areas, limited urban production
Food waste collection infrastructure?
No HH/business food waste collection
Establish FW collection
Existing HH food waste collection
Regional/ national
Develop and encourage UPA
Existing networks and communities
Local
Rural
Small farmers / self-sufficient households?
Mostly self-production
At home
Many rural households without production
Local
Generate green energy
Close the nutrient loop

Food waste recycling – potential benefits

Reduce damages from landfill
- Reduced methane emissions
- Reduced leachate & air pollution
- More sanitary & improved conditions for waste pickers

Nutrient recycling & improved soil
- Fertiliser for farms, urban agriculture, city parks & gardens
- Improve soil quality
- Reduce reliance on synthetic fertiliser & associated damages
- Reduce reliance on imports

Energy generation
- Generate sustainable energy locally to substitute fossil-fuel energy
- Co-generation of heat
- Improve energy security & reduce reliance on imports

Jobs & industry
- Collections of waste
- Treatment & use

Quality of life & wellbeing
- Reduced pollution
- Parks & UPA

Food waste data - & reduction?

Introducing food waste collections

Understand the potential

- **Data:** waste composition and mass flow; how this relates to type of stakeholder (different buildings/areas, demographics);
- **Collection Logistics:** review existing waste collection routes, vehicles, infrastructure (including type/quality of roads);
- **Treatment capacity/logistics:** what capacity do we have, and how can we can plan this to grow? What end market for energy or compost?;
- **Understand roles and responsibilities:** Which administrative body deals with waste, for whom? In absence of municipal collections, have community groups/private enterprises established?

Introducing food waste collections (2)

Identify suitable collection approaches:

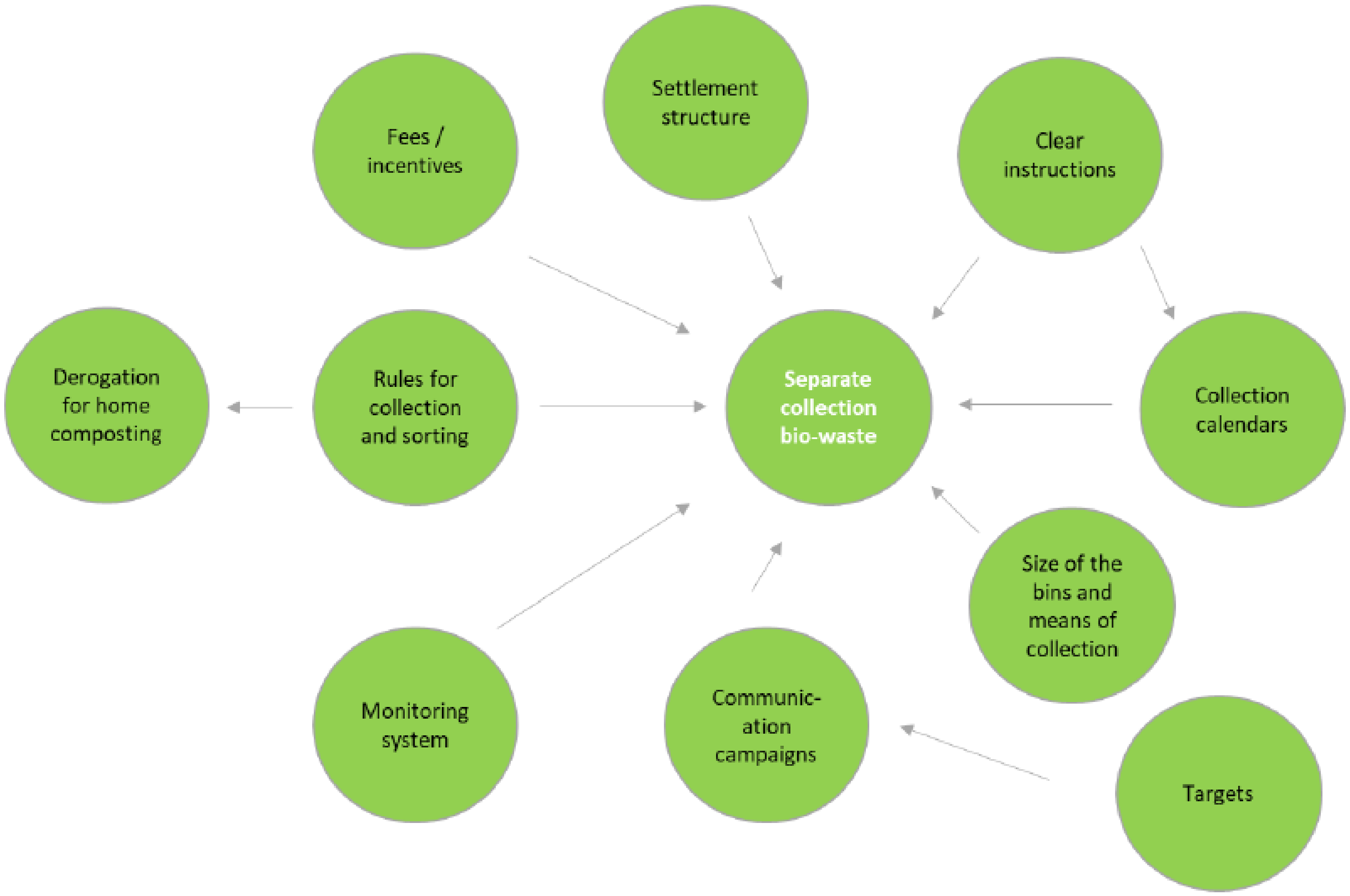
- **Door-to-door kerbside** (waste vehicles);
- **Drop-off points** (communal areas) – remember they must be designed for food waste! (pests, ‘yuck’ factor)

Encourage engagement:

- **Building design** to incorporate space for waste collection
- **Free bins/bags for residents** – ‘opt out’ rather than ‘opt in’
- **Frequent collections** – e.g. organic/recycling collected more regularly than residual waste
- **Financial structures** – landfill fees for municipalities, ‘pay-as-you-throw- for residents

Useful links: [1], [2] , [3], [4], [5], [6]

Factors influencing food/organic waste collection



Taken from European Compost Network guidance

Urban & Peri-urban agriculture

Growing of food (plants, fruit trees and animals) within and around cities and its associated activities

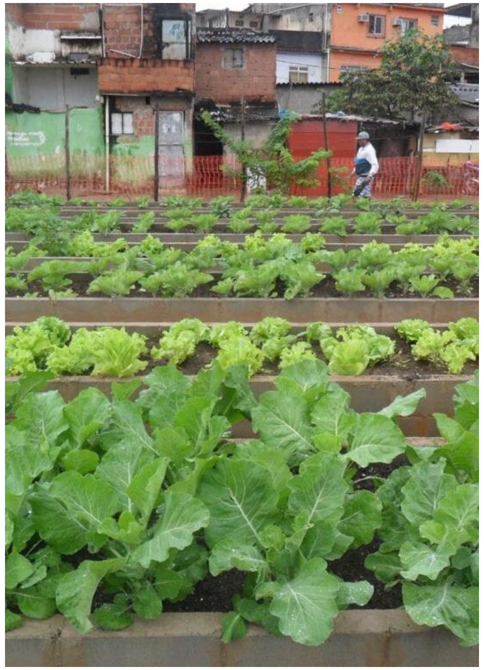
The typologies are often classified by type/scale of production, market engagement, ownership (public/private), location (indoor/outdoor) and level of technology and innovation.

Urban agroforestry

Rooftop gardens

School gardens

Aquaponics and hydroponics



Community gardens

Urban & Peri-urban agriculture

- **Host of benefits**
  - Greenery, increased food security, reduced miles traveled, maintained biodiversity, education on ecology + food production
- **Yet, not a universal solution, site-specific risks must be understood**
  - UPA poses a health risk if land is polluted, can increase demand of water in water-stressed cities
- **Opportunities for circularity**
  - Closing nutrient loops: nutrient recycling from food waste and wastewater, reducing discharge into other ecosystems and increasing resource efficiency

Current UNEP initiatives in UPA

UNEP's work on UPA supports data collection, capacity-building, awareness-raising, and the development of policy frameworks and governance mechanisms

Global level

- **Urban Agriculture and Circularity Think Piece with International Resource Panel**
- **Discussion paper on urban agriculture, poverty alleviation and food waste reduction**
- **UNFSS coalitions – Urban Food Systems coalition**
- **Creation of Interactive webpage on UA and cities (partnership with Yale)**
- **Podcasts and radio program on urban agriculture**

Country and City level

- **Pilot projects in India (Andra Pradesh), Brazil (Rio de Janeiro), Mauritius (Vacoas and Port Louis)**
- **Support to multi-stakeholder dialogues and capacity building on SFS and UPA in Uganda (Kampala) and Indonesia (Semarang), and planned for 2024 in Indonesia (Surakarta), Tanzania (Arusha) and Vietnam (Hanoi)**

Indonesia, Semarang: governance and UPA in regional planning

Kampala, Uganda: technology replication and policy dialogues

Jobs and financial impact – waste treatment

Solution	Financial benefit per ton diverted	Job potential (jobs per thousand tonnes FW treated)
Centralised Anaerobic Digestion	**Net: $-18.8** Gross financial benefit: $223 Investment: $-242	c. 1.03
Centralised Composting	**Net: $-16.9** Gross financial benefit: $187 Investment: $-203	c. 1.07
Community Composting	**Net: $-54.9** Gross financial benefit: $212 Investment: $-267	c. 1.03
Home Composting	**Net: $-74.5** Gross financial benefit: $110 Investment: $-185	N/A

All based on figures from the US, taken from ReFED Solutions Database

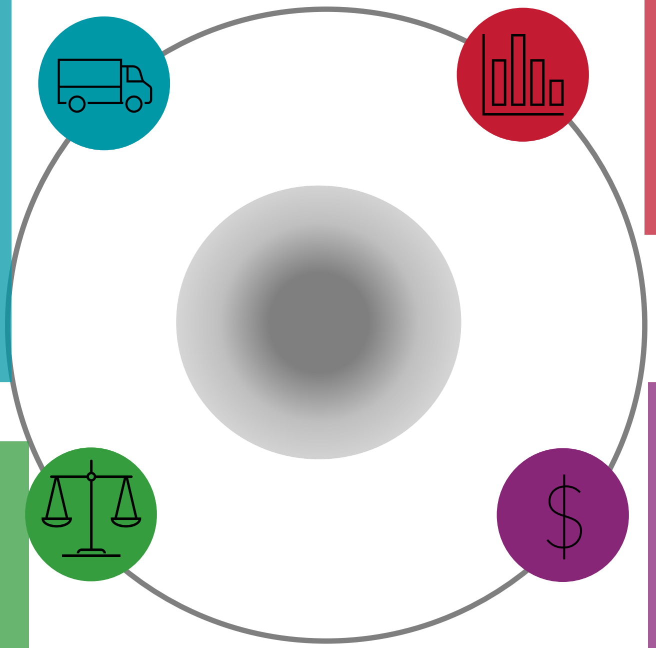
Transitioning to a circular food system: Urban, Sub-national or National ?

Transitioning to a circular food system is feasible nationally and at sub-regional and urban scales but there are several considerations to be made.

Logistics:

- How are wastes/surpluses currently treated, by whom?
- Is there good cold chain management within your region and logistics infrastructure?
- If you have a product/s in mind, where are surpluses generated? Nationally or in specific regions? Is manufacturing/processing in clusters or spread out?

If surpluses are available from one specific region or industrial cluster, it may be more suitable to set up operations within the vicinity.



Data:

- What do you know about waste streams and surpluses available?
- Do you have nationally available production data? Can you generate new data?
- What livestock is produced and what are they currently fed?

There may only be national data available and therefore a study may be needed to identify current waste streams in an urban area.

Regulation:

- What waste/surplus regulation is determined by the region/city and what is set nationally?
- Does the regulatory environment obstruct any circular approaches? (Redistribution, animal-feed)

A circular food system on a sub-national scale may require building around the regulatory environment.

Finance:

- Are there opportunities to work with a big manufacturer or producer?
- Could grants be made available for start-ups?

There are opportunities for financing circular food systems in a local or urban scale this can include philanthropic or aid funding or collaboration with big businesses.
For businesses, the cost is an investment and can reduce disposal costs & create revenue