



Week 2: The Circular Butterfly

Unit 1: The Circular Economy Butterfly

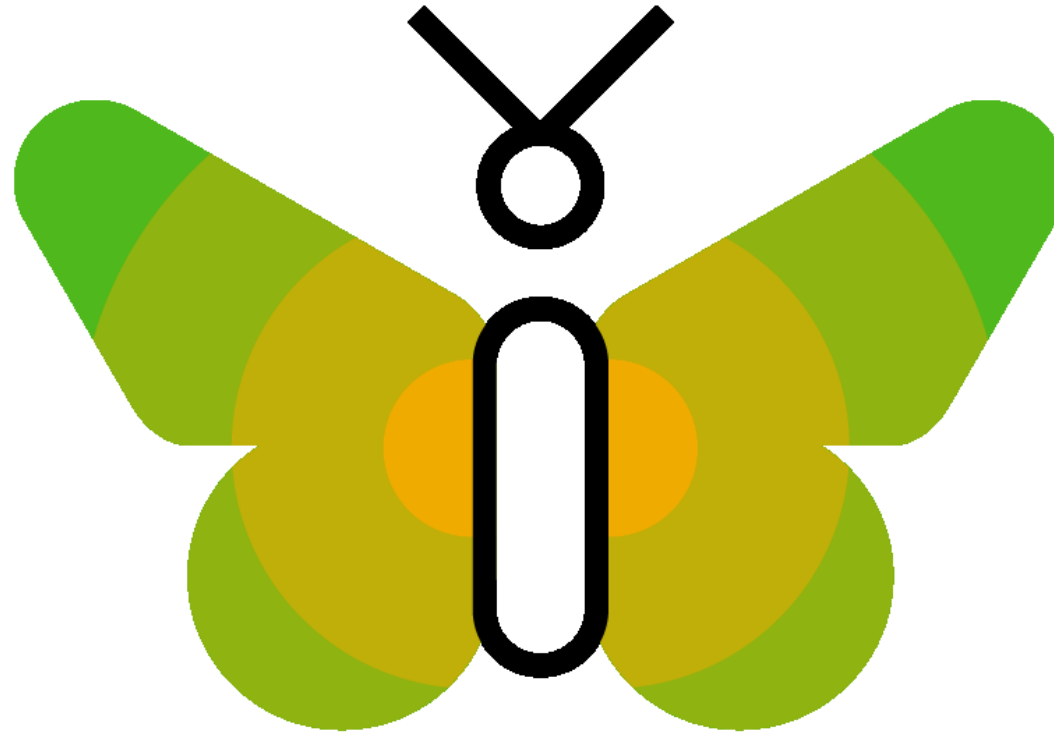
The circular economy butterfly

Content overview

- How we explain the circular economy graphically: the well-known “butterfly diagram” (courtesy of the Ellen Macarthur Foundation)
- The body of the butterfly
- The right wing (the technical loops)
- The left wing (the biological loops and cascades)



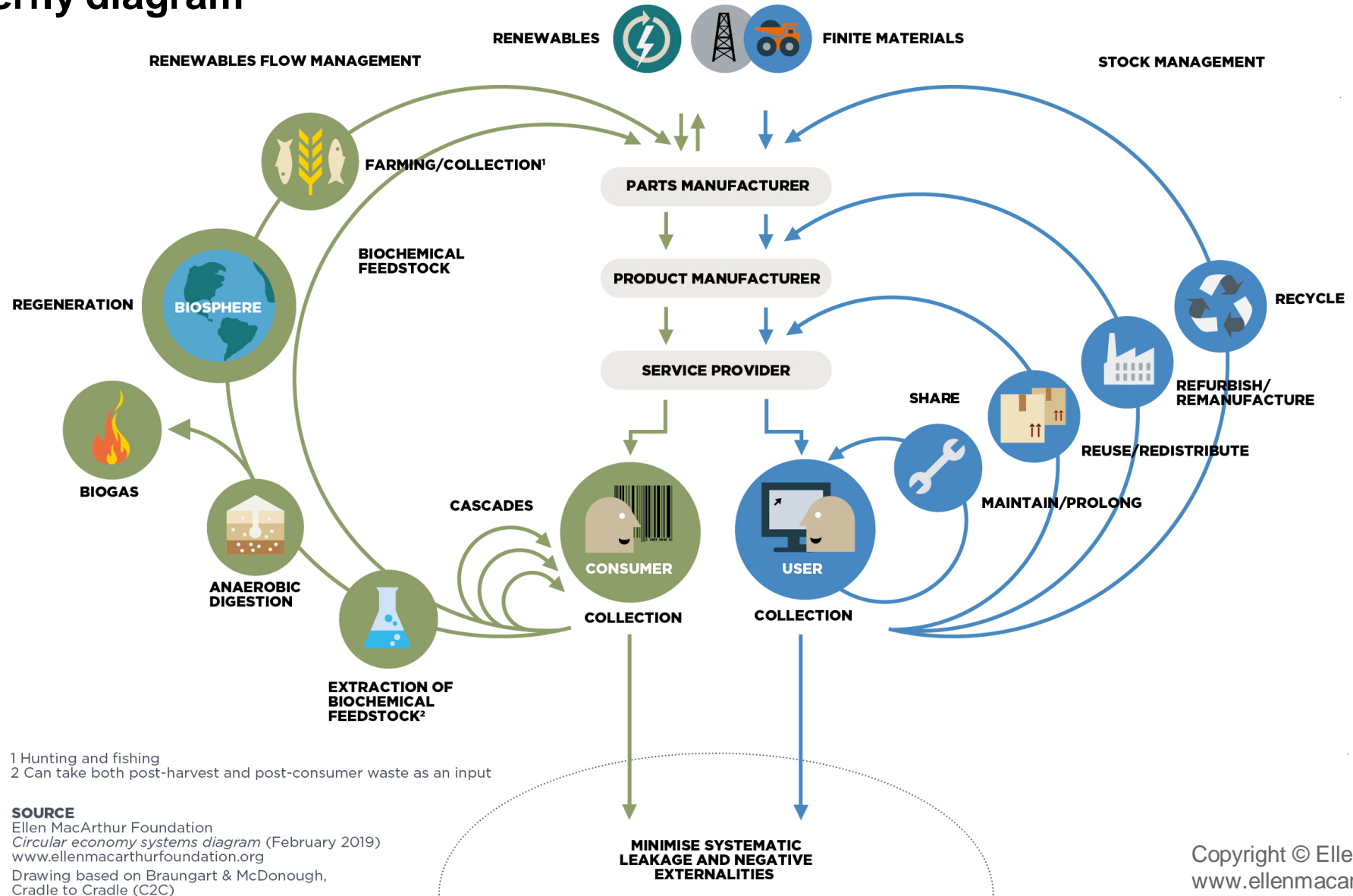
The circular economy butterfly
The butterfly



<https://www.ellenmacarthurfoundation.org/>

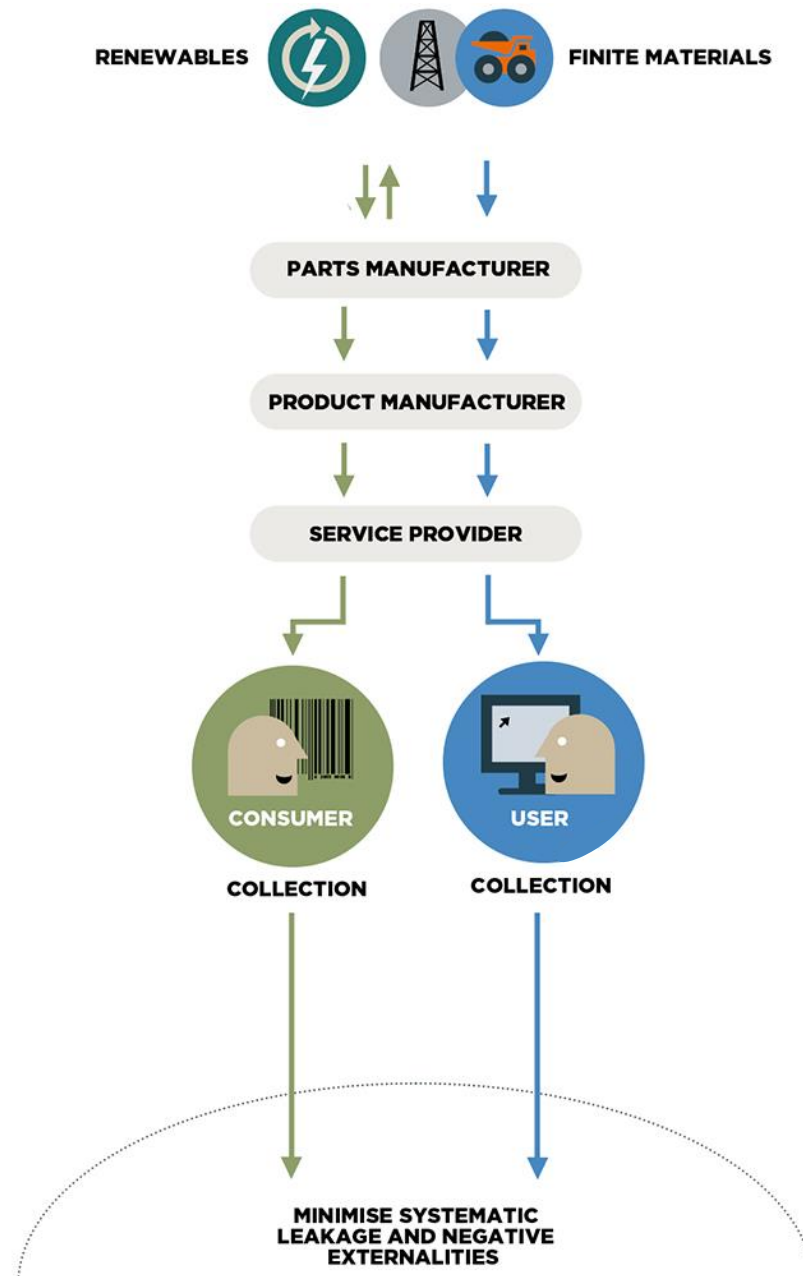
The circular economy butterfly

The butterfly diagram



The circular economy butterfly

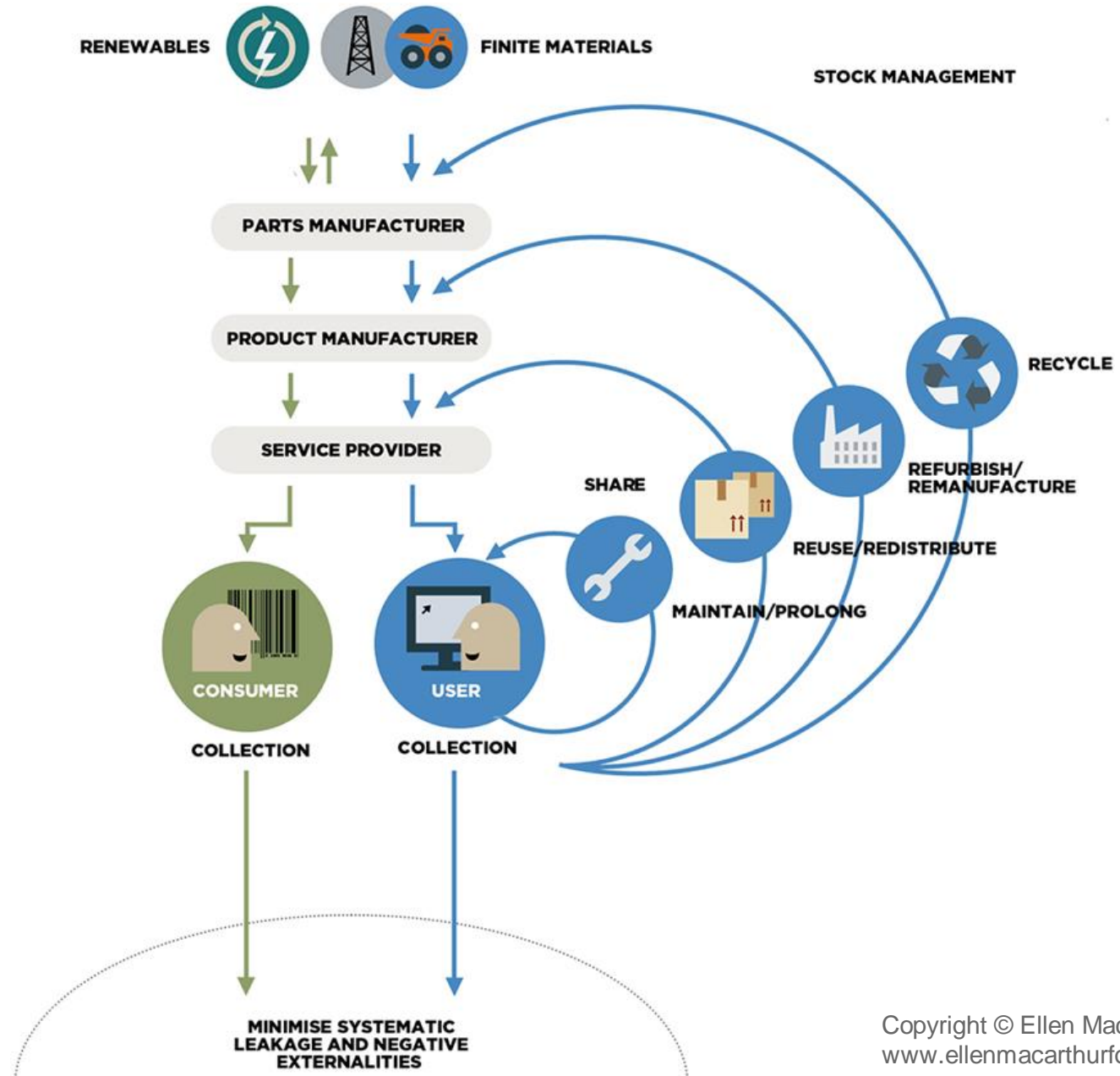
The butterfly center



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The circular economy butterfly

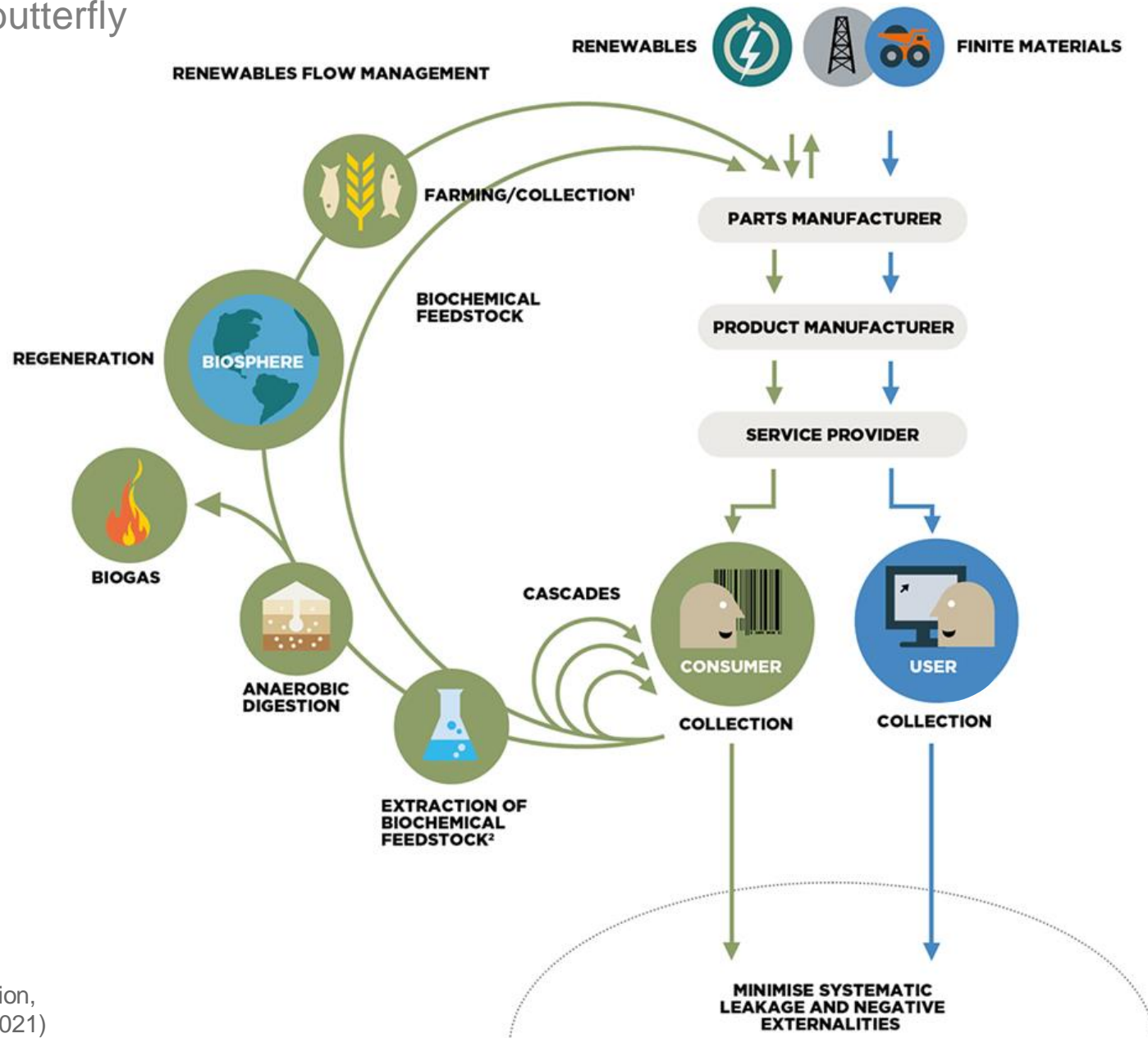
Technology loops



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The circular economy butterfly

Biological loops

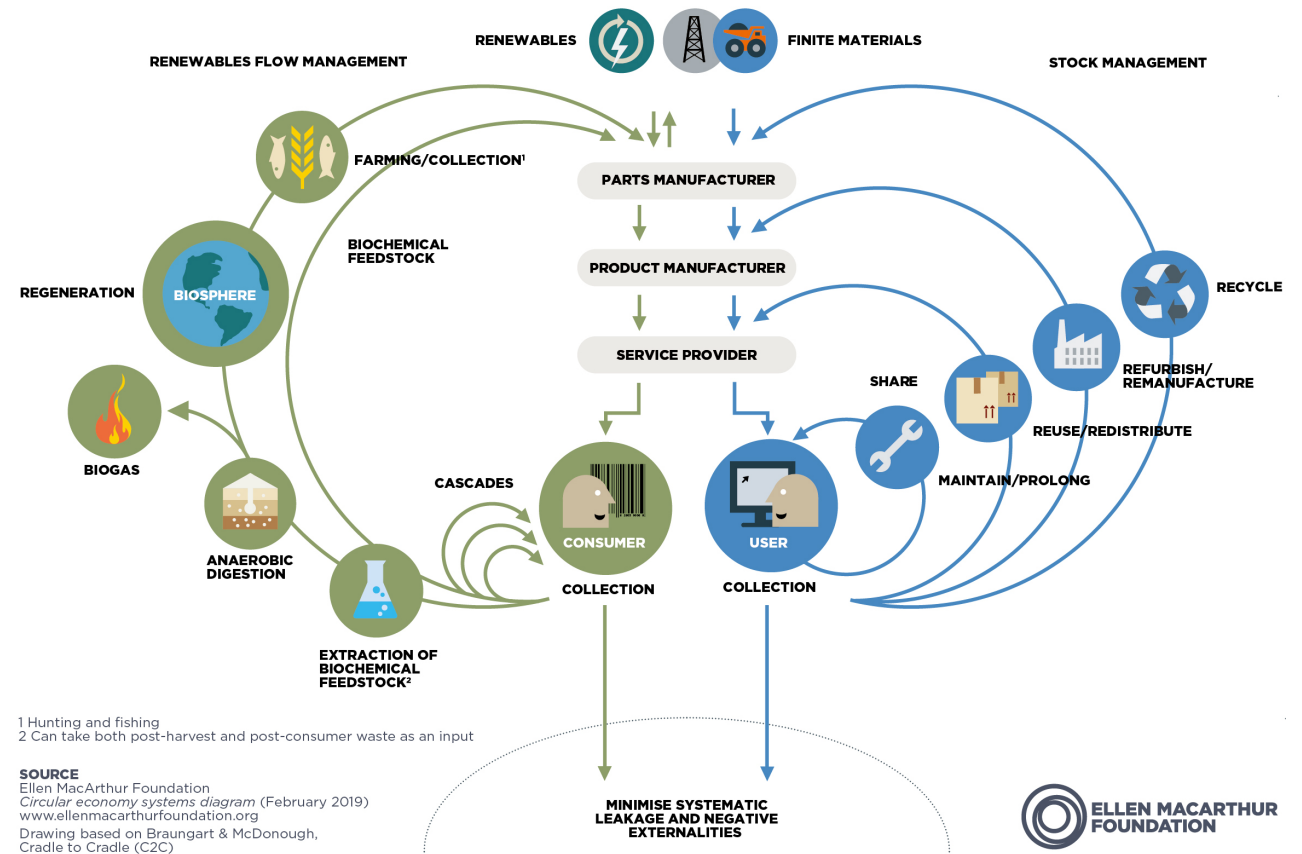


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The circular economy butterfly

Learning points

- The Ellen MacArthur Foundation has produced a well-known graphical representation of the circular economy known as the “butterfly diagram”.
- The central component shows how design, materials, and energy add value at various stages.
- The right wing shows how various feedback loops can be used to retain and enhance value for **technical** materials and products.
- The left wing illustrates how **biological** materials can be reused and cascaded until they are returned to the natural in such a way as to enhance and regenerate the biosphere.

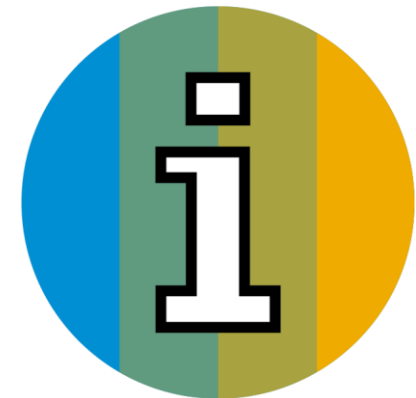


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The circular economy diagram

Further links and material

- Ellen MacArthur Foundation:
<https://www.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail> – Tab 6
- Two-minute summary video:
<https://www.youtube.com/watch?v=EqBivOsNtFg>
- The link between circular economy, butterfly diagram, and technology: GreenBiz article by Ken Webster:
The origins of the circular economy, 2017
<https://www.greenbiz.com/article/origins-circular-economy>



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Week 2: The Circular Butterfly

Unit 2: Keeping the Highest Value – Are All Loops Equal?

Keeping the highest value – Are all loops equal?

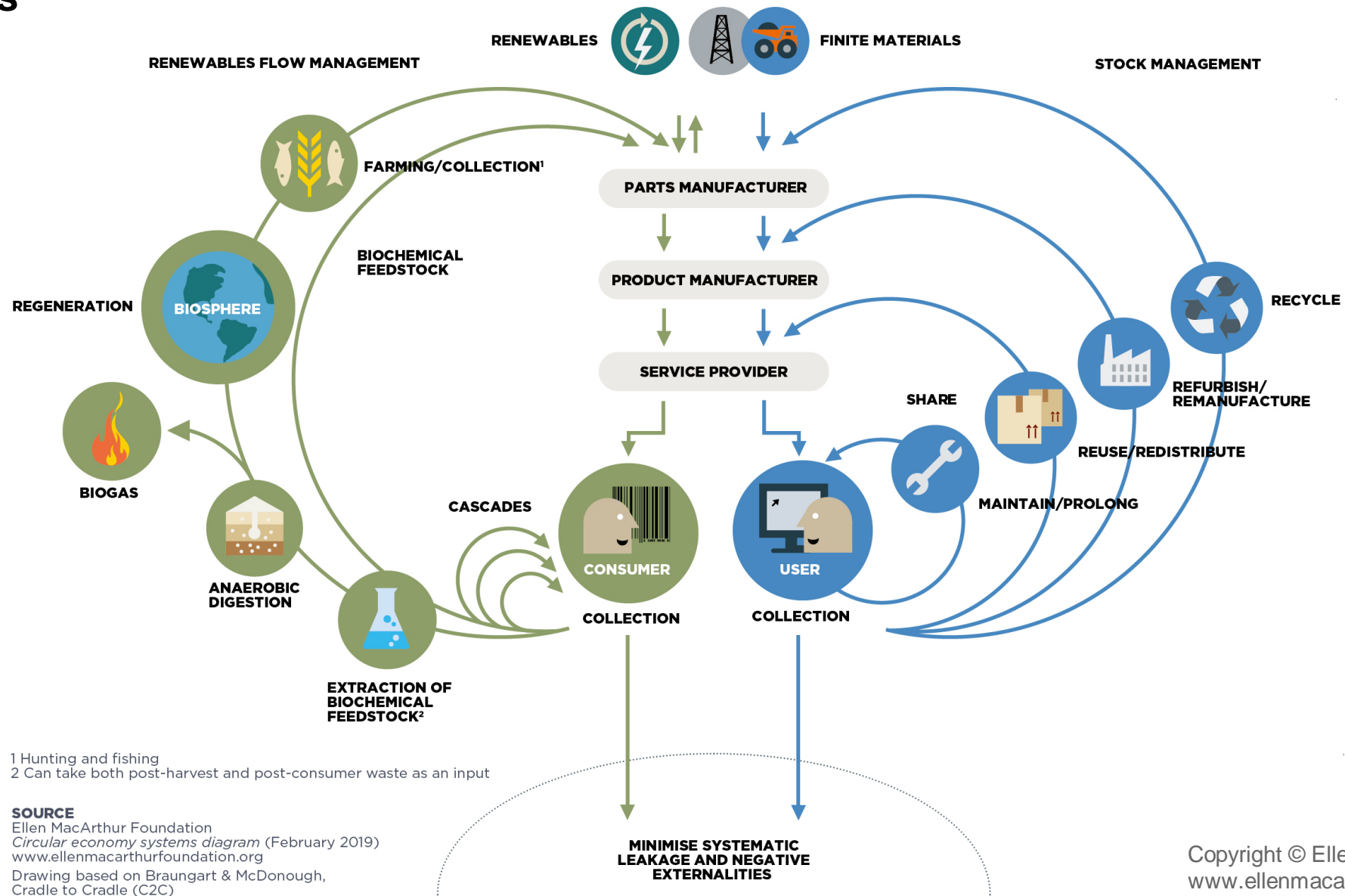
Content overview

- Looking more deeply at the circular economy loops
- Understanding value retention in the loops
- Are all loops equal?
 - Illustrations with recycling, remanufacturing, and redistribution



Keeping the highest value – Are all loops equal?

The loops



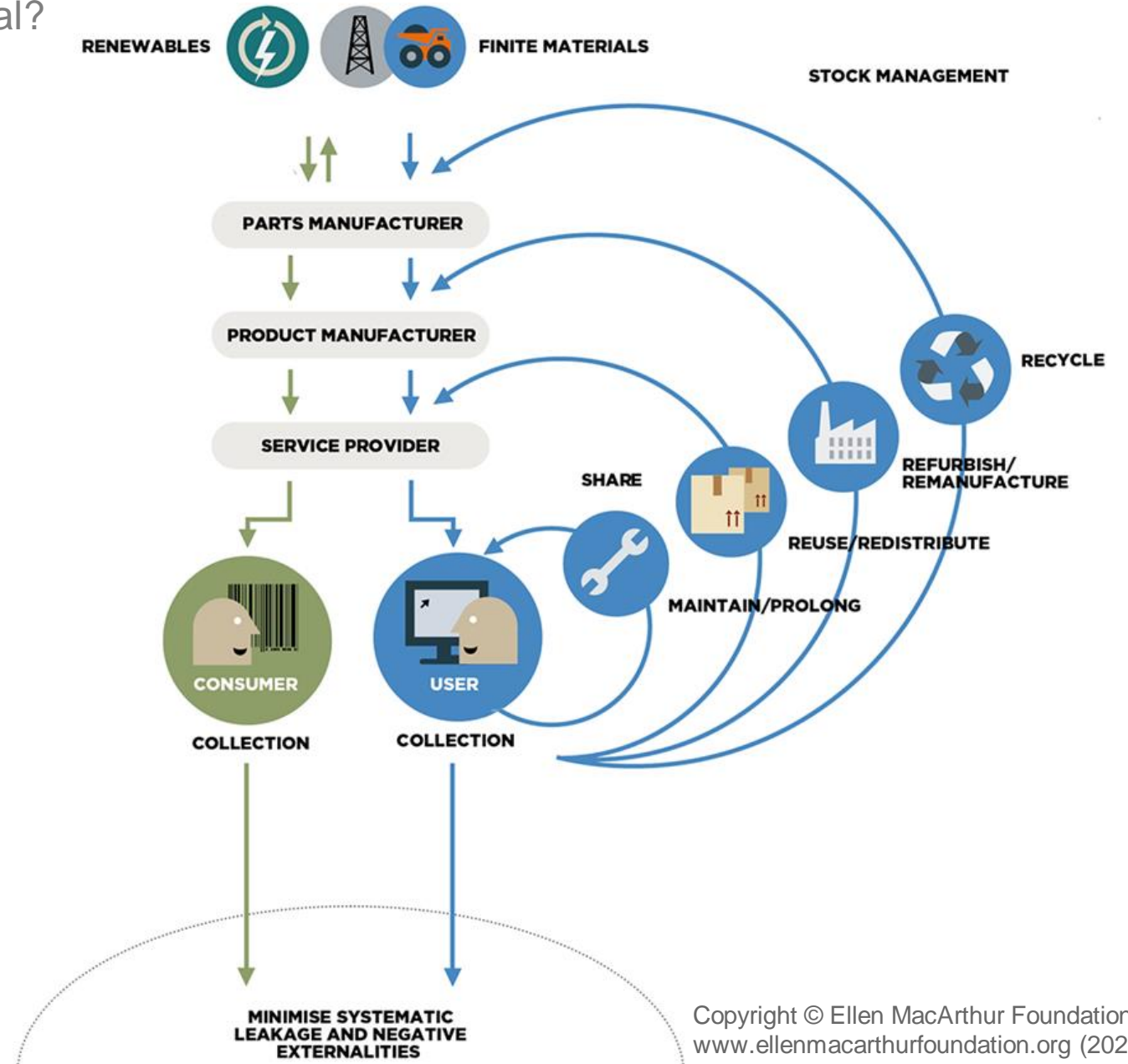
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Keeping the highest value – Are all loops equal?

Retaining the highest value

Outer to inner:

- Recycle
- Refurbish/Remanufacture
- Reuse/Redistribute
- Maintain/Prolong
- Share

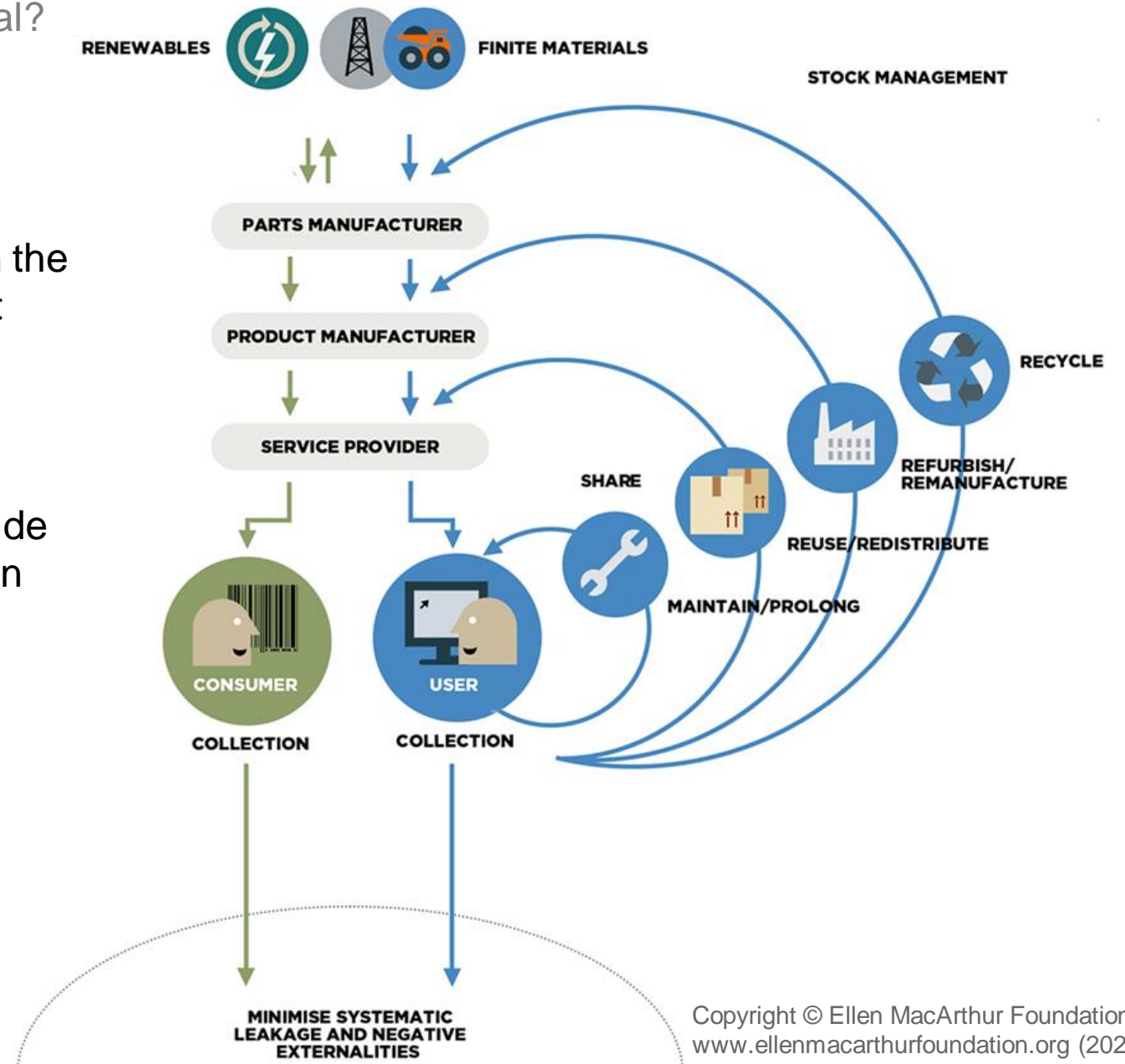


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Keeping the highest value – Are all loops equal?

Summary

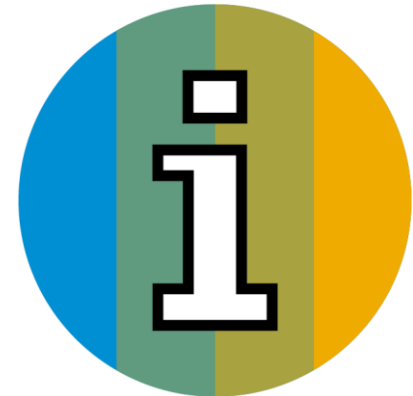
- The technology loops are designed to retain the value of materials and products and prevent value being lost.
- Each loop would typically loop to a different actor in the value chain.
- Each successive loop moving from the outside to the inside provides more potential to retain value.



Keeping the highest value – Are all loops equal?

Further reading

- Sharing: <https://www.shareable.net/>
- Some ideas for sharing apps:
<https://www.shareable.net/5-free-apps-to-swap-share-and-sell-your-extra-stuff/>
- *The Circular Economy: A Wealth of Flows, 2nd Edition* (2017) Ken Webster, *Chapter 5*.



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Week 2: The Circular Butterfly

Unit 3: Regenerating the Environment

Regenerating the environment

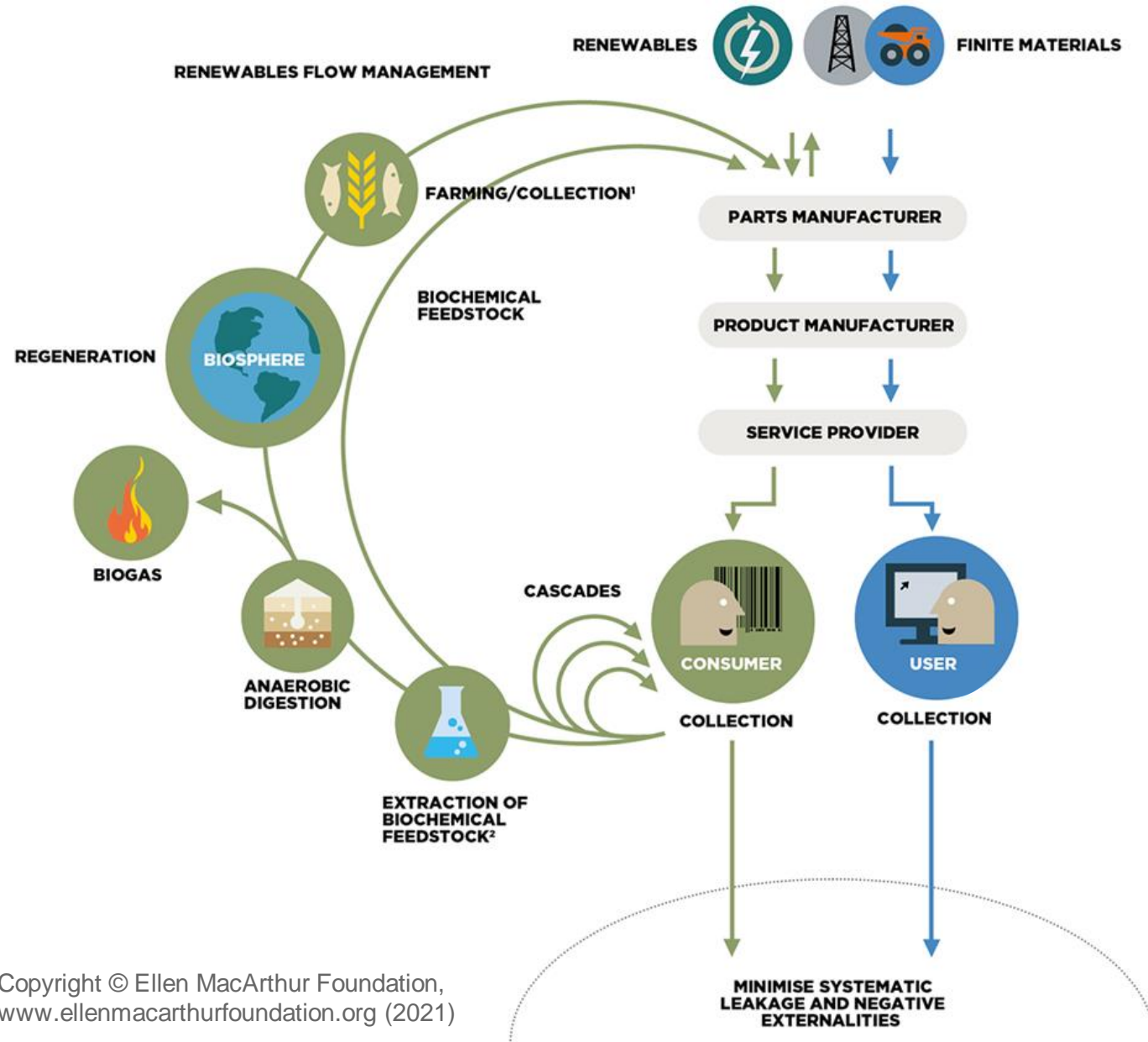
Content overview

- Recap on biological loops
- One example of regenerating the biosphere – What measures does this large organic farm business take to reduce the burden on the environment?
- How do Riverford regenerate the natural environment?



Regenerating the environment

Recap on biological loops



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Regenerating the environment

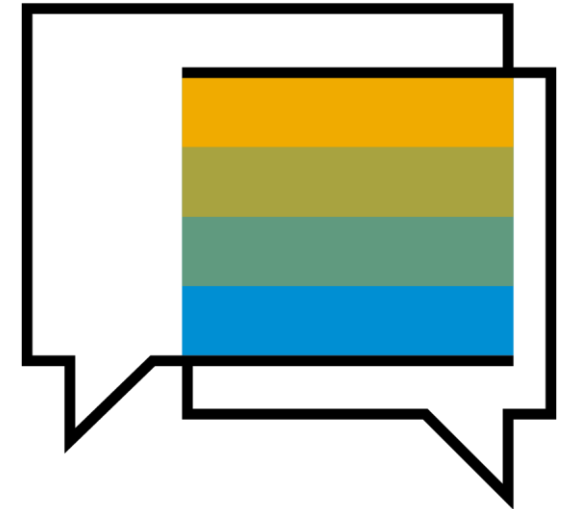
Michael Jordan in an interview with Edward Scott



Edward Scott,
Assistant Harvest Manager, Riverford



Michael Jordan,
Education Portfolio Manager for
Sustainability & Academic Ambassador,
SAP



Regenerating the environment

Riverford uses tracked vehicles as one way to reduce soil compaction



Learning points

Preserve soil health and manage pests and disease:

- Rebuild soil fertility by using field rotation (5 year cycle) – don't use artificial fertilizer
- Avoid or reduce soil compression – 80% of damage is from a tractor – use tracked vehicles, tailor cropping
- Bring in beneficial insects instead of using insecticides
- Use kites, electric fence, and similar to prevent damage from animals

Preventing/designing out waste:

- Deliver direct – educate customers so that they will accept vegetables that differ in size and shape
- Use waste as food for a dairy farm
- Compost any remaining waste and return it to the field

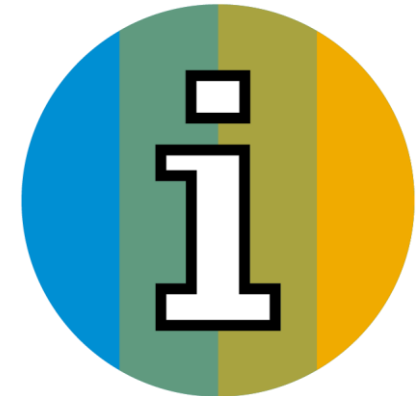
Purchased vegetable from third parties:

- Work with like-minded growers that maintain the same standards and avoid long transport routes
- Accept seasonal availability (not all vegetables are available all year round)

Regenerating the environment

Further links and material

- Riverford Organics Web site: <https://www.riverford.co.uk/>
- Riverford environmental magazine, *Wicked Leeks*:
<https://wickedleeks.riverford.co.uk/>
- Riverford on Facebook <https://www.facebook.com/riverford/>
- Soil Association <https://www.soilassociation.org/who-we-are/>



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Week 2: The Circular Butterfly

Unit 4: Waste as Resource, Waste as Value

Waste as resource, waste as value

Content overview

- Resources and waste
 - Resource and population growth
 - The amount of waste that is recycled
 - Plastic waste problem
 - Electronic waste problem
 - Textile waste problem
- The opportunity: waste as value





During the 20th century...
Resource use grew >2x
population growth



90%

RECYCLED



91%

WASTE

Source: Circularity Gap Report, 2020 – <https://www.circle-economy.com/resources/circularity-gap-report-2020> (the world is now only 8.6% circular)

An underwater photograph showing a large, spotted shark swimming towards the camera. The shark's body is covered in a pattern of dark spots on a lighter background. In the foreground, a large, crumpled white plastic bag is floating. The background is filled with various pieces of plastic waste, including bags and fragments, floating in the water. The overall scene is set in clear, blue-green water.


Ocean plastic waste expected to triple by 2040

Source: <https://www.imperial.ac.uk/news/200553/ocean-plastic-triple-2040-immediate-action/>

A woman with long brown hair, wearing a light pink blazer and black pants, is walking away from the camera through a mobile phone store. The store has white display tables with various smartphones on them. In the background, there is a wall with a colorful grid of squares in shades of orange, red, white, blue, green, purple, and yellow. There are also signs and posters on the walls, including one that says 'SELFIEPINNE'. The text 'In North America there are already >10 connected devices per person' is overlaid in large white font across the center of the image.

In North America there are already >10 connected devices per person

Source: Statista and Deloitte



**1 ton of circuit boards are
estimated to contain 40-800 times
more gold and 30-40 times
more copper than one ton of
mined ore**

Source: <https://earth911.com/eco-tech/20-e-waste-facts/>



**We are now producing ~20
garments each year for
every person on earth**

Source: <https://reverseresources.net/news/how-much-does-garment-industry-actually-waste/>

Waste as resource, waste as value
Potential values – packaging

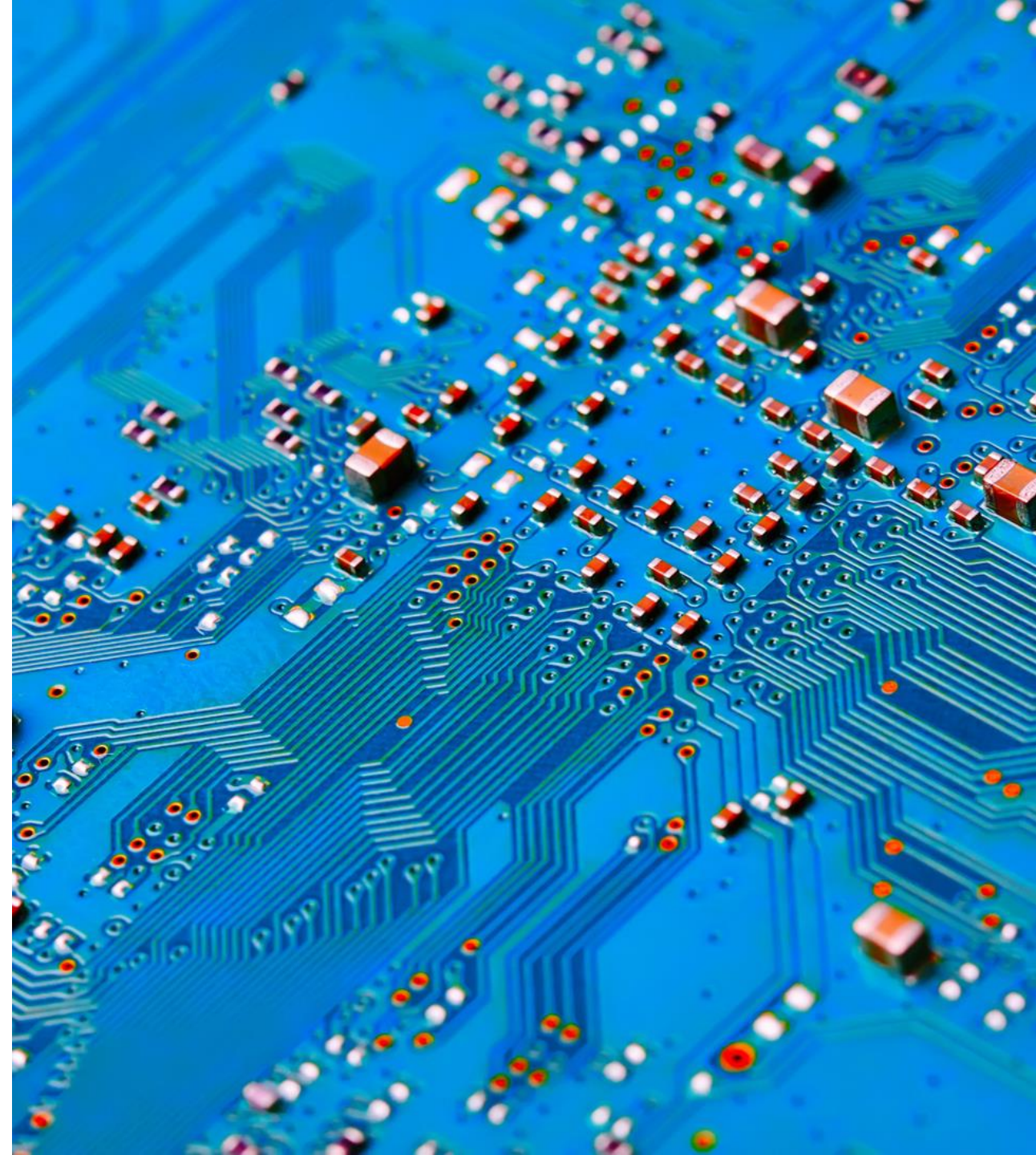
The global [plastic packaging market](#) size is expected to **reach USD 486.2 billion by 2028**, according to a new report by Grand View Research, Inc. (2021), registering a **CAGR of 4.2% from 2021 to 2028**. The rapid expansion of the food & beverage, personal care, and pharmaceuticals sectors, coupled with the rising penetration of organized and e-retail across the world, is expected to fuel market growth.



Waste as resource, waste as value

Potential values – e-waste

- Global e-waste volumes grew by 21% between 2014 and 2019, [according to the United Nations](#), a pace that will lead to a doubling of e-waste in just 16 years. The world discarded 53.6 million tons of e-waste in 2019.
- Only 17.4% of e-waste discarded in 2019 was recycled, the [United Nations reports](#).
- [The value of the raw materials](#) contained in the e-waste produced in the U.S. (13m tons) during 2019 was \$7.49 billion.
- At a global level, e-waste is approximately **\$32m** and growing.
- **Summary: We threw away billions of dollar's worth of materials into landfills that could be used again.**



Waste as resource, waste as value

Potential values – fashion and textiles

- Clothing sales have almost doubled from \$1 trillion in 2002 to \$1.8 trillion in 2015. ([Greenpeace 2017](#))
- Fashion consumption is expected to grow, with sales of clothing projected to rise to \$2.1 trillion by 2025. ([Greenpeace 2017](#))
- [The UN says](#) that by 2050, the equivalent of almost three planets could be required to provide the natural resources needed to sustain current lifestyles, given the growth in global population.
- **More than \$500 billion of value is lost every year due to clothing underutilization and the lack of recycling**, according to the Ellen MacArthur Foundation ([New Textiles Economy Report, 2017](#))



Waste as resource, waste as value

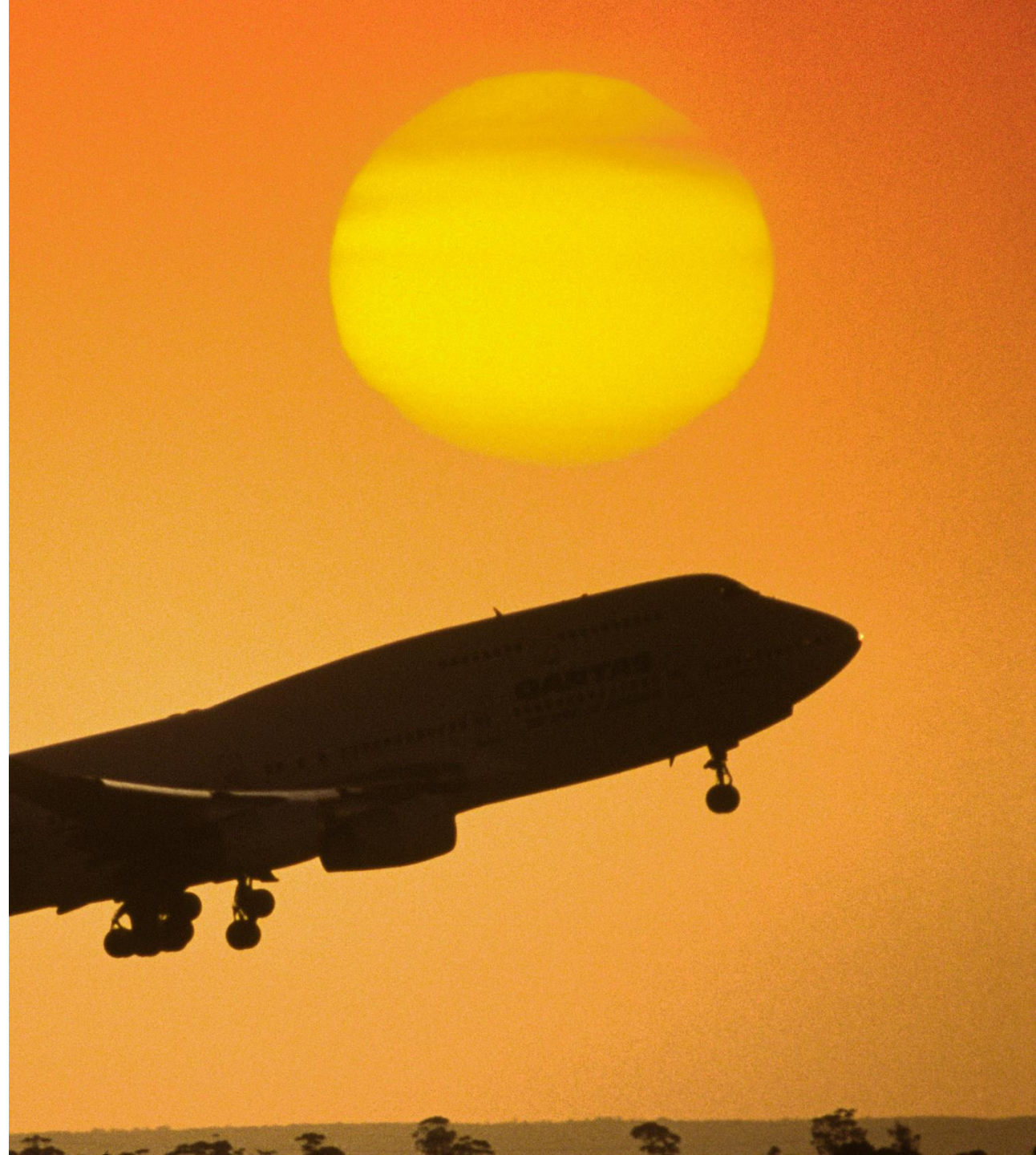
The jumbo in the room...

You thought recycling was hard? Think again!

“It costs a plane’s owner between £60,000 to £120,000 to dismantle a 747, depending on what is required. The entire process can take up to 12 weeks.”

“Up to 50% of an older 747 can be recycled, whereas a newer Airbus A320 can have 95% of its parts reused.”

Source: <http://news.bbc.co.uk/1/hi/magazine/8542482.stm>



Waste as resource, waste as value

Further links and material 1/2

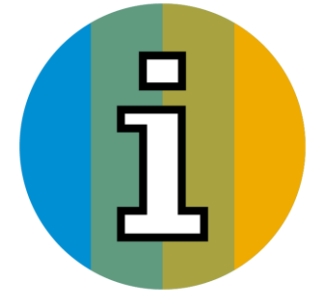
- Plastic Waste Growth <https://www.imperial.ac.uk/news/200553/ocean-plastic-triple-2040-immediate-action/>
- Breaking the Plastic Wave, Pew Research Trust <https://www.pewtrusts.org/en/research-and-analysis/articles/2020/07/23/breaking-the-plastic-wave-top-findings> and https://www.pewtrusts.org/-/media/assets/2020/07/breakingtheplasticwave_report.pdf
- Circularity Gap Report, 2020 <https://www.circle-economy.com/resources/circularity-gap-report-2020> (The world is now only 8.6% circular.)
- Earth Day: <https://www.earthday.org/> and resources <https://earthday.lbl.gov/resources>
- Connected Devices in North America: <https://techjury.net/blog/how-many-iot-devices-are-there/> (Statista) and Deloitte study is quoted in: <https://variety.com/2019/digital/news/u-s-households-have-an-average-of-11-connected-devices-and-5g-should-push-that-even-higher-1203431225/>
- Electronic waste facts: <https://earth911.com/eco-tech/20-e-waste-facts/>
- Fashion statistics quoted in this unit with original sources – see *EcoWarrior Princess*: <https://ecowarriorprincess.net/2018/10/facts-statistics-about-fast-fashion-inspire-ethical-fashion-advocate/> and <https://www.juliusbaer.com/en/insights/wealth-report/cost-per-wear-the-environmental-impact-of-our-wardrobes/> and <https://reverseresources.net/news/how-much-does-garment-industry-actually-waste>



Waste as resource, waste as value

Further links and material 2/2

- UK Government report 2019
<https://publications.parliament.uk/pa/cm201719/cmselect/cmenvaud/1952/full-report.html>
- Global Fashion Agenda & Boston Consulting Group, [Pulse of the Fashion Industry](#) (2017)
- Ellen MacArthur Foundation – A New Textiles Economy (2017)
<https://www.ellenmacarthurfoundation.org/publications/a-new-textiles-economy-redesigning-fashions-future>



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Week 2: The Circular Butterfly

Unit 5: Secondary Waste Markets


Content overview

- How waste impacts climate change
- The value of identifying and monetizing unused inventory
- Leveraging blockchain and machine learning/AI to track, trace, and minimize waste streams
- Automating data collection for sustainability and consumer storytelling, supporting the supply chain of the future
- How technology is used to save money and benefit the environment



Secondary waste markets
Waste opportunity





Secondary waste markets

Unused textiles in warehouses

\$120 BILLION

SITTING. WAITING. WASTED.

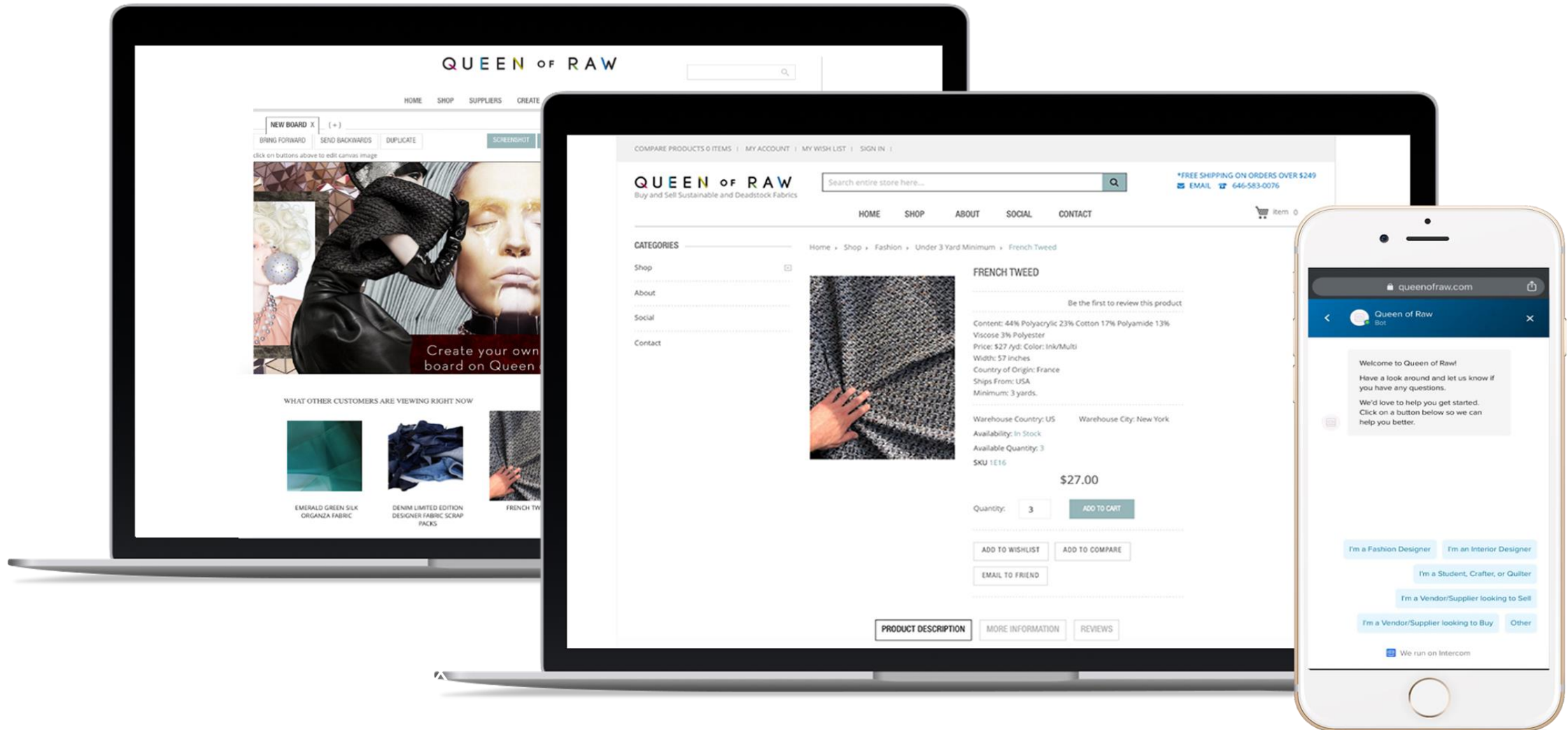
Secondary waste markets

River polluted by dyeing textiles



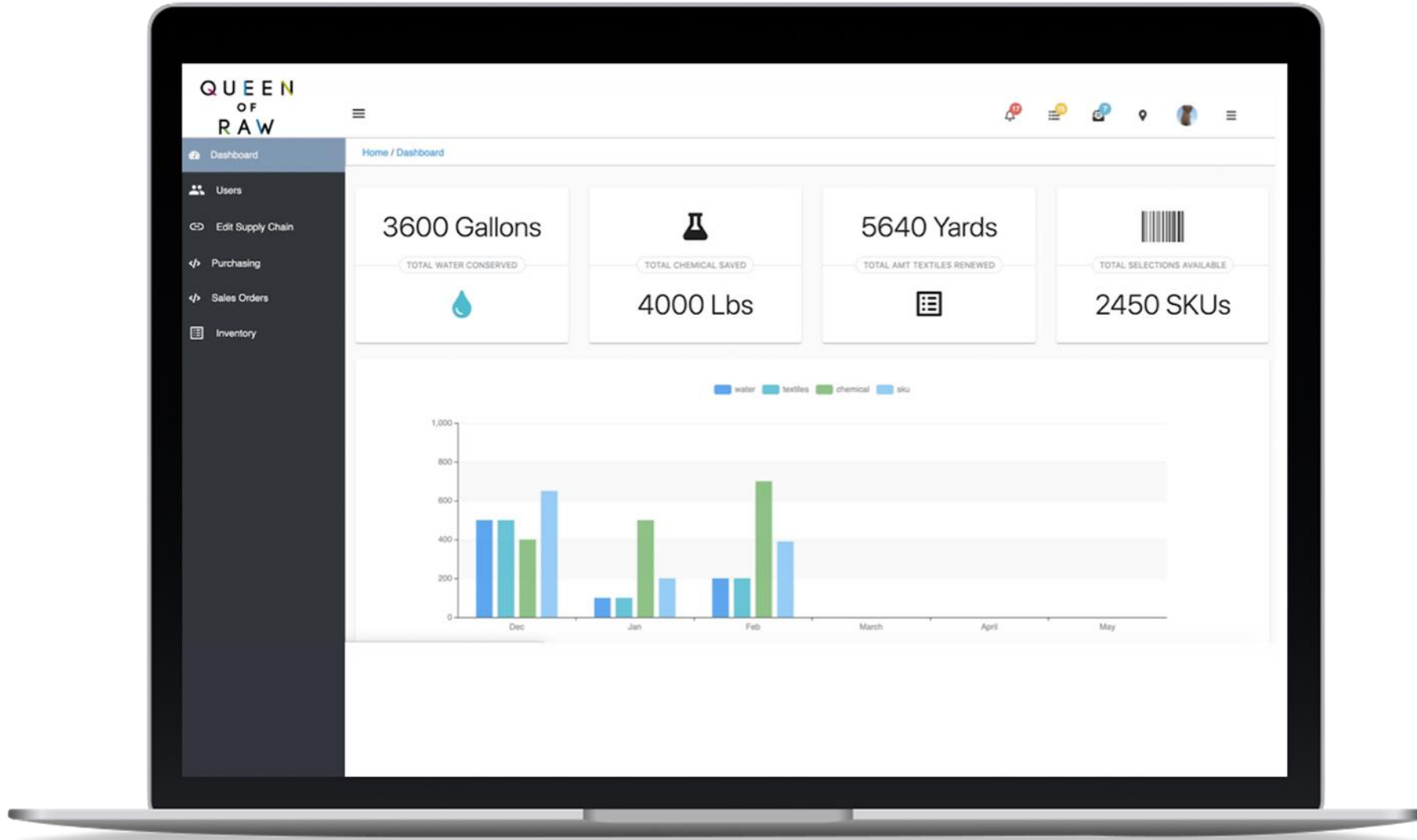
Secondary waste markets

Solution: global marketplace



Secondary waste markets

Solution: integrated software



Secondary waste markets

Solution: integrated software



The screenshot shows the mmx software interface. The top navigation bar includes the mmx logo, a menu icon, and notification icons for 17 alerts, 15 messages, and 7 emails. The left sidebar contains navigation options: Dashboard, Users, Edit Supply Chain, Purchasing, Sales Orders, and Inventory (highlighted). The main content area is titled "Home / Inventory/ Inventory - Select inventory to add". Below the title, it says "Select Inventory:" and "Search, browse and select (select via checkbox) your inventory for update/migration." A progress indicator shows three steps: 1. Select feed, 2. Select Inventory from feed (current step), and 3. Review and submit selections. A search bar is present with the text "To search by date or feed name, type and hit enter". Below the search bar is a table with the following data:

			quantity	
10	Feb 10 2020	SAP API 982y201 - Blue - Denim	345345	<input checked="" type="checkbox"/>
9	Feb 9 2020	SAP API efewfew44- White - Cotton	342	<input checked="" type="checkbox"/>
8	Feb 9 2020	SAP API 2545425r - Green - Nylon	108	<input type="checkbox"/>
7	Feb 8 2020	SAP API 98289282 - Black - Leather	41	<input checked="" type="checkbox"/>

At the bottom of the interface, there are "SELECT" and "CANCEL" buttons.

Secondary waste markets

Measuring impact and ROI

QUEEN OF RAW

Buy and Sell Sustainable and Deadstock Fabrics

Home • Shop • Fashion • Under 3 Yard Minimum • French Tweed

FRENCH TWEED

Be the first to review this product

Content: 44% Polyacrylic 23% Cotton 17% Polyamide 13% Viscose 3% Polyester
Price: \$27 yd. Color: Ink/Multi
Width: 57 inches
Country of Origin: France
Ships From: USA
Minimum: 3 yards.

Warehouse Country: US Warehouse City: New York
Availability: In Stock
Available Quantity: 3
SKU 1E16

\$27.00

Quantity: 3 **ADD TO CART**

96% organic cotton and 4% spandex

520 yards in Hong Kong

USD \$4.90 per yard

Track impact and ROI

Welcome to Queen of Raw!
Have a look around and let us know if you have any questions.
We'd love to help you get started. Click on a button below so we can help you better.

I'm a Fashion Designer I'm an Interior Designer
I'm a Student, Crafter, or Quilter
I'm a Vendor/Supplier looking to Sell
I'm a Vendor/Supplier looking to Buy Other

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Week 2: The Circular Butterfly

Unit 6: Cleaning Up the Linear Economy – Ocean Plastic

Cleaning up the linear economy – Ocean plastic

Content overview

- What happens if the circular butterfly loops are not closed – the problem of ocean plastic, described by Emily Penn
- What is the impact on human health from this problem?
- What can we do about it?

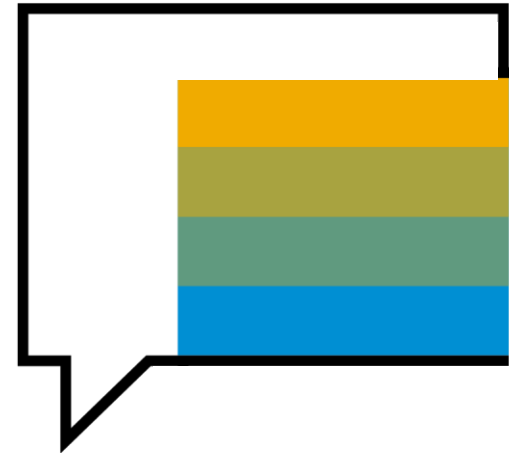


Cleaning up the linear economy – Ocean plastic

Emily Penn at the SAP Sustainability Summit in April 2021



Emily Penn,
Ocean Advocate and Skipper,
Co-Founder of eXXpedition



Cleaning up the linear economy – Ocean plastic

Learning points

- Plastic and microplastic can be found in the ocean even thousands of kilometers away from land. Plastic goes in the food chain of sea animals and eventually humans, and has a chemical impact on human health.
- Plastic needs to be stopped at the source. This is not easy, as the list of sources for plastic pollution are endless and so are the solutions for avoiding it.
- www.SHIFT.how showcases possible solutions and intends to help individuals and businesses navigate their way to find the right solutions that work for them.
- Business has the opportunity to scale solutions and to drive change closer to the source where the problem begins. We need to gain insights into our supply chains and waste chains to better understand where resources come from and where waste goes.
- We have the opportunity to do things differently.

The screenshot displays the SHiFT website interface. At the top, there is a navigation menu icon on the left, the SHiFT logo in the center, and a search icon on the right. Below the logo, a text prompt reads: "Find your role in solving ocean plastic pollution by using the filters above." The main content area is a grid of 14 filter cards, each with a title and a representative image. The filters are: "ABOUT SHiFT" (green background), "SHINE WITHOUT GLITTER" (beach litter), "TRY PLASTIC FREE GARDENING" (seedling), "SIGN UP FOR A VEGETABLE BOX" (vegetables), "REPLACE PLASTIC FOOD SACHETS WITH SEAWEED" (hands holding seaweed), "JOIN A VIRTUAL CLASS ON PLASTIC POLLUTION" (diver), "SWITCH TO NAKED COSMETICS" (bar soap), "REPLACE PACKAGING WITH TECHNOLOGY" (smartphone), "REPLACE STYROFOAM WITH MUSHROOMS" (mushroom), "UTILISE PLASTIC-FREE BUBBLE WRAP" (hands holding cardboard), "BAN COUNTRIES FROM EXPORTING PLASTIC WASTE" (cargo ship), and "USE WET WIPES THAT BREAK DOWN IN WATER" (wet wipe). To the right of the "BAN COUNTRIES" card, there is a text block: "GLOBALLY, THE WORLD PRODUCES OVER 390 MILLION TONNES OF PLASTIC PER YEAR, THE EQUIVALENT WEIGHT OF ALL HUMANS ON EARTH." Below this text is a "Source" link. At the bottom of the page, there is a filter bar with icons for "SOURCE", "SEA", and "SEA" (with a question mark), and a "www.shift.how" URL on the far right.

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Thought experiment

If only ...

Thank you.

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