



Seminar Nasional Pengkajian dan
Penerapan Sains Teknologi 2024

Sustainability through Closed-Loop Supply Chain

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Outline

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- Sustainability

2

- Closed-Loop Supply Chain

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- Case Study in Computer Industry

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- Concluding Remarks



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Sustainability

Environmental Problems

- ☐ Air pollution
- ☐ Water pollution
- ☐ Toxic pollutants
- ☐ Deforestation
- ☐ Solid waste pollution
- ☐ Global warming
- ☐ Drought, Desertification, and Water Scarcity
- ☐ Loss of Biodiversity



Source: Ververidis Vasilis/Shutterstock



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Sustainability

Important Milestones



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1987

UN's
Brundtland
Report

- **The World Commission on Environment and Development (WCED)** published a report entitled "Our common future", known as "Brundtland Report".
- The Commission's chairwoman: Gro Harlem Brundtland
- The Report is due to critical global environmental problems
- The commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."
- (<https://www.un.org/en/academic-impact/sustainability>)

1994

Triple Bottom
Line
(TBL/3BL)

- Coined by **John Elkington** (a business writer)
- TBL/3BL consists of People, Planet and Profit
- People: the social equity bottom line
- Planet: the environmental bottom line
- Profit: the economic bottom line
- Social-Environment-Economic becomes three pillars of sustainability

2015

UN's
Sustainable
Development
Goals

- **Leaders of all 193 countries of the United Nations** adopted Agenda 2030, "Transforming our world: the 2030 Agenda for Sustainable Development".
- Agenda 2030 introduced the 17 United Nations Sustainable Development Goals as a call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere.
- The SDGs are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice.
- <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

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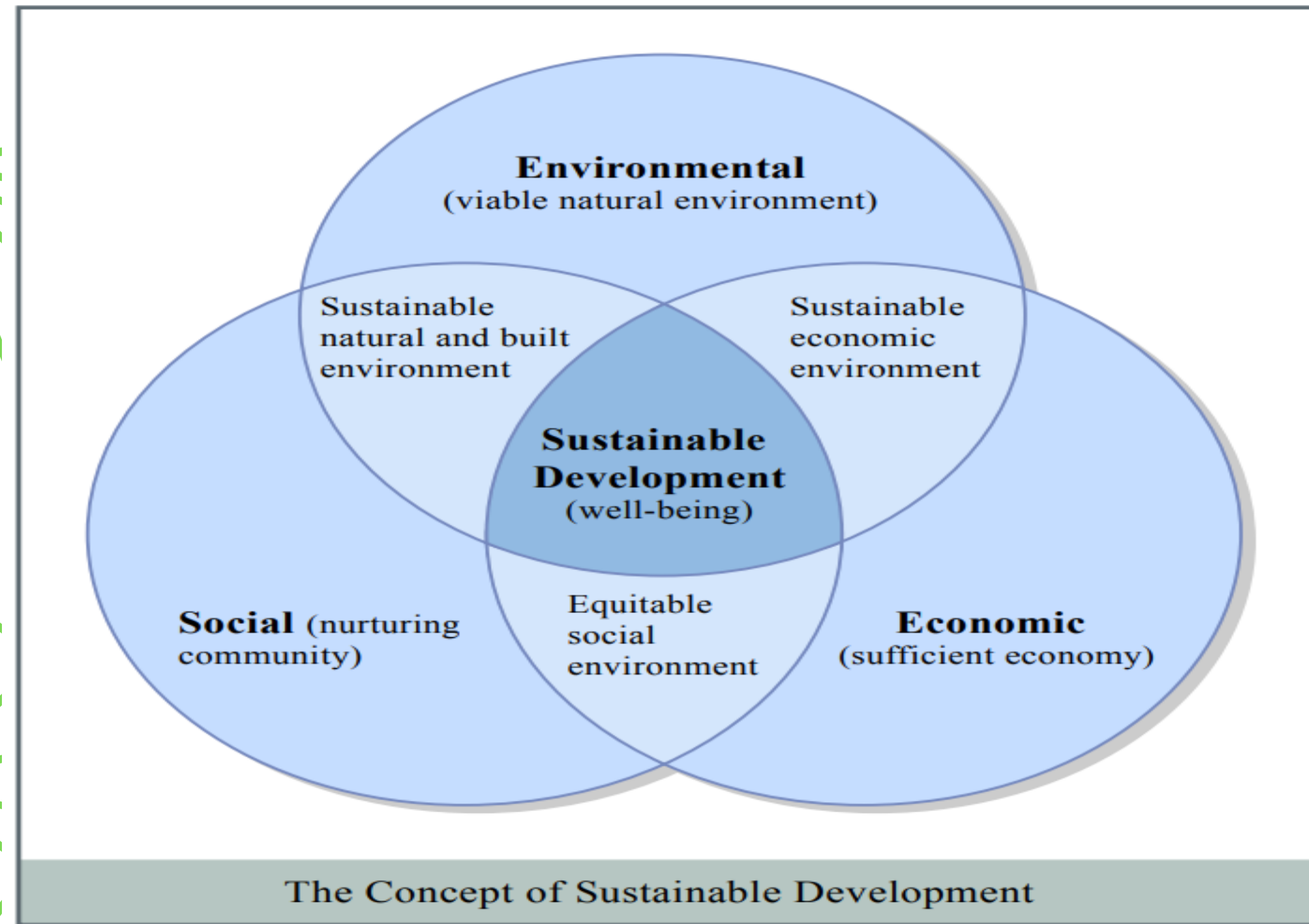
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Sustainability

The 3 Pillars



- **Economic:** what things cost - and how to make a business out of providing infrastructure, goods or services
- **Environmental:** what impact those things have on nature and the earth's support systems - which are finite
- **Social:** how those things serve the needs and quality of life of people and their communities

Figure by MIT OCW.



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Sustainability

The 17 UN SDGs

SUSTAINABLE DEVELOPMENT GOALS



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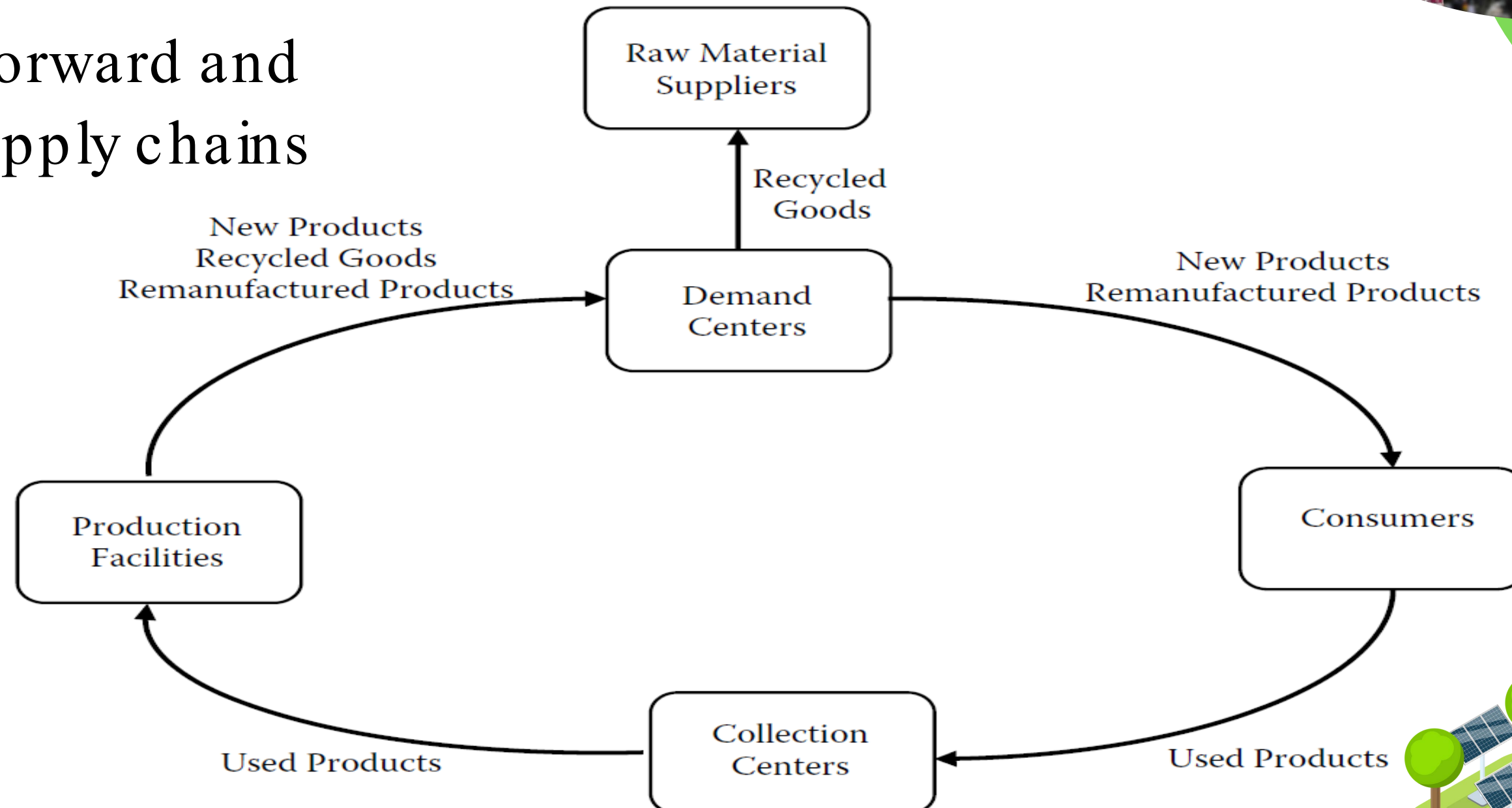
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Closed-Loop Supply Chain

The combination of forward and
backward/reverse supply chains

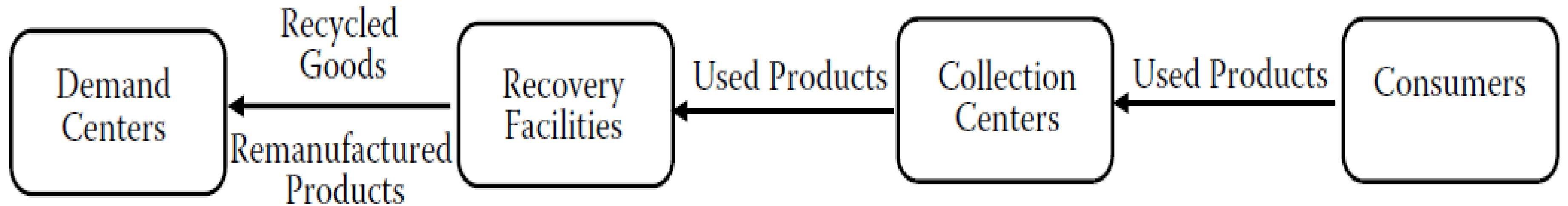


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Reverse Supply Chain



- Also known as **reverse logistics**
- Consists of a **series of activities** required to **collect** a used product from a consumer and **reprocess** it (used product) to either **recover** its leftover market value or **dispose** of it.
- Implementation of any reverse supply chain requires **at least three parties**:
 - **collection centers** where consumers return used products
 - **recovery facilities** where reprocessing (remanufacturing or recycling) is performed
 - **demand centers** where customers buy reprocessed products, viz., outgoing goods from recovery facilities.

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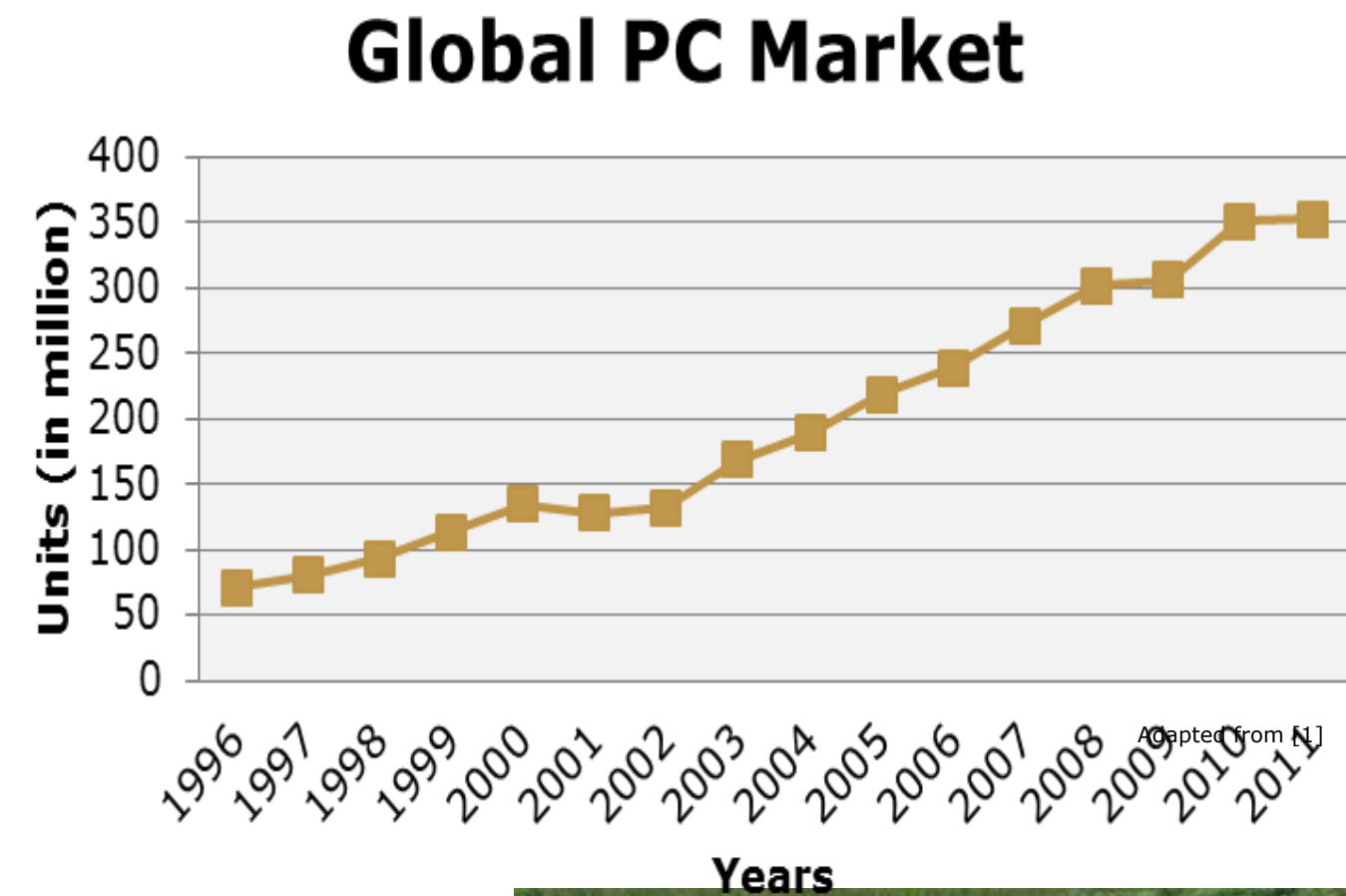
Case Study: computer industry

- The high-tech electronics industry is **the world's largest and fastest growing manufacturing industry**.
- Computer production results in **the use of thousands of toxic chemicals** and electronic waste poses **a significant threat to human and ecological health**.
- Some 600 million computers will be rendered obsolete by end of 2010 in the USA alone (Hamilton, 2009).
- **E-waste has become one of the fastest growing and most toxic waste streams**.
- Now, the companies have to engage in **processing used products due to the enforcement of environmental regulations** by Local/State/Federal governments.
- **The escalating deterioration of the environment**, e.g. diminishing raw material resources, overflowing waste sites and increasing levels of pollution.
- **Waste (hazardous or non-hazardous) needs to be avoided or minimised** to enhance environmental sustainability.





- Huge & faster rate of computer consumption



- Most e-waste landfilled and slightly recycled

- Environment deterioration



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E-waste collection rate (e-waste collected and managed in an environmentally sound way/e-waste generated), 2019 (percentage)



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VAST MAJORITY OF THE WORLD'S ELECTRONIC WASTE IS NOT BEING SAFELY MANAGED

E-WASTE COLLECTION RATES
(2019)



LATIN AMERICA AND
THE CARIBBEAN



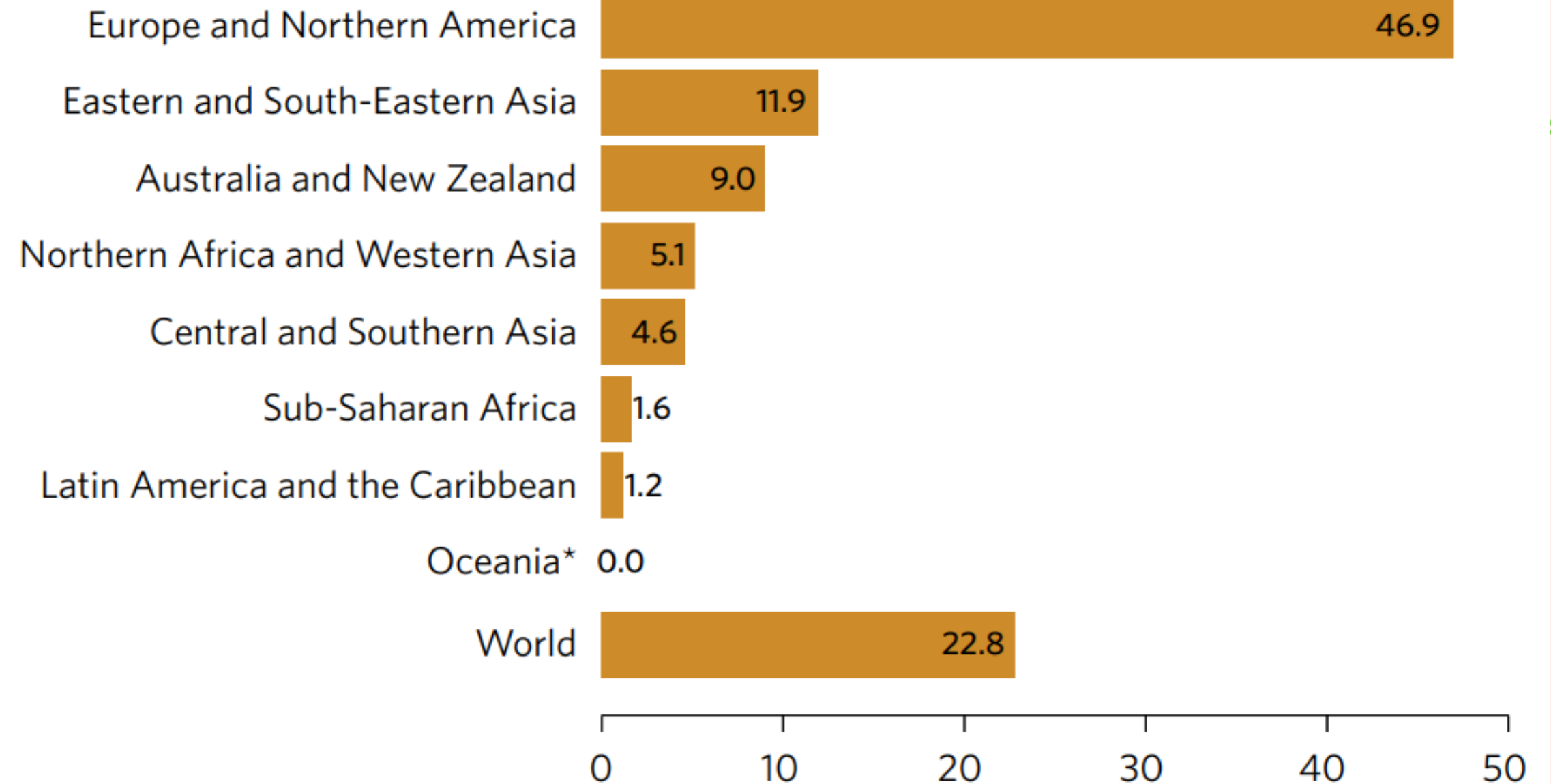
SUB-SAHARAN
AFRICA



EUROPE AND
NORTHERN AMERICA



GLOBAL AVERAGE



*Excluding Australia and New Zealand.

<https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>

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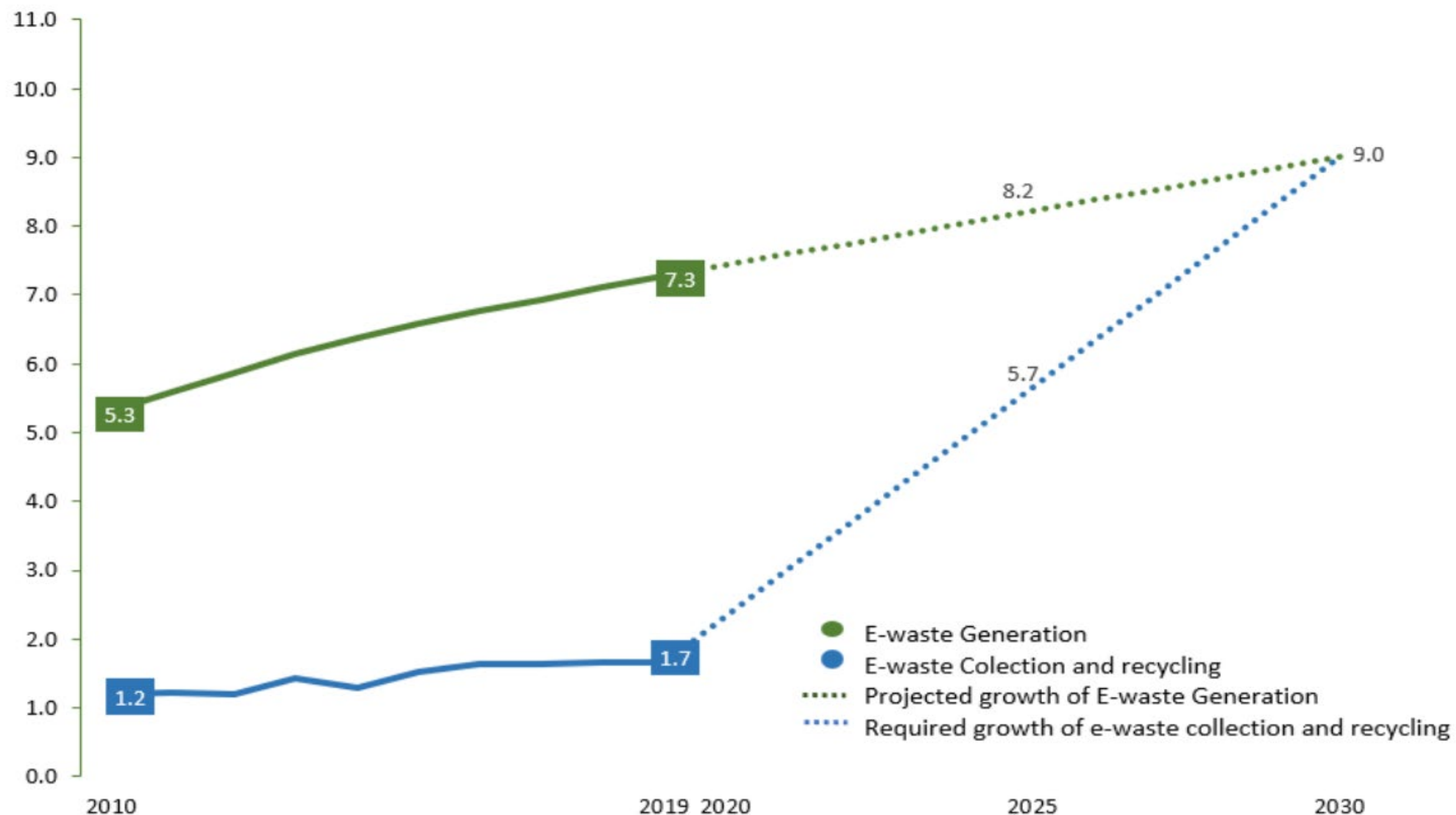


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E-waste generation (2010-2019), and projected e-waste generation (2020-2030) e-waste recycling (2010-2019) and required growth (2020-2030) to ensure environmentally sound management of all generated e-waste (kg per capita)

https://unstats.un.org/sdgs/report/2022/extended-report/Extended-Report_Goal-12.pdf

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Source: h41112.www4.hp.com



Source: local.yahoo.com /neighbors/s44091

- ❑ Regulations and legislations to protect and preserve the environment (EU: WEEE & RoHS Directives 2002; Australia: The Product Stewardship Act 2011)
- ❑ Opportunity to recover and reclaim the remaining values in computer waste
- ❑ Compliance to regulations (protect and preserve the environment) while benefiting manufacturer through **reverse logistics & closed-loop supply chain**



Source: www.southeasterndata.com



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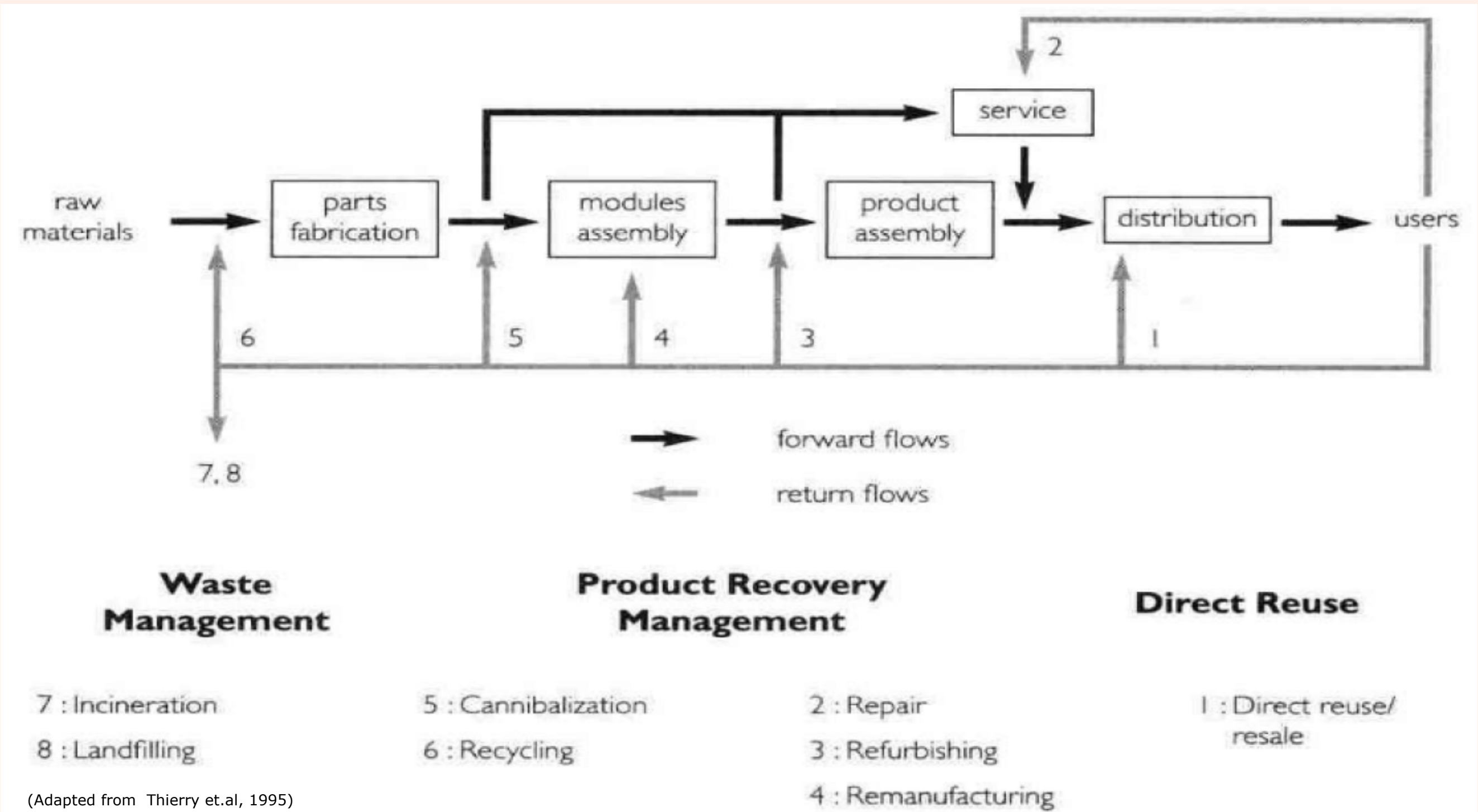
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Computer Recovery Options in Closed Loop Supply Chain

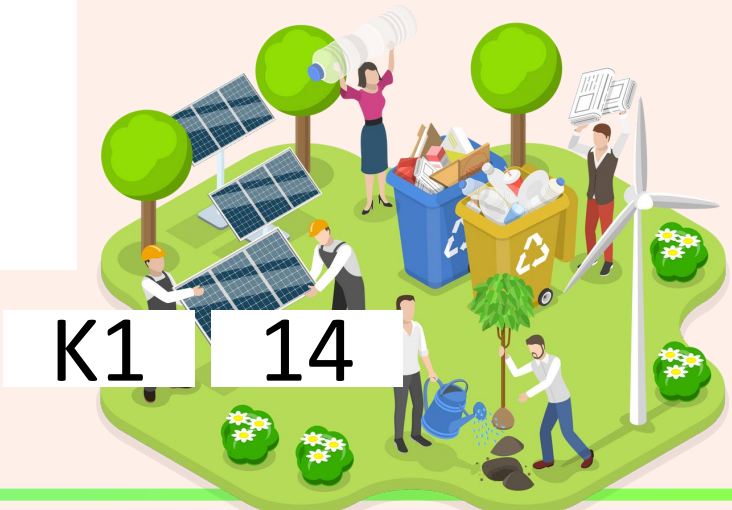


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(Adapted from Thierry et.al, 1995)

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Computer Recovery Option Comparison

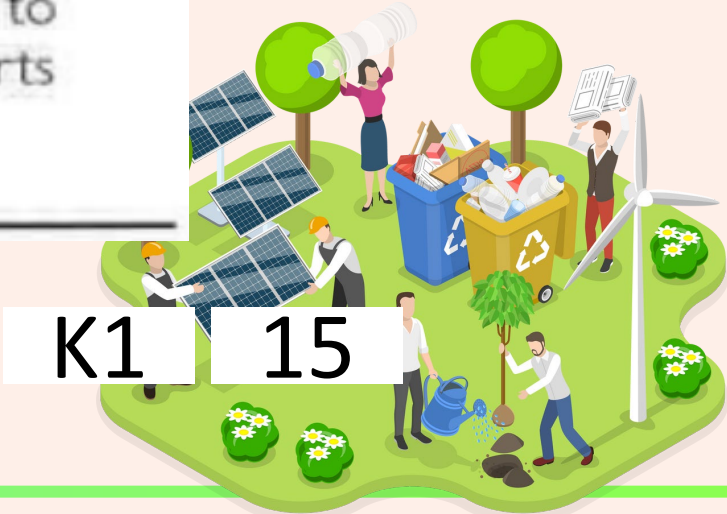


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	Level of Disassembly	Quality Requirements	Resulting Product
Repair	To product level	Restore product to working order	Some parts fixed or replaced by spares
Refurbishing	To module level	Inspect all critical modules and upgrade to specified quality level	Some modules repaired/ replaced; potential upgrade
Remanufacturing	To part level	Inspect all modules and parts and upgrade to <i>as new</i> quality	Used and new modules/parts combined into <i>new</i> product; potential upgrade
Cannibalization	Selective retrieval of parts.	Depends on process in which parts are reused	Some parts reused; remaining product recycled/disposed
Recycling	To material level	High for production of original parts; less for other parts	Materials reused to produce new parts

(Adapted from Thierry et.al, 1995)

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Closed-Loop Supply Chain Benefits Sustainability



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1. **Saving natural resources:** We conserve land and reduce the need to drill for oil and dig for minerals by making products using materials and components obtained from reprocessing rather than virgin resources.
2. **Saving energy:** It usually takes less energy to make products from reprocessed materials and components than from virgin resources.
3. **Saving clean air and water:** Making products from reprocessed materials and components creates less air and water pollution than from virgin resources.
4. **Saving landfill space:** When reprocessed materials and components are used to make a product, they do not go into landfills.
5. **Saving money:** It costs much less to make products from reprocessed materials and components than from virgin resources.



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Concluding Remarks



Sustainable Development requires an integrated approach that take into consideration environment and social concerns along with economic growth.



Closed-Loop Supply Chain (CLSC) as an integral part of managing supply chain has been expected to alleviate environmental burden and deterioration.



The well managed return operations in CLSC will be able to reduce the depletion rate of natural resources as the reverse process enables to reclaim valuable materials which can be used to produce new parts and products, and to reduce the pollution rate of land, water and air which are substantial for environmental sustainability.

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Thank you!

Do you have any questions?



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