Co-funded by the European Union

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Funded by the European Union

CiRCLETECH 101079354 Funded by the European Union - Twinning partnership to deliver enhanced networking for circular technological and socio-economic impact, raising research excellence and strengthening management capacity.

# European Green Deal, circularity in the construction field and the New European Bauhaus An overview

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Prometheus Missing:

*Critical Materials and Product Design*

23 JULY 1952 – EUROPEAN COAL AND STEEL COMMUNITY

”to make war not only unthinkable but materially impossible” through regional integration

TUDelft

EU GREEN DEAL

# PILLARS

## RESOURCES

SINGLE USE PLASTICS DIRECTIVE

PACKAGING & PACKAGING WASTE REGULATION

WASTE FRAMEWORK DIRECTIVE

SECTOR SPECIFIC PRODUCT REGULATION
e.g. Construction Products Regulation,
End-of-Life Vehicles Directive,
Toy Safety Directive

WEEE

ECODESIGN FOR SUSTAINABLE PRODUCTS REGULATION

BATTERY REGULATION

CRITICAL RAW MATERIALS ACT

BIOECONOMY STRATEGY

NET ZERO INDUSTRY ACT

## DUE DILIGENCE

NATURE RESTORATION LAW

CORPORATE SUSTAINABILITY DUE DILIGENCE DIRECTIVE

EU FORCED LABOUR REGULATION

DEFORESTATION-FREE PRODUCTS REGULATION (EUDR)

DIRECTIVE OF THE PROTECTION OF THE ENVIRONMENT THROUGH CRIMINAL LAW

EMPOWERING CONSUMERS FOR THE GREEN TRANSITION DIRECTIVE

GREEN CLAIMS DIRECTIVE

Conflict Minerals Regulation

## EMISSIONS

EMISSIONS TRADING SYSTEM - II

FIT FOR 55 PACKAGE

CARBON BORDER ADJUSTMENT MECHANISM

ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE

INDUSTRIAL EMISSIONS DIRECTIVE

ES

www.exsulting.com

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# Result of applying the CRM methodology, 2023

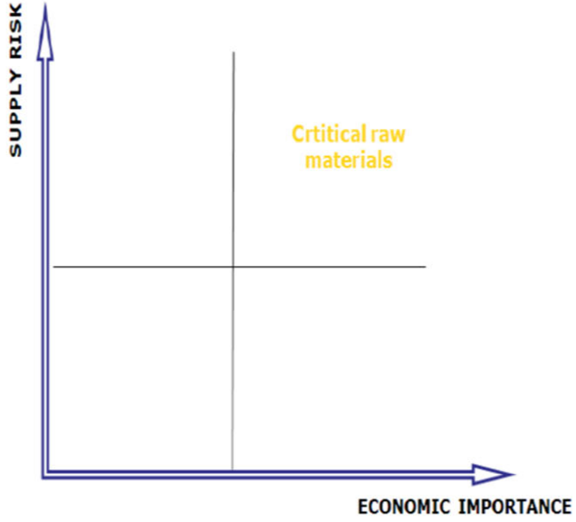
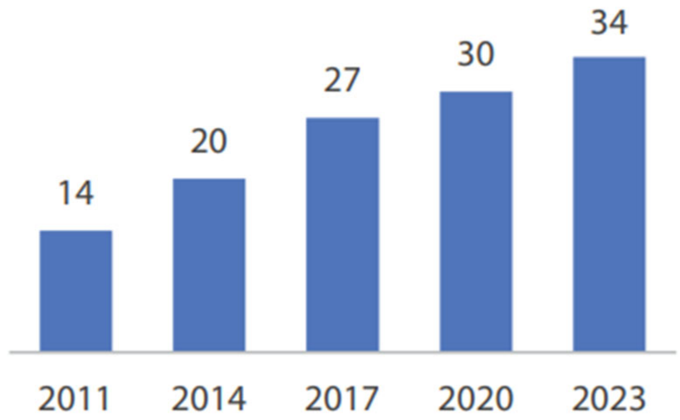



Figure 2 – Number of CRMs for the EU




Source: EPRS.

**2023 Critical Raw Materials (*new CRMs in italics*)**

| | | | |
|---|---|---|---|
| aluminium/bauxite | coking coal | lithium | phosphorus |
| antimony | *feldspar* | LREE | scandium |
| *arsenic* | fluorspar | magnesium | silicon metal |
| baryte | gallium | *manganese* | strontium |
| beryllium | germanium | natural graphite | tantalum |
| bismuth | hafnium | niobium | titanium metal |
| boron/borate | *helium* | PGM | tungsten |
| cobalt | HREE | phosphate rock | vanadium |
| | | _copper*_ | _nickel*_ |

**2023 Critical Raw Materials (*Strategic Raw Materials in italics*)**

| | | | |
|---|---|---|---|
| aluminium/bauxite | coking coal | *lithium* | phosphorus |
| antimony | feldspar | *LREE* | scandium |
| arsenic | fluorspar | *magnesium* | *silicon metal* |
| baryte | *gallium* | *manganese* | strontium |
| beryllium | *germanium* | *natural graphite* | tantalum |
| *bismuth* | hafnium | niobium | *titanium metal* |
| *boron*/borate | helium | *PGM* | *tungsten* |
| *cobalt* | *HREE* | phosphate rock | vanadium |
| | | _copper*_ | _nickel*_ |

* Copper and nickel do not meet the CRM thresholds, but are included as Strategic Raw Materials.

European Commission

TU Delft

# Materials – products….the made in EU vs imported.

Table 2 – Supply risks for the EU and EU share of global production volumes (examples)

| 15 key technologies | Supply chain steps | | | | | |
|---|---|---|---|---|---|---|
| | Raw materials | Processed materials | Components | Assemblies | Super assemblies | Systems |
| Li-ion batteries | 2 % | 4 % | 3 % | 6 % | | |
| Fuel cells | 3 % | 15 % | 25 % | 12 % | | |
| Wind turbines | 2 % | 15 % | 24 % | 18 % | 34 % | |
| Traction motors | 2 % | 12 % | 9 % | 19 % | | |
| Solar photovoltaics | 4 % | 12 % | 11 % | 2 % | | |
| Drones | 4 % | 18 % | 9 % | 11 % | 6 % | |

Data source: European Commission, Joint research Centre, 2023. Note: % indicates average EU share in global production for the supply chain step. In red: EU is vulnerable. In black: EU is not vulnerable.

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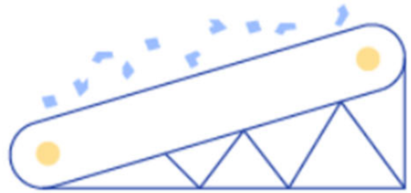
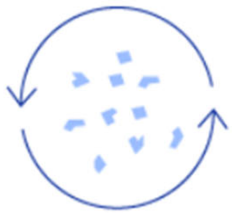
# Targets by 2030

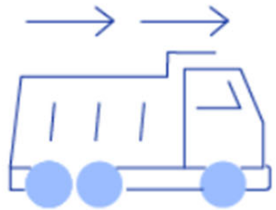
**EU EXTRACTION:**
at least **10%** of the EU's annual consumption from EU extraction



**EU PROCESSING:**
at least **40%** of the EU's annual consumption from EU processing

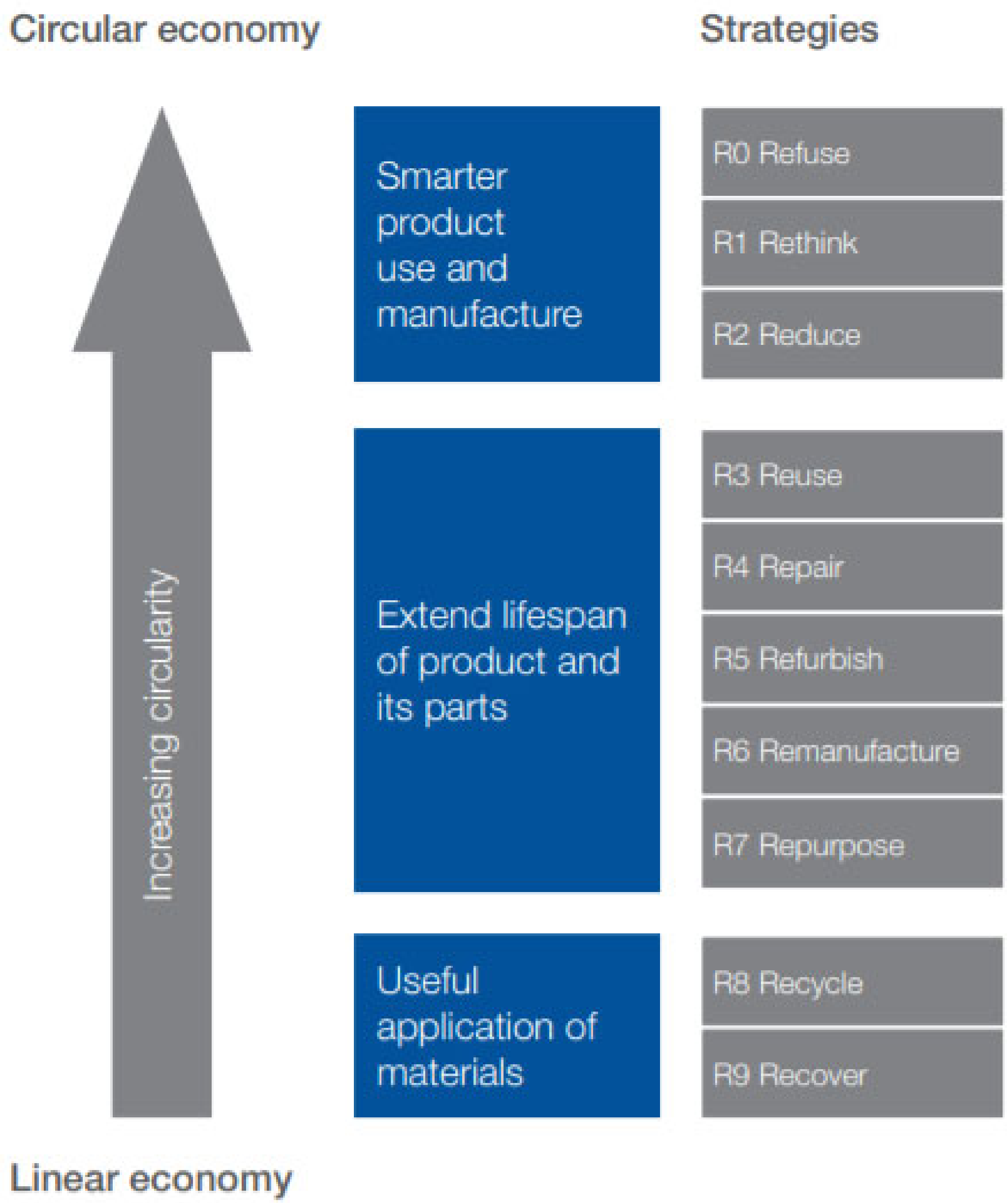


**EU RECYCLING:**
at least 2**5%** of the EU's annual consumption from domestic recycling



**EXTERNAL SOURCES:**
not more than **65%** of the Union's annual consumption of each strategic raw material at any relevant stage of processing from a single third country

# Secondary supply Circular direction of travel: The strategies




Source: (Kirchherr, et al., 2017)

# Eco-design – MEErP Methodology for Ecodesign of Energy-related Products

# In the CRM Act….

**Step 1:** shortlist the **CRMs potentially in the product group**

| Material | Application | Share | NACE-2 sector | EOL-RIR | EOL-RR | High priority | RECYCLE MORE or ADD RECYCLED CONTENT | DECLARE Q.TY | EXTEND LIFE |
|---|---|---|---|---|---|---|---|---|---|
| Beryllium | Electronic and telecommunications equipment | 42% | C26 - Manufacture of computer, electronic and optical products | 0% | 0% | X | | X | |
| Beryllium | Transport and Defence ; Vehicle electronics | 17% | C26 - Manufacture of computer, electronic and optical products | 0% | 0% | X | | | |
| Cobalt | Magnets | 7% | C27 - Manufacture of electrical equipment | 22% | 32% | X | X | | |
| Cobalt | Battery | 3% | C27 - Manufacture of electrical equipment | 22% | 32% | X | X | | |
| Dysprosium | Magnets | 100% | C25 - Manufacture of fabricated metal products, except machinery and equipment | 0% | 0% | X | | X | |
| Erbium | Lighting | 26% | C27 - Manufacture of electrical equipment | 1% | 1% | X | | X | |
| Europium | Lighting | 100% | C27 - Manufacture of electrical equipment | 38% | 34% | X | | X | |
| Fluorspar | Refrigeration and air conditioning | 9% | C27 - Manufacture of electrical equipment | 1% | 4% | X | | | |
| Gadolinium | Magnets | 38% | C25 - Manufacture of fabricated metal products, except machinery and equipment | 1% | 1% | X | | X | |
| Gadolinium | Lighting | 25% | C27 - Manufacture of electrical equipment | 1% | 1% | X | | X | |
| Gadolinium | Magnetic Resonance Imaging - MRI | 8% | C21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations | 1% | 1% | X | | | |
| Gallium | Integrated circuits | 70% | C26 - Manufacture of computer, electronic and optical products | 0% | 0% | X | | X | |
| Gallium | Lighting | 25% | C27 - Manufacture of electrical equipment | 0% | 0% | X | | X | |
| Gallium | CIGS solar cells | 5% | C26 - Manufacture of computer, electronic and optical products | 0% | 0% | X | | | |
| Germanium | Infrared optics | 47% | C26 - Manufacture of computer, electronic and optical | 2% | 12% | X | | X | |

**Step 2: collect quantitative data** on the Bill of Material for the shortlisted CRMs **& BIM**

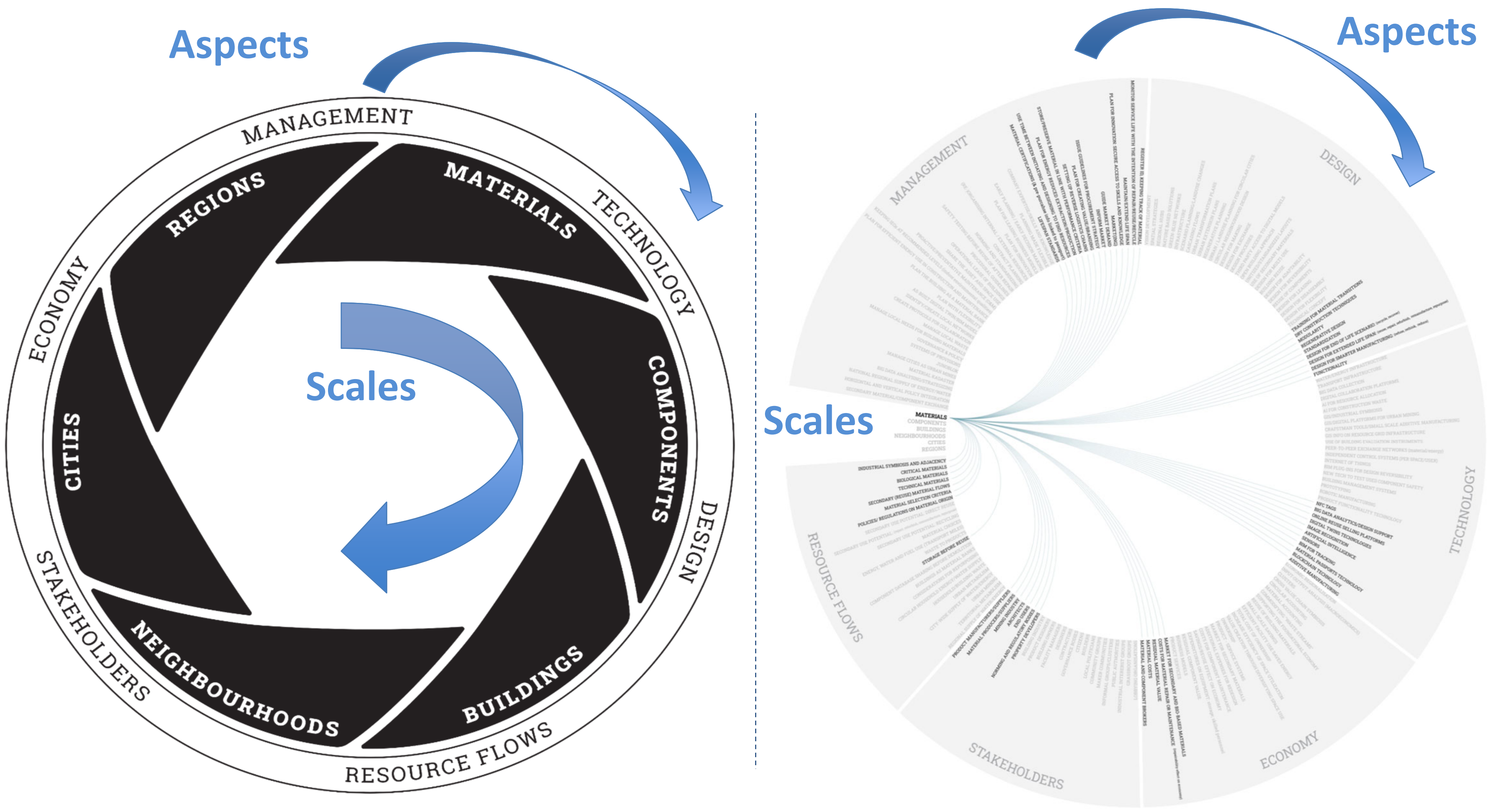
**Step 3:** look at available information from criticality assessment to define **possible strategies**, e.g.:

- Declare quantity (when data is not available)
- Extend lifetime (especially in the case of low substitutability)
- Improve recyclability and/or recycled materials (especially in the case of low substitutability)

European Commission

A Circular Built Environment
in the context of material criticality.

# Creating a shared understanding: the “Scales to Aspects” Model



# CRMs products in buildings
# A few examples

| 2023 Critical Raw Materials (*new CRMs in italics*) | | | |
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| antimony | *feldspar* | LREE | scandium |
| *arsenic* | fluorspar | magnesium | silicon metal |
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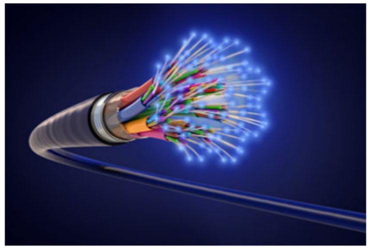
| boron/borate | *helium* | PGM | tungsten |
| cobalt | HREE | phosphate rock | vanadium |
| | | *copper** | *nickel** |

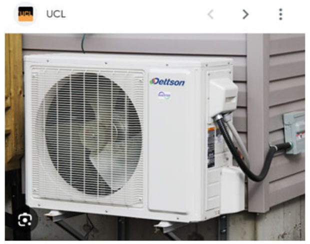
Kitchen systems

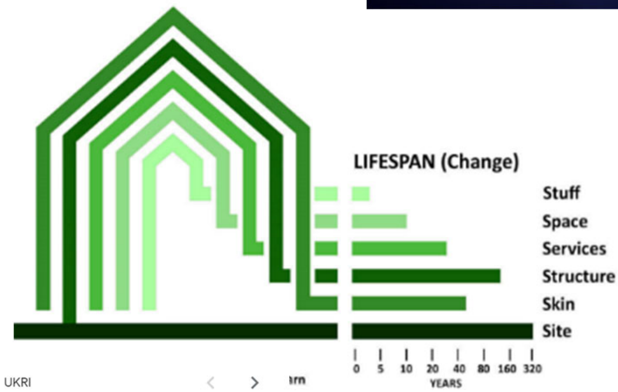
Digital systems, sensors

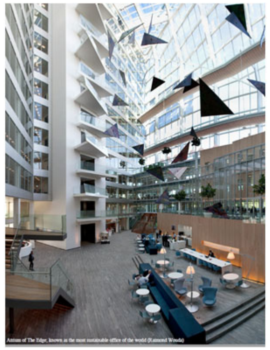
Pumps, motors, drive systems



Door systems



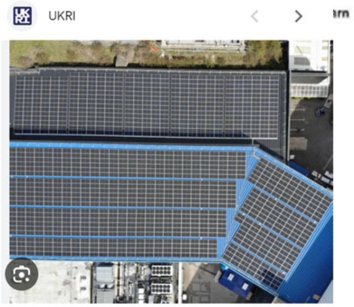



Fire, emergency systems

Heating, Cooling, Ventilation systems Building Services


Energy Superhub Oxford (ESO) – UKRI




Green transformation for UK science estate – UKRI

Power systems

Lighting systems

Lifts

Solar PV, Heatpump, Battery systems

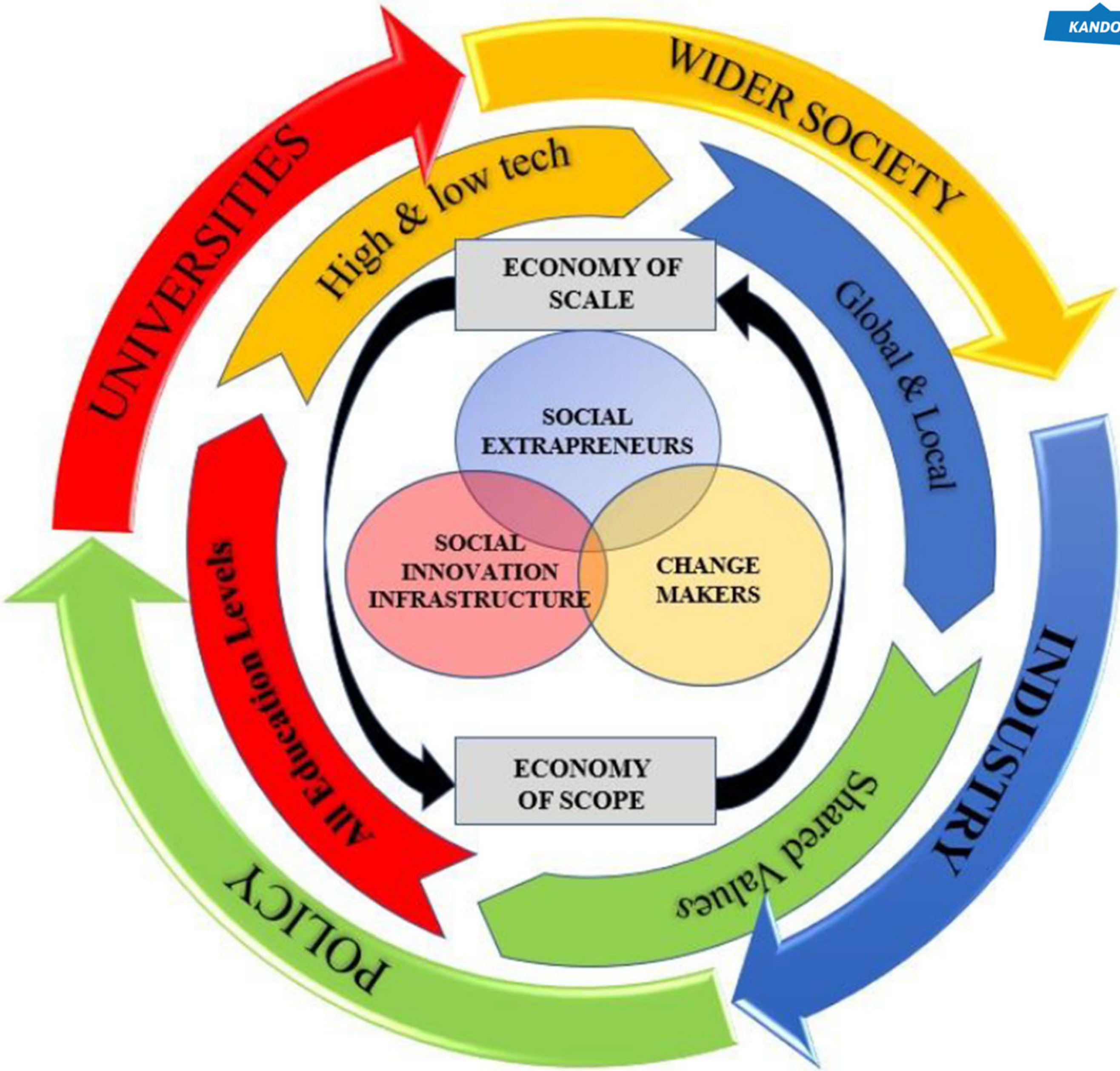
Structures Facades

Escalators

Toilets, bathrooms, Water systems

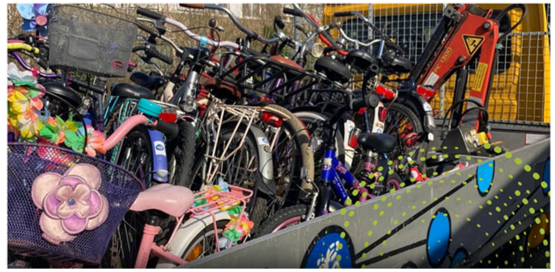
Infotainment

# Beautiful, sustainable, together…




Fligure 7.1 A social innovation model for an inclusive circular economy

## KanDoen Venlo MakerSpace



Pop-Machina

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 821479

Sinead Ouillon,

**A City's journey towards Circular transition through citizen mobilisation.**
**PhD thesis, Sept 2024**

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