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Jaarsymposium Circulaire Maakindustrie

[Workshop]

# Building a resilient supply chain for Critical Raw Materials (CRMs) in the telecommunication sector

Energy Management & Circular Economy Team of KPN
Yeji Park – Researcher Circularity for Critical Raw Materials
Gloria Flik – Researcher Critical Raw Materials for Future Technologies

# Introduction

**Gloria Flik**

Critical Raw Materials for Future Technologies

**Yeji Park**

Circularity of Critical Raw Materials

kpn

# Contents

## I. Presentation

10:05 **Material Criticality for the core and future equipment**
**Gloria Flik** | Researcher Critical Raw Materials for future technologies

10:10 **Achieving a circular use of CRMs**
**Yeji Park** | Researcher Circularity of Critical Raw Materials

## II. Workshop

10:15 **Brainstorming session on Miro**

10:35 **Discussion**

10:55 **Closing**

# What are critical raw materials (CRMs)?

## As defined by the European Union [1]

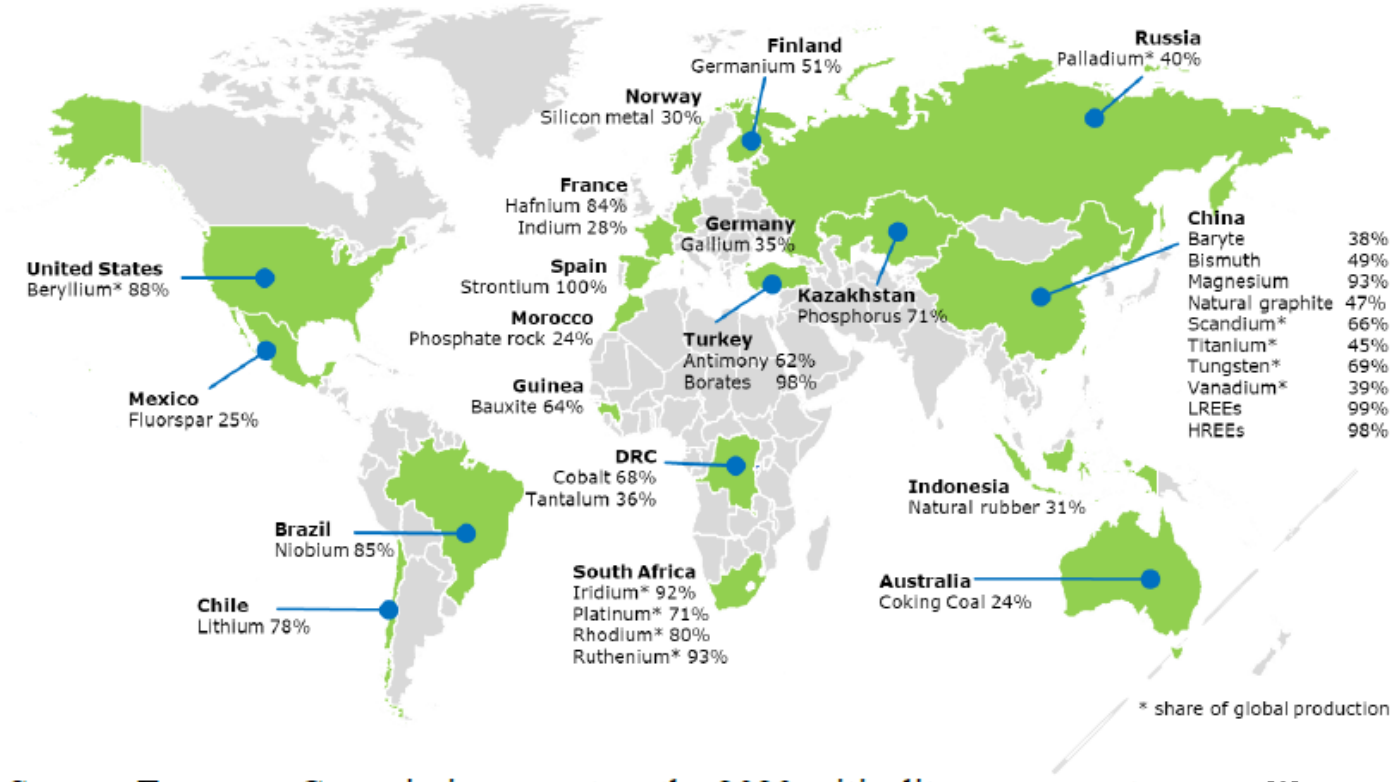
**Critical raw materials**

- Economic importance
- Supply risk

**Reasons for material criticality [3]:**

- Scarcity Risk
- Geopolitical Risk
- Demand Risk
- Environmental Risk
- Supply Chain Risk
- Market Risk
- Social Risk

Biggest supplier countries of CRMs in the EU




Source: European Commission report on the 2020 criticality assessment [2]

# How to start?

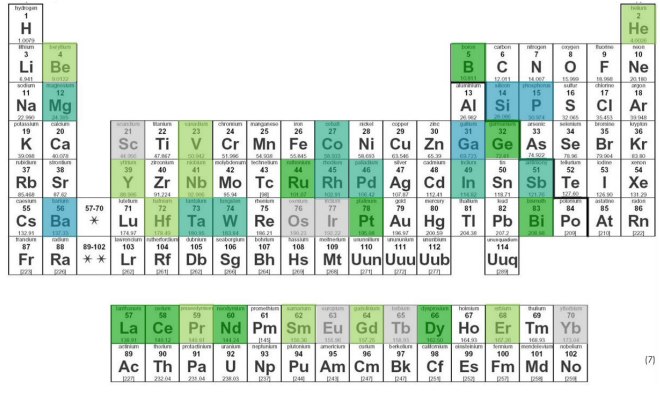
## From the equipment to the mitigation strategy

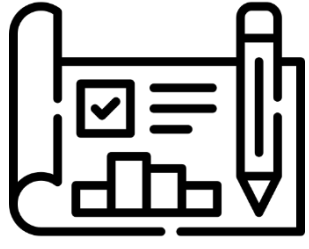
**Step 1**
Identify Key Equipment

**Step 2**
Identifying Raw Material Content

**Step 3**
Conduct Criticality Assessment

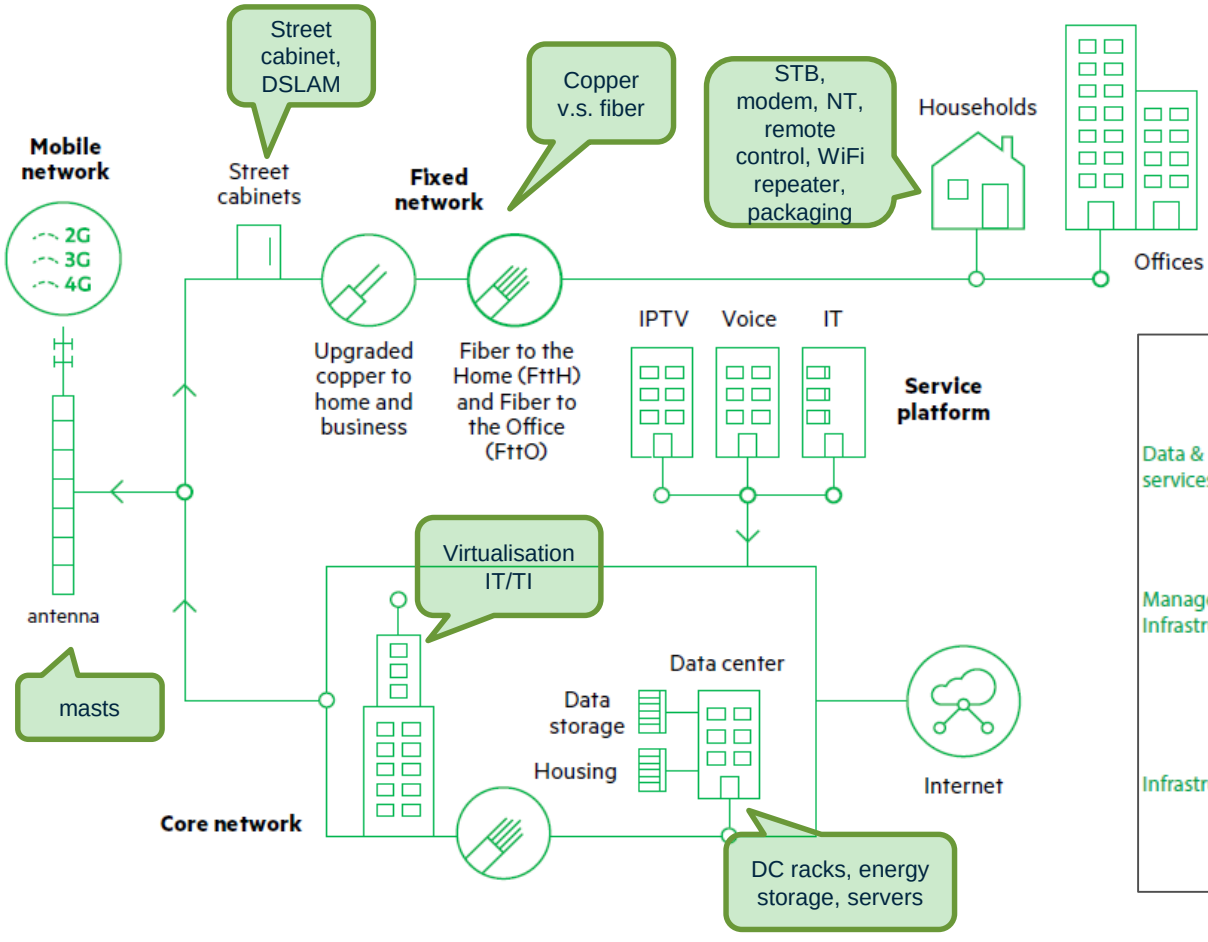
**Step 4**
Determine Mitigation Strategies



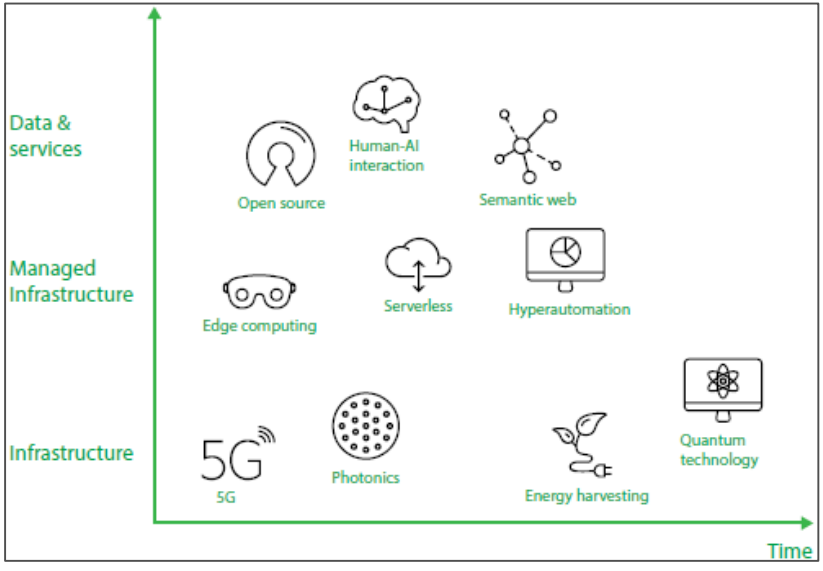


# Step 1 + 2 : Identification of Core equipment & Raw Material Content

## Close collaboration with suppliers necessary



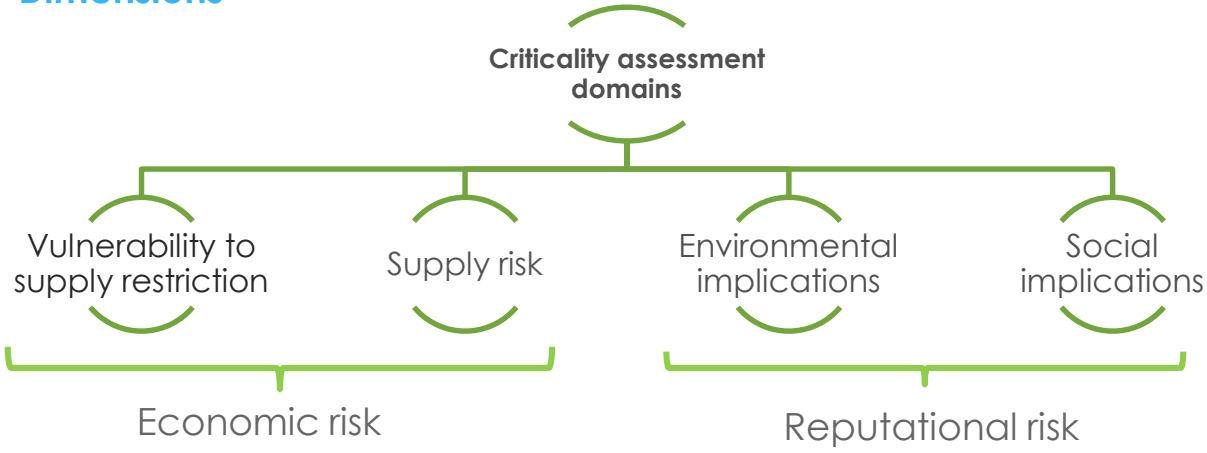

### Future Research – Strategic Importance




*KPN Technology Book 2020*

# Step 3: Criticality Assessment

## Dimensions



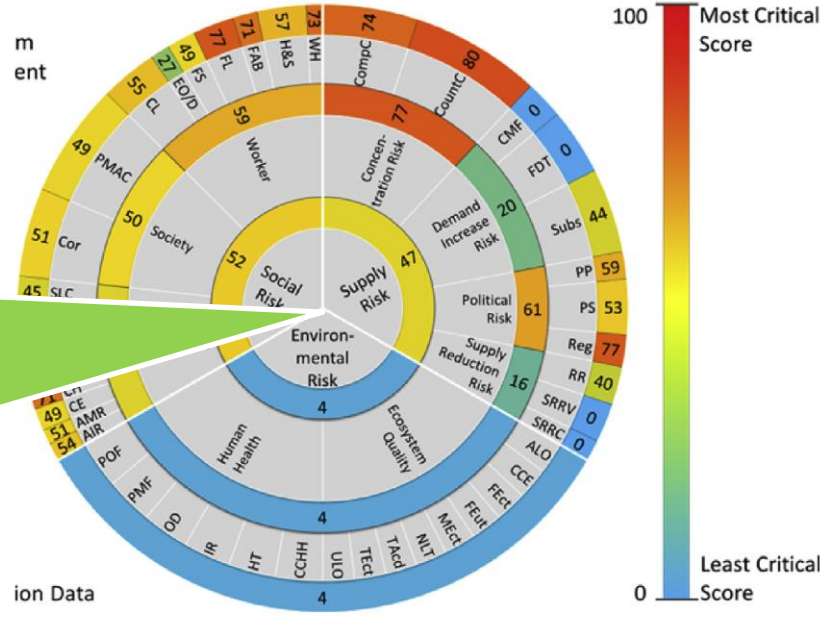

Which material should be prioritized?

Where may KPN encounter high risks?

?

Example of the Assessment of Aluminum (Kolotzek et al., 2018))

[4]



# Step 3: Criticality Assessment

## Examples based on literatures

**1 Goal & Scope Definition**

The system at risk → The objective of the assessment → Material focus

**2 Quantified Risk**

| | Vulnerability to Supply Restrictions | Supply risk | Environmental implications | Social implications |
|---|---|---|---|---|
| | Potential damage from involuntarily reduced use of materials | Likelihood of supply disruption | Damage caused by raw material extraction and likelihood of emerging reputational risk | Social hotspots on the country level. |
| **Example Indicators** | Substitutability | Country concentration | Ecosystem Quality | Local Community |
| | Product value | Depletion time | Human Health | Society |
| | Future demand | Substitutability | | Worker |
| | Strategic importance | Import dependence | | |
| | Material value | Recyclability | | |
| | Spread of utilization | Demand growth | | |

**3 Source**

| Vulnerability to Supply Restrictions | Supply risk | Environmental implications | Social implications |
|---|---|---|---|
| Helbig et al. (2016) – How to evaluate raw material vulnerability – An Overview. **[5]** | Achzet et al. (2013) – How to evaluate raw material supply risk **[6]** | Graedl et al. (2011) – Methodology on Metal Criticality Determination **[7]** | Kolotzek et al. (2018) – A company-oriented model for assessment of raw material supply risks, environmental impacts and social implications **[4]** |

# Step 4: EU Critical materials in KPN products

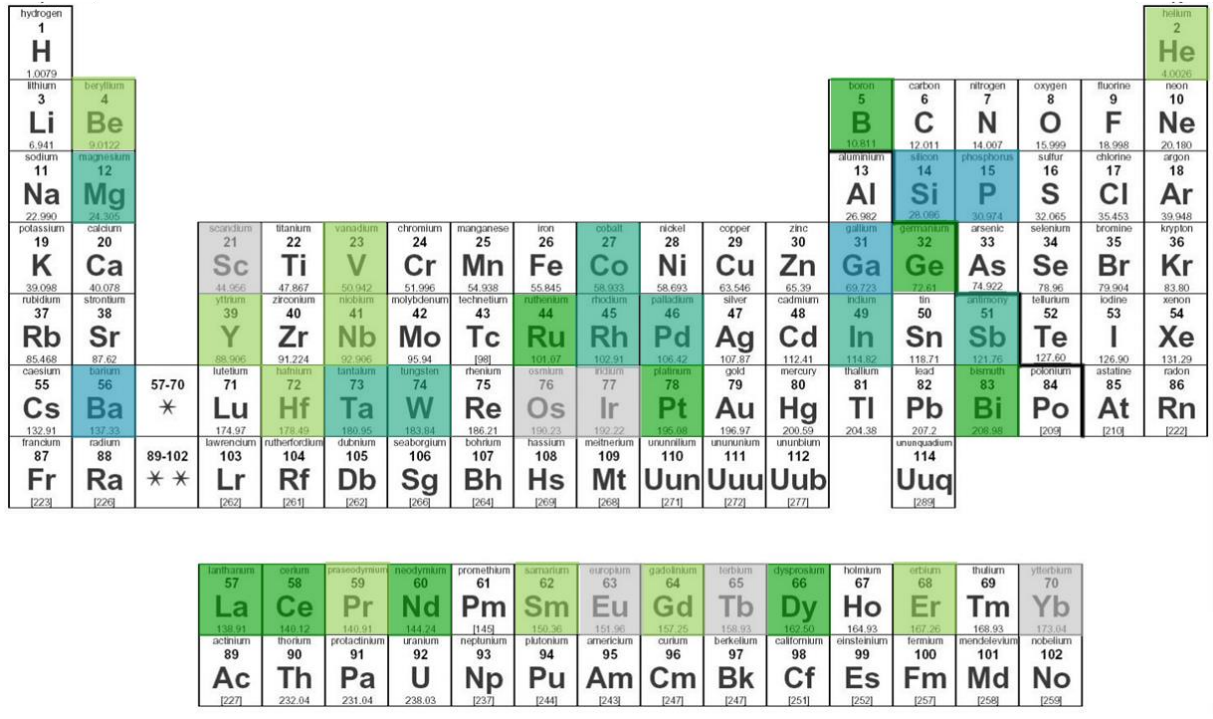
## Occurence in KPN products

Data on 4 products

Number of products the material is contained in:

1 2 3 4

on EU list




From simple PCBs ...to complex PCBs ?

**Remote Control** | **Modem** | **Core router** | **Blade Server**

# Mitigation strategies

## Example: Rhodium

**Rhodium (Rh)**

Function:
- Plating of electric contacts
- Constituent of capacitors and resistors

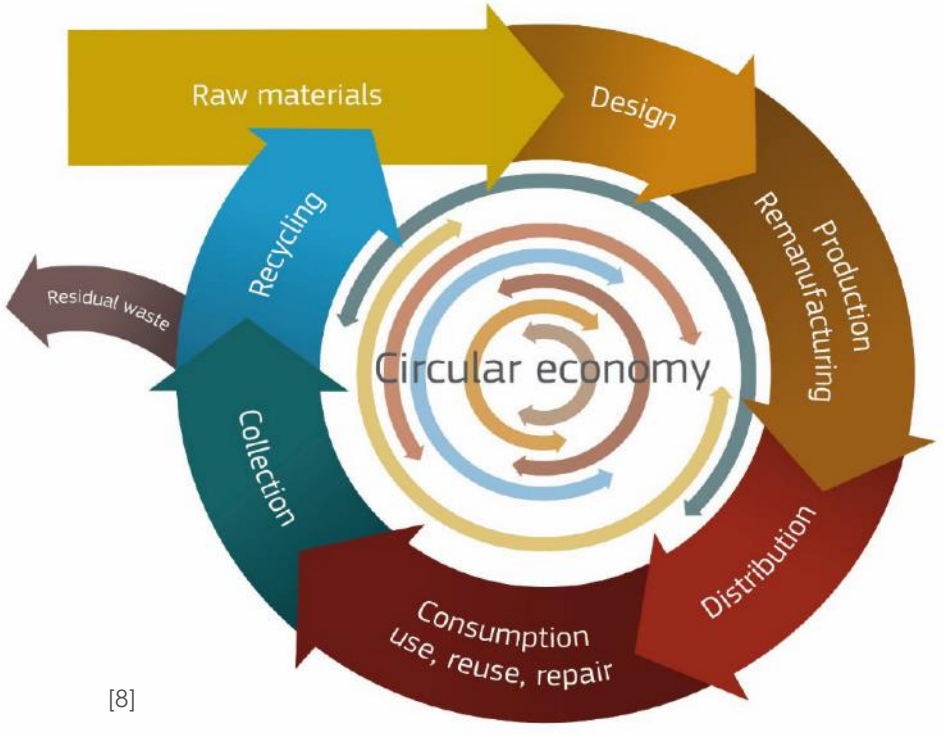
**Hotspots**

Companion metal, hardly substitutable
Political stability/regulations
80% South Africa

| Associated risk | Mitigation strategy: Internal & External | Mitigation strategy: Systemic |
|---|---|---|
| Economic risk | • Design for reuse/refurbishment/recyclability<br>• Use secondary material source<br>• Substitution to non-critical materials | • Demand-based recycling targets<br>• Research subsidies and standardization<br>• Trade agreements |
| Environmental risk<br>Social risk | • Transparency<br>• Due diligence on suppliers<br>• Sourcing CERA (CErtification of RAw Materials) certified components/materials | • Translating externalities into pricing<br>• Trade agreements incl. social and environmental conditions for goods |

# Achieving the circular use of CRMs

## Expansion of CE application from mass material to CRMs



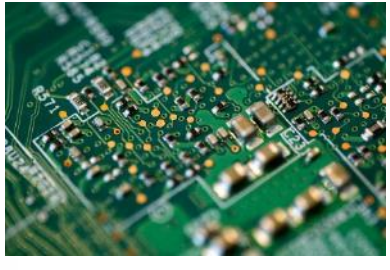

[8]

**Mass materials**

*Plastic*

*Copper*

*Aluminium*

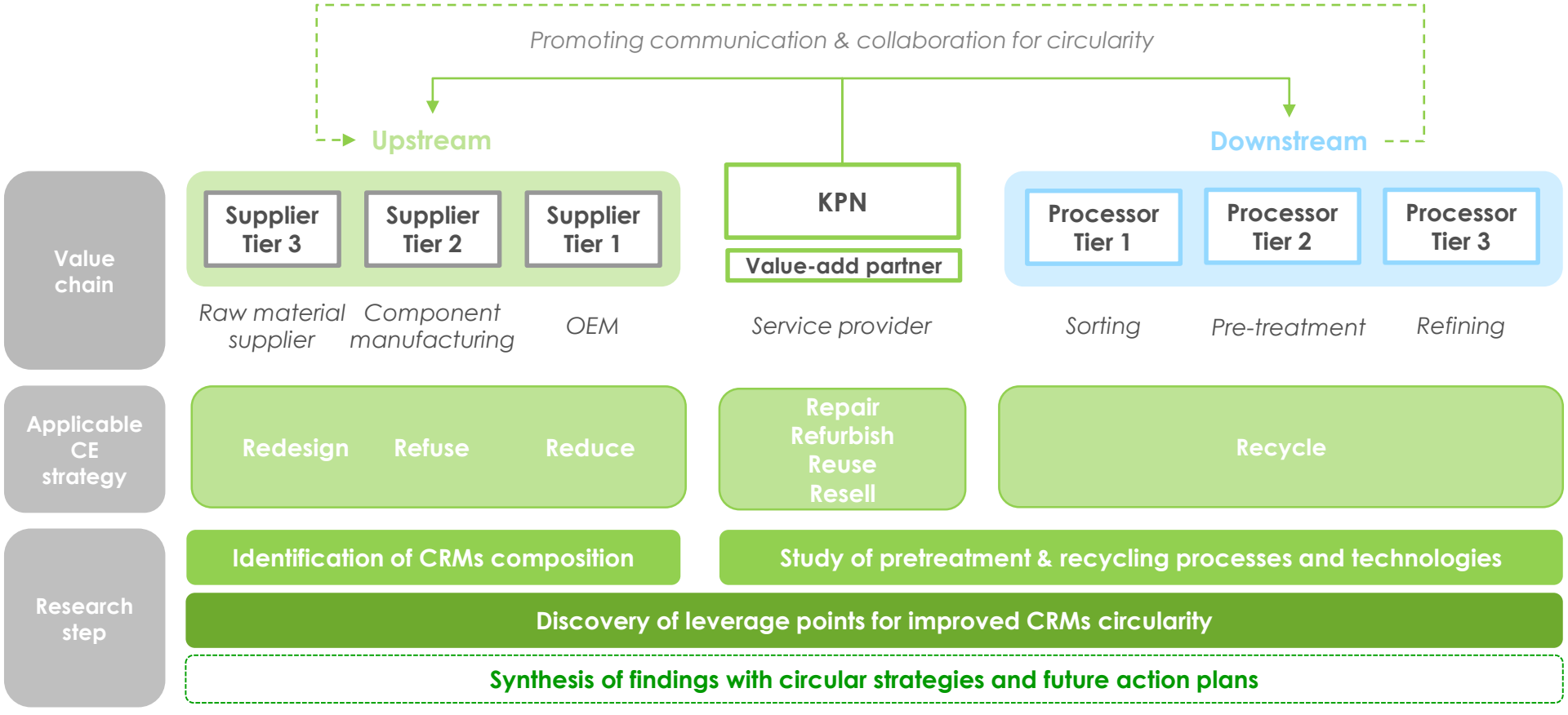


*Printed Circuit Board (PCB)* - *Component* - *CRM*

**Critical raw materials**

# Improving the circularity of CRMs in KPN's equipment

## Research plan and main concepts



# Circular strategy for CRMs

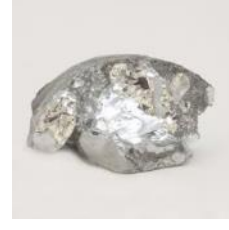
## Example of three CRMs commonly used in ICT device

*Smartphone*

*Modem*

46
**Pd**
**Palladium**
106.42

49
**In**
**Indium**
114.818



31
**Ga**
**Gallium**
69.723

# Case example: Circular strategy for three CRMs

## Product value chain of ICT equipment

### Cradle to grave value chain

| Materials production | | Product development & production | | Use | | | End of Life | |
|---|---|---|---|---|---|---|---|---|
| Raw material extraction | Material processing | Product design/development | | Purchase/ Distribution | Use | Collect | Pre-treatment | Smelting |
| | | Component manufacturing | Product manufacturing | | | | | |

# Case example: Circular strategy for three CRMs

## Product value chain with specifications on CRM contents

### Cradle to grave value chain

| Materials production | | Product development & production | | Use | | | End of Life | |
|---|---|---|---|---|---|---|---|---|
| Raw material extraction | Material processing | Product design/development | | Purchase/ Distribution | Use | Collect | Pre-treatment | Smelting |
| | | Component manufacturing | Product manufacturing | | | | | |

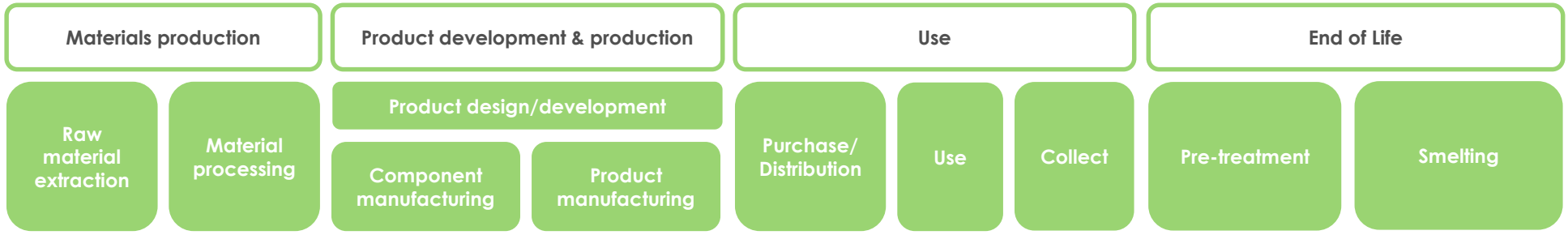
### CRMs specifications

| | | Application | Concentration in WEEE [9] | EOL treatment (Recycling rate) [9] | |
|---|---|---|---|---|---|
| Pd |  | Capacitors, ICs, electrode, and etc. | 30 – 200 ppm | Physical treatment | Pyrometallurgy (50%) |
| In |  | LCD panels, LEDs | 0.05 – 1 % | Crushing & separation | Hydrometallurgy (<1%) |
| Ga |  | LEDs, ICs | 2 – 140mg/kg(PCB)[10] | . | . |

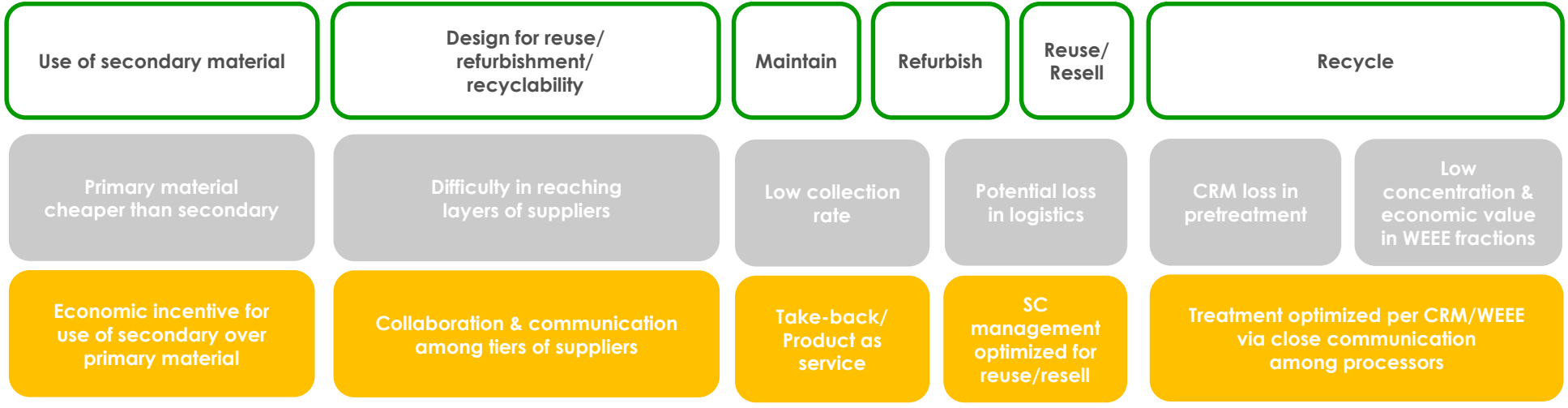
# CRMs flow throughout product value chain

## Case example of 3 CRMs

### Cradle to grave value chain




### Applicable CE strategy| Leverage points

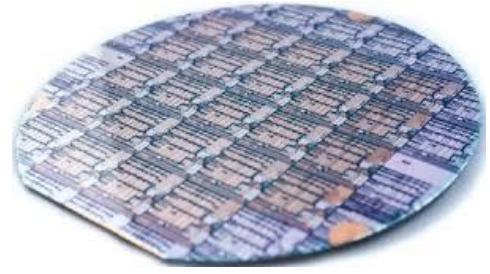


# CRMs application in other industries

## CRMs circularity: crucial topic to a wide range of industries

*Auto catalyst*

*LCD*



*Semiconductor*

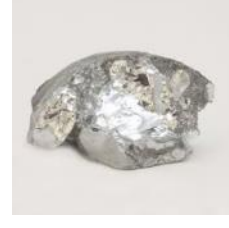
*Jewellery*

*Solar panel*

*Optoelectronic*

46
**Pd**
**Palladium**
106.42

49
**In**
**Indium**
114.818



31
**Ga**
**Gallium**
69.723

# Workshop

First please follow our instruction on the shared screen
And then enter the Miro link shared in the chat!

# Discussion

# Contact information

**Gloria Flik**

gloria.flik@kpn.com

**Yeji Park**

yeji.park@kpn.com

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