REPUBLIC OF SLOVENIA
MINISTRY OF ECONOMIC DEVELOPMENT AND TECHNOLOGY

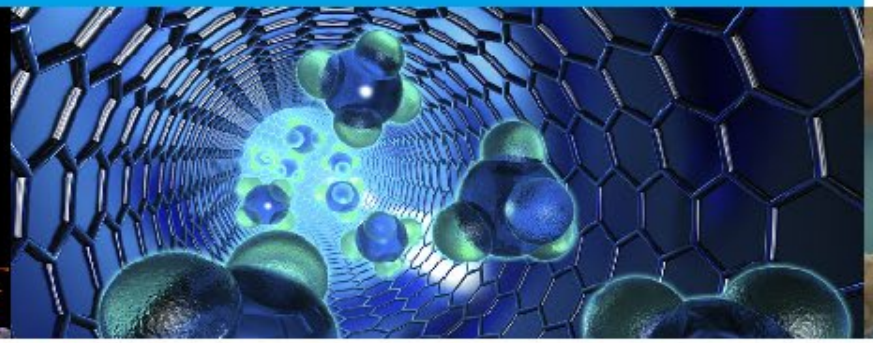
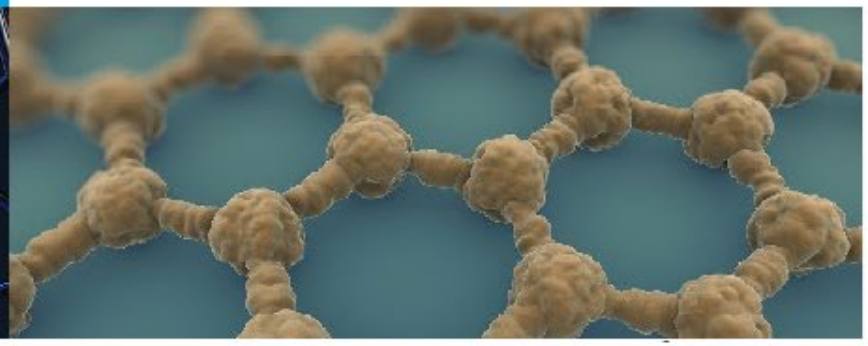
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND



Green & digital technologies for CE

RUDI PANJTAR

SRIPTOP
Strategic Research Innovation Partnership
FACTORIES OF THE FUTURE

Jožef Stefan Institute

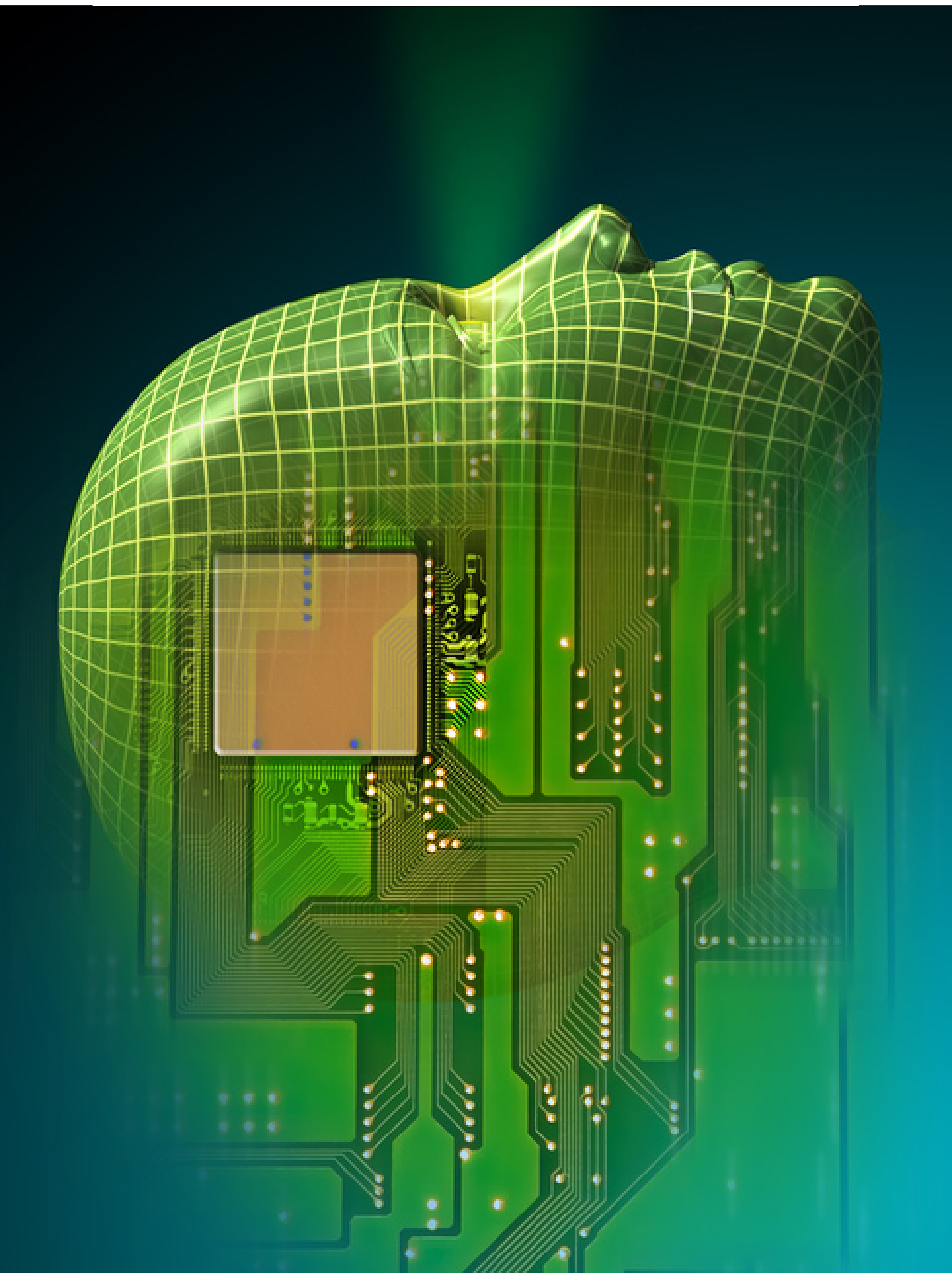
kcstv
competence centre for advanced control technologies

TEC
RAZVOJNI CENTER ORODJARSTVA SLOVENIJE
SLOVENIAN TOOL AND DIE DEVELOPMENT CENTRE

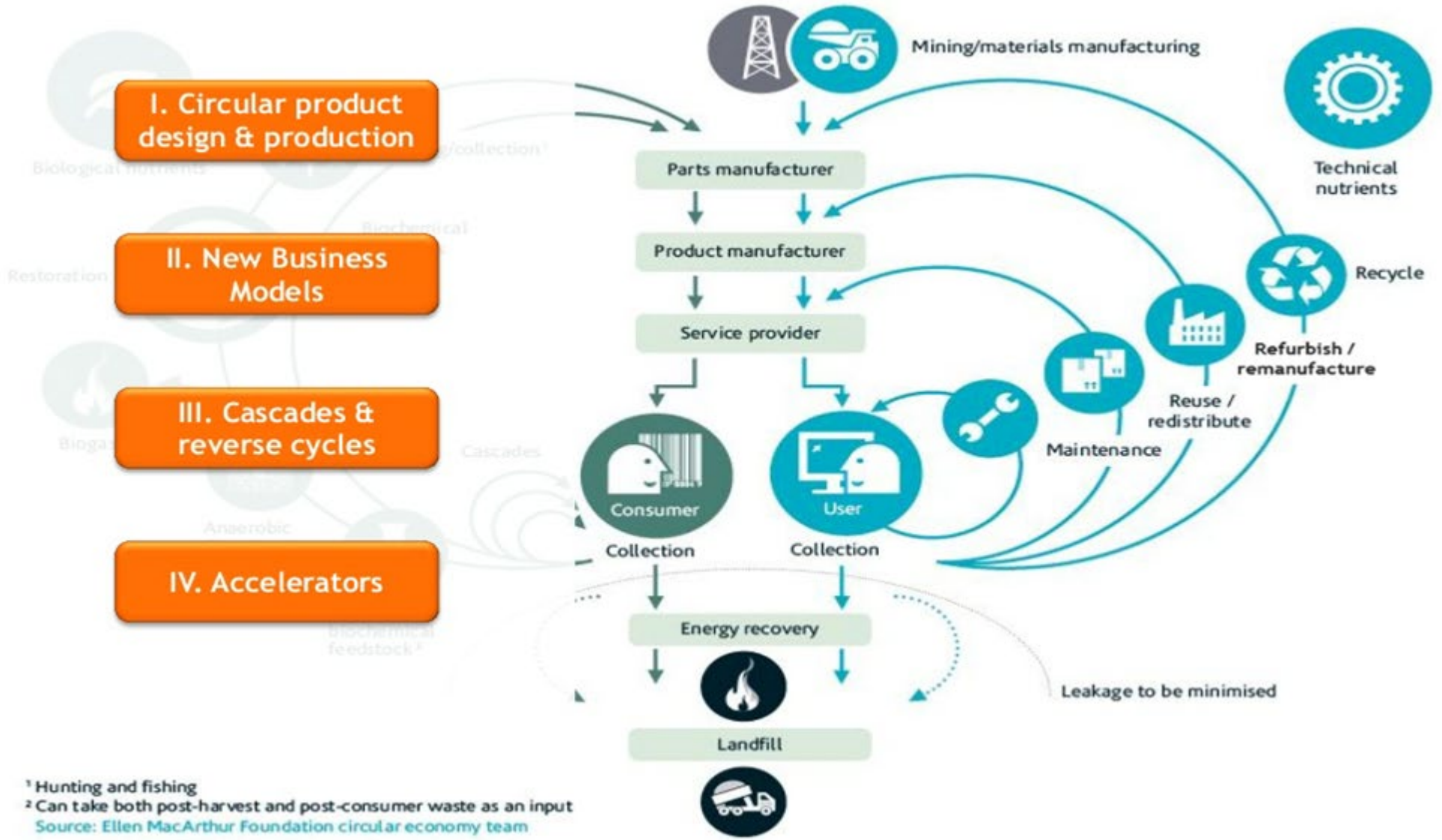
Gospodarska zbornica Slovenije

green

DIGITAL



Building blocks of Circular Economy

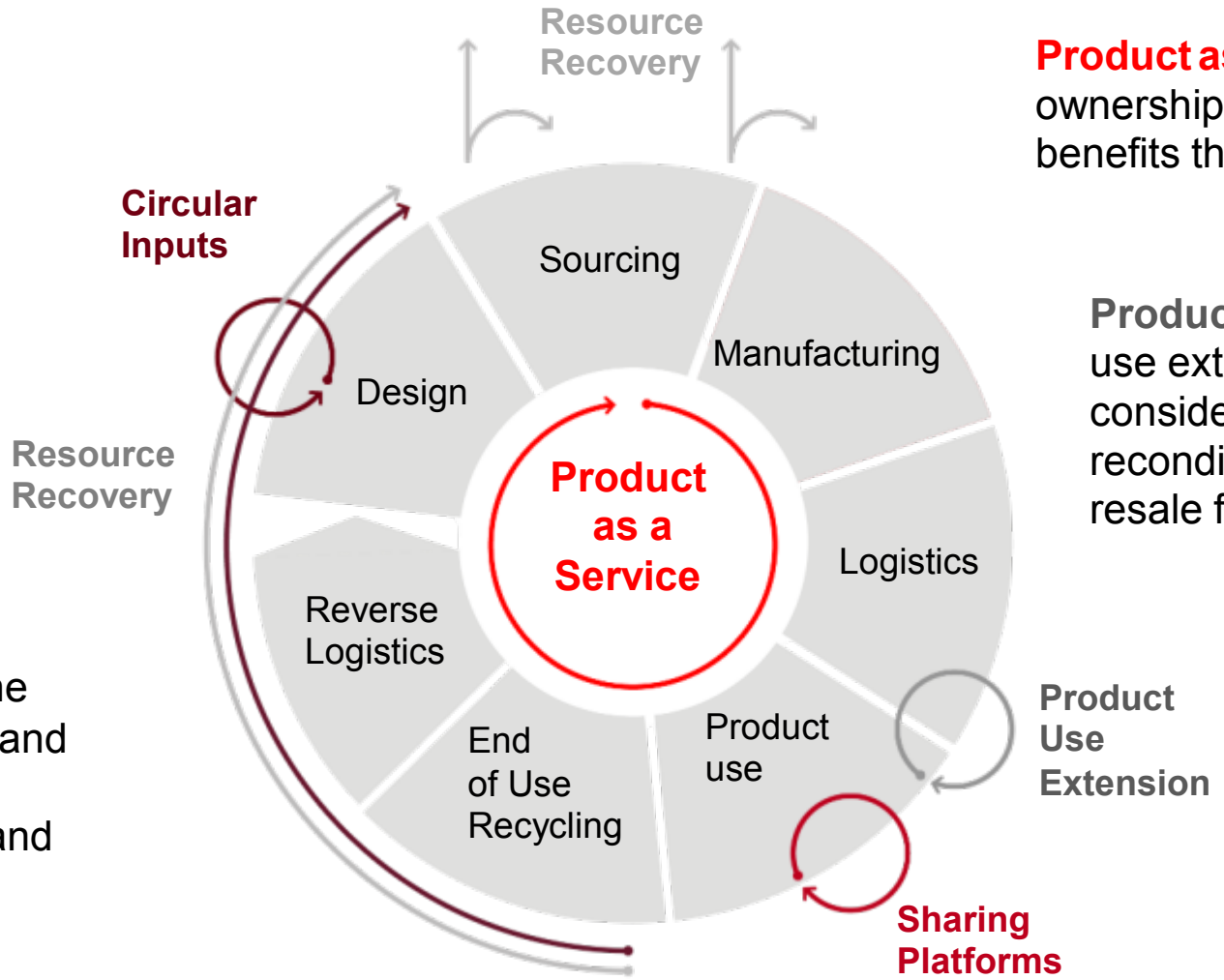


The circular business models

can be mapped across the value chain, focus on both production and consumption, and provide a proven framework for circular transformation

Circular Inputs: Using renewable sources, bio-based materials and man-made materials, that are recycled or highly recyclable, to enable partial or total elimination of waste.

Resource Recovery: Using the embedded materials or energy at the end-of-use of a product and recovering through collection, aggregation and processing.



Product as a Service: Retaining ownership of products and selling benefits through a service model.

Product Use Extension: Product's use extended through design considerations, repairs, reconditioning, upgrades and resale for second use.

Sharing Platforms: Optimizes utilization rates of products and assets through shared ownership, access and usage.

There are five key enablers

They were found through analyzing 1500+ case studies which are essential to capturing the full potential of the circular business models

CONSUMER ENGAGEMENT

Re-shape what it means to consume to support evolving customer demands and to drive new behaviors.

DESIGN

Plan for product clarity to enable longer use-cycles and end-of-use recovery.

REVERSE LOGISTICS

Create takeback loops by managing the return and recovery of products back into the value chain.

ECOSYSTEMS

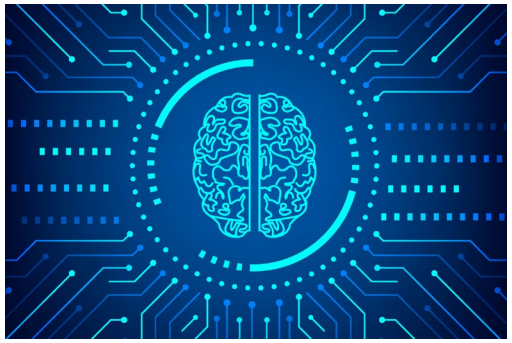
Embrace the power of external engagement and build new networks to unlock circularity at scale.

DISRUPTIVE TECHNOLOGIES

Accelerate with 4IR innovations to enable the smart use of resources and create new opportunities.

Disruptive 4IR technologies

are the single most important enabler accelerating the transition to a circular economy



DIGITAL

Technologies based on computer, electronics and communication sciences, which make use of the increasing volume of information and connectedness of physical resources.

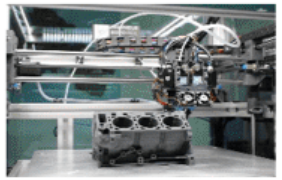
PHYSICAL

Technologies based on basic properties of materials, energy, forces of nature and their interactions.

BIOLOGICAL

Technologies based on biological aspects, including, but not limited to: biological systems and living organisms (or derivatives thereof), to make products and processes for specific uses.

17 technologies explored in the Industry 4.0 Adoption Report 2020

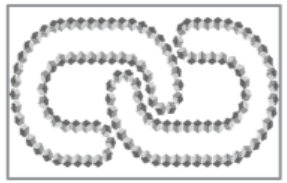
1. 
3D Printing

2. 
5G

3. 
Artificial Intelligence

4. 
Augmented Reality

5. 
Automated Guided Vehicles

6. 
Blockchain

7. 
Cloud

8. 
Cobots

9. 
Cybersecurity

10. 
Digital Twin

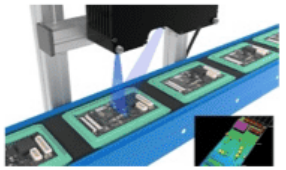
11. 
Drones

12. 
Edge Computing

13. 
IoT

14. 

IoT Platforms

15. 
Machine Vision

16. 

Quantum Computing

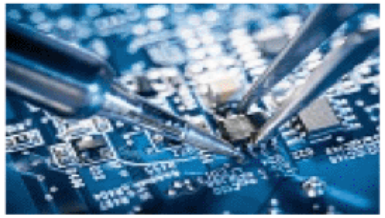
17. 
Virtual Reality

Source: IoT Analytics Research 2020

Industry 4.0 adoption by industry: automotive ahead

1

Automotive
36%

2

Comp., electronic & electric
29%

3

Metals & mining
29%

4

Process industries
29%

5

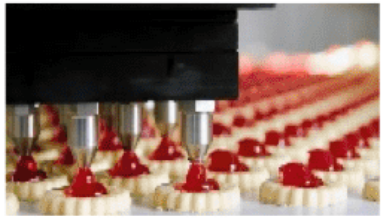
Machinery & equipment
26%

6

Energy
25%

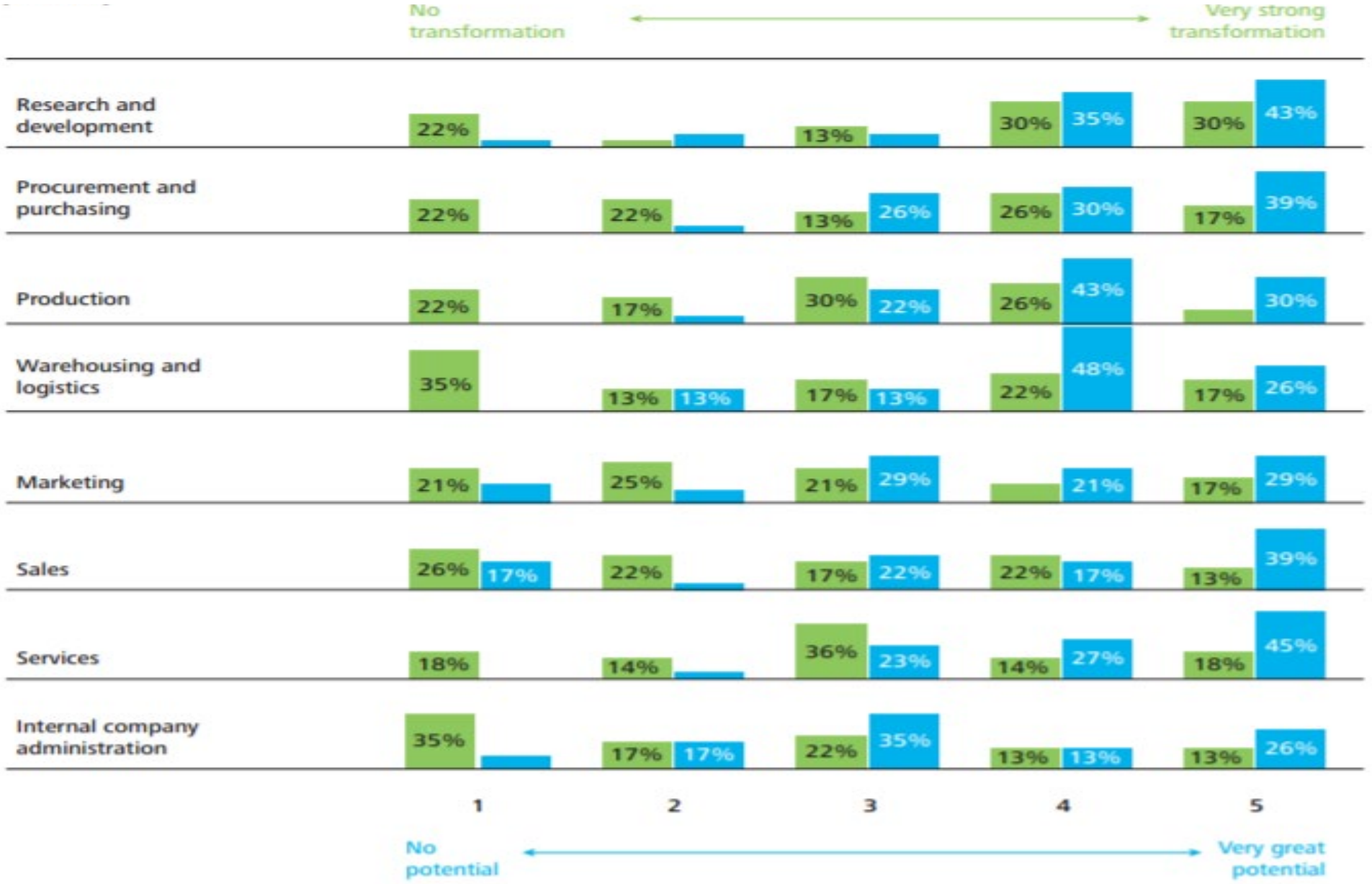
7

Other discrete industries
24%

8

Other hybrid industries
24%

Note: Percentages indicate how many respondents stated that each of 17 shortlisted technologies are either "fully rolled-out" or "extensively rolled-out" across their organizations today;
Source: IoT Analytics Research 2020; n=150

Transformation segments within company and future potential for Industry 4.0



Question: Which business segments in your company have undergone the most and the least transformation as part of industry 4.0?

Question: Which business segments within your company have the greatest potential to benefit from the digital transformation to industry 4.0?

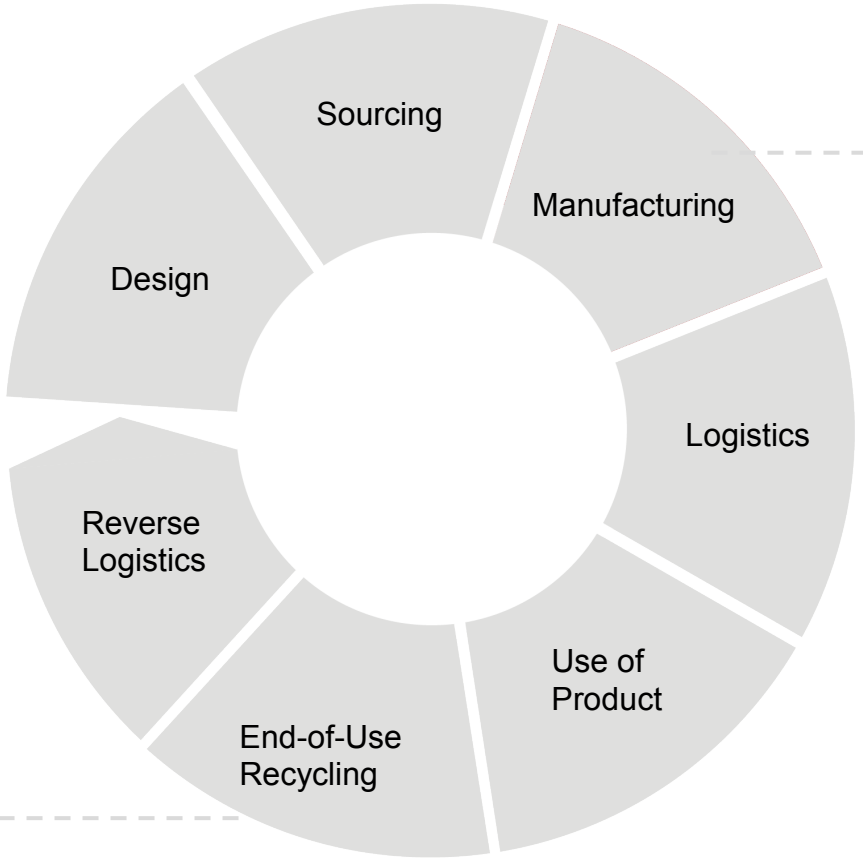
Source:https://www2.deloitte.com/content/dam/Deloitte/ch/Documents/manufacturing/ch-en-manufacturing-industry-4-0-24102014.pdf

The most competitive businesses deploy combinations of technologies to achieve the best performance

Liam, Apple's iPhone disassembly robot, has 29 arms and is capable of dismantling a discarded iPhone in 11 seconds, and separating its component parts into usable materials, capturing the value from previously discarded resources at an unprecedented rate. To date, Apple has captured 61 million pounds of material that is reusable in future products, including 2,204 pounds of gold, to a value of $40 million.

Machine Vision

Robotics



Lorenz
Deutsche Wasserzähler

Jurney from linear manufacturer to data supplier. Circular design : modular design, adaptive elektronics, lead free brass housing.
100% reuse circular model with service bussines model..

Robotics

IOT

Data Analytics

Logistic

Cross-cutting themes are driving the circular transition of industries

- The need to sustainably **meet challenges of growing** demand – to do more with less, while reducing negative impact – is being felt across industries (e.g. produce more food with less deforestation).

- Policymakers are targeting industries with **regulations focused on accelerating transition** (e.g. regulations focused on appliance recovery and recycling).

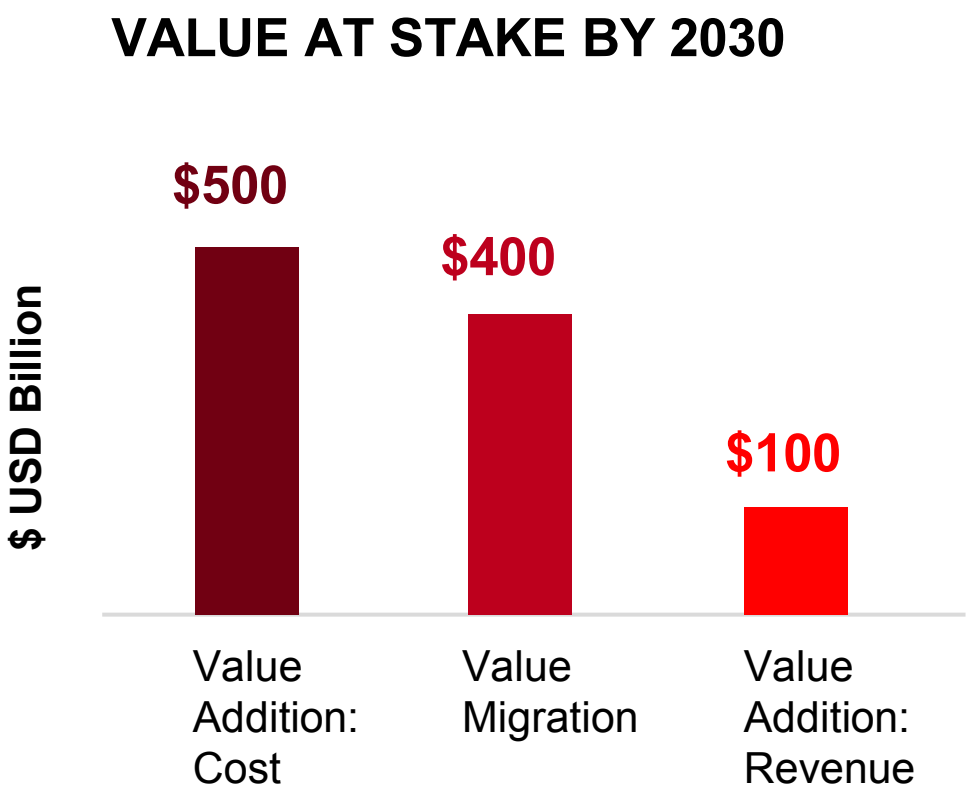
- Public awareness of waste-related issues (e.g. plastics, 'fast fashion') is driving **consumer pressure on both B2C and B2B industries** – from FMCG to chemicals and mining – to address their concerns through circular solutions.

- **Technology advancements** are happening across industries, enabling new circular opportunities, from machine vision to reduce food waste, to pressurized CO_2 to eliminate water from the textile dyeing process.

- **Opportunities for industry cross-over and transformation** (e.g. at the intersection of end-of-use recovery and circular inputs) are growing, as technology and infrastructure unlock new possibilities.

Industries CAN generate FINANCIAL value

and maintain or improve market share through circular opportunities



TYPES OF CIRCULAR VALUE

Value addition through reducing costs, such as through designing **leaner products**, sourcing **circular materials**, improving forecasting to **reduce unsold product** or **producing more efficiently.**

Value migration between industry players or from one type of product/service to another, driven by **growth in alternative products** (e.g. EVs in automotive; renewables in utilities) and **refurbished/second-use markets** (e.g. fashion, electronics devices).

Value addition through new sources of revenue, such as **circular business models**, brand differentiation and **market share** or **premium pricing** in some industries.

Each industry is at a different stage

in their circular transition with unique waste challenges, but there is potential to realize significant value through large-scale adoption

Oil and Gas

$80 bn

Household

$5 bn

Electricity

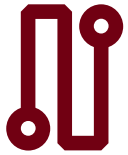
$300 bn

ME&I

$135 bn

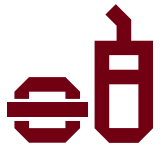
Devices/ICT

$30 bn



Personal Mobility

$385 bn



FMCG
Fast-moving consumer goods

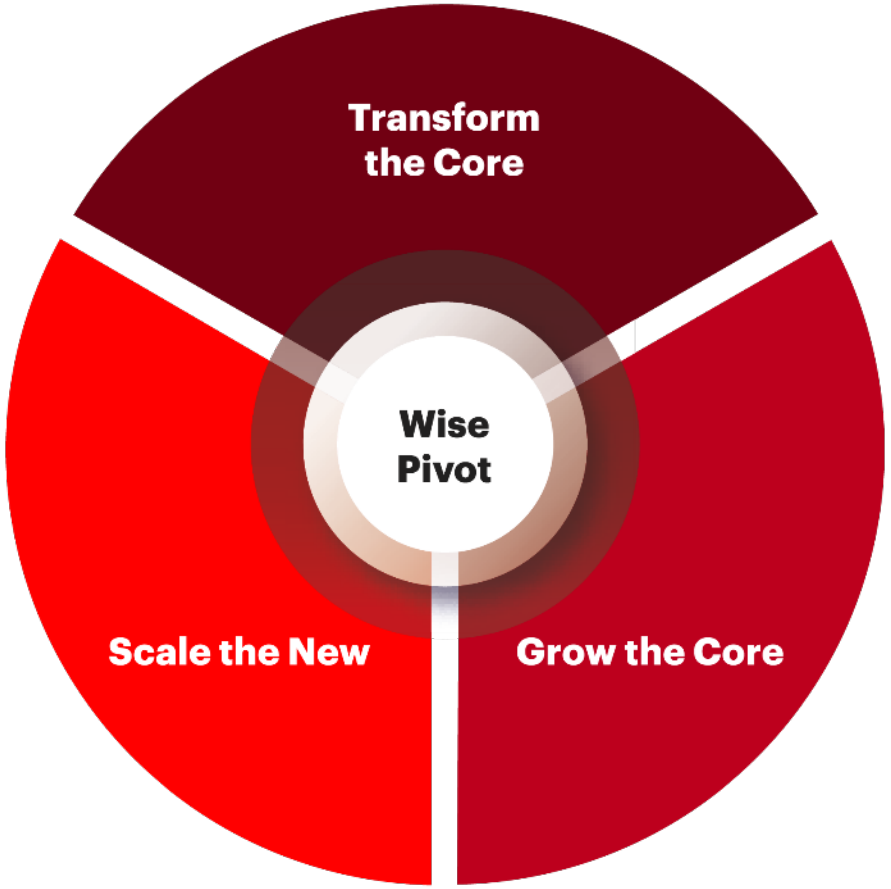
$65 bn

Fashion

$55 bn

*Average industry value at stake by 2030

The wise pivot provides a roadmap for the transition to a circular business



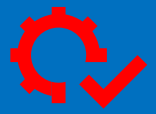
01 **Transform the existing value chain** to remove waste, reduce value erosion and drive up investment capacity.

02 **Grow the core business** organically with circular offerings embedded to sustain fuel for investments.

03 **Invest in disruptive growth opportunities** that will take organizations' circular journeys to the next level.

Organizations must mature across

FOUR fundamental dimensions in order to successfully pivot to circularity



OPERATIONS

Addressing the value lost through the operations and by-products of business processes across energy, emissions, water and waste.

PRODUCTS & SERVICES

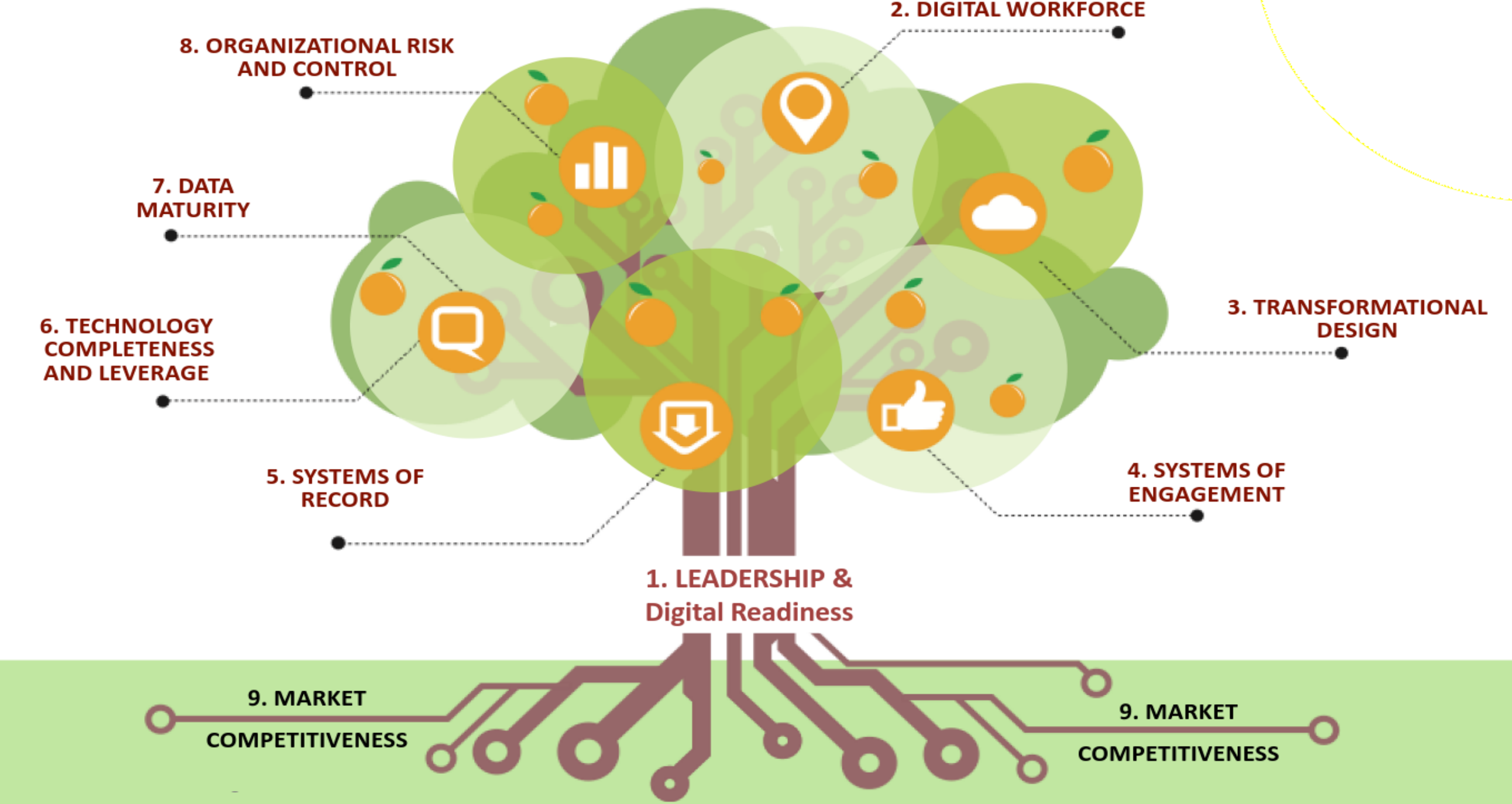
Rethinking the design, lifecycle and end-of-use of a product or service to optimize usage, eliminate waste and close product loops.

CULTURE & ORGANIZATION

Embedding circular principles into the fabric of an organization through redefined working practices, policies and procedures.

ECOSYSTEM

Collaborating and partnering with public- and private-sector actors to create an enabling environment for collective transformation.


2. DIGITAL WORKFORCE
8. ORGANIZATIONAL RISK AND CONTROL
7. DATA MATURITY
6. TECHNOLOGY COMPLETENESS AND LEVERAGE
3. TRANSFORMATIONAL DESIGN
5. SYSTEMS OF RECORD
4. SYSTEMS OF ENGAGEMENT
1. LEADERSHIP & Digital Readiness
9. MARKET COMPETITIVENESS
9. MARKET COMPETITIVENESS

The transition to a circular business models has different financial implications

Circular aspect	Conventional business models	New business models
Value added	Circular business models could produce products or services that customers value higher.	Increased pricing power, revenues or competitive advantage.
Pay per use	Implementing a pay per use scheme increases the demand for working capital in comparison to a 'sell after production' business model.	Increased working capital demand, spreading of cash flows over time, increased costs for receivables management and possibly increased credit risk on clients.
Cost of materials / production	Increased return flows of used products or materials can lower production costs and the need for working capital if virgin materials are more expensive to source.	Possible lower working capital demand and lower production costs can boost profit margins.
Ownership	If producers retain ownership of products during their life cycle it provides them with strong incentives to look after these products, maintain them well and make them valuable at the end of life. From a circular point of view this has strong advantages but it comes with increased financial obligations.	Balance sheet extension increases capital demand. Ownership also raises the question how to value goods on the balance sheet (valuation).
Asset tracking	Tracking sold products and services in order to perform maintenance over the life span or take them back at the end of the lifecycle requires knowledge about the whereabouts and conditions of the so called 'installed base'. Innovations like the 'internet of things' make easy tracking possible but require investments.	Increased R&D costs or investments in tracking and tracing devices.
Return flow	The return flow of products might be costly to handle.	Increased transportation and handling costs.
Supply Chain Finance	Supply chain finance lowers working capital costs in the supply chain.	Lower working capital costs and better cash flow management

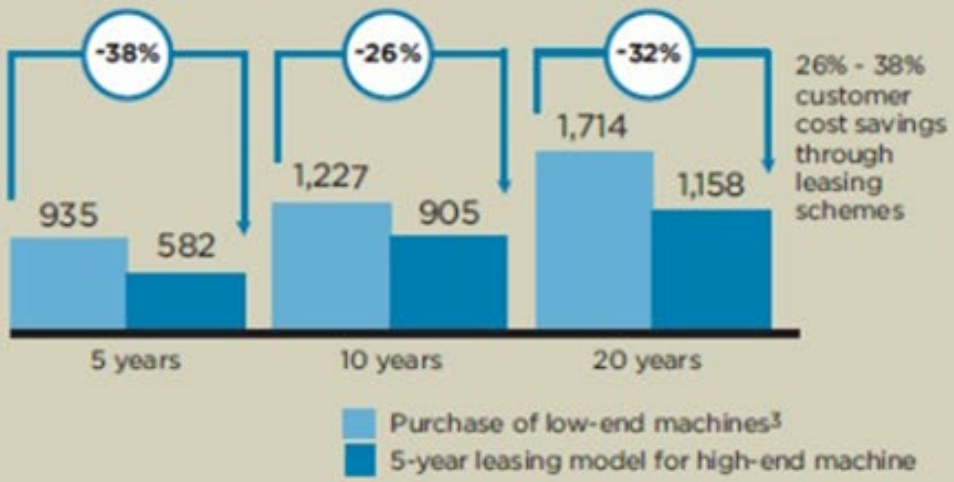
Financing technology & Circular business model

Both user and manufacturer profit from new business models

User

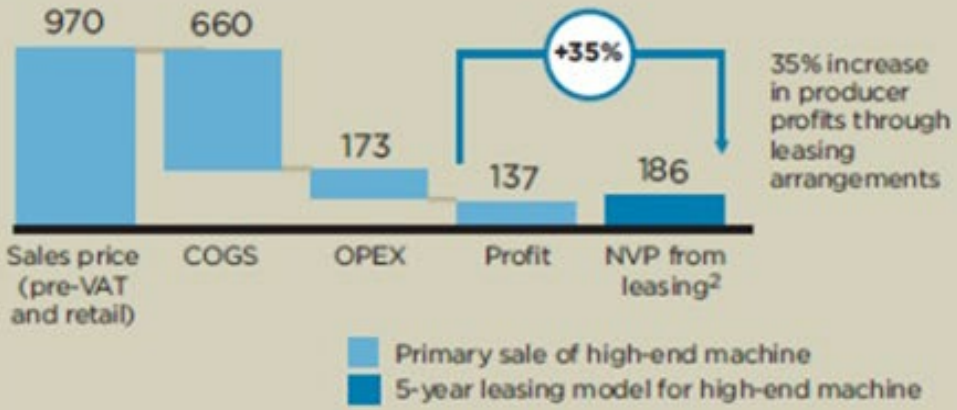
FIGURE 13
Washing machines: Leasing durable machines can be beneficial for both parties

Customer's net present costs[1] of washing machine usage over time[2]
USD per customer



Manufacturer

-end machine manufacturer's profits primary sale and leasing
per machine



1 Here, net present cost is the sum of a customer's discounted cash outflows for washing machine purchases over a specific time horizon (5, 10, and 20 years)
2 Applied 8% discount rate
3 Low-end washing machines with a lifetime of 2,000 cycles and cost around USD 540

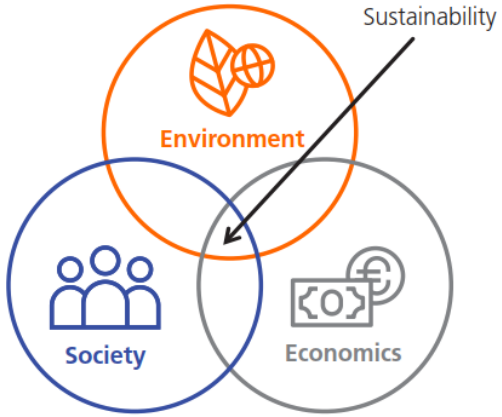
+ savings per machine: material (about 108 kg. steel & energy (2,5 ton CO2)
+ high-end machines are well suited for refurbishment and remanufacturing
Small fact: more households own a washing machine than a car

Source: Allen McArctur Fundation

From linear to circular financial wisdom

Financers can facilitate the transition towards a circular economy in many ways:

- Get familiar with circular business models and their financial implications.
- Put the right incentives in place.
- Cash flow should be top of mind.
- Incorporate ‘circular value’ of resources in the financial business case.
- Develop leasing arrangements for products with circular potential.
- The end user must have an incentive to participate – important !
- Incorporate the characteristics of circularity in risk and pricing models.
- Offer services that help clients build circular business models.
- Other:
  - *By developing knowledge on and gaining experience with new pricing tools that incorporates environmental and social costs and benefits in the profit and loss statement of a business. In doing so the ‘total cost’ of the goods and services to the society become visible.*
  - *By partnering with equity providers if the risk return profile of the circular business case does not match debt finance.*
  - *By partnering with crowdfunding platforms if the circular business case involves the community.*
  - *By acting as a launch customer with regard to circular sourcing and procurement.*



Investors and policymakers must help remove barriers to support organizations in the global transition

by targeting new approaches which overcome linear structures and systems

INVESTORS

- **Reevaluating** **measurements** of **financial risk**
- **Adapting** the **corporate finance toolkit"** [1]
- **Mobilizing** the required capital, **$3.9tn** a year in developing countries alone [2]

POLICYMAKERS

- **Steering** regulations towards practices that **yield** the **highest value** of waste & scarce materials
- **Incentivizing** **circular behavior** through **taxation**
- **Investing** in **infrastructure** to **recover & recycle** materials and **integrate** back into production
- **Redefining** **waste definitions** to avoid discarding material with **unlocked value**
- **Refining** product **quality** and **safety regulation** to reduce limits on **product reuse**

[1] Katherine Garrett-Cox, CEO of Gulf International Bank (UK)
[2] UNCTAD, "Promoting investment in the sustainable development goals," 2018,

WE DARE MIGHTY THINGS!

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FACTORIES OF THE FUTURE

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Gradniki, orodja in sistemi za
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Thank you for your attention!

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