

27.03.2023

Digital technologies and the Circular Economy

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GOFORE

Lecture contents

- Introduction
 - Who am I?
 - What is Gofore?
- What are digital technologies (DTs)?
- How have DTs changed the way businesses operate?
- How do DTs enable circular business models?
- Case examples
- The future skills of a sustainability consultant



Who am I?

- PhD researcher at Aalto University School of Business
- Sustainability Consultant at Gofore
 - ESG & Sustainability data
 - Technology advisory, management consulting, service & business design
 - Change management

Passion: solving sustainability problems

- How to use digitalization as a tool for advancing sustainability
- Circular business models and ecosystems



My personal vision

Technology



Human sciences



- ✓ Interdisciplinary team
- ✓ Designing sustainable systems
- ✓ Solving complex problems



Design



Business

My journey to sustainability consulting

GOFORE

BearingPoint®

Creative
Sustainability



A! Aalto University
School of Business

DEMOS
HELSINKI / tietoevry



 UNIVERSITY
OF TAMPERE

2011

2015

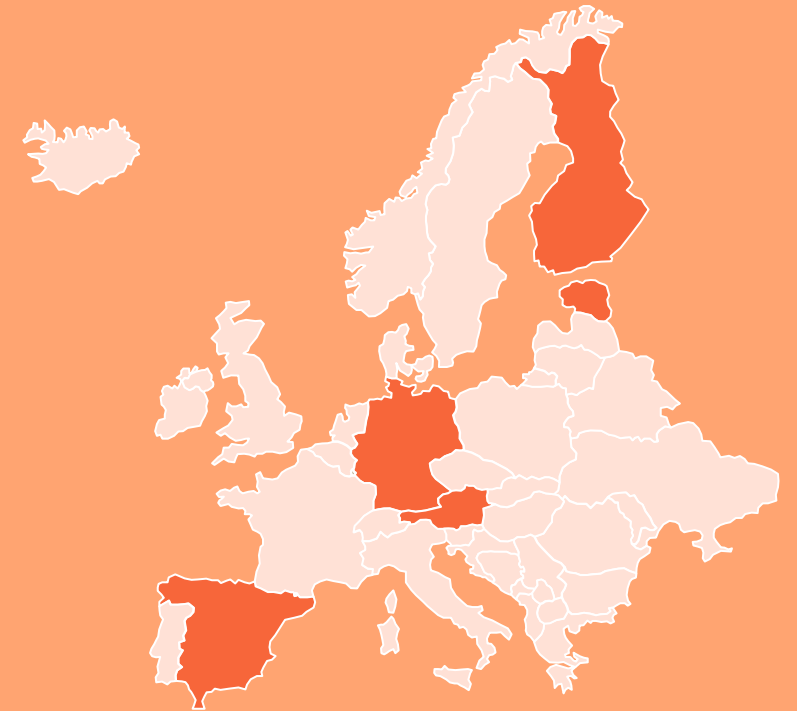
2017

2020

2022

What is Gofore?

With our technology, business and design expertise, we bring together ambitious businesses and societies to thrive in a digital age that's sustainable, functional and mutually successful.



1300

GOFOREANS

150

MEUR REVENUE 2022

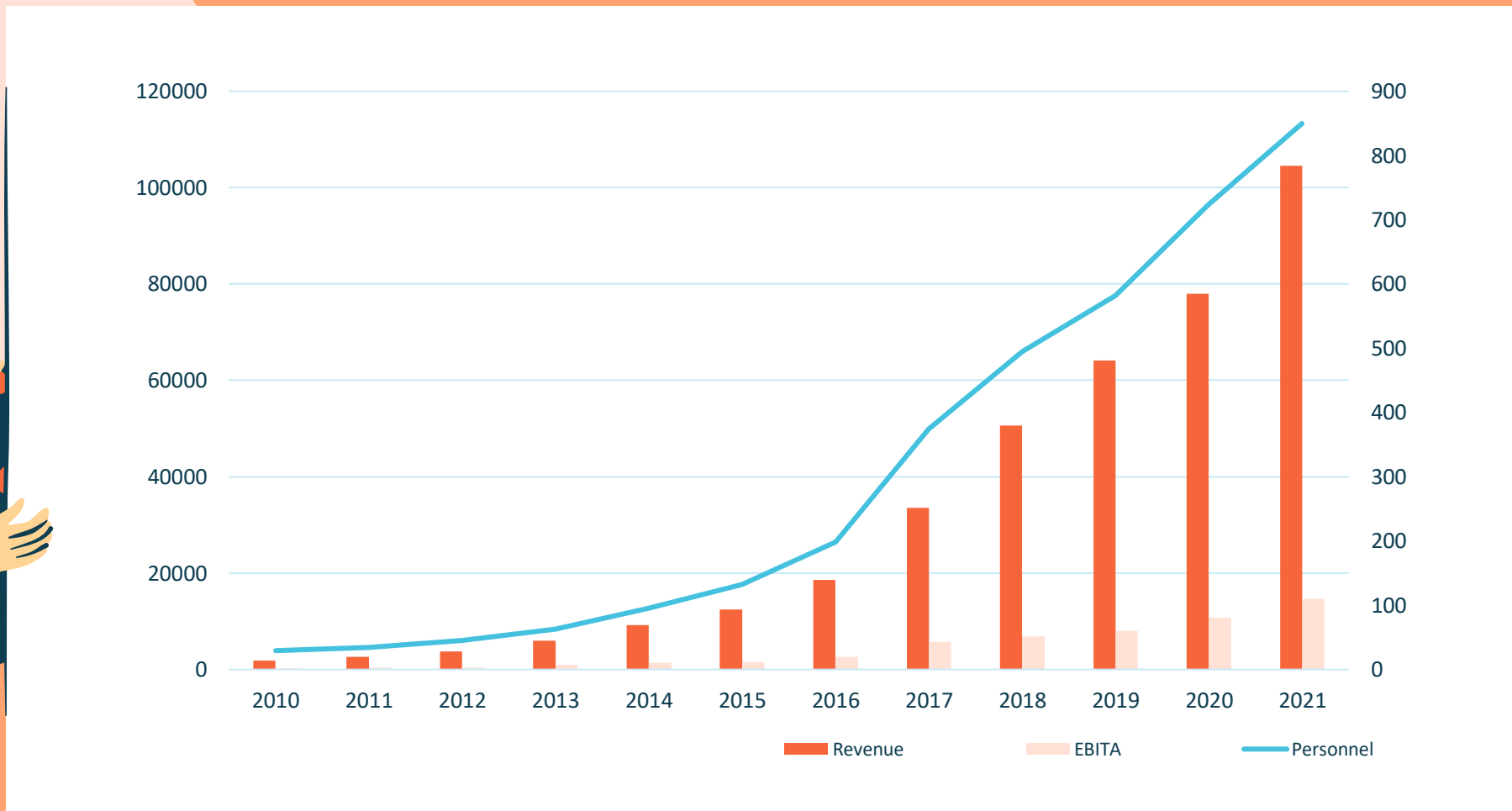
21

YEARS IN BUSINESS

19

OFFICES IN EUROPE

Growing and profitable



As pioneers in ethical digital transformation, we have a responsibility to shape the future right way

Positive impact brings rewards for business, people and the planet

We consider potential projects and partnerships through three lenses:

- Is it good for our people
- Does it meet our ethical standards
- Does it support our strategy of making a positive impact

It's about equality, accessibility and sustainability

We treat all people and the planet we live in with respect and care – making sure we're always mindful of these aspects in our daily work.

We use data & tech responsibly

Technology is an exciting enabler of many great things, but ignorance or carelessness of its pitfalls can have serious consequences. We won't allow that, not on our watch.



Our Advisory Services are extensive and they come highly recommended by our clients

270+

Management and digital transformation consultants with multi-disciplinary skills

500+

Successful engagements in the past 3 years alone and many more on-going

64%

Of the largest Finnish companies are already our clients (Top-50 list in 2021)

52_{NPS}

Our clients recommend our people and services highly (April 2022)



Metso:Outotec



**aimo
park**

elisa

Meaningful progress comes from a place of trust and close cooperation - together achieving more clarity, smarter ways of working and improved performance.

PONSSE



+ KEMPOWER

e-on

VOITH



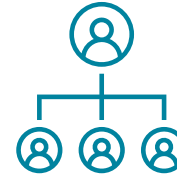
Observations



Sustainability is finally becoming a business imperative



Increasing demand for sustainability from all stakeholders



Sustainability is becoming more integrated across companies' functions



Companies are launching "eco-portfolios"

Digitalisation can enable and accelerate sustainability



- Digital tools and technologies can help organisations transform their operations and design more intelligent, sustainable products and services
- Creating a connected, data-driven and digital enterprise enables tracking and monitoring sustainability and finding more sustainable ways to create shared value
- Both digitalisation and sustainability transformation require a holistic approach and integrating various perspectives – and this is where we can help

What are digital technologies?

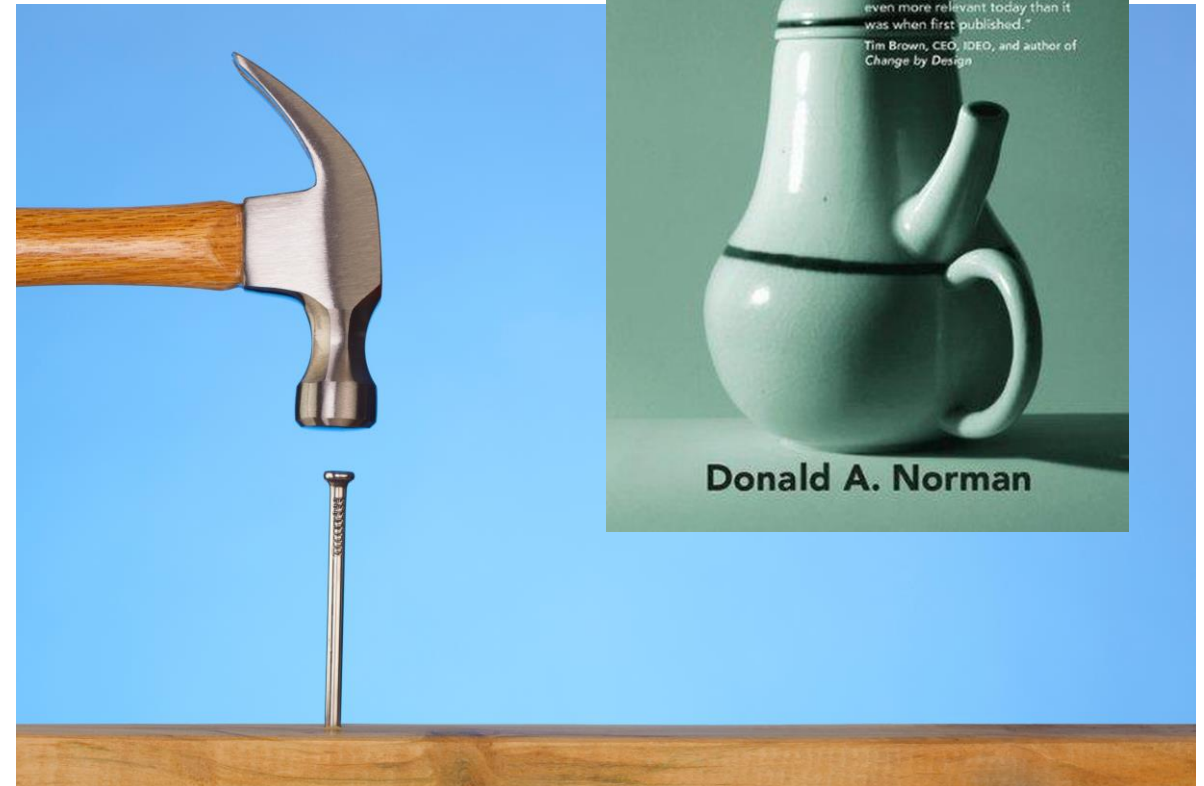
Technology

Technology = a manner of accomplishing a task especially using technical processes, methods, or knowledge

(Merriam Webster)

Knowledge = knowing how to achieve a goal in a repeatable, step by step manner

The design of a technology contains knowledge about how to achieve goal. A hammer has knowledge about how to drive nails into planks.



Analog technology

Analog = representing signals in a physical form (e.g., vinyl record uses physical grooves to represent audio data)

(Merriam Webster)

Analog technologies = technology that stores, processes, and transmits information (signals) in an analog format.



Digital technology

“Digital format = representing signals using binary digits, or bits (1s and 0s), which can be interpreted by electronic devices.”

(Merriam Webster)

Digital technologies = technology that stores, processes, and transmits information (signals) in a digital format.



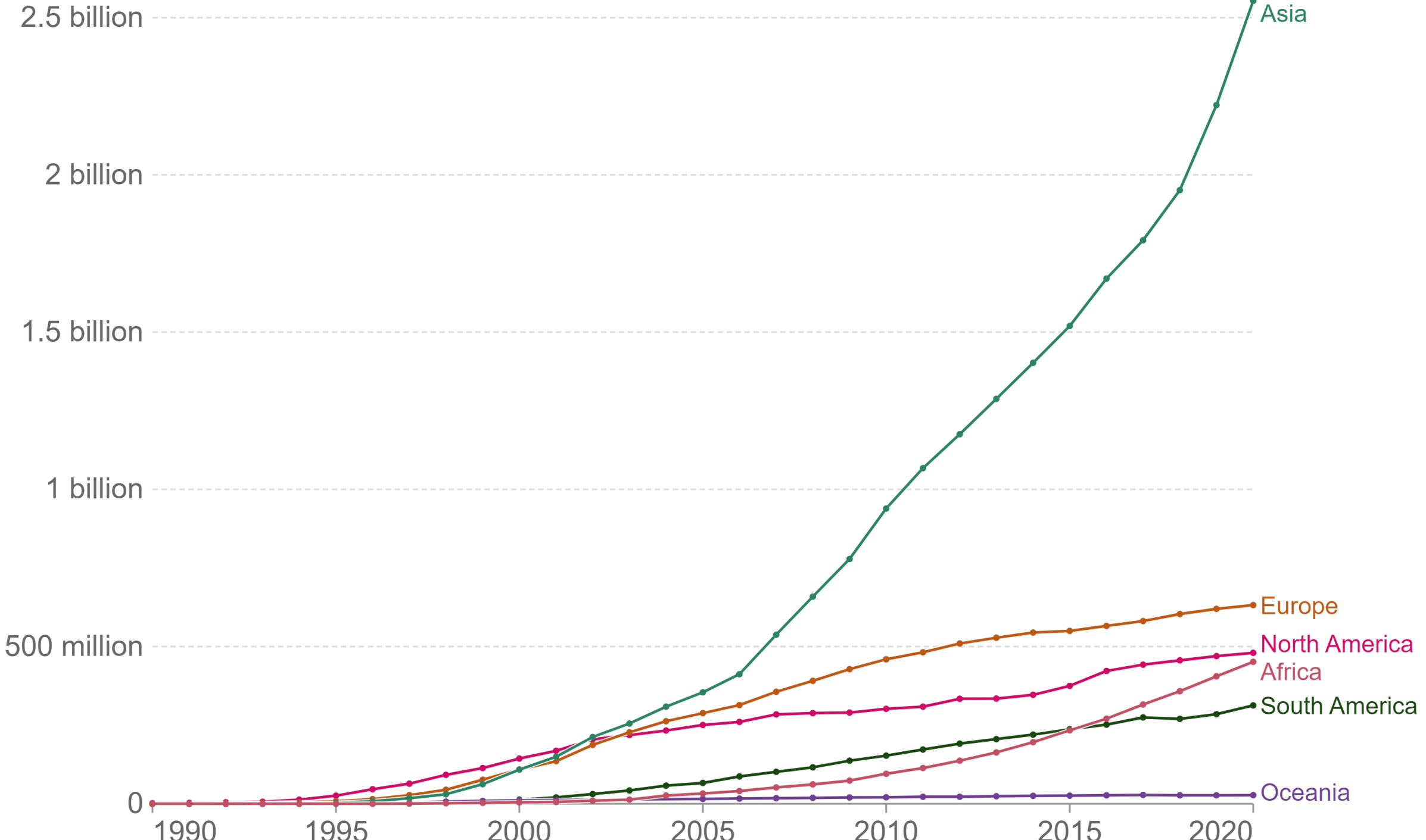
Key concepts

Concept	Definition	In other words	Examples	Source
Digitization	“The encoding of analog information into digital format. Digitization makes physical products programmable, addressable, sensible, communicable, memorable, traceable and associable”	Turning something that is in analog format into digital format	<ul style="list-style-type: none"> • Changing from printed text documents to electronic files • Sending email instead of paper mail 	Yoo et al., 2010: 725
Digitalization	“Strategic transformation through organizational changes that are implemented with digitization projects , with the end goal of enabling major business improvements”	Applying digitization at larger scale	<ul style="list-style-type: none"> • Using Enterprise Resource Planning (ERP) software to digitize a business process • Installing computers to automobiles 	Warner & Wäger, 2019:
Digital transformation	“Digital transformation is concerned with the changes digital technologies can bring about in a company’s business model , which result in changed products or organizational structures or in the automation of processes ”	Changing how a business works at a fundamental level	<ul style="list-style-type: none"> • Uber: creating a digital platform to match taxi drivers with customers • Netflix: replacing brick and mortar movie rentals with streaming services 	Hess et al., 2016: 124

Digitization & Digitalization began in the 1960s

- Early computers were used in the military, e.g., radars
- First computers were large mainframes and often required an entire room to house them
 - Used by universities, large corporations, government agencies, and other large institutions
- Personal computers introduced in the 1970s. John Blankenbaker's Kenbak-1 considered the first PC
- In 1969, 4 computers connected to ARPAnet
- By late 1970s, various local networks across the globe
- In 1981, DARPA published the finalized specs to TCP/IP -> virtual handshake allowed connecting smaller networks to a global network and sending messages and files globally
- In 1991, World Wide Web introduced





Digital technologies have transformed business and society

- Most organizations today use some digital technologies to support their key processes and tasks
- Examples of modern enterprise software
 - Customer Relationship Management (CRM)
 - Enterprise Resource Planning (ERP)
 - Supply Chain Management (SCM)
 - Patient databases
- Increasingly delivered via the internet
- Digital platforms transformed the way we interact and who we interact with
- Completely new business models have emerged
- Huge amounts of data is generated, collected, and analyzed every day



Data is the key

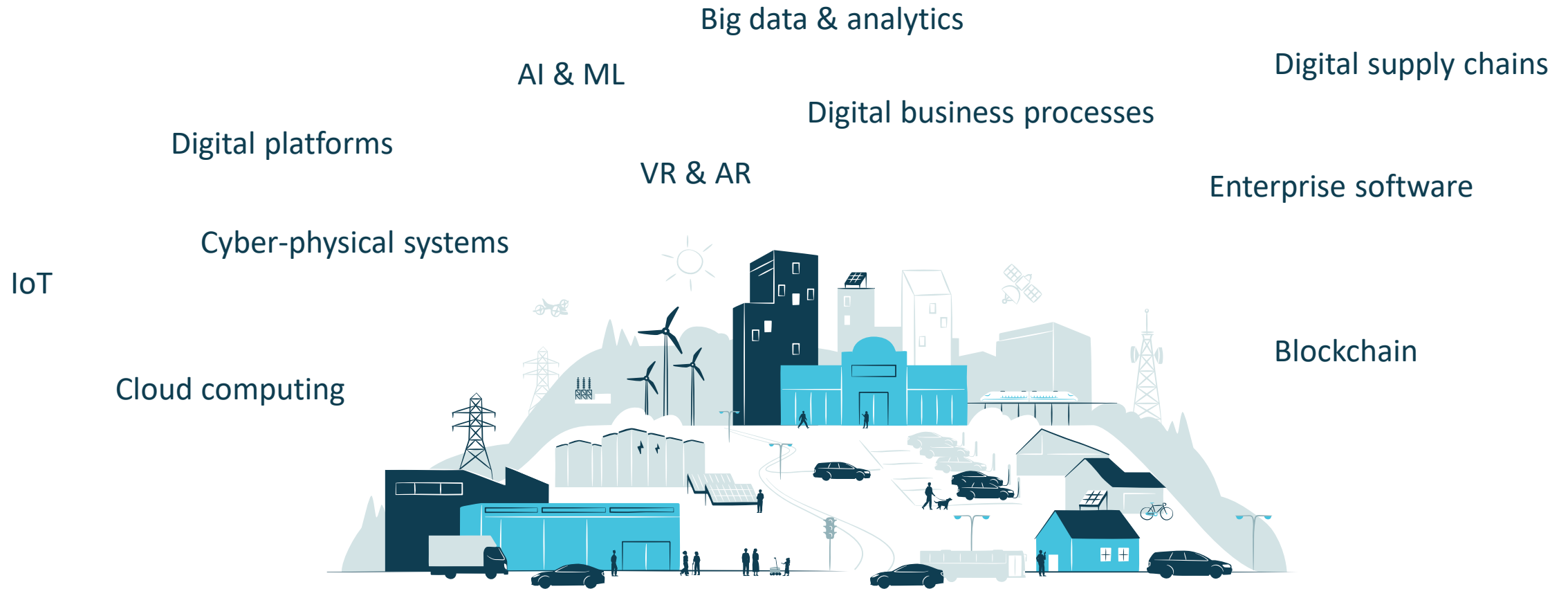
Digital technologies enable

- Data collection (e.g., sensors, IoT, cyber-physical systems)
- Data integration (e.g., cloud, blockchain)
- Data analysis (e.g., AI, ML, data analytics)

Collecting, integrating, and analyzing data with more sophisticated techniques allows more advanced applications and use cases.



Advanced use cases



Concept	Definition
Internet of Things (IoT)	The networking capability that allows information to be sent to and received from objects and devices (as fixtures and kitchen appliances) using the Internet.
Artificial Intelligence (AI)	Intelligence = ability of an agent (individual or collective) to perceive its environment and rationally direct its actions towards a desired goal. Artificial intelligence is the ability of a system to replicate natural intelligence. Types of AI include narrow AI, general AI, and so-called super AI.
Machine Learning (ML)	A field of computer science and artificial intelligence that involves developing algorithms and statistical models that enable computer systems to automatically learn from and improve upon data, without being explicitly programmed.
Digital Twin	A digital twin is a virtual representation of a real-world object or system used to digitally model performance, identify inefficiencies, and design solutions to improve its physical counterpart.
Blockchain	Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network. An <i>asset</i> can be tangible (a house, car, cash, land) or intangible (intellectual property, patents, copyrights, branding). Virtually anything of value can be tracked and traded on a blockchain network, reducing risk and cutting costs for all involved.

Digital Twins



How digital technologies
enable the CE?

Example: Whim

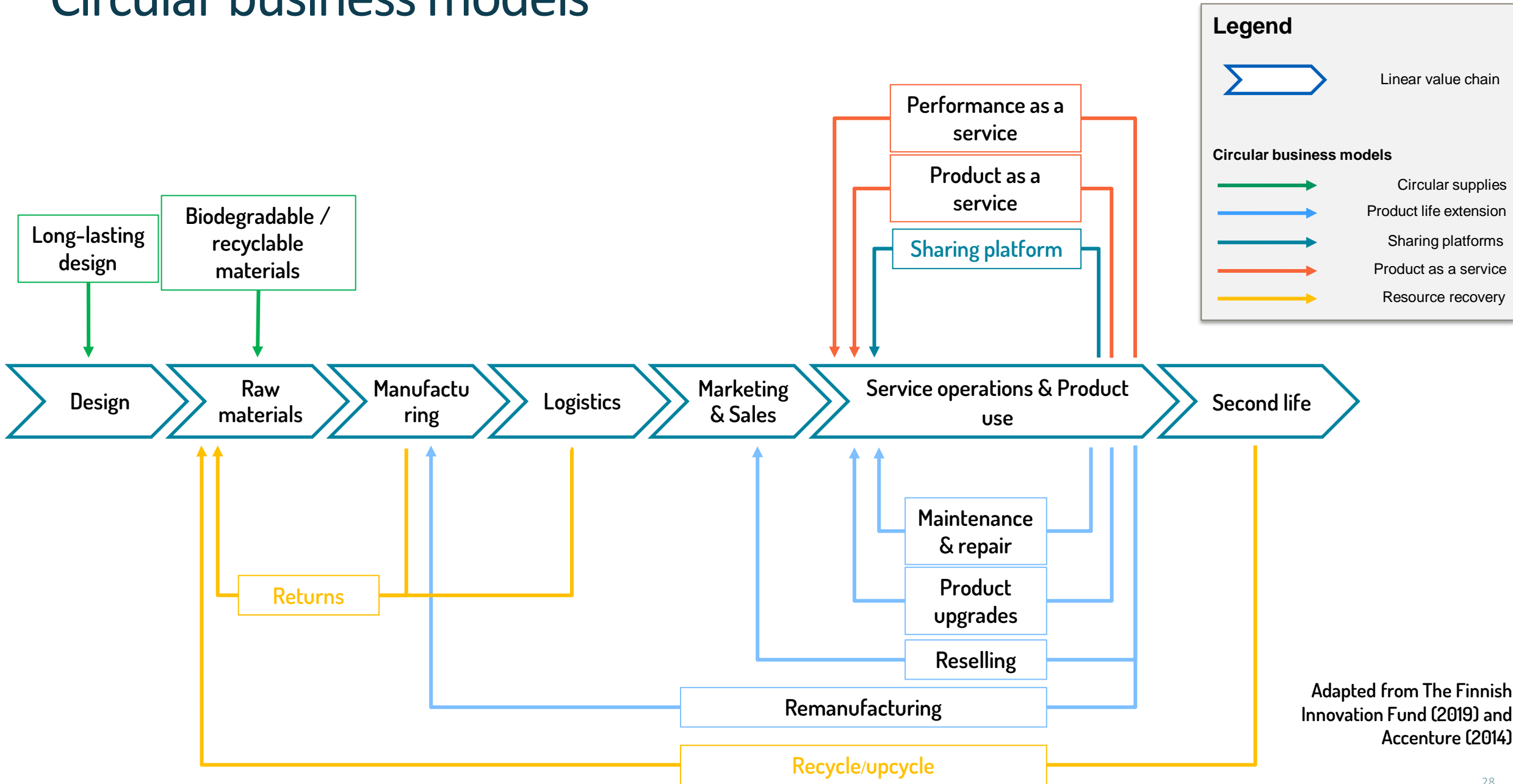
- Multi-sided platform
- Internet-based marketplace
- Standard protocols and interfaces allow partners to connect to the platform
- Enabled by smart phones and fast internet connections

Other multi-sided, digital platforms that enable the sharing platform business model:

- Skipperi, Venuu, Airbnb, Materiaalitori, Tori.fi



Circular business models



Adapted from The Finnish Innovation Fund (2019) and Accenture (2014)

Example: Ponsse

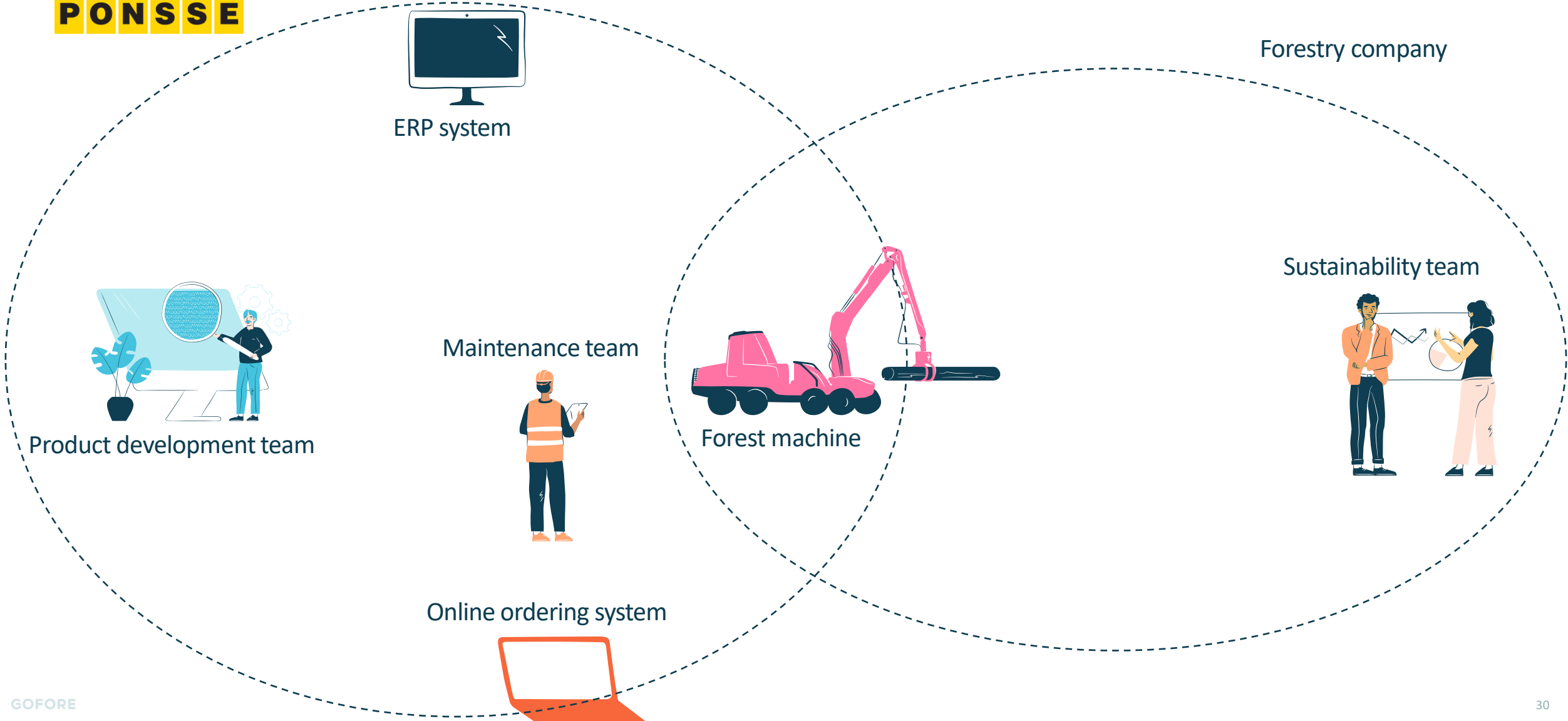
- Digital technologies are used for data collection and data integration:
 - IoT technologies collect machine health and usage data, including fuel consumption
 - An ERP system integrates data for maintenance and product development operations
 - Online ordering system allows customers to directly order spare parts inventory



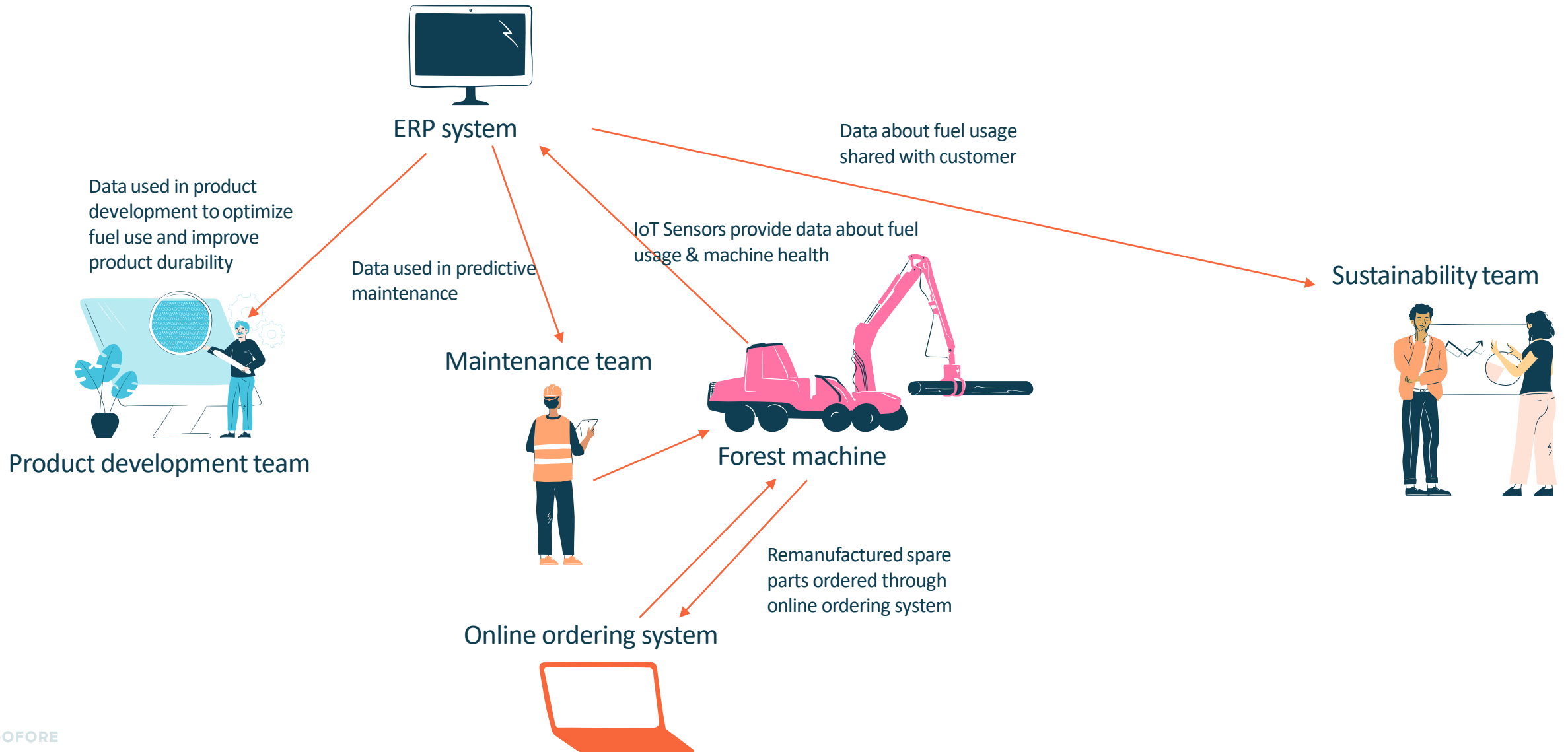
- Source: Väisänen (2020); Ranta et al. (2021)

Business model: Product life extension

PONSSE



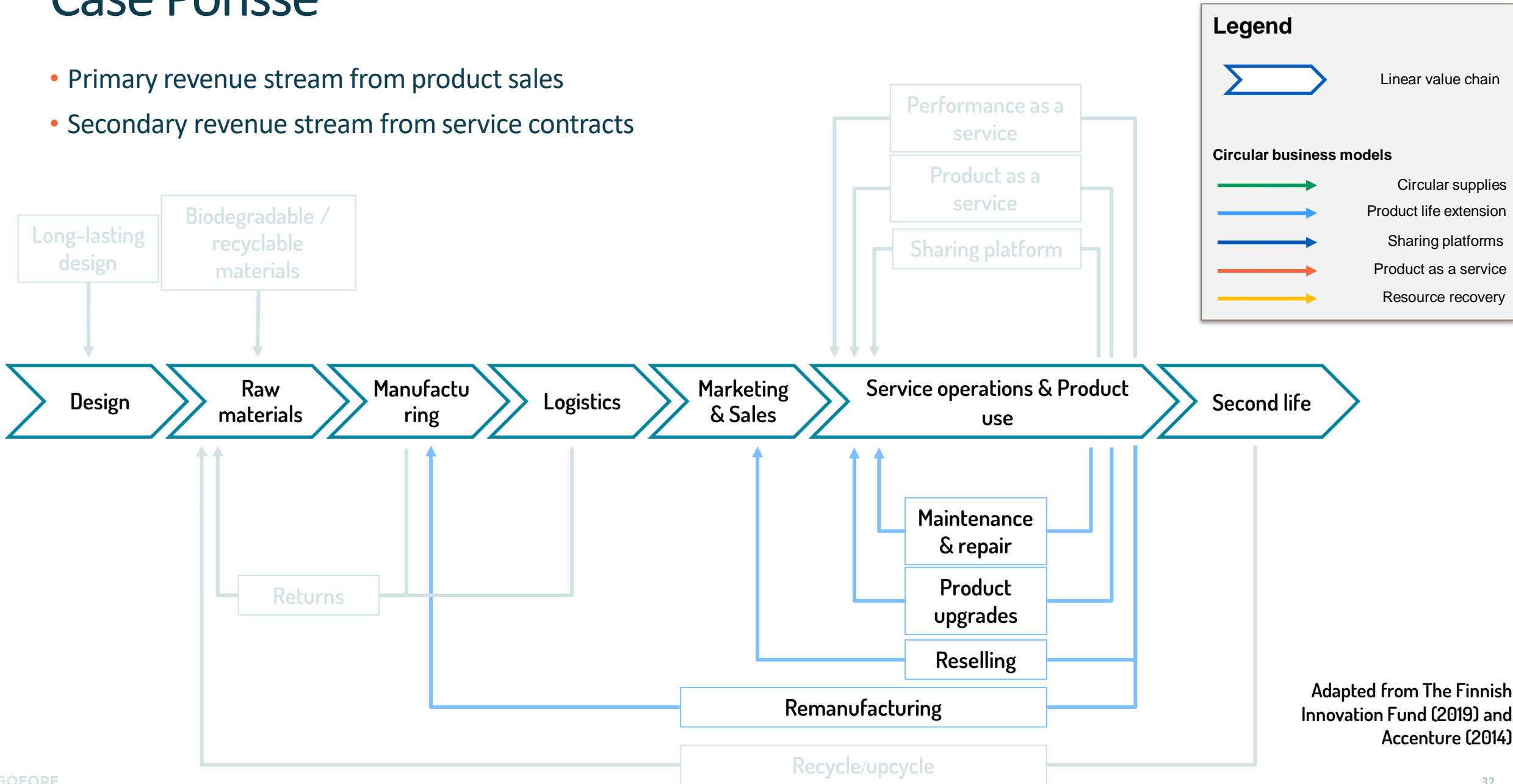
Business model: Product service system



Case Ponsse

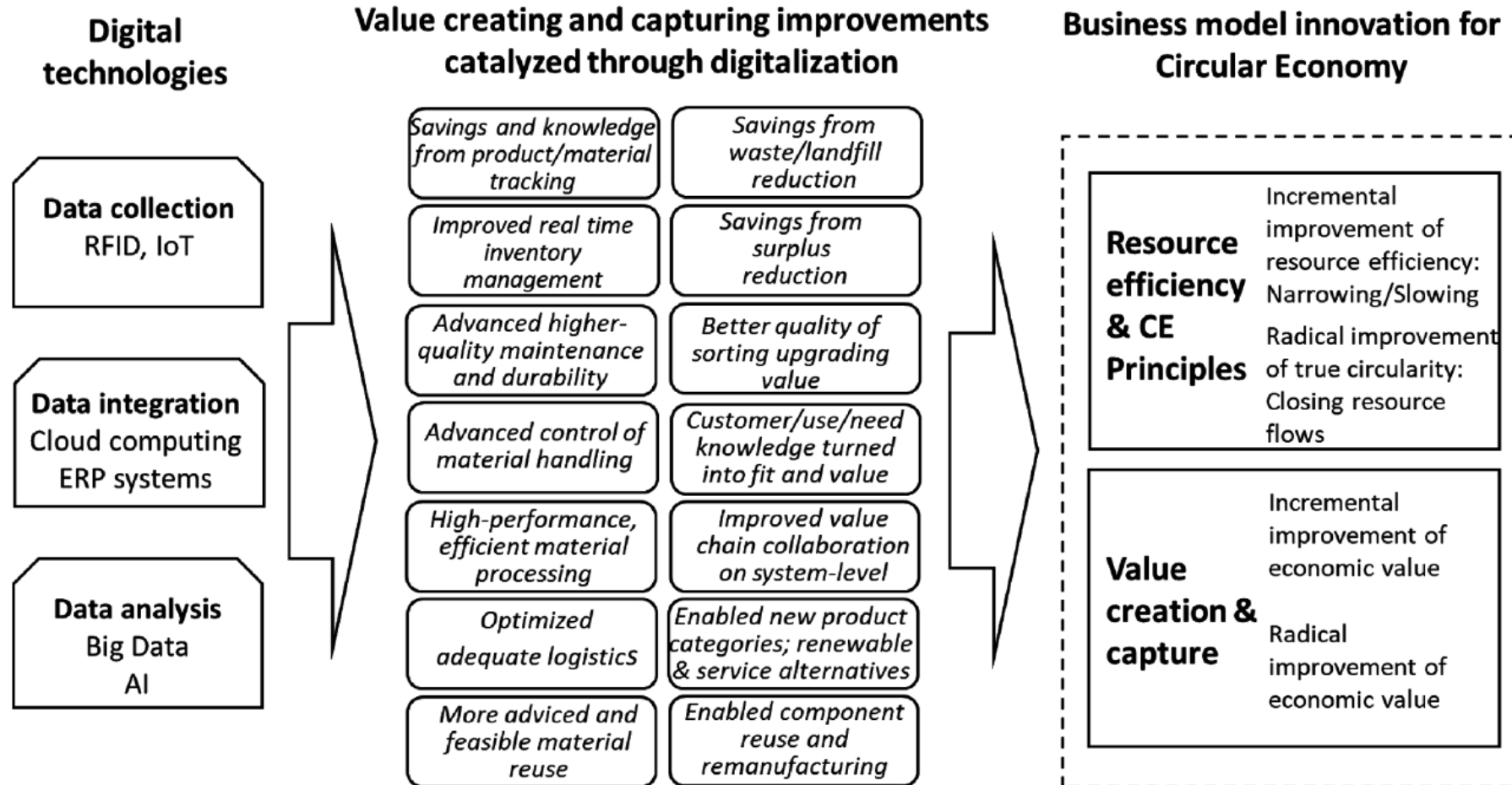


- Primary revenue stream from product sales
- Secondary revenue stream from service contracts



Adapted from The Finnish Innovation Fund (2019) and Accenture (2014)

How digital technologies enable the Circular Economy



Case Hilti

Data collection technologies employed

- IoT used to gather data, e.g., location and maintenance status of tools
- Data delivered to customers via the internet (web and mobile interfaces)
- RFID tags combined with IoT sensors on the tools enable easy access to instructional information and maintenance services for a specific tool

IoT and cloud reduce the time to identify available tools

- Reduces warehousing needs
- Smaller fleet of tools needed (just in time logic)
- *Narrower resource flows*

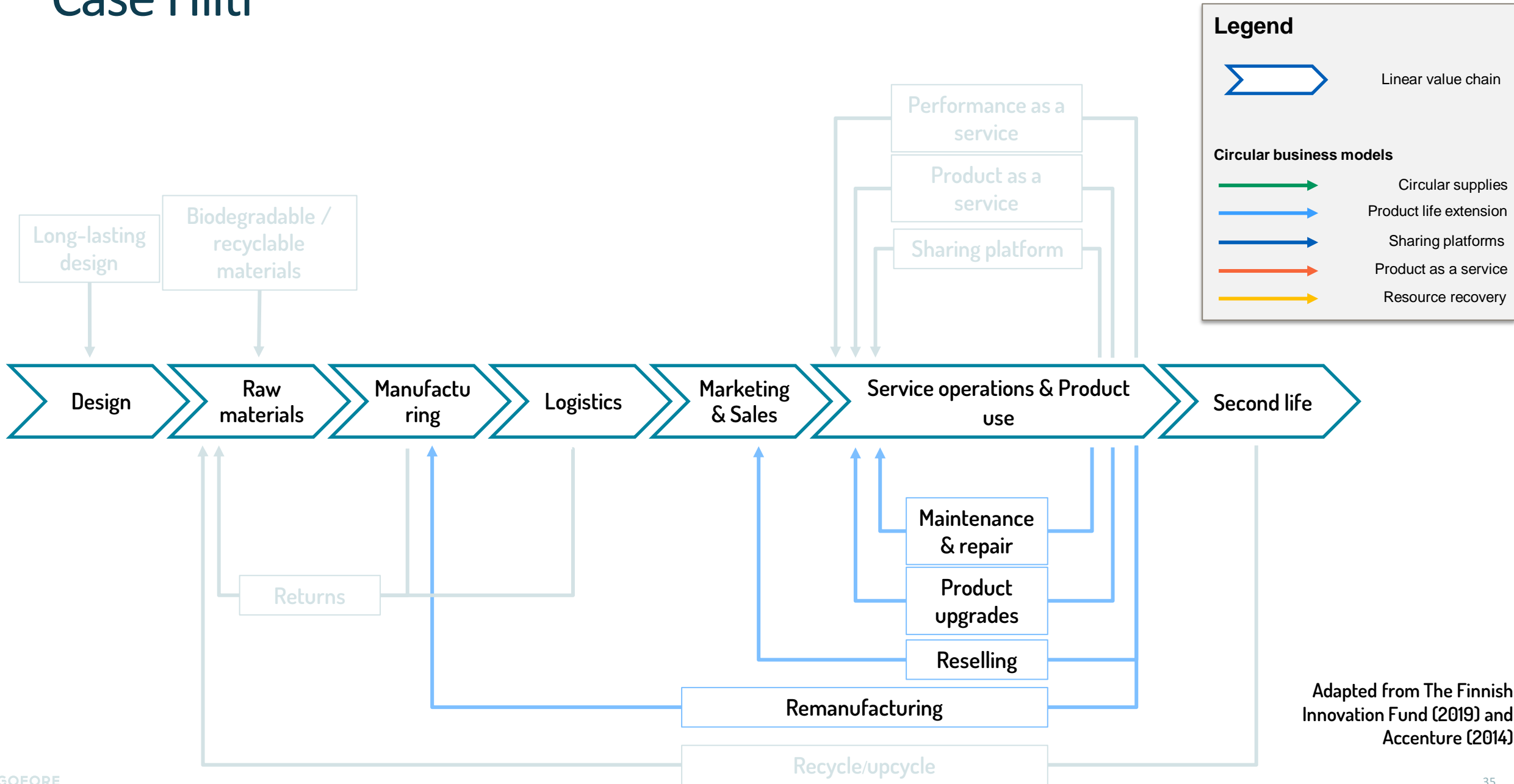
Streamlined access to maintenance services

- Tools maintained in better condition
- Reducing premature breakdown of tools
- *Slower resource flows*

Ability to fulfill customer needs with smaller fleet of tools + ability to access health and maintenance history of tools + improved fleet maintenance level

- Improved cost efficiency -> *lower costs*
- Improved service quality -> *increased revenue*

Case Hilti



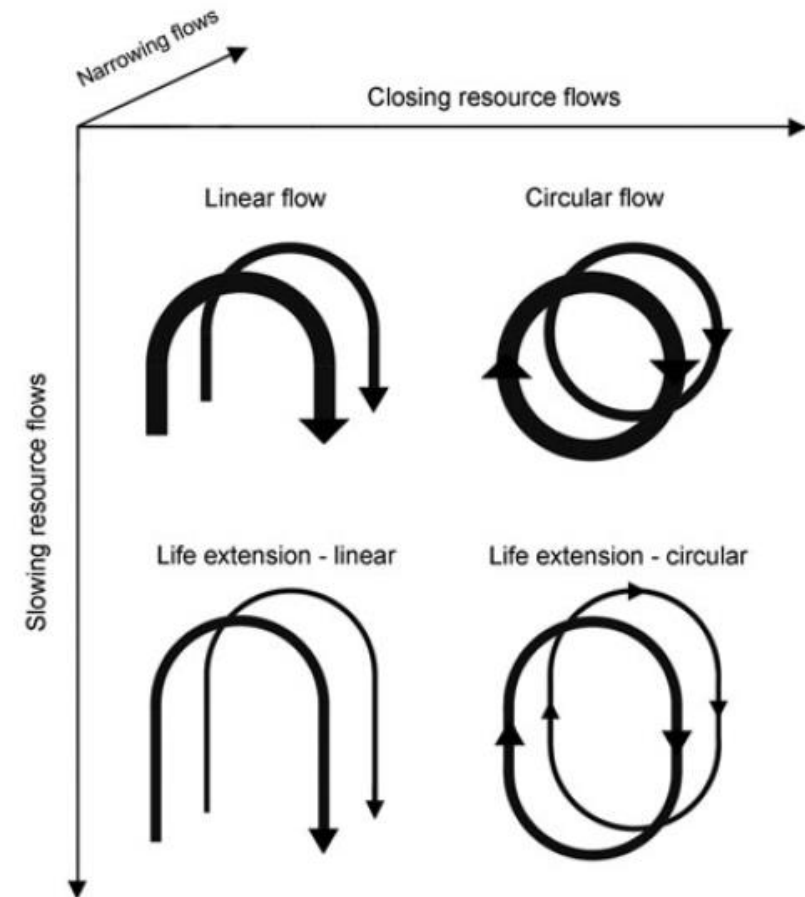
Adapted from The Finnish Innovation Fund (2019) and Accenture (2014)

Data is the key

Data enables

- Tracking & tracing materials
- Optimizing resource efficiency
- Sharing resources with new partners (sharing platforms and circular ecosystems)
- Turning products into services

All of these are required to slow, narrow, close, and extend resource flows.



Bocken et al. (2016)



Exercise

Digital Supply Chain Management



Excercise

- Create a service-based business model around a physical asset (product, equipment, factory, ships, engines...)
- Use a combination of technologies to enable the business model
 - Digital twin
 - IoT
 - Cloud
 - Machine Learning or AI
- Prepare to present the idea to others
- Use your imagination!

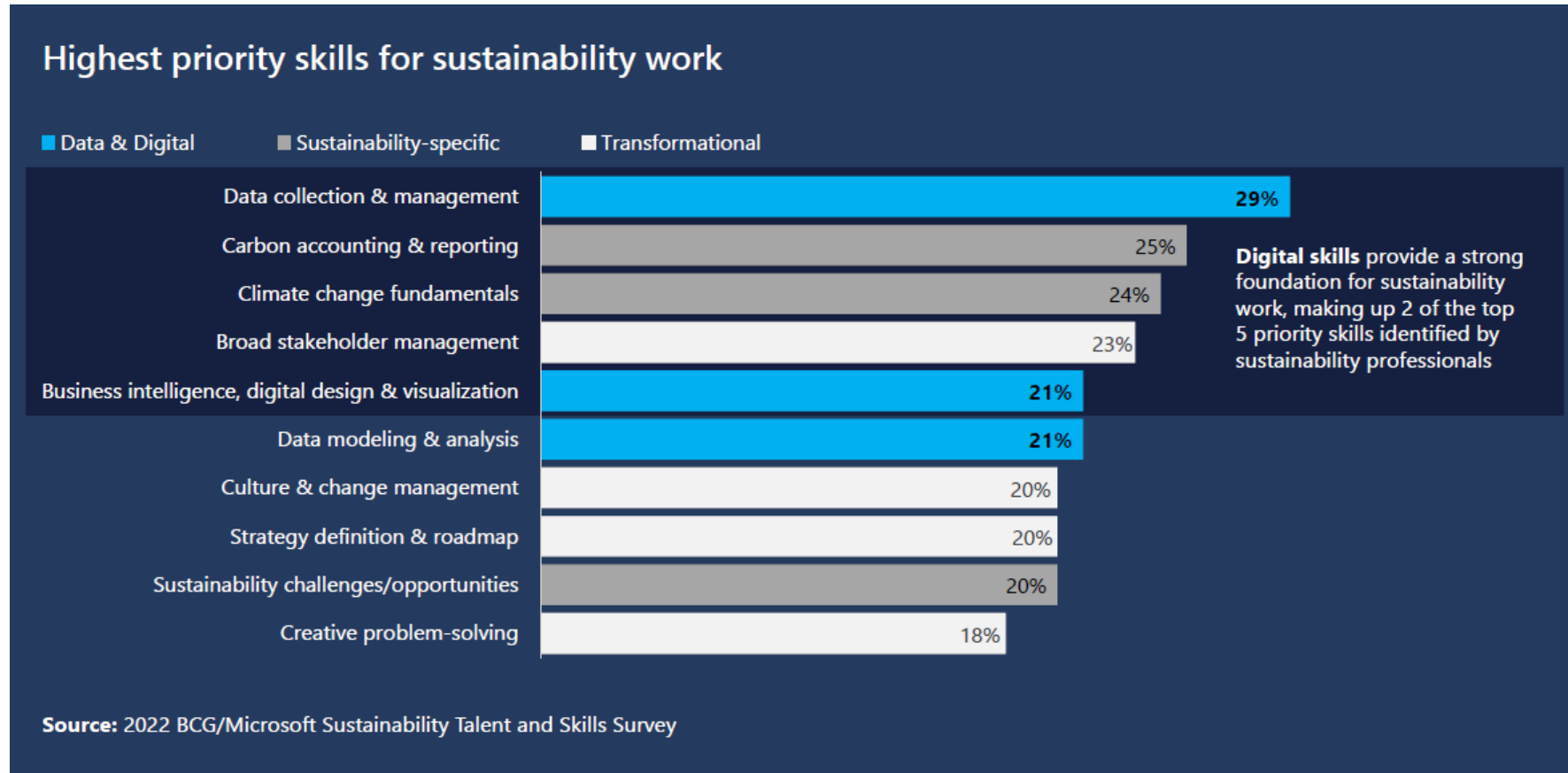
Final thoughts

- True green and digital transformation requires systems thinking
-> it's about designing sustainable systems, not about implementing pieces of technology in isolation
- Combining technologies and tools to achieve a holistic purpose is the key
- It's hard to predict how different technologies impact society in the long term
 - We tend to underestimate how quickly technologies evolve and overestimate how quickly we can adopt them
 - Changing people and processes is difficult, behavior change is difficult
 - Technological and societal change occurs nonlinearly -> periods of incremental change are followed by rapid transformation
- We need to be vigilant about how we use technology, complex socio-technical systems are like living organisms -> they have a life of their own



The future skills of a sustainability consultant

Millions of workers will be needed to meet the world's climate and sustainability goals



Source: BCG/Microsoft Sustainability Talent and Skills survey 2022

Skills of a sustainability consultant

- Systems thinking
- Futures thinking
- Circular thinking
- Design thinking
- Sustainability science
- Digital skills
- Transdisciplinarity
- Change management



Source: BCG/Microsoft Sustainability Talent and Skills survey 2022

Example


NESTE

Business Data Analyst

Neste · Espoo, Uusimaa, Finland 2 weeks ago · 84 applicants

 Full-time · Mid-Senior level

 5,001-10,000 employees · Renewable Energy Semiconductor Manufacturing

 5 connections · 1 company alum · 375 school alumni

 See how you compare to 84 applicants. [Retry Premium Free](#)

 Skills: Data Analytics, Data Visualization, +7 more

Apply 

Saved



Your Main Responsibilities In Creating a Sustainable Future Are

- Develop, test, implement, and maintain reporting models, which include identification of attributes and KPI's, data transformation, and exploratory data analysis
- Collaboration with business to identify & review data needs, data models, data inconsistencies, and business logics/formulas for initiating data discovery
- Visualize and report data findings creatively in a variety of visual formats that appropriately provides insights to the organization

You will work closely with different kinds of business key stakeholders, Neste Data Platform team, and other business / data analyst development team members in Renewables to identify old and new data related needs and solutions.

The best combination to success in this role


- Bachelor's/Master's degree in e.g. engineering, business, data science
- Experience in data visualization with Power BI (including also DAX formulas) and dimensional data modelling.
- Have a developer mindset
- Handle data fluidly and have understanding of analytics development
- Understanding the benefits of modern data platform capabilities
- Fluent English skills are a must, both written and oral

We also value

- A strong hunger and curiosity to work with complex initiatives and drive these forwards with a high level of independence
- Courage to challenge and scrutinise the development initiatives to ensure clear value add of all efforts
- Understanding of data management & governance
- Understanding of SQL language, databases (cloud native)
- Business process understanding and ability to define hypotheses to validate with data analysis

We are now looking for a new team member whose passion is to see a more sustainable world, and who has a high drive to capture value through digital technology savviness.

Pioneering
an ethical digital
world.

A large, solid teal circle is positioned to the right of the main text, partially overlapping the word "digital".

GOFORE

References

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