Nordic Circular Economy Playbook 2.0

Transform & Scale

Nordic Innovation

accenture

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Executive summary

This playbook builds on the Nordic Circular Economy Playbook, and is tailored to companies in the Nordic manufacturing industries. It provides examples on the following five sub-sectors: (1) machinery & equipment, (2) maritime, (3) energy, (4) transportation, (5) construction

- Companies **need to transform and scale their business** as a response to increased pressure from industry drivers, as well as unlocking new business opportunities in order to face climate change related challenges

- Circular economy and circular business models are about turning inefficiencies in linear value chains into business value. This playbook **identifies key circular business models** for the industry sub-sectors as well as **key ecosystem actors to enable transformation** across the value chain

- There are three stages a company typically needs to undergo on their transformation journey; *explore & shape*, *attract & win*, and *scale and keep growing.* This playbook focuses on the third stage and **outlining the main challenges when scaling,** which are related to people & culture, new collaborations, lack of transparency, and the sustainability organisation ownership

- The playbook is also **describing the key enablers to fully transform and become a circular business**; (a) focus on making one part of the business fully circular before scaling, (b) integrate data & technology in the entire transformation journey, (c) invest in the people and the organisation, and (d) have a dedicated transformation team

Playbook content

Guidance for companies on how to successfully transform and scale circular economy

1 Industry specific drivers

This chapter will help you:

- Understand the increased requirements from stakeholders on circular economy and sustainability transparency across the value chain
- Learn why transformation to a circular economy is needed

Additional material that can be found in the Nordic Circular Economy Playbook:

- Understand why the circular economy offers an advantage compared to the linear value chain in terms of addressing inefficiencies and untapped value potential
- Learn why now is a good time to shift from linear to circular business
- Supporting tools: Value case tool to calculate high-level business case for circular business models

CHAPTER SUMMARY

Industry specific drivers

- Governments and regulators need to deliver on their circular economy and climate commitments, forced through policies and regulations at record speed as well as companies setting their own circular targets
- The increased pressure from regulators, B2B customers, and investors push businesses to change their way of working by adopting new business models
- Businesses should embrace opportunities stemming from resource and climate change related challenges, thus giving them a first-mover advantage and unlocking growth opportunities

Increased pressure from stakeholders push manufacturing companies to transform their business, entering untapped circular opportunities

Introduction of drivers

REGULATORS

- New circular and sustainability regulations are proposed and **entered into force at a record speed**
- The scope of regulation is expanding – **regulations cover the entire value chain** (incl. material, design, production processes, and waste handling)
- The enforcement starts with prioritized industries, incl. energy, construction, transportation etc.

B2B CUSTOMERS

- Companies are facing increased pressure from **buyers' supply chain sustainability targets**
- There are **accelerating requirements for** upstream suppliers **to report on ESG, and to showcase** concrete actions towards circularity and carbon reduction
- B2B customers **require greener products and services** from their value chain partners to meet customer requirements and keep competitive position

INVESTORS

- Investors are **adjusting their portfolios towards sustainability,** encouraging portfolio companies to develop their **ESG reporting and carbon data disclosure**
- Investors are placing **greater emphasis on companies' ESG performance** when making investment decisions
- Companies that are acting have **priority to access financial resources**

Being both **resource and carbon** intensive, the manufacturing industry is at the **forefront facing the challenges,** as well as the **massive business opportunities ahead when emerging on a circular transformation journey**

EU regulations are updated at a record speed with increased ambitions to drive transformation towards circular economy

Regulators

	European Green Deal[1]	Circular Economy Action Plan[4]	EU Taxonomy[6]
What is new?	EU Climate Law effective **in July 2021**[2] • Reduce net GHG **by at least 55% by 2030** • Followed by "Fit for 55," a set of policy proposals enabling the implementation of the European Green Deal[3]	• An updated **Ecodesign Directive** to be adopted in 2022; Mandatory criteria for **Green Public Procurement** to empower public buyers; Revising EU Consumer Rights Directive to include **product durability** and **repairability**, to protect against false claims[5] • A new **SME Strategy** to enable local solutions for circularity, with support to scale up	The **first EU Taxonomy Climate Delegated Act** entered into force on 1 January 2022 • A new **Corporate Sustainability Reporting Directive (CSRD)** is set to be adopted by late 2022 • Circular Economy is listed as a high priority area for future EU legal acts
Key impacts	• **Transportation**: zero emissions from new cars by 2035 • **Construction**: 35 million buildings to be renovated by 2030 • **Energy**: 40% renewable energy target for 2030; 36-39% energy efficiency targets for final and primary energy consumption	• Circularity actions focus on components and materials, incl. **batteries and vehicles, packaging, plastics, textiles** • Key sectors cover: **electronics and ICT, construction and buildings, food, water and nutrients**	• The Climate Delegated Act cover the economic activities on roughly **40% of listed companies** in carbon intensive sectors - energy, manufacturing, transport, and buildings are at the front line • CSRD extend the scope to **all listed companies, including SMEs**, an increase from the 11,000 companies to nearly 50,000 companies in the EU

Take-aways

- **Fast Development –** New legislation enter into force within a year following proposal phase
- **Expanding scope –** Regulations cover the entire value chain (incl. material, design, product use, production processes and waste)
- **Priority industries –** Industries that are high-carbon and resource intensive are already impacted

[1] European Green Deal; [2] European Climate Law, [3] Fit for 55, [4] Circular Economy Action Plan, [5] EU Consumer Rights Directive, [6] EU taxonomy for sustainable activities

Companies in B2B markets are facing increasing pressures from buyers' supply chain sustainability targets

B2B Customers

Pressure from B2B customer

- Increased focus on supply chain shortages has magnified the concern over raw material and key-components availability, and **increased need for supplier resilience and resource efficiency**[1].
- Sustainability is becoming **the norm** in the downstream buyers' procurement strategy.
- Requirements to upstream suppliers go beyond basic compliance, to **focus on scope 3 emissions and a holistic environmental, social and governance** (ESG) framework.
- Circular business models enable upstream B2B companies **to gain competitiveness** by cost saving (e.g., reduce waste), value migration (**growth in alternative products and services**, such as maintenance service in machinery) and new **value stream generation** (e.g., reuse and resell vehicle components).[2]
- Companies in B2B markets are also **experiencing increased pressure from end customers** to act on sustainability and circularity[3]. Their purchase intentions are crucial for the successful implementation of circular business models. End customers **expect companies to take sustainable action** e.g., transparent communication around sustainability.[4]

Examples of buyer commitments

MAERSK

"We will **integrate ESG across supplier lifecycle** stages and establish **end-to-end visibility on supplier performance** through collaboration and engagement with an ultimate goal of co-development and innovation **towards sustainable outcomes**."[5]

SKANSKA

"We want to create a sustainable and secured supplier base…with the goal to **achieve a carbon neutral value chain in the construction** and civil engineering sector by 2045, we encourage you as a supplier or subcontractor to establish climate goals."[6]

Vestas

"We are committed to reduce carbon emissions from our supply chain by 45% per MWh generated by 2030, and to **produce zero-waste turbines** by 2040… **Suppliers are asked to set targets** for reducing scope 1 and 2 (extending to scope 3 emissions from 2022), and to **measure production waste for products delivered to Vestas.**"[7]

[1] Fjord Trends 2022: Emerging Trends & Challenges | Accenture, [2] The Circular Economy Handbook | Accenture Strategy, [3] The Circular Economy Handbook: Realizing the Circular Advantage | Accenture, [4] GlobalTrade, [5] Sustainable Procurement | Maersk, [6] For suppliers | skanska.se, [7] Supplier Sustainability (vestas.com)

Investors are holding companies under increased scrutiny and accountability for their sustainability actions

Investors

Number of investors committing to accelerate sustainability in their portfolio is growing,…

- Investors are more active than ever to integrate ESG in the companies they invest in and engage in the portfolio companies' **transition plan towards sustainability and circularity,** new regulations such as the EU Sustainable Finance Disclosure Regulation **mandates that investment managers to classify and disclose their sustainability risks.**[1]
- **Over 4000 investors and service providers** are members of Principles for Responsible Investment (PRI), **to include ESG in their investment**[2]; More than **450 financial firms**, with controlling assets of over $130 trillion, joined the Glasgow Financial Alliance for Net Zero (GFANZ) **to make climate considerations a part of every capital allocation decision.**[3]

…with increasing requirements on data transparency and accountability pushed on companies, and…

- The demand for validated and comparable sustainability reporting is increasing for both small and large companies[4], and investors are encouraging portfolio companies to take one step forward towards **ESG reporting and carbon data disclosure.**
- While having ESG data is becoming a hygiene factor, **harnessing data** to gain valuable insights using digital solutions such as artificial intelligence is key to **integrate ESG** in investment decisions for risk prevention and value creation.[5]

…companies that are acting are favoured by those providing financial opportunities

- Financial resources (such as the EU Green Bond) are **prioritizing acceleration of green transition and decarbonization in key sectors**, e.g., energy production and distribution, resource-efficient housing, and low-carbon transport infrastructure.
- *"We analyse ESG factors to select the best possible investments, and we focus on influencing companies to progress in a sustainable direction and to contribute to the positive development of our societies."* - Danske Bank[6]

[1] European Sustainable Finance Disclosure Regulation [2] About the PRI | PRI Web Page | PRI (unpri.org) , [3] GFANZ-Progress-Report.pdf (bbhub.io) , [4] Nordic Sustainability Reporting Standard [5] ESG investing: All eyes on data and AI | Accenture Capital Markets Blog, [6] Danske Bank

2 Vision for the future

This chapter will help you to:

- Understand how the future ecosystem can look like for manufacturing industries and that circularity only can be achieved together; it requires building an ecosystem of partners in order to achieve scale and economic viability
- Learn which circular business models are the most promising in your industry and what role you can play in the ecosystem

Additional material that can be found in the Nordic Circular Economy Playbook:

- Assess the major inefficiencies and waste driver in your linear value chains as a lens for untapped circular opportunities
- Explore technologies that can enable your selected circular business model(s)
- Supporting tools: Business model development toolkit, Ecosystem partner identification tool

CHAPTER SUMMARY

Vision for the future

- The circular economy offers companies the opportunity to turn inefficiencies in linear value chains into business value
- Based on the inefficiencies that occur across the value chain as well as the external drivers for each industry sub-sector, three key circular business models have been identified for each sub-sector
- To unlock the circular business value, ecosystem collaboration is important. Therefore, key actors in the ecosystem have been outlined for the key opportunities in each sub-sector
- Circular business model examples from leading Nordic and global manufacturing companies demonstrates a strong case for circularity

The circular economy is about turning inefficiencies in linear value chains into business value

Inefficiencies in linear value chains

1. UNSUSTAINABLE MATERIALS

Material and energy that cannot be continually regenerated

– for example, direct and indirect materials are not renewable or bio-based

2. UNDERUTILISED CAPACITIES

Underutilised or unused products and assets

– for example, products are not operating full hours or full functionality is not useful

3. PREMATURE PRODUCT LIVES

Products are not used for their entire possible working life

– for example due to new models and features or lack of repair and maintenance

4. WASTED END-OF-LIFE VALUE

Valuable components, materials and energy are not recovered at disposal

– for example, not recycled or recovered at end-of-life

Putting the customer at the centre enables companies to focus on the value adding activities

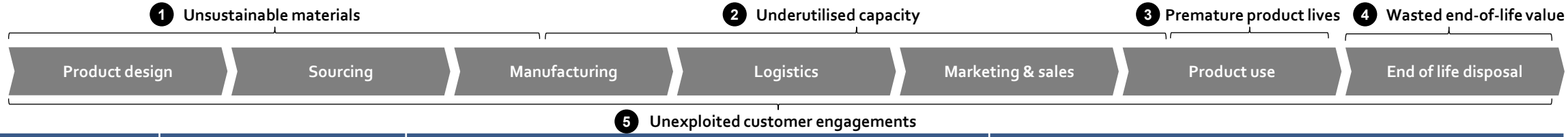
5. UNEXPLOITED CUSTOMER ENGAGEMENTS

Sales organisation focus on selling functionality of products rather than addressing the customer problem

– for example, missing opportunities to engage customers throughout the product life-cycle to offer additional services and add-on sales

Source: Accenture, Appendix 3 for more details

Inefficiencies are largest at the start and end of the manufacturing value chain – add on and after sales services have unexploited potential



	Inefficiency	Inefficiency level	Description of results	Comments on the current state
1	Direct materials	Medium	For 29% of companies the spend on recyclable/renewable materials is 50% or more of direct material spend, while 19% spend less than 5% on renewables	The use of recyclable and durable material is quite common, however most of the material is from non-circular sources
	Indirect materials	Medium	67% of companies spend less than 50% of their indirect material spend on recyclable/renewable materials, and 22% of the companies spend more than 80%	Companies spend an intermediate amount on circular indirect material such as renewable, recycled, or reused material
2	Availability	Medium	36% of companies report that their products are idle for less than 20% of the time, while 45% report that the products are idle more than 50% of the time	Several companies report that their products have long idle time and are underutilized, e.g., they are not operated 24/7, waiting time before use, or seasonal downtime
	Operational fit	Very low	39% of companies fully customise their products to meet customer needs and requirements, while 52% meet customer expectations with a standard solution	Most products are customized to fit the requirements of the customers. e.g., regarding operating efficiency, product operations and planning
3	Lifetime	Low	36% of companies report that their products last for over 20 years, while another 32% report that their product lifecycle is 11-20 years long	Most products are built and used for a long lifetime, using durable materials
	Functionality	Medium	For 36% of companies the share of revenues coming from products that are designed for a long life is 80%, while 23% of the companies have a share of long-life revenue below 10%	There are large variations on % of revenue that comes from products that are designed for a long life e.g., through enhanced reparability, modularity, or upgradeability
	Waste in production	Medium	45% of companies recycle over 80% of their production waste. However, 41% of companies say they recycle less than 50%	Many companies report that they recycle most of their production waste, nevertheless there are still several companies where this inefficiency is high
4	Take-back	Medium	For 43% of companies the share of products taken back from customers in dedicated return schemes at end-of-life is less than 5%	Most of the companies have a limited take back scheme, as this has not been seen as their responsibility
	Recycling	Medium	29% of the companies recycle over 80% of products at end-of-life. 57% say that they recycle less than 50% of products	There are large differences between the companies, some have high recycling rates while others have low and moderate recycling rates
5	After-sales	High	For 32% of companies the share of revenues from add-on sales is less than 10%, while for 16% of the companies it can be between 50%-80% of revenue	The large majority has limited revenue from after sales services
	Add-on sales	High	59% of companies state that their share of revenues from add-on sales is less than 10%	Few companies have explored add on sales efforts

Source: Analysis based on output from Nordic Circular Industries workshops. More detailed information on the output in Appendix 2.

Five business models reduce the inefficiencies and create value for companies

Circular business models

Reform resource use

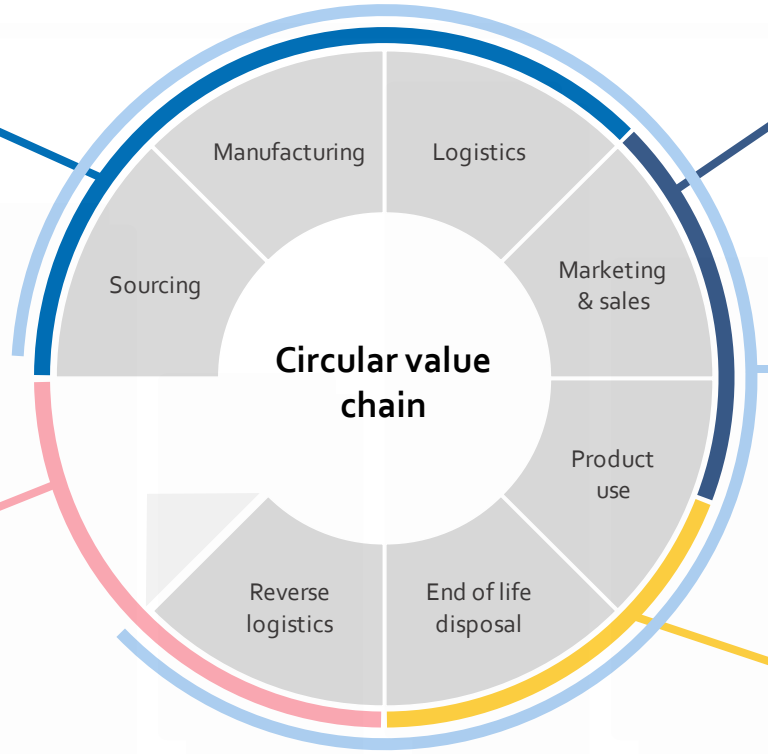
CIRCULAR INPUTS

Use of renewable energy, bio-based or potentially completely recyclable materials, and design products that are durable and easy to repair

Recover value in waste

RESOURCE RECOVERY

Recovery of usable resources or energy from waste or by-products



Optimise capacity use

SHARING PLATFORM

Increased usage rates through collaborative models for usage, access, or ownership

Offer outcome-oriented solutions

PRODUCT AS A SERVICE

Offering of products for use with retention of product ownership, which incentivises increased resource productivity along the entire life cycle

Extend life cycles

PRODUCT USE EXTENSION

Extension of the life cycle through repair, maintenance, upgrading, resale and remanufacturing

Source: Accenture, Appendix 3 and Nordic Circular Economy Playbook for more details

Companies can explore the sub-models individually or as powerful combinations

Circular business models

Example synergy:
Modular product design enables enhanced reparability and upgradeability

Business model	Sub-model	Description
CIRCULAR INPUTS	Build to last	Design products that are durable and easy to repair (e.g. modular)
	Circular supplies	Use recyclable materials in production, e.g. renewable and bio-based materials, chemicals & energy to increase recovery rates
SHARING PLATFORM	Share	Develop solutions that enable increased use of capacity
PRODUCT AS A SERVICE	Product as a service	Offer customers to use a product against a subscription fee, or use-based charges instead of owning it
	Performance as a service	Offer customers to buy a pre-defined service and quality level and commit to guaranteeing a specific result
PRODUCT USE EXTENSION	Repair & Maintain	Deliver repair and maintenance services to extend the life of existing products in the market
	Upgrade	Improve product performance by upgrading existing components with newer ones
	Resell	Resell products that have reached their usage limit to second and third hand markets
	Remanufacture	Retake and perform industry-like restoration or improvement of original functionality of products and remarket them with lower price
RESOURCE RECOVERY	Recycle/upcycle	Collect and recover materials from end-of-life products and reuse them in own production
	Return	Return wasted parts and materials to the source (e.g. waste and by-products from own production)

Source: Accenture, Appendix 3 and Nordic Circular Economy Playbook for more details

Key opportunities have been identified for industries to reduce inefficiencies and create value as companies scale and transform

Key circularity opportunities

Industry sectors	Key opportunities	Industry scope
Machinery & Equipment	**Design** machinery with **maintenance and repairability** in mind, as well as **sharing platforms to increase use of unutilized capacity**	Manufacturing of machinery and equipment
Maritime	**Repair and upgrade** vessels and equipment to **improve performance and extend product life,** as well as **sustainable recycling**	Manufacturing of ship parts and maritime equipment
Energy	**Design** for circularity, **resell platforms** and **upcycling/recycling** of electrical equipment to extend lifetime	Manufacture of electrical equipment
Transportation	**Optimize and extend lifetime** of components and vehicles by build-to-last**, product (component) as a service, and remanufacturing** of vehicles	Manufacturing of motor vehicles, trailers, and their parts and equipment
Construction	**Recycled input material, recycling, remanufacturing and resell schemes** for waste and material handling	Manufacturing of buildings, and their materials and components

Source: Analysis based on desktop research, insights from workshop programs and interviews with industry experts

Inefficiencies occur across the value chain, especially in production from underutilized capacities, and at the end-of-life

Key opportunities: Machinery & Equipment (1/3)

Waste pools[1]	Inefficiency
Energy and resource intensive production processes, using unsuitable indirect materials	●
Industrial machinery not utilized on optimal capacity levels	◑
Products are not necessarily designed for reparability or upgradeability, and O&M services are not fully exploited	●
Products designed for long lifecycles, often without focus on dismantling	◕
Full potential of after-sales and add on sales is not exploited	◑

Industry specific drivers
Repair and energy efficiency criteria are evolving as well as requirements for recycled content and waste reduction[2]
Customers prefer access over ownership, with an increasing need for services.[3] Buyers are pushing for green energy sources and a lower CO_2 footprint throughout the product lifecycle[4]
Investors encourage machinery companies to set sustainability targets and a circularity agenda, and prioritise investing in companies that have secure long-term access to critical raw materials[5]

Conclusion

- **Large inefficiencies occur in the production** of machinery and equipment through processes like casting, forging, machining, and welding
- Lack of circular design creates inefficiencies at end-of-life when **machines are not operated at optimum performance, and components are difficult to upgrade or recycle**
- Industry drivers **push for repair and energy efficiency standards** as well as lowered CO_2 footprint throughout the value chain
- Customers are increasingly **in need of new services** e.g., valuing access over ownership

Inefficiency: ● Very high ◕ High ◑ Medium ◔ Low ○ N/A

[1] Analysis based on desktop research, insights from workshop programs and interviews with industry experts, [2] The Circular Economy Action Plan, [3] Industrial Companies Service Transformation | Accenture, [4] Sustainable Supply Chains for Net Zero Emissions | Accenture, [5] CRMs for Strategic Technologies and Sectors in the EU

Design machinery to increase repairability and product maintenance as well as sharing platforms to increase use of unutilized capacity

Key opportunities: Machinery & Equipment (2/3)

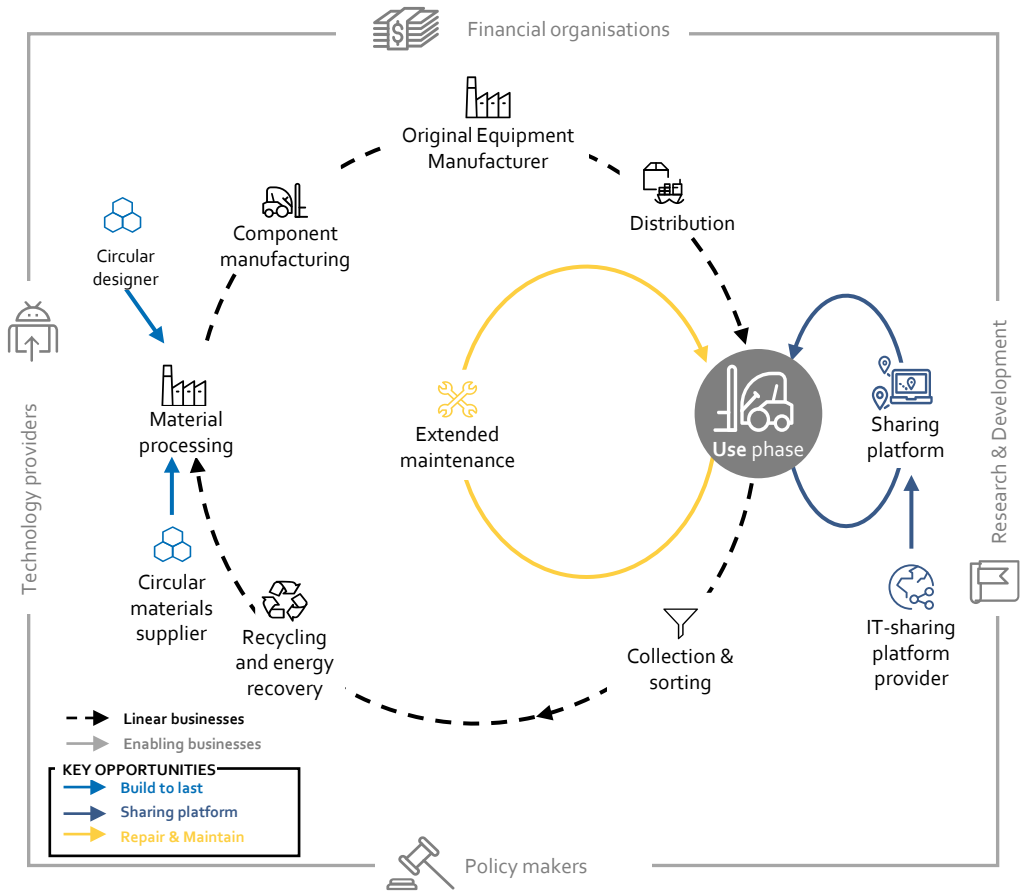
	Key opportunities	Enablers	Examples
	**Build to last** Design machinery and equipment to increase repair and machine-upgrade possibilities, increase the use of recycled material as production inputs, and redesign energy intensive products	• **Investments in R&D** to improve energy intensive solutions, e.g., investigate replacement of steel with fibre-reinforced plastic • **Value awareness** for the recovery of metallic materials and how to reuse it in new components • **Implement solutions for simple disassembly** at end-of-life such as material passports and modular components	• Danfoss **design** their high-pressure pumps so that parts can be **refurbished**, or **replaced, and recycled** if worn out[1] • Hybrit is a joint initiative from SSAB, LKAB and Vattenfall developing **fossil free steel**[2] • Metallco is a Norwegian recycling group that **sells recycled metal** types[3]
	**Sharing platform** Develop solutions that enable use of unutilized capacity, e.g., platforms to share and track machines that have high value and are easily transportable	• Address the **synergies between digitization and sustainability** and how it creates value for the company • **Technologies such as IoT, sensors and analytics** to collect, monitor and use data to drive business development	• eRent offers a digital platform for companies where **machines, devices and other goods can be shared and tracked**[4] • Pro-Quip Equipment Sharing Platform **enables trade of equipment** between oil fields[5]
	Repair & maintain Increase use of products by repairing and maintaining machines and components e.g., change only the broken parts of machinery, repair and refurbish old equipment to the same working conditions as a new one	• **Monitor and manage material flows** across value chain through e.g., digital solutions such as a sensors, embedded chip or digital twin to **optimize maintenance process** • **Training** to ensure optimum performance and correct maintenance improving energy efficiency and lifetime	• Volvo Construction Equipment allows customers to **return equipment for refurbishment** to ensure optimal working conditions[6] • HMS software enables **industrial hardware to communicate and share information** for monitoring, reporting, analytics and maintenance[7]

[1] Danfoss [2] Hybrit [3] Metallco [4] eRent [5] ProQuip Equipment [6] Volvo Construction Equipment [7] HMS Network

To unlock key opportunities in the industry, ecosystem actors need to know their role and together collaborate across the value chain

Key opportunities: Machinery & Equipment (3/3)

Circular ecosystem for key opportunities



Key enabling actors

	Role	Description	Example
Build to last	Circular designer	Designs machinery and equipment allowing for upgrades, repairs, and use of recyclable material during production. Requires knowledge on how to dissemble the products	Danfoss works to improve reusing and recycling of materials across the value chain, and design their products with a sustainable end-of-life mind[1]
Build to last	Circular materials supplier	Supplies recycled materials such as metals to the manufacturer e.g., a waste management company	Stena Recycling collects, recycle and sell materials such as ferrous and non-ferrous metals, electronics, and paper[2]
Sharing platform	IT – sharing platform provider	Platform provider using IoT, such as sensors, to provide sharing of data services such as use patterns, maintenance monitoring and equipment sharing services for the machinery and equipment ecosystem actors	HMS software enables industrial hardware to communicate and share information[3]
Repair & Maintain	Extended maintenance	Provides maintenance services to keep the machinery and equipment performance as high as possible during its use life e.g., a machine manufacturer or equipment rental company	Bilfinger Nordics provides services to machining, turbine and valve maintenance, etc.[4]
Enabling	Research & Development	Supports knowledge creation on sustainable materials, metal recovery, and technologies to optimize maintenance and production processes e.g., universities, commercial research organisations, think tanks etc.	Swedish Chalmers UOT has developed a new algorithm that reduces energy consumption for industrial equipment[5]
Enabling	Policy makers	Provides incentives for businesses to consider recovery practices while at the same time reducing legislative hindrances to do so e.g., repair and energy efficiency criteria are evolving	The EU Ecodesign Directive provides EU-wide rules for improving the environmental performance of products[6]
Enabling	Technology provider	Provides technology services for the machinery & equipment ecosystem actors i.e. IoT for fleet management	Telenor worked with HMC to link their heavy-machinery to a global network, so they could collect and analyse data for more efficient and reliable use[7]

[1] Danfoss, [2] Stena Recycling, [3] HMS Network, [4] Bilfinger Nordics, [5] Chalmers, [6] Ecodesign Directive, [7] Telenor

Inefficiencies occur in all parts of the maritime value chain and industry drivers push for greener solutions during the lifecycle

Key opportunities: Maritime (1/3)

Waste pools[1]	Inefficiency
Most input materials in ships are recyclable and durable – yet, the use of sustainable indirect materials is limited	◑
Many ships have long idle time at ports, mainly caused by a poor supply chain connection point. Vessels are also often operated with limited use of available capacity	●
Ship operators are increasingly interested in refurbishment, but the cost efficiency of these upgrades is often a blocker	◑
Ship owners can easily change home location of vessels to avoid EU regulations, resulting in vessel dismantling under poor conditions that causes significant pollution[2]	◕
After-sales and add-on sale efforts are limited for most maritime industry players	◕

Industry specific drivers
IMO adopted a 10-year mandatory GHG reduction target. EU Ship Recycling Regulation and Basel Convention to control hazardous material, safe, and environmental friendly end-of-life ship recycling[3]
Service vessel customers and container shipping customers pushing for sustainable solutions, e.g., H&M and IKEA[4]
The Poseidon Principles provide a framework for integrating climate considerations into lending decisions to promote international shipping decarbonization[5]

Inefficiency: ● Very high ◕ High ◑ Medium ◔ Low ○ N/A

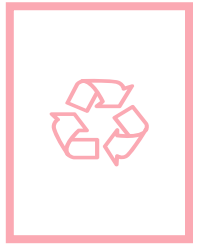
Conclusion

- **Inefficiencies occur in all parts of the maritime value chain** where **underutilised capacity** is the largest waste pool. Vessels often have long idle time or are not operated at full capacity, creating unnecessary costs and emissions
- Other inefficiencies are **wasted end-of-life value,** lack of recycled material in new vessels, as well as unexploited customer engagements, i.e., manufacturer can **establish platforms** to strengthen customer relations
- Industry drivers push the maritime industry for a green transition, especially on **GHG reduction criteria,** forcing the industry to change ways of working, moving to new energy sources and a circular mindset

[1] Analysis based on desktop research, insights from workshop programs and interviews with industry experts [2] Exploring shipping's transition to a circular industry | SSI, [3] IMO, Sustainable shipping [4] Cargo Owners for Zero Emission Vessels (coZEV) [5] Poseidon Principles

Repair and upgrade vessels and equipment to improve performance and extend product usage are big industry opportunities

Key opportunities: Maritime (2/3)

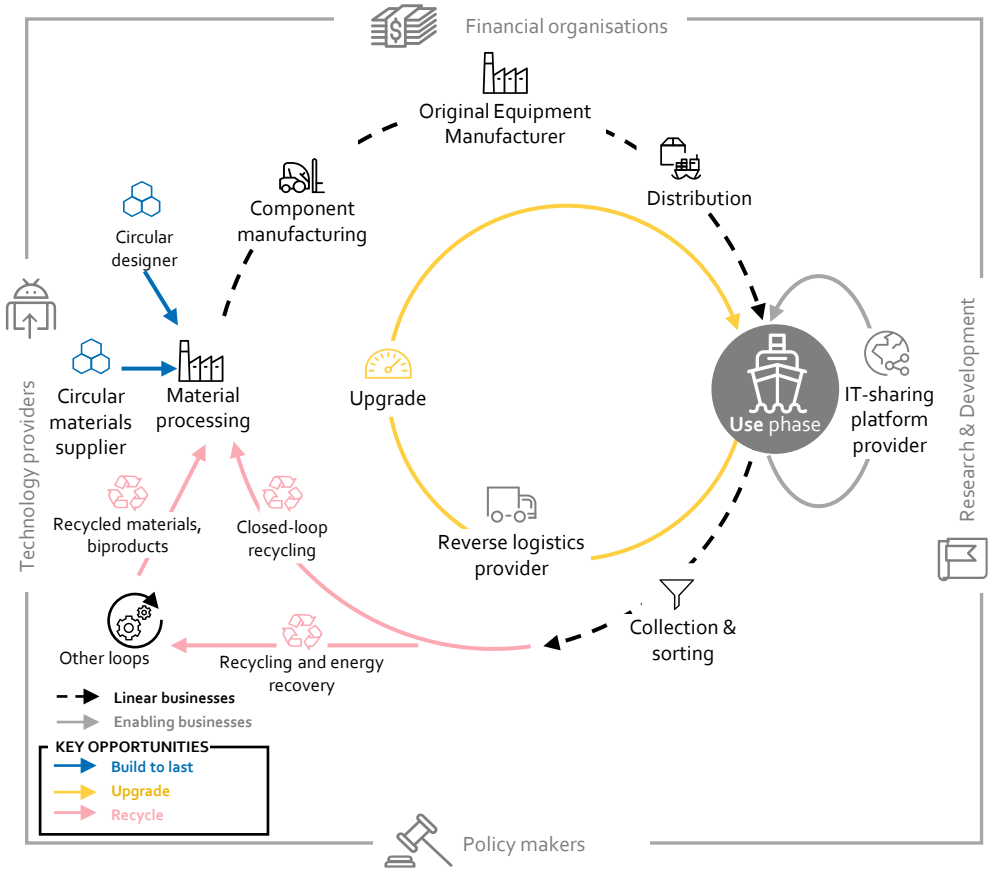
	Key opportunities	Enablers	Examples
	**Build to last** Designing ships with flexibility, recyclability, ease of repair and long lifetime in mind, so that ships designed today can meet future decarbonization requirements as well adapt to the opportunities that digitization and technology provide, e.g., retrofitting of green propulsion system	• **Investment in R&D** on how to design ships for flexibility, repair and recyclability • Investments in technologies such as big data, real time simulation technology and AI to **design energy efficient ships and reduce carbon emissions** • Implement solutions for **simple disassembly and recyclability** in the design phase	• Vard focus on **flexibility when designing ships**, combining different technical solutions for optimal performance today and the future[1] • Maersk's **Cradle-to-Cradle Passport** is a database that lists the material composition of the ship's main parts, enabling better recycling of materials and parts used in vessel construction[2]
	Upgrade Upgrade vessels and shipping products to improve performance and reduce emissions e.g., improve hull design and propeller optimization	• **Investments in R&D** to improve energy-efficient solutions • KPIs incentivising the **transition to greener fuels** • **Sensors, IoT, and reliable connectivity** to enable live tracking and monitoring of vessels and maritime equipment	• Ulstein Group **provides vessel upgrades**, such as hull optimization, system improvements and ballast modifications[3]
	**Recycle** Recycle ships after product end-of-life, recover materials to reuse in production e.g., steel, iron, aluminium and plastics	• Increased end-of-life **responsibility for the shipowners** • **Reverse logistics infrastructure** to handle scrapped vessels • Data to **control waste material flows** to secure high-quality material for recycling and to identify material types	• Green Yard **recycle and resell materials and components** through a partner network and local sales[4]

[1] Vard [2] Maersk Cradle to Cradle Passport [3] Ulstein Group [4] Green Yard

To unlock key opportunities in the industry, ecosystem actors need to know their role and together collaborate across the value chain

Key opportunities: Maritime (3/3)

Circular ecosystem for key opportunities



Key enabling actors

	Role	Description	Example
Built to last	Circular designer	Designs vessels and maritime equipment for a circular life, allowing for upgrades, disassembly, recycling etc. enabling ability to upgrade and recycle vessels	Breeze Ship Design focus to accelerate sustainable solutions in naval architecture[1]
Built to last	Circular material supplier	Supplies recycled materials to the manufacturer or component supplier	Rimeco buy and sell used ferrous and non-ferrous metals[2]
Upgrade	Upgrader	Upgrades existing components of the vessels to increase the performance and energy efficiency of the route. Expertise on how to upgrade vessels e.g., modernization of steering systems and interfaces and propulsion upgrades	MAN Energy Solutions' preform upgrade services to keep engines, systems and maritime equipment compliant and competitive[3]
Recycle	Recycler	Dismantles vessel and sorts different elements which can then be further processed, e.g., ship recycler and waste management company	Fornaes is a Danish ship recycling company and seller of used ships and equipment[4]
Enabling	Reverse logistics provider	Collects and transports returning equipment or components to bring them to specific destinations for recovery, enables remanufacturing, upgrade and recycling e.g., waste management company	Eimskip is an Icelandic transport and logistic company delivering reverse logistic services[5]
Enabling	IT platform provider	Provides platform services for ecosystem actors or for inhouse use for sharing of data on e.g., on use patterns, maintenance and vessel history through data gathering and analytics during the use phase	Kockumation provides automation platform to manage entire ship systems during operation[6] Boatflex, sharing platform for boats[7]
Enabling	Research & Development	Supports knowledge creation and development on topics such as energy efficiency, sustainable design and recycling e.g., universities, commercial research organisations, think tanks etc.	VTT Technical Research Centre of Finland[8]
Enabling	Technology Provider	Provides technology services such as AI, IoT and advanced analytics for the maritime ecosystem actors e.g., AI to improve visibility of circular performance, or machine learning to optimize resource use that can cut cost and reduce emissions	Wärtsilä's predictive maintenance service combines AI and advanced diagnostics to proactively identify potential failures of equipment that cause vessels to run less efficiently[9]

[1] Breeze Ship Design [2] Rimeco [3] Man Energy Solutions [4] Fornaes [5] Eimskip [6] Kockumation [7] Boatflex [8] VTT [9] Wärtsilä

Unsustainable materials used in production and wasted end-of-life value are large inefficiencies in the industry

Key opportunities: Energy (1/3)

Waste pools[1]	Inefficiency
Use of both direct and indirect recyclable or renewable materials in production is limited	●
Capacity use of energy equipment is not always optimized	◑
Electrical equipment is often replaced due to limited opportunities for upgrades and customers opting for newest technologies	◕
Recycling is very limited, volume and the value of recovered materials are low, many products are sold outside the Nordics	●
Providing outcome-oriented solutions is very rare in the industry	◕

Industry specific drivers
'Circular Electronics Initiative' promoting longer product lifetimes for electrical and electronic equipment.[2] EU climate act sets 40% renewable energy and 36-39% efficiency targets for 2030[3]
Utilities companies push decarbonization targets and raise the requirements of operational efficiency[4]
Increasing investment in energy transition, with a record of $755 billion invested globally in renewable energy, electrified transport, energy storage, hydrogen and CCS in 2021[5]

Inefficiency: ● Very high ◕ High ◑ Medium ◔ Low ○ N/A

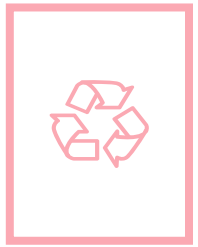
Conclusion

- Inefficiencies occur in all parts of the electrical equipment manufacturing value chain, in which the use of **unsustainable materials** to produce electrical components and products, and **wasted end-of-life value** are the biggest inefficiencies for the industry
- Electrical equipment is often produced with an aim to be energy efficient, but **not necessarily with a focus on durability, repairability or recyclability**
- The industry has clear renewable energy and energy efficiency **targets from regulatory drivers such as the EU Green Deal**, as well as from B2B customers such as utilities companies

[1] Analysis based on desktop research, insights from workshop programs and interviews with industry experts; [2] Circular Economy Action Plan; [3] European Climate Law [4] Vattenfall [5] Energy Transition Investment Trends 2022

Design for easier disassembly, platform to resell, and recycling of equipment are key opportunities

Key opportunities: Energy (2/3)

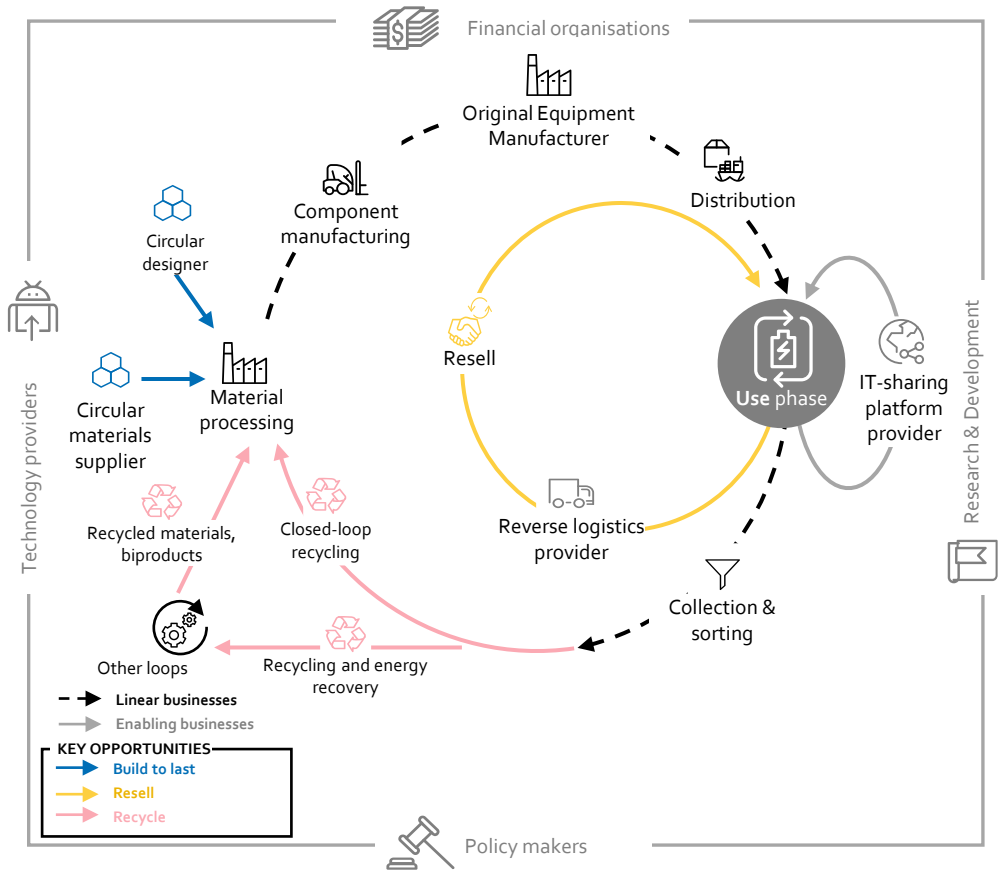
	Key opportunities	Enablers	Examples
	**Build to last** Design products and components that are easy to repair, easy to recycle at end-of-life, and can be made from recycled materials	• **Knowledge on how to design** energy efficient components and products using sustainable materials that can be recovered at end-of-life • **Investments in R&D** and **implementation of KPIs** to slow down demand of new materials	• Vestas currently **manufactures wind turbines that are 85% recyclable** and aim to achieve zero-waste wind turbines by 2040[1] • Schneider Electric offers green programs to customers with a focus on **reducing materials in products and increase product performance**[2]
	Resell Resell components and e-waste that have reached their useful life to second and third hand markets	• **Knowledge on how to reuse assets** through the marketplace e.g., decommissioned electronics, to other subsidiaries or third parties e.g., brokers/dealers • **Track equipment** throughout the value chain, using technologies such as blockchain, to create trust and meet resell standards • **Take back systems as reverse logistics** to collect and sort used electrical equipment	• Vodafone has an **Asset Marketplace**, a B2B solution that **allows resell and repurpose of large decommissioned electrical items like masts and antennae.** Vodafone has committed to reuse, resell or recycle 100% of its network waste within 2025[3]
	**Recycle/upcycle** Collect, sort, and recycle products and components at end-of-life e.g., metals such as iron, copper, and gold from e-waste	• **Incentives for customers to return products** or components through e.g., refunds and discounts • Data to **control waste material flows** to secure high-quality material for recycling	• Elanders collects used IT assets, and **refurbishes and resells** products at a reduced price[4]

[1] Vestas [2] Schneider Electric [3] Vodafone [4] Elanders

To unlock key opportunities in the industry, ecosystem actors need to know their role and together collaborate across the value chain

Key opportunities: Energy (3/3)

Circular ecosystem for key opportunities



Key enabling actors

	Role	Description	Example
Build to last	Circular designer	Designs equipment with a circular mindset, extends the lifetime, allowing for upgrades, repairs, reuse, disassembly, recyclability etc.	Stena recycling uses their knowledge in materials and recycling to deliver design for recycling services[1]
	Circular materials supplier	Supplies recycled material and e-waste such as copper and iron to the manufacturer e.g., waste management company	Metallco, a Norwegian recycling group, sells recycled metal [2]
Resell	Reseller	Resells equipment and e-waste to second and third hand markets e.g., an asset marketplace. Ensures that quality standards on material and equipment are met	Recipo handles end-of-life electronic products for their partners. They resell recycled plastic and e-waste back to the electronic manufacturers to produce circular products[4]
Recycle	Recycler	Dismantles electrical equipment and sorts different elements and e-waste which can then be further processed e.g., waste management company	NG Metall takes care of obsolete electronics, both recycles and resells recycled materials through global sales channels, to be reused in new products[3]
Enabling	Reverse logistics provider	Collects and transports returning equipment or components in order to bring them to specific destinations for recovery, enabling resells and recycling	Grundfos has a take back scheme for used circulators. The scheme covers the Danish market and has been developed in cooperation with wholesalers[5]
	Technology provider	Provides technology services to ecosystem partners e.g., digital platform solutions for handling of e-waste or used electrical equipment, to repair, collect, resell and recycle	The Urban Mine Platform database, developed by the WEEE Forum-led consortium, maps the whereabouts and structure of e-waste to facilitate an efficient collection[6]
	Research & Development	Research how to trace and collect electrical equipment ,and how to use more recycled materials and decrease demand for new materials etc.	Nordic Energy Research is a platform for co-operative energy research and policy development[7]
	Policy makers	Provides incentives for businesses to consider recovery practices while at the same time reducing legislative hindrances to do so e.g., The Circular Economy Action Plan	EU's WEEE Directive is the main law for the generation and management of waste from electrical and electronic equipment[8]

[1] Stena Recycling [2] Metallco [3] Recipo [4] NG Metall [5] Grundfos [6] Urban Mine Platform [7] Nordic Energy Research [8] WEEE

Inefficiencies occur especially in the design and end-of-life phase, drivers push for greener solutions and for phase out of fossil fuels

Key opportunities: Transportation (1/3)

Waste pools[1]	Inefficiency
Vehicle design is not optimized for ease of repair, recycling or resource efficiency. Virgin material is mainly used in components, high recycling rate but low quality	
Private vehicles are often left unused for long periods of time, and the capacity utilisation for commuting is low	
Maintenance mainly happens according to schedule, not according to need, wasting some lifecycle effects	
Complexity in recycling due to contamination e.g., use of glue in fixation, makes repair, change of components and recycling challenging	
Aftersales and add-on sales opportunities from the manufacturers are relatively well exploited	

Industry specific drivers
Regulators push to decarbonize the sector. EU will ban new fossil fuel cars from 2035, and requirements are emerging for recycled plastic content in vehicles, waste reduction and sustainable battery handling[2]
B2B customers are transitioning to green vehicles, requesting suppliers to meet their demand as well as with increasing requirements on logistic efficiency[3]
Increase in public and private financing invested in green transportation, such as electric vehicles and charging infrastructure, alternative fuels, intelligent and efficient public transport infrastructure[4]

Conclusion

- Inefficiencies occurs across the transportation value chain, especially in the design and end-of-life phase. Few vehicles are designed for disassembly, **recycling, repair and recovery of vehicles is challenging**
- Industry **drivers push for a decarbonization of the vehicle-fleet,** moving to fossil-free vehicles. At the same time, **new battery regulations** are emerging and B2B push for sustainable handling of end-of-life products
- The move to **batteries will be a strong enabler for increased circularity,** but will also demand more control of the product process due to the use of scarce raw materials

Inefficiency: Very high · High · Medium · Low · N/A

[1] Analysis based on desktop research, insights from workshop programs and interviews with industry experts, [2] World Economic Forum, [3] European Environment Agency, [4] World Bank

Build to last, repair and maintain, and remanufacturing of vehicles are key opportunities for the industry

Key opportunities: Transportation (2/3)

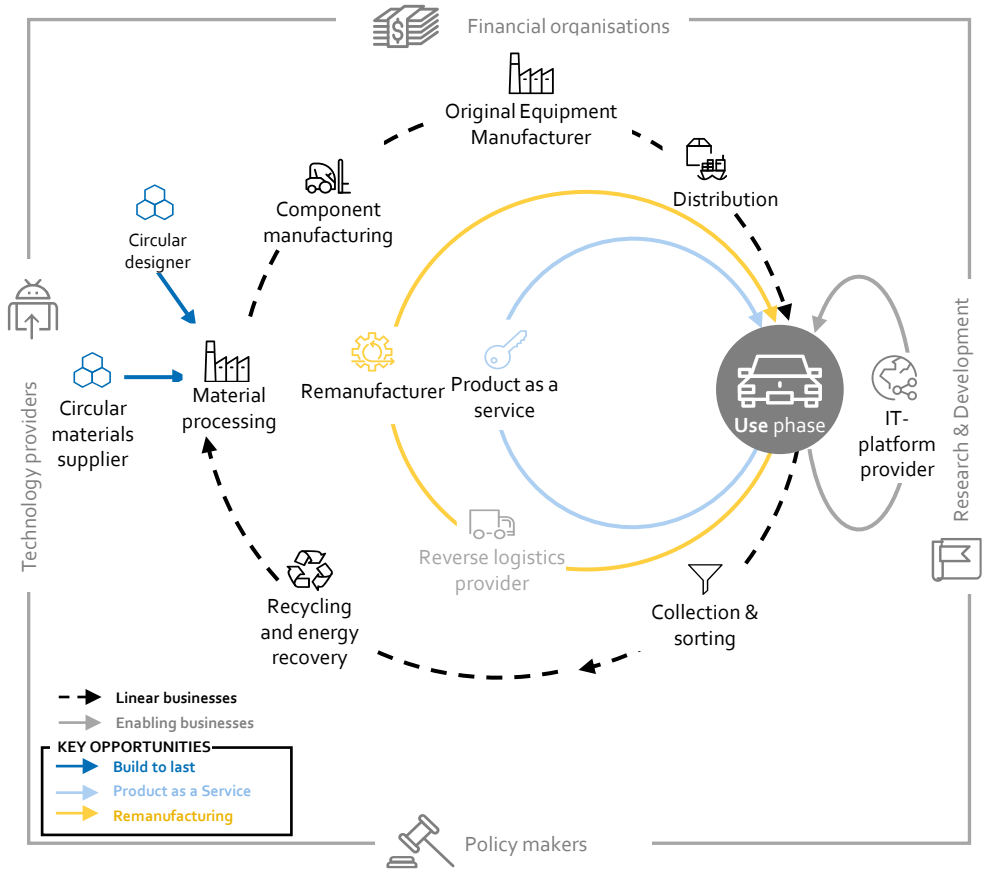
	Key opportunities	Enablers	Examples
	**Build to last** Design to optimize lifetime of components and vehicles by emphasizing efficient design, use recycled content in materials, as well as improved repairability and reuse of vehicles	• **Increase knowledge and adaption** of design for recyclability • **Implement solutions for simple disassembly** at end-of-life such as material passports and modular components • **Investments in R&D** to redesign products e.g., methods to reduce the amount of metals that need to be mined for EV batteries	• Tesla brands its cars as **designed to last,** with durable material and replaceable parts. It **works with third-party** actors for return and recycling of car bodies, electrical equipment and tiers[1] • BMW's i Vision Circular shows a concept where a car can be made from **recycled or bio-based materials and is 100% recyclable at end-of life**[2]
	Product (component) as a Service Extend lifetime of vehicle by offering critical components to be sold as a service, incentivising users to optimize maintenance and enabling reuse e.g., pay-per-use, leasing of batteries	• Knowledge of how to **design for multiple-life use** and high recyclability • **Autonomous robotics** and other technologies enabling **efficient component swapping**. • Use digital solutions such as **IoT sensors to monitor components,** which predict and notify when repair or swapping is necessary	• NIO has a **Battery as a Service** (BaaS) solution where customers buy an EV car without battery and then **subscribe to battery packs** offering different battery capacities and use sensors and cloud computing systems for automated battery swapping[3] • Lots Group offers **Transportation as a Service,** delivering or picking up a certain mass, volume or number of items in a given timeframe[4]
	Remanufacturing Take back products and remanufacture components to extend lifetime and increase usage in the aftermarket e.g., in new vehicle production, second life for batteries etc.	• **Investments in scrap recovery and advanced recycling** technologies e.g., methods for recycling hard plastics • **Reverse logistics infrastructure,** channel material towards specialized facilities e.g., remanufacturing plant • **Monitor and manage material flows** to ensure standards are met	• Renault Group **recover vehicles at end-of-life** for both remanufacturing and recycling[5] • Faurecia Service **provides remanufacturing services** for their Diesel Particulate Filters to OEMs and fleets[6] • Man Truck & Bus takes back and **remanufacture components found to be reusable**

[1] Tesla [2] BMW [3] NIO [4] LOTS Group [5] Renault Group [6] Faurecia Service [7] Man Truck & Bus

To unlock key opportunities in the industry, ecosystem actors need to know their role and together collaborate across the value chain

Key opportunities: Transportation (3/3)

Circular ecosystem for key opportunities



Key enabling actors

	Role	Description	Example
Build to last	**Circular designer**	Designs components and products to enable the use of recycled material, and designs components to enable repairability and recycling of vehicles	Tesla brands its cars as designed to last, with durable material and replaceable parts[1]
Build to last	**Circular material supplier**	Supplies recycled material such as metals to the manufacturer or component supplier	Kuusakoski supplies recycled raw materials such as aluminium, silver and recycled plastic[2]
Product as a service	**Products as a Service provider**	Offer a product against a subscription fee or usage-based charges instead of customers owning it. Critical components to be sold as a service, incentivising optimized maintenance and enabling reuse	Volta Trucks offers Trucks-as-a-Service on a pay-per-use basis[3]
Remanufacture	**Remanufacturer**	Repairs and brings equipment to a new-like condition through disassembly, cleaning, reassembly, coating and testing	Toyota Material Handling remanufactures forklifts[4]
Enabling	**Reverse logistics provider**	Collects and transports returning vehicles or components in order to bring them to specific destinations e.g., a recycling company	Stena Recycling offers pick-up services for waste types e.g., trucks[5]
Enabling	**IT platform provider**	Provides insights on use patterns through data gathering and analytics during the use phase, helps users understand when vehicles need service and reparation	BMW uses a cloud-based platform to share data for maintenance and production[6]
Enabling	**Research & Development**	Supports knowledge creation and development on topics such as redesigning of vehicles components, remanufacturing, energy efficiency and battery recovery	The Norwegian Manufacturing Research Centre does research on e.g., remanufacturing[7]
Enabling	**Policy makers**	Provides incentives for businesses to consider recovery practices while at the same time reducing legislative hindrances to do so, e.g., the EU Green deal or The Circular Economy Action Plan	EU Green Deal; zero emissions from new cars by 2035, circular actions for batteries from vehicles[8]
Enabling	**Technology provider**	Provides technology services such as AI, IoT and advanced analytics to transportation value chain actors e.g., through real time monitoring	BMW employs AI throughout the value chain, and is a key technology in their digital transformation[9]

[1] Tesla [2] Kuusakoski [3] Volta Trucks [4] Toyota Material Handling Sweden [5] Stena [6] BMW [7] Norwegian Manufacturing Research Centre [8] EU Green Deal [9] BMW

Wasted end-of-life value is the largest waste pool, drivers pressure the industry for better waste handling and energy efficiency

Key opportunities: Construction (1/3)

Waste pools[1]	Inefficiency
Virgin material is most common input source, recycled material is not able to compete on price	◔
Underutilized equipment and long idle time, inefficiencies in transportation due to use of multiple suppliers	◔
As user needs changes, it is difficult to repurpose buildings, causing premature decommissions	◑
Waste from the construction sector accounts for 30-40% of the total waste generated in the Nordics[2]	●
Lack of communication between stakeholders, resulting in limited discussions on finding sustainable solutions	◔

Industry specific drivers
The EU Sustainable Built Environment Strategy sets the goal to increase material efficiency (e.g., material recovery, demolish waste) and to reduce climate impacts throughout the lifecycle of a building[3]
Green procurements e.g., the City of Stockholm's action plan for circular construction[4], Skanska target to become carbon-neutral across value chain by 2045 etc.[5]
Financial institutions and property companies are realizing the investment opportunities and growth potential for developing sustainable buildings[6]

Conclusion

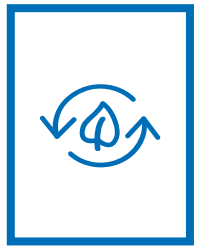
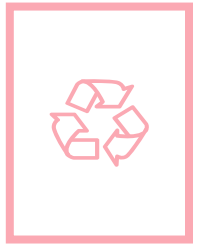
- **Wasted end-of-life value is the largest inefficiency** in the construction industry, and the price for reused and refurbished material is high, making it **difficult to compete with virgin material**. Buildings are built for a long lifetime and are difficult to disassemble
- **Take-back schemes** from manufacturers of components at end-of-life **are rare**
- Industry drivers are becoming **increasingly aware of the inefficiencies in the industry,** especially around waste handling, energy efficiency, and carbon footprint

Inefficiency: ● Very high ◔ High ◑ Medium ◔ Low ○ N/A

[1] Analysis based on desktop research, insights from workshop programs and interviews with industry experts, [2] Circular Economy in the Nordic Construction Sector (2018) [3] Strategy for a Sustainable Built Environment | European Parliament ,[4] City of Stockholm [5] For suppliers | skanska.se, [6] Global Alliance for Buildings and Construction

Recycled input material, reuse and resell schemes for waste, and material handling are circular opportunities for the industry

Key opportunities: Construction (2/3)

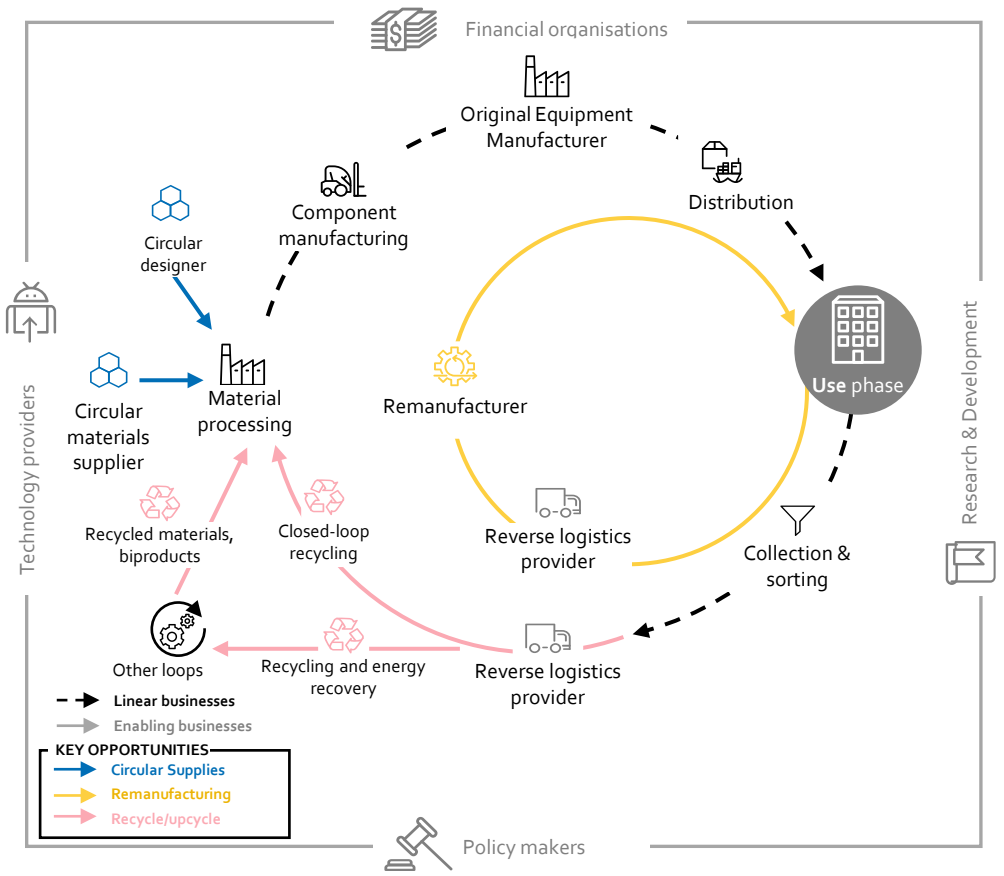
	Key opportunities	Enablers	Examples
	**Circular supplies** Increase the use of recycled and recyclable inputs when producing materials e.g., recycled steel, bricks, gypsum etc.	• Internal knowledge **on how to design** construction products using recyclable material • Traceability systems in place **to secure material trust** in the ecosystem • KPIs to **incentivize use of recycled material** in products	• Isotimber is a building material supplier, their wall elements consists of 99% wood. The **design is suitable for disassembly and reuse,** which can extend the product's service life by many years[1]
	Remanufacturing/Resell Take back products and remanufacture components to extend lifetime and increase usage in the aftermarket e.g., collecting and reusing material from the construction sites	• **Reverse logistics infrastructure,** channel material towards specialized facilities • **Monitor and manage material flows** to indicate which construction components that can be reused and ensure standards are met	• Eurovia uses recycled aggregate collected from recycled products of deconstruction[2] • Loopfront is a platform for **mapping and registration of construction materials,** creating a marketplace to reuse, recycling and sale of construction materials[3]
	**Recycle/upcycle** Collect and recover materials of end-of-life buildings and constructions sites to be reused e.g., reuse of asphalt, rubble, bricks, metals, wood materials etc.	• Data to **control waste material flows** to secure high-quality material for recycling • **Incentives for customers to return products** or components through e.g., refunds and discounts • Treatment **capabilities to reprocess and recycle materials** from returned products or production waste	• Brukspecialisten **implements circular concepts in the brick value chain,** delivering services such as reusability plans in the design phase, maintenance planning for lifetime extension and collection of certified bricks for recycling[4] • Strabag has **increased the percentage of recycled asphalt** used in the production of asphalt mixture in Germany (34%), Austria (13 %) and Poland (41%)[5]

[1] Isotimber,[2] Eurovia [3]Loopfront, [4] Brukspecialisten [5] Strabag

To unlock key opportunities in the industry, ecosystem actors need to know their role and collaborate across the value chain

Key opportunities: Construction (3/3)

Circular ecosystem for key opportunities



Key enabling actors

	Role	Description	Example on actors
Circular supplies	Circular designer	Designs buildings and their materials and components in a way that allows for flexibility, use of recyclable materials, durability, energy efficiency etc.	Granlund group provides design and consulting services to the build industry where energy efficiency and carbon footprint reduction are key aspects in their projects[1]
Circular supplies	Circular materials supplier	Supplies recycled and bio-degradable materials, that are abundant or can be recovered, to the component supplier or to the final assembly line of the OEM e.g., waste management company	Brukspecialisten's concept Grönt Murverk delivers bricks that can be dismantled and reused at end-of-life[2]
Remanufacturing	Remanufacturer /Resell	Repairs and brings equipment to a fresh alike condition through disassembly, cleaning, reassembly, coating and testing	Loopfront's platform helps plan demounting, transportation and storage of waste, and reserve material for reuse or resell as well as track waste, emissions and financial savings[3]
Recycle/upcycle	Recycler/upcycler	Removes coatings and separates metals from products, preparing material to be made into new products and ensures that material maintain the right quality	AF Gruppen has developed a technology to harvest, clean and recycle contaminated construction materials, extracting 80% of the mass as reusable materials and 20% as contaminated mass for further treatment[4]
Enabling	Reverse logistics provider	Collects and transports waste and used material or components from construction sites in order to bring them to specific destinations for recovery	DSVM is a provider of environmental, transportation and construction-related services in Denmark, Sweden and Norway[5]
Enabling	Research & Development	Supports knowledge creation and development on topics such as circular material design, biodegradable materials and material tracking	KTH Live-In Lab, in collaboration with Einar Mattson among others, is accelerating innovation in the public construction sector, making resource-efficient and sustainable buildings of the future[6]
Enabling	Policy makers	Provides incentives for businesses to consider recovery practices while at the same time reducing legislative hindrances to do so, e.g., the EU Green deal or the Circular Economy Action Plan	The EU Green Deal wishes to renovate 35 million buildings by 2030[7]
Enabling	Technology provider	Provides technology services for the construction industries e.g., traceability technologies or technologies enabling smart recycling	ZenRobotics is a smart robotic recycling company using AI-based sorting robots to sort and recycle, e.g., construction waste[8]

[1] Granlund group [2] Brukspecialisten [3] Loopfront [4] AF Gruppen [5] DSVM [6] KTH Live-In Lab [7] EU Renovation wave [8] ZenRobotics

3 Consisting gaps

This chapter will help you to:

- Learn the importance of shifting to a customer-value delivery focus in the organisation, to adopt circular business models across own operations and value chain
- Understand the challenges that companies are facing when transforming and scaling new business models related to organisation, ecosystem and data

Additional material that can be found in the Nordic Circular Economy Playbook:

- Nine capabilities that can enable companies to increase circularity in the organisation
- Assess capability gaps and identify actions to bridge them as well as identify potential technology partners and suppliers
- Understand the key steps, common barriers and success factors for the stages "Explore & shape" and "Attract & win"
- Supporting tools: Culture gap analysis and funding requirements analysis

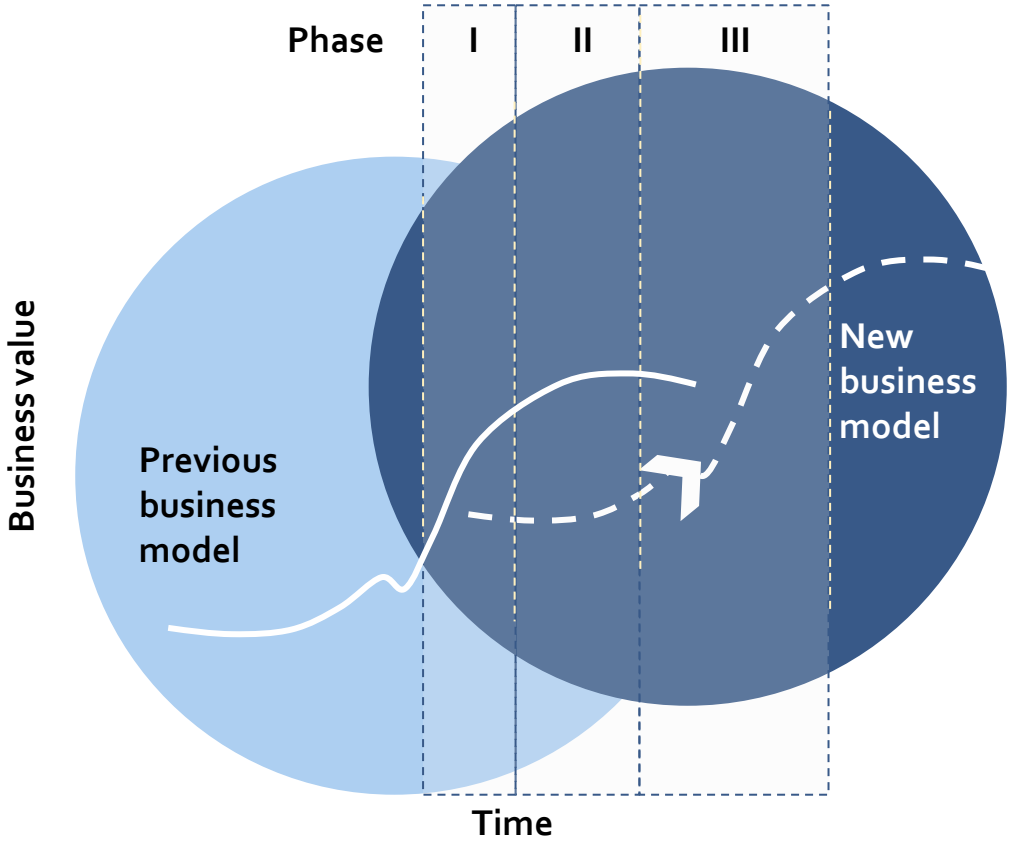
CHAPTER SUMMARY

Consisting gaps

- The transformation journey required to leverage the circular advantage typically takes companies through three different stages
  - They first "Explore & shape" to develop concepts for target business models, look for partners, design and test prototypes. They then "Attract & win", as they develop required processes and partnerships and pilot new solutions. Finally, they "Scale fast & keep growing" by adopting multiple circular business models across their operation
- Most companies struggle to transform and scale and have not made it through pilot stage. Main challenges are typically related to (a) people & culture, (b) new collaborations, (c) lack of transparency, and (d) sustainability organisation ownership

The transition from the previous to the new business model is gradual and has three phases

Three phase transformation



I **Explore & shape**

Develop concepts for target business models, look for partners, design and test prototype(s)

II **Attract & win**

Develop processes and partnerships, and pilot new solution to convey benefits

III **Scale fast & keep growing**

Adopt multiple circular business models across own operations and value chain

Source: Accenture, Appendix 2 for more details

In each phase, customer value delivery, collaboration and resource handling follow circular business logic

Scale fast and keep growing

PLAYBOOK FOCUS

	I. Explore & shape *Develop concepts for target business models, look for partners, design and test prototype(s)*	II. Attract & win *Develop processes and partnerships and pilot new solution to convey benefits*	III. Scale fast & keep growing *Adopt multiple circular business models across own operations and value chain*
Customer value delivery	• Apply customer-centric design process and detail concept with **needs addressed** and potential **functions** • Prototype and **test new solution with customers**	• **Implement pilot concepts** and enable customers with new solutions • **Raise awareness** and promote new solutions	• Apply circular **concepts across offerings** within product and service portfolio, incorporating multiple business models • Use **circularity as a differentiator** to remain competitive and profitable
Organisation & collaboration	• Assess and strengthen internal capabilities and processes • Identify **cooperation partners** complementing own capabilities	• Ensure dedicated resources focusing on opportunities and **engage broader organisation** • **Define circular targets** to incentivise and drive change in organisation • **Engage in external dialogues**, collaborations and partnerships	• Ensure **strong buy-in across business** and at leadership level • Use credibility, scale and leverage to **solve global circular barriers**
Resource handling	• Analyse and prepare required **changes** in production	• **Improve internal knowledge** of circular materials and processes • **Adapt production** to manage circular materials and products	• Incorporate **circular thinking across business units**, demonstrating proven impact at multiple levels

Old business model

New business model

Time

Source: Accenture, Appendix 2 for more details

Transforming to a circular business requires different capabilities and a focus on the end-to-end customer journey

Organisational change

	From product focus and piloting…	…to transformation and scale of circular business
Customer value delivery	• Understand customer usage and expected product attributes • Improvement of products **not always desired by customers** • Prototype and **test new solution with customers and suppliers** • Focus on product sales, demand generation and **maximizing profits**	• Continuously engage with customers to get deep insights on **how the product is used** in order to **sell value-adding solutions** and meet customer needs • Look at the end-to-end customer journey to **maximizing customer value**
Organisation & collaboration	• Sustainability team siloed from business and sustainability strategy is **not integrated into core business** • Metrics **product revenue and market share** • Engage with **key partners** and customers through dedicated project team	• Change mindset in organisation and **phase out old business model** • Organize around products/services to drive **cross-functional collaboration,** using clear, **practical and visionary targets** e.g., customer acquisition cost, customer churn, customer satisfaction • Connect with an **ecosystem of partners in multilateral exchanges** with a defined common value proposition and
Resource handling	• Leverage traditional and robust processes • Valuable components, materials and energy **are not recovered at disposal** • Analyse and prepare **required changes in production**	• New capabilities and mindsets are required within sourcing and manufacturing for an **improved understanding** of how material selection, waste management and manufacturing services impact environmental footprint and quality of product • **Maximise returns** on embedded values **across product life cycle**

Source: Accenture, Appendix 2 for more details

Understanding the importance of people & culture, new collaborations and transparency are key to achieve full transformation and scale

Main challenges

People & Culture

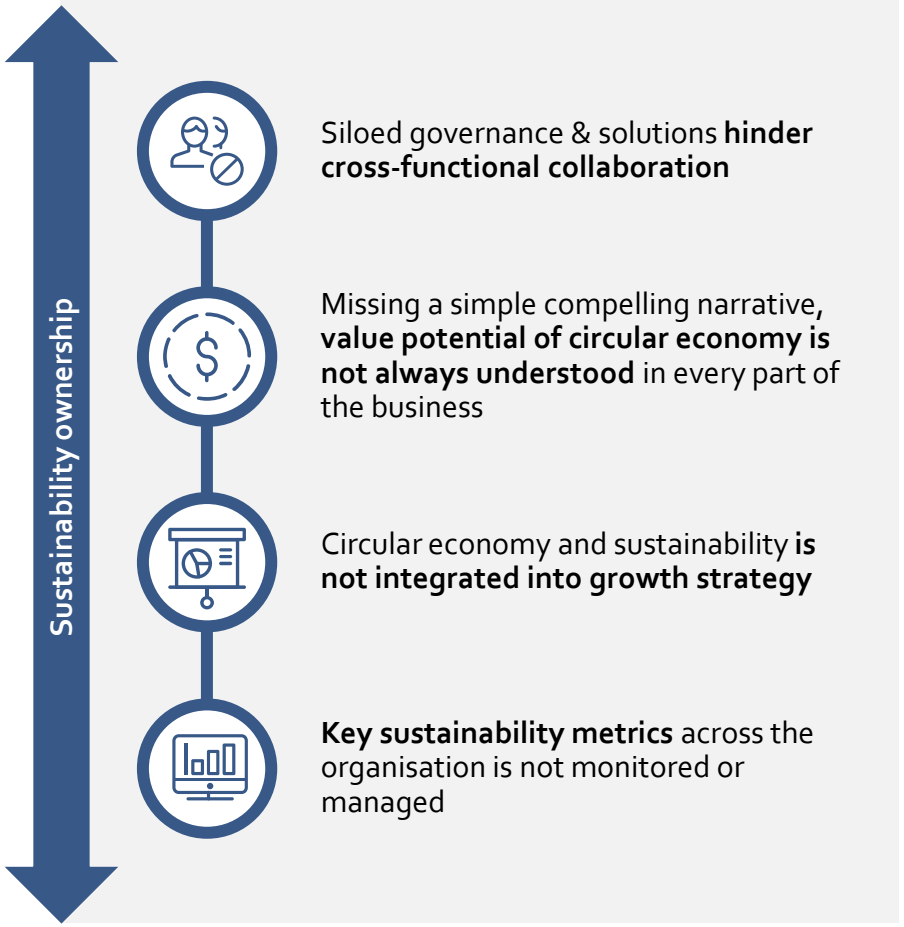
- **Knowledge on how to drive circular economy** in different circular business models e.g., how to design circular products, how to endorse the new circular culture etc.
- **Lack of incentives to change** e.g., from leadership, in procurement and sales etc.
- A **resource gap** makes it difficult to prioritize sufficient assets to fully enable transformation

New collaborations

- Knowledge on how to **collaborate with internal and external parties** to enable change across the value chain
- Establish and understand the **common value proposition** e.g., organisations get stuck in the initial stages, questing the value-add and if they get a fair share of value

Lack of transparency

- **Lack of understanding the potential of data sharing,** how to share and the reluctance to **share data** between organisations is a challenge
- Reliable sources for many categories of **sustainability data unavailable** and it is difficult to create linkages from data to end enterprise value, **metrics are missing to support decisions**
- **Lack of centralized standards** to ensure data alignment across value chain



Companies face several barriers during their circular transformation journey

Output from Nordic Circular Industries workshops

Barriers	Challenges
Securing financing	Funding requirements vary for all business models, and therefore need to be thoroughly assessed and described. Companies see **funding as a barrier for scaling circular concepts**, larger companies often have more challenges competing for internal funding while smaller companies face challenges related to securing funding from external sources.
Uncertain business case	Management require a secure business case from the pilot before deciding to scale. To prove this **circular business models often requires economies of scale,** and it is therefore difficult to get the mandate to continue from pilot stage.
Leadership commitment	The transformation process needs to be well-managed and embraced by leadership to support change in the long-term. Several companies describe that their company has a clear tone from the top, but they **struggle with anchoring and prioritizing circular business models** across the organization.
Sufficient resources	There is a challenge of **insufficient resources when prioritizing new circular innovations**. Projects are competing on the same resources, and at the same time project tasks are often added on top of existing workload.
Internal resistance to change	**Cross-functional collaboration** and **customer-centricity** are fundamental aspects to a circular business; however, these aspects are often not developed in linearly operating companies. Circular economy's role in achieving the sustainability agenda is not sufficiently understood, i.e., the correlation between increase of circular economy resulting in decrease of carbon emissions.
Customer adoption	When changing or altering a business model to a circular model, customer adoption is often a challenge. Many companies find it **difficult to promote the right value to the customer,** understand how to introduce new solutions to them, and how to make the customer trust that the new product has the same quality as the old one.
Establishing partnerships	To engage with ecosystem partners, actors that can provide the required capabilities and know-how need to be identified. There is a reluctance among many companies to collaborate with competitors. Many **companies see sustainability and circularity as a competitive advantage,** and therefore have difficulties in finding a common value proposition and sharing data with external actors.
Regulations	Organizations mention regulations as both one of the most important drivers and barriers to circular transition. Where regulations are clear it can strongly influence the business to get the mandate and momentum to adjust, however **where regulations are unclear** or not yet developed, regulations **become a barrier for change.**

Source: Analysis based on output from Nordic Circular Industries workshops in 2022

4 Transformation & Scale

This chapter will help you to:

- Understand enablers that can help companies successfully overcome barriers, transform and become circular businesses

Additional material that can be found in the Nordic Circular Economy Playbook:

- Identify actions to be implemented in terms of culture, ecosystem partners and financing, to avoid typical pitfalls
- Learn how to design a transformation roadmap with concrete next steps, responsibilities and milestones
- Supporting tools: Roadmap development tool

CHAPTER SUMMARY

Transformation & Scale

- For companies to fully transform and become circular businesses, enablers are typically related to four elements:
  - (a) focus on high impact, starting with making one product fully circular to test and learn, (b) use data & technology to lever and unlock business value, (c) enable people to drive culture change and build capabilities, and (d) ensure the success of implementing circular business models by having a dedicated transformation team

To overcome barriers, four enablers can help companies successfully transform

Enablers

Focus on high impact

Starting with one product that is fully circular can help testing and learning to accelerate the journey

Data & Technology

Weaving circular intelligence into the core business and across value chain increases transparency, collaboration and unlocks new business value

Enable people

People are at the heart of the transformation and resources needs to be invested to drive culture change, build new capabilities and set new targets

Transformation Team

To ensure the success of transforming and implementing circular business models, organisations need a dedicated transformation team

Starting with making one product fully circular can help test, learn and secure commitment to accelerate the transformation journey

Focus on high impact

Key activities

1. Start with **one product** to easier track material flow, gain knowledge along the way and set examples
2. Get customer insight of demand **from end-to-end customer journey**
3. Build **standards and requirements** across the organisation, and together with partners across the value chain to ensure transparency
4. Use learnings and frameworks to **accelerate and transition the business**

Case example

Timberlands first step to become 100% Circular and Net Positive by 2030[1]

100 % products designed for circularity

Timberland has the goal to become 100% circular by 2030 and used the high impact approach as starting point

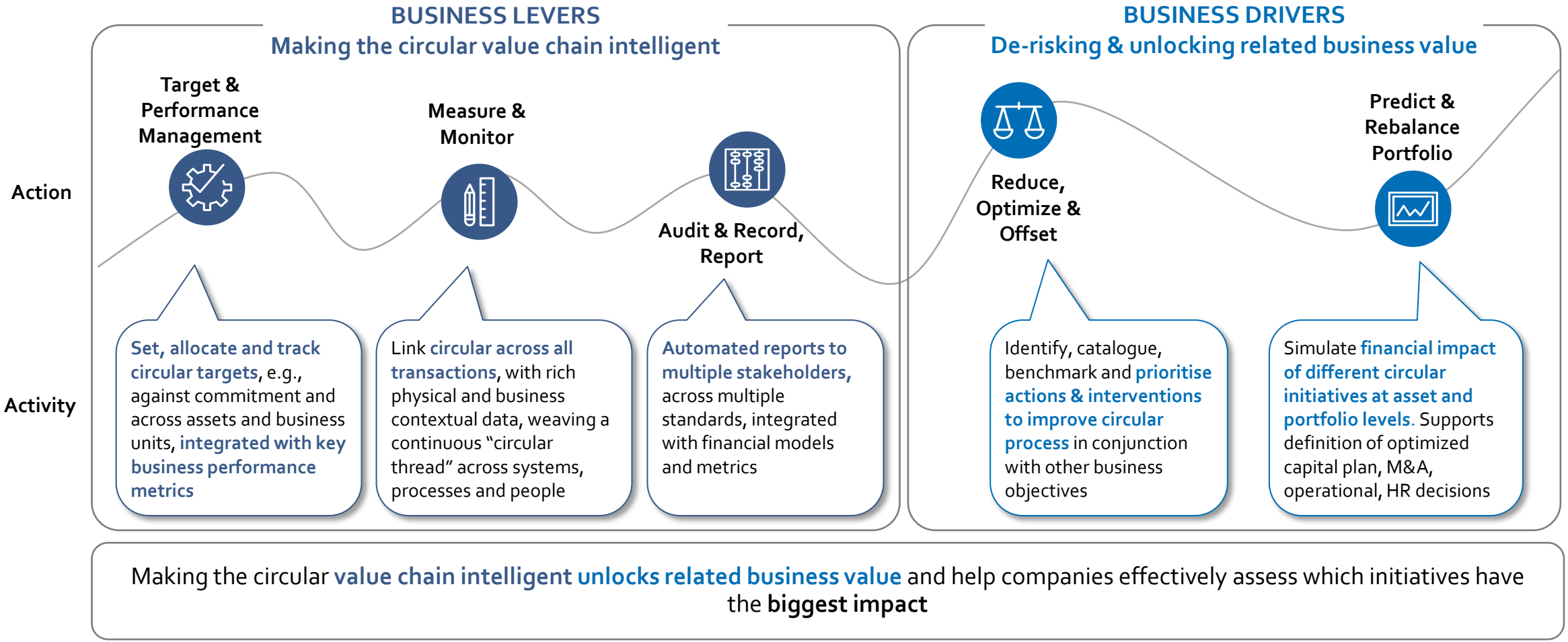
- Their **first step** was to **change the material for one product,** using materials that would otherwise have gone to **waste** e.g., scrap rubber for soles
- Timberland created a **strong commitment across** the organization, which enabled the adaption to take the next step
- They continue by designing the product to be **recyclable** at end-of-life, for **easy disassembly** and **reuse** of materials
- Timberland **continued scaling** and established the infrastructure of a global **take-back programme & circular design platform** called TimberLoop, to keep products/materials in circulation for as long as possible[2]

Test without breaking the bank → **Size the consumer's willingness-to-pay** → **Learn in the process** → **Scale**

[1] All Timberland Products to be 100% Circular, Net Positive by 2030 [2] TimberLoop

Weaving circular intelligence into core business and across value chain increases transparency, collaboration and unlocks new business value

Data & Technology



Making the circular **value chain intelligent unlocks related business value** and help companies effectively assess which initiatives have the **biggest impact**

An increased flow of data across the value chain will accelerate the development of circular business models

Circular data flow

Circular business models can be supported by data sharing

CIRCULAR INPUTS
Data on dismantling, recycling processes, user behaviour, and product performance is fed into product design phase to optimize design, features and durability

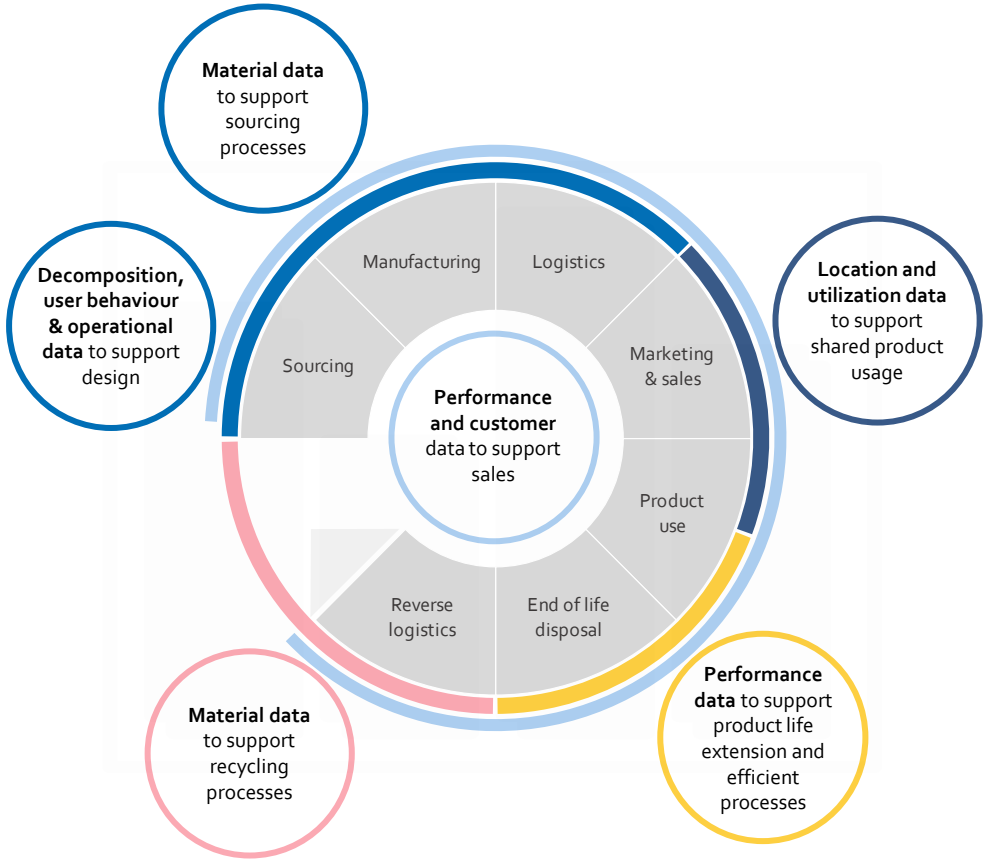
SHARING PLATFORMS
Accessing location and utilization data on the products facilitates Sharing Platforms, and improved access to product performance data allows companies to analyse data patterns of their product and sell it to the customers as a service

PRODUCT AS A SERVICE
Accessing information about product performance and customer behaviour to provide Product as a Service offerings to customers

PRODUCT USE EXTENSION
Data and digital technologies are employed to optimize maintenance and parts replacement, extending the life of the product

RESOURCE RECOVERY
Accessing information about the properties and previous use of the product facilitates the recycling process

Circular data flows



Source: Accenture & Nordic Innovation, Appendix 2 for more details

People are at the heart of the transformation and resources need to be invested to drive culture change, build new capabilities and set new targets

Enable people

Acknowledge that a transformation is required and **develop targets and incentives for employees** to drive circular initiatives. **Integrate circular initiatives into business-as-usual** and scale across operations

- **Circular KPIs**
- **Measure** change adaption
- **Track development** over time

Reframing current status and integrate **circular goals at all levels**, designates clear accountability for circular outcomes

- Show **leadership commitment** and equip leaders as change agents
- Engage stakeholders at a all levels
- Trigger a mindset shift and **ensure employees internalise it for good**

Have transparent and **engaging communication and skills building**

- Conduct trainings and build skills for the future
- **Embed the new ways of working** into the organisation
- Manage transformation talent
- **Motivate employees**

To ensure the success of transforming and implementing circular business models, organisations need a transformation team

Transformation Team

Transformation team improves transformation outcomes and **enables the circular business transformation and integration in the organisation**

- A transformation team **clarifies, aligns, measures, directs and intensifies transformative change** to deliver value
- It **enables the organisation to occupy the future state** with a forward-looking, data-driven vision & outcome-oriented, integrated approach

Focus	Vision and value-driven approach	Governance and integration	Transformation team
Description	• A **vision** is at the core of successful transformations • **Value driven approach** identifies, measures and ensures progress toward business outcomes	• **Governance models and control mechanisms** help the transformation to move forward • Transformation plans **integrated across** to ensure that vision and value are achieved	• The transformation team is a **cross-functional, dedicated team** focused on talent, value, and integration/governance
Key activities	• **Clearly defines the commitment** and the way forward • Describes the **value proposition** in detail • **Creates KPIs to track and measure** the value delivered	• Defines **governance and reporting** • Set **KPIs** • **Coordinates and aligns** integration design to vision	• Helps the organisation **build and attract the right skills** needed to transform • **Tracks and measures** value added • **Develops and enforces** the integrated plan across the organisation

Appendix 1

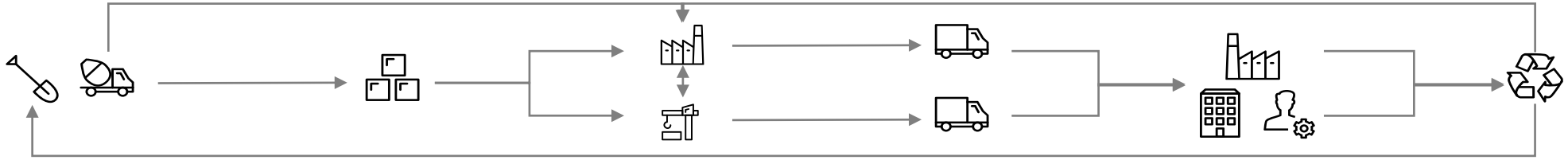
Value chain of the industries

Machinery & equipment

Currently, the machinery & equipment value chain is focused on building efficient, long-lasting products

In scope | Out of scope

Raw material processing | Components manufacturing | Manufacturing | Logistics | Operation/end-use | Decommissioning



	Raw material processing	Components manufacturing	Manufacturing	Logistics	Operation/end-use	Decommissioning
EXAMPLE ACTORS	SSAB, Hydro, outokumpu	Danfoss, COMPONENTA, STÅLA TUBE, aq, NORDIC ALUMINIUM	KONE, ABB, CARGOTEC, KONGSBERG, marel, ebmpapst, KONECRANES	HAVATOR, ILS, Wallenius Wilhelmsen, JANHUNEN	YIT, HKSCAN, VATTENFALL, SÖDRA, fortum, SKANSKA	Delete, PURKUPHA, NG Norsk Gjenvinning
KEY PRODUCTS AND SERVICES	Production of raw materials including • Steel • Iron • Aluminium alloy	Manufacturing components, such as • Simple metal components that mainly include bending, moulding and casting (pipes, screws, hinges etc.) • Other components such as plastic support structures and electrical equipment	Manufacturing all types of machinery and equipment, such as • Engines and turbines • Pumps, compressors and valves • Agriculture, forestry, mining and metallurgy machinery • Lifting and handling machinery	Providing transportation services, such as • Transportation of entire plants, large shipments of industrial equipment, production lines, large-scale systems and devices	Creating products and services of industrial customers in various sectors, such as • Logistics, automotive, general manufacturing, mining, agriculture, pulp & paper, construction and energy	Offering products and services, such as • Recycling: including the demolishing, transportation and recycling of old industrial equipment • Providing raw materials extracted from the recycled products
EXAMPLE CE INITIATIVES*	• Circular supplies – using and creating materials with high recyclability	• Build to last – component technical life is a very important KPI for a manufacturing company	• Build to last - applying modular design • Product use extension services (repair & maintain, upgrade and remanufacture) are increasingly common	• *N/A*	• Build to last, circular supplies, repair & maintain and upgrade – the operators aim for a deep relationship with the end-user	• Recycle & return – the decommission companies make business from returning raw materials back to the start of the value chain

*Examples of the circular economy initiatives pursued by some Nordic companies in the industry

Maritime

The maritime value chain is complex with a large group of heterogeneous players with varying circular maturity levels

In scope | Out of scope

	Ship design	Raw material processing	Component & equipment manufacturing	Assembly & integration	Operation	Maintenance & upgrade	Decommissioning
EXAMPLE ACTORS	NSK SHIP DESIGN, SSPA, FORESHIP, ENGIO	SSAB, Hydro, outokumpu	WÄRTSILÄ, ABB, Promeco, KONGSBERG, MOBIMAR	HELSINKI SHIPYARD, KLEVEN, KAEFER, ULSTEIN, MOEN	Wallenius Wilhelmsen, Finnlines, CONTAINERSHIPS	TURKU REPAIR YARD, ULSTEIN	Delete, GRIEG GREEN, Hans Langh

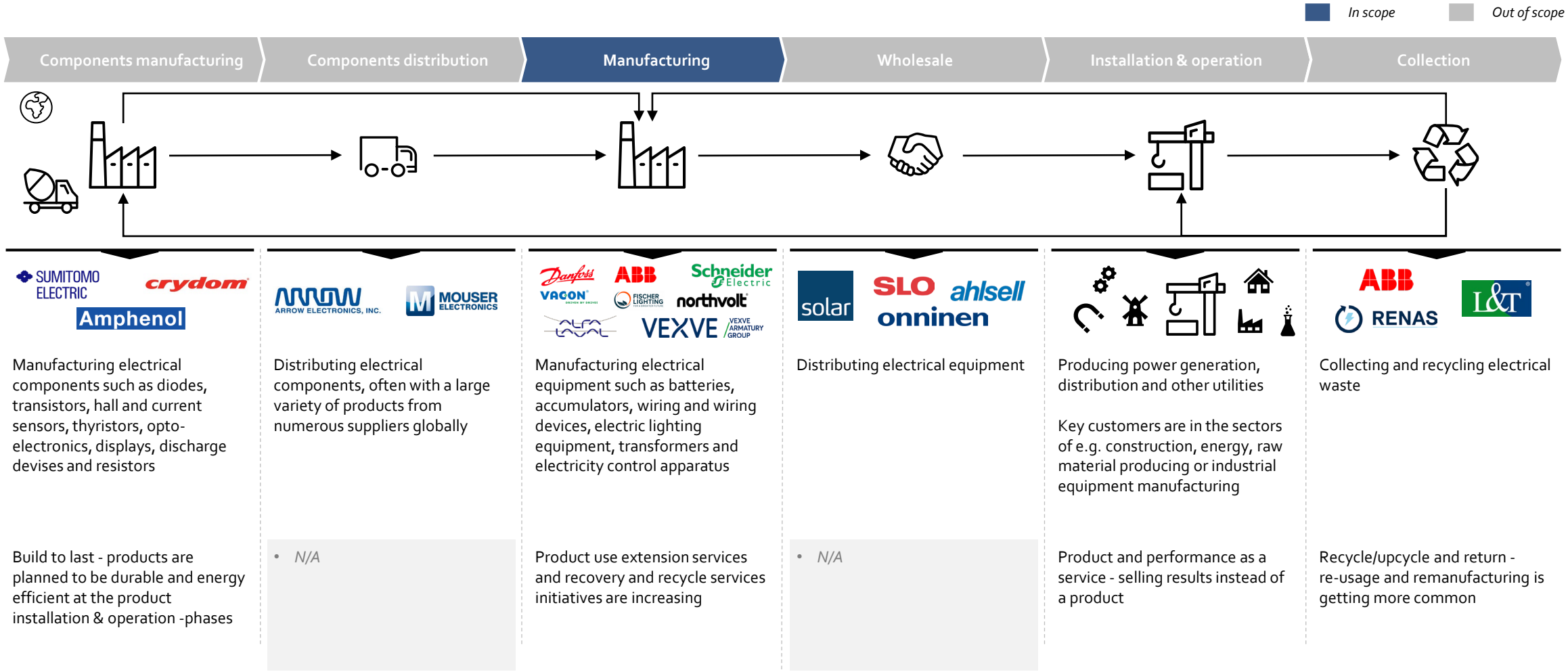
KEY PRODUCTS AND SERVICES	Provides ship design, offshore engineering and construction support
	
	Services span from concept development to project management during shipbuilding
		Produces raw materials including:
		• Aluminum & stainless steel
		• Composite material
		• Syntactic foam
		• Concrete
			Creates main equipment and integrated solutions, incl.
			• Superstructure, rigging, etc.
			• Propulsion and power engines
			• Other systems and solutions (e.g. HVAC, energy mgmt., navigation, safety etc.)
			• Interior equipment (e.g. cabins, bathrooms, doors, etc.)
				• Manufactures the hull of the ship and assembles the ship by cutting, forming, welding, fitting and joining the different parts of the ship together
				• Finalises the ship by
				  • Painting & coating the ship
				  • Installing machinery & equipment
				  • Furnishing the interior
				• Conducts dock and sea trials to test the ship and make final fixes
				• Organises a celebratory launch for the ship
					Equips the ship for transporting goods and/or passengers, and operates it	Conducts repair, maintenance and conversion projects, incl. e.g. damage repairs, equipment replacements, refurbishing, and repainting	Provides various services for end-of-life vessels
							• Dismantling & cutting into blocks
							• Sorting out and processing materials
							• Washing & waste disposal

EXAMPLE CE INITIATIVES*	Build to last –modular design principles	Circular supplies – creates material with high recyclability	• Build to last – high use of modular design principles, some use of recycled materials • Return waste materials to source • Product-as-a-service – only some players have started providing these	• Build to last - applying modular design • Product use extension services (repair & maintain, upgrade and remanufacture) are increasingly common	Rental agreements – chartering	Lifecycle services – repair, refurbishment, repainting, etc.	• Recycle/upcycle • Return

*Examples of the circular economy initiatives pursued by some Nordic companies in the industry

Energy

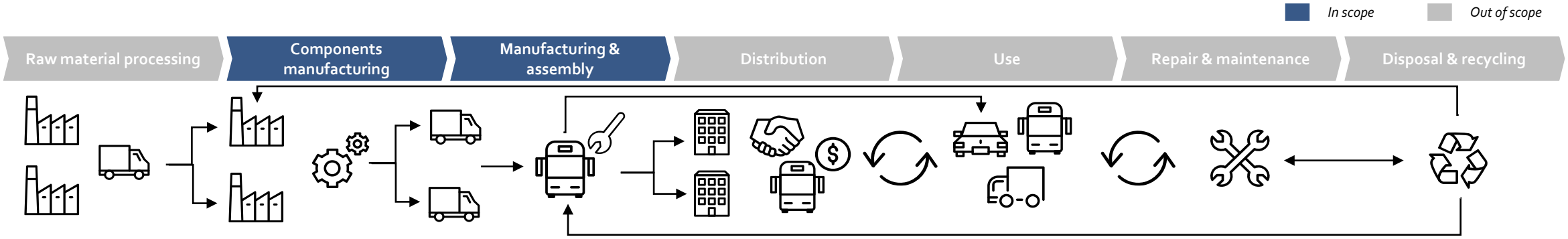
Currently, the electrical equipment value chain aims to build durable and energy-efficient products



*Examples of the circular economy initiatives pursued by some Nordic companies in the industry

Transportation

The transportation value chain is fairly circular, but improvement areas still exist - especially in resource use

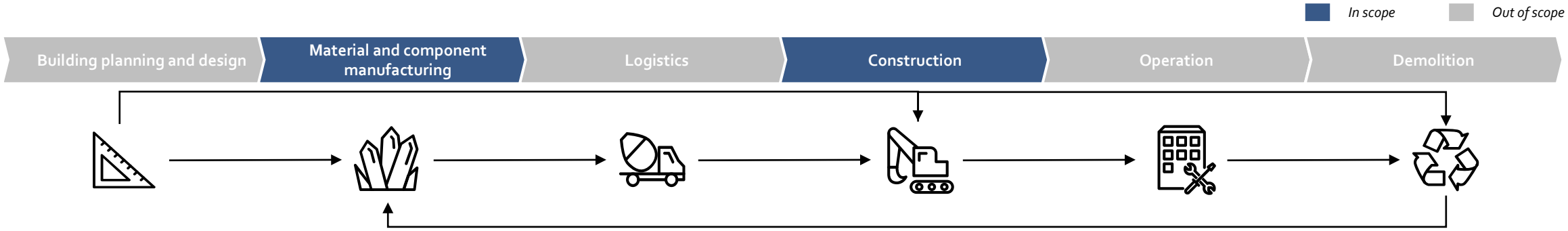


	Raw material processing	Components manufacturing	Manufacturing & assembly	Distribution	Use	Repair & maintenance	Disposal & recycling
EXAMPLE ACTORS	SSAB, Hydro, outokumpu, PLASTIX	Nokian Renkaat, Raufoss Couplings, Fenno, veoneer, Ekeri	Volvo, Scania, valmet automotive	Volvo, Scania, VEHO, Hilla	DHL, DB Schenker, DSV, Nobina	Werksta Bilskadecenter, Bilxtra, Assistor	Helik Teigen AS, Stena Recycling, Suomen Autokierrätys
KEY PRODUCTS AND SERVICES	Produces raw materials including • Steel • Aluminium • Rubber • Plastic • Glass • Fabrics	Manufactures main parts and equipment of vehicles, including • Bodies, trailers, semi-trailers • Parts, accessories and electronics (incl. engines, brakes, seats, windows, sensors, cameras, HVAC etc.)	Provides services such as manufacturing engineering, body welding, painting and final assembly of vehicles	Distributes vehicles for sale Sells both new and used vehicles and provides after sales support Provides vehicle sharing & rental services	Provides logistics services or transports people from one place to another	Provides repair & maintenance services (incl. damage repairs, repainting, reinstallation etc.) Sells spare parts and accessories	Provides collection, treatment and recycling services for end-of-life vehicles, incl. separation of reusable components, crushing, and separation of materials to be reutilised
EXAMPLE CE INITIATIVES*	Circular supplies – creates material with high recyclability	• Build to last – durable products that are easy to repair, somewhat modular design • Return	• Build to last – somewhat modular design principles • Return	• Rentals – renting, leasing • Resell – market for used vehicles	• *N/A*	• Lifecycle services – repair, maintenance, refurbishment • Remanufacturing	• Recycle/upcycle • Return

*Examples of the circular economy initiatives pursued by some Nordic companies in the industry

Construction

The construction value chain is fragmented with numerous suppliers who have various circular maturity levels



	Building planning and design	Material and component manufacturing	Logistics	Construction	Operation	Demolition
EXAMPLE ACTORS	SWECO, Mdd, COWI	SAINT-GOBAIN, Wienerberger, Caverion, KONE	bring, postnord, DB SCHENKER	NCC SKANSKA, VEIDEKKE	COOR, Toma FACILITY MANAGEMENT	Remeo SORTERA Group, NG Norsk Gjenvinning
KEY PRODUCTS AND SERVICES	Provides planning and design for the components, systems and ultimately the complete building, including material choices.	Produces materials, such as gypsum boards, cement or steel, and partly/fully assembled components such as ventilation systems, elevators or floor panels.	Transports material and components from the production site to the construction site and transports packaging and surplus material away from the construction site.	Constructs the complete building on the site, including cutting and assembling of individual components.	Operates the building to accommodate the requirements of the tenants, such as energy management and required maintenance, upgrades and refurbishment.	Demolition of the building and separation of components and material if possible. The material is either recycled or sent to landfill.
EXAMPLE CE INITIATIVES*	Build to last - buildings are planned to be energy efficient at the operation phase and use of material banks to track material information throughout the lifecycle	Circular supplies - the end materials are made of recyclable materials and materials that are durable	• *N/A*	Build to last - use of pre-fabricated and modular components which minimizes waste generation at the site	• Product and performance as a service - selling lightning as a service instead of a product • Circular supplies - smart energy management	• Recycle/upcycle and return - recycle construction waste • Sharing platform - re-selling of surplus material or waste material

*Examples of the circular economy initiatives pursued by some Nordic companies in the industry

Appendix 2

Current state analysis and circular opportunities

INTRODUCTION

Circular maturity survey

Purpose

The circular maturity survey was conducted to understand the starting point of Nordic manufacturing companies in adopting the circular economy principles.

Content

The survey included reflection of current inefficiency assessment focused on understanding the occurrence and level of the five inefficiencies of the linear model:

- Unsustainable materials
- Underutilised capacities
- Premature product lives
- Wasted end-of-life value
- Unexploited customer engagements

Outcome

In total, 24 Nordic manufacturing companies replied to the survey. The responses were collected in workshops in August – October 2022.

Detailed results of the survey are presented in the following pages.

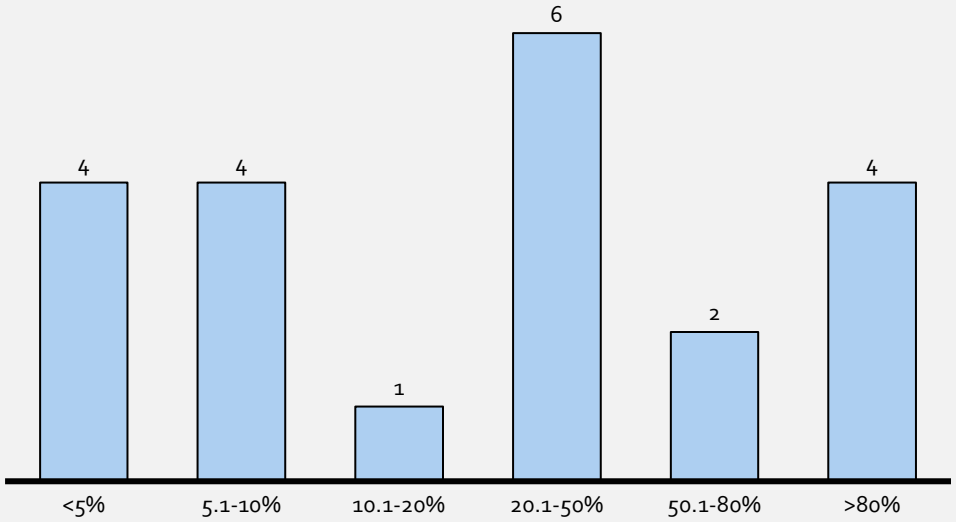
RESULTS – CIRCULAR MATURITY SURVEY

Inefficiency assessment (1/5)

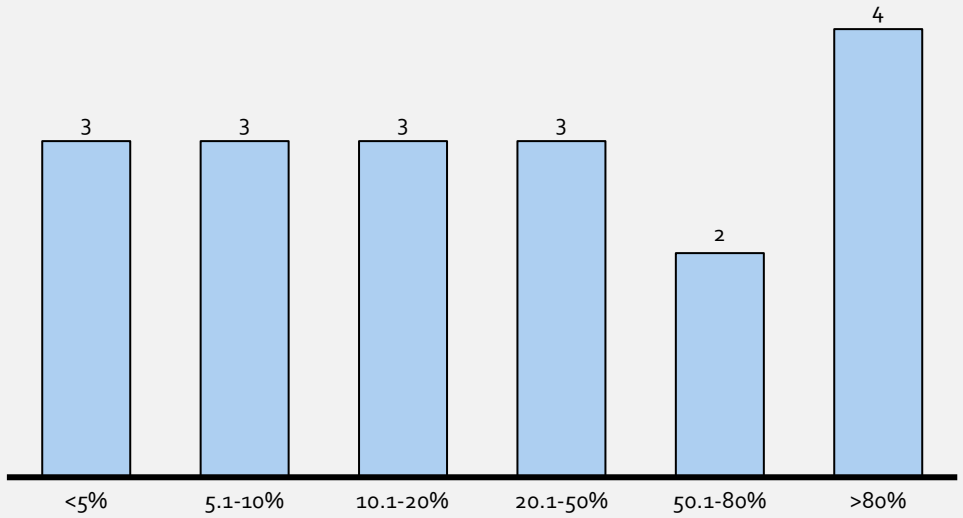
1) Unsustainable materials

Material and energy that cannot be continually regenerated (e.g., direct and indirect material is not renewable or bio-based)

Direct Material: What % of direct material spend is spent on circular material such as renewable, recycled or reused materials?



Indirect material: What % of indirect material spend (=not clearly allocated to a certain product) is spent on circular material such as renewable, recycled or reused materials?



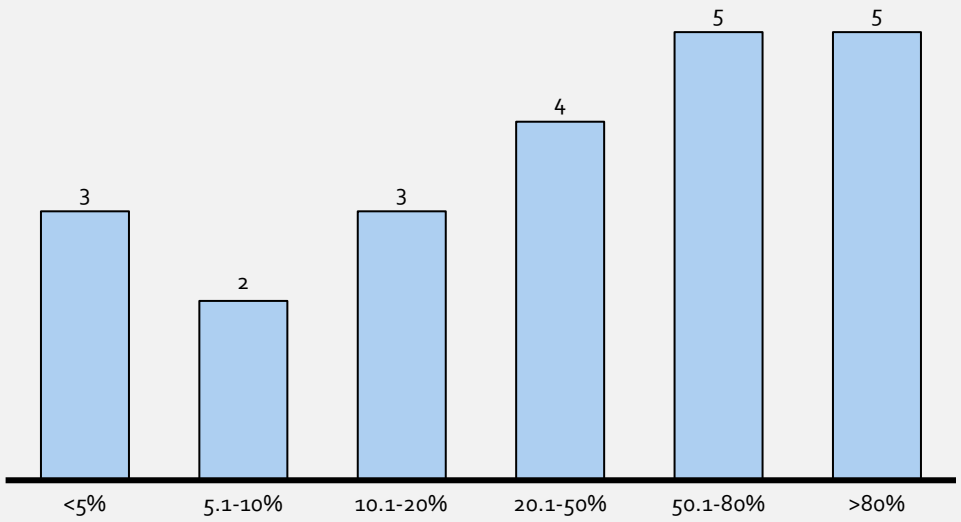
RESULTS – CIRCULAR MATURITY SURVEY

Inefficiency assessment (2/5)

2) Underutilised capacity

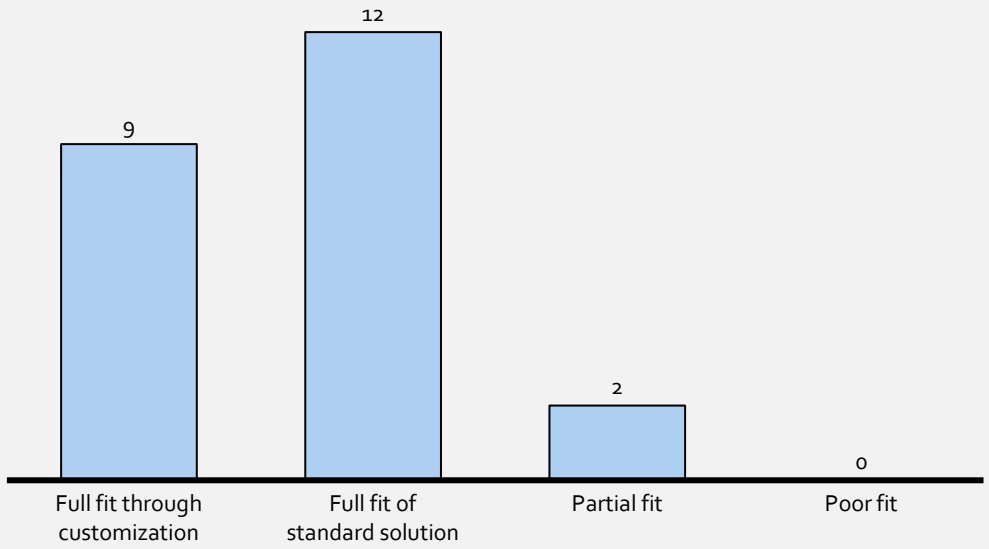
Underutilised or unused products and assets (e.g., products are not operating full hours or full functionality is not used)

Availability: What % of time is the product not used by the customer/end user? (e.g., if only used in summer, 1h a day)*



** % of 24hours x 365 days per year*

Operational fit: To what extent does the product fit the requirements of the customer e.g., regarding operating efficiency, product operations planning?



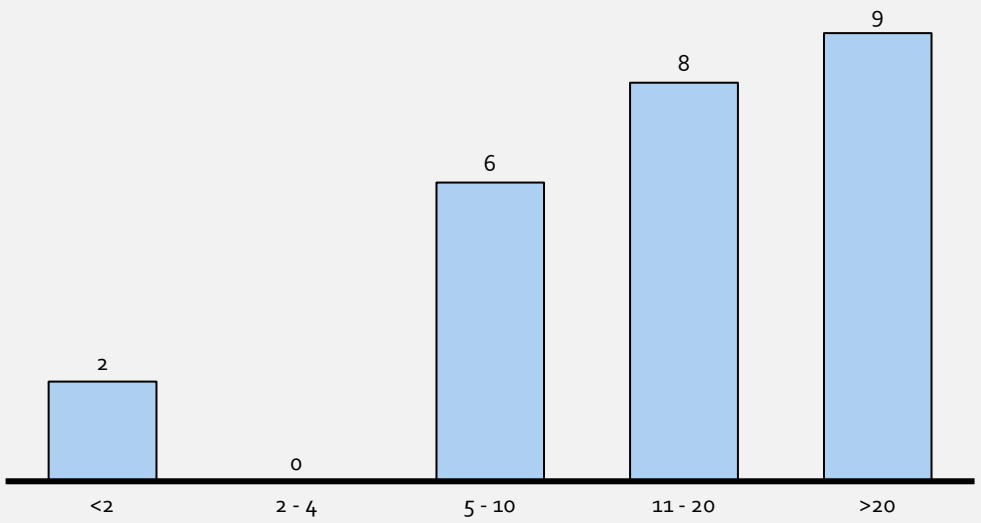
RESULTS – CIRCULAR MATURITY SURVEY

Inefficiency assessment (3/5)

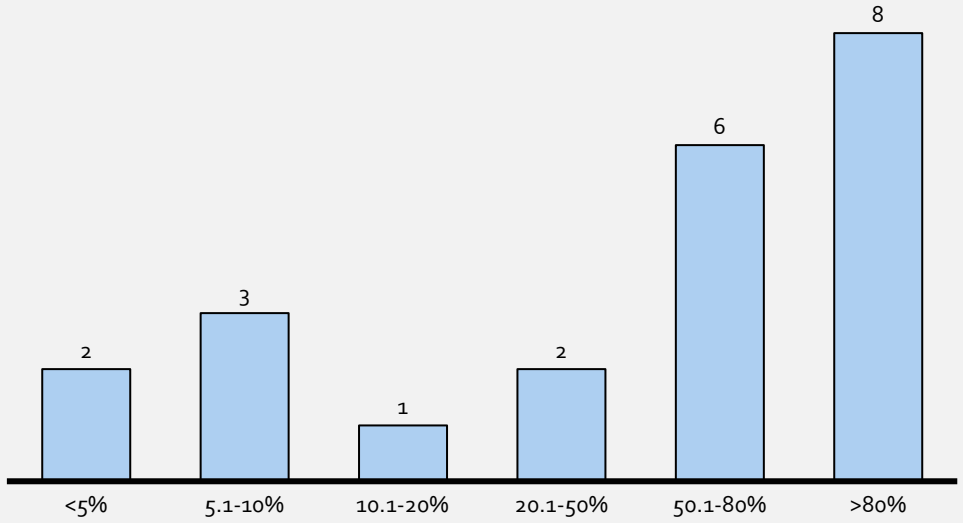
3) Premature product lives

Products are not used to the fullest possible working life (e.g., due to new models and features or lack of repair and maintenance)

Lifetime: What is the current average duration of a product life (in years)?



Functionality: % of revenue that comes from products that are designed for a long life e.g. through enhanced repairability, modularity, upgradeability



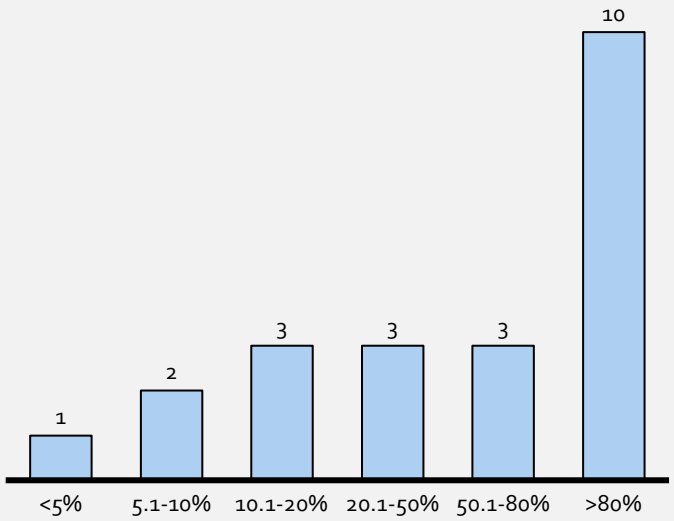
RESULTS – CIRCULAR MATURITY SURVEY

Inefficiency assessment (4/5)

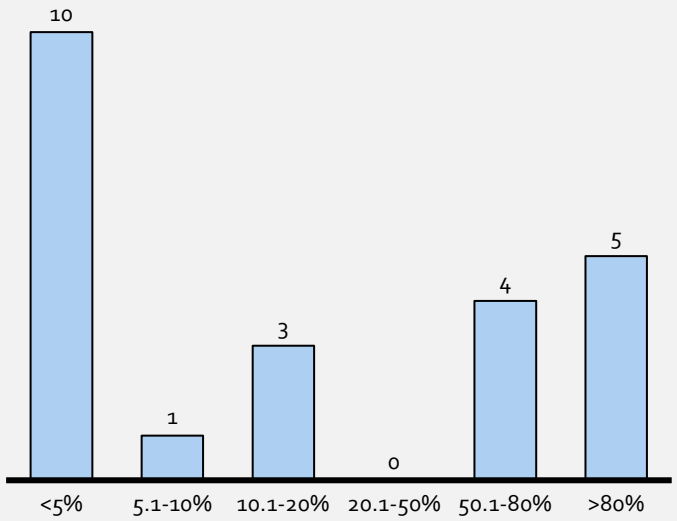
4) Wasted end-of-life value

Valuable components, materials and energy is not recovered at disposal (e.g., not recycled or recovered at end of life)

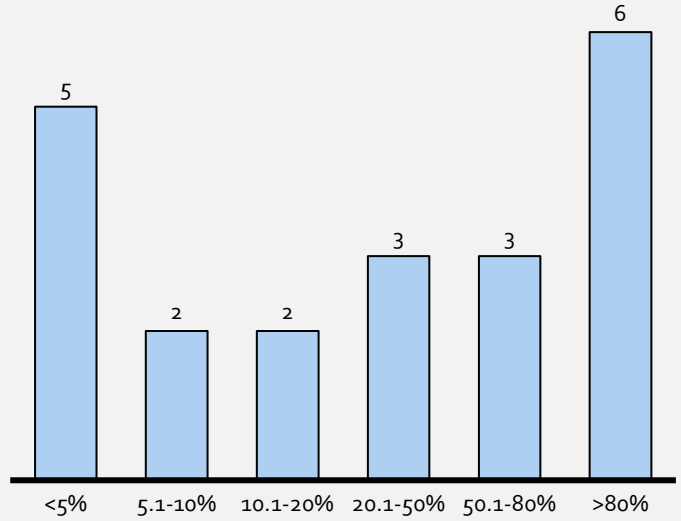
Waste in production: % of waste from production that is recycled (based on weight)



Take back: % of products taken back from customer in dedicated return scheme at end-of-life



Recycling: % of products recycled at end-of-life



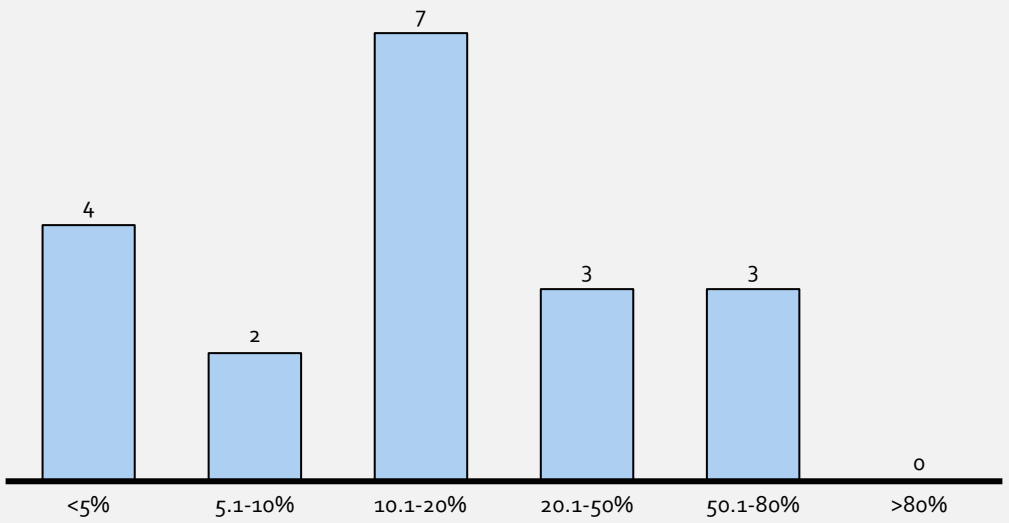
RESULTS – CIRCULAR MATURITY SURVEY

Inefficiency assessment (5/5)

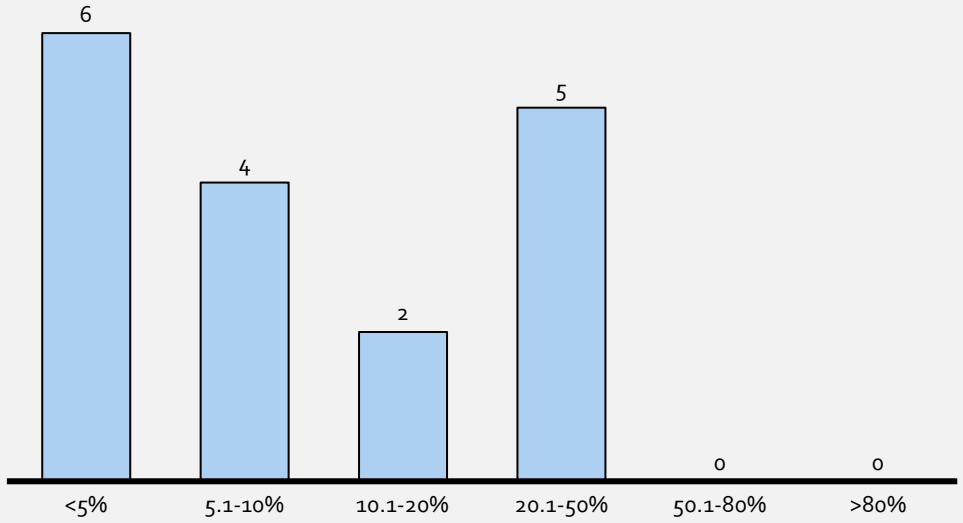
5) Unexploited customer engagements

Material and energy that cannot be continually regenerated (e.g., direct and indirect material is not renewable or bio-based)

After sales: % of revenue from after sales services



Add-on sales: % of revenue from add-on sales



Appendix 3

Additional details on sources

ADDITIONAL DETAILS ON SOURCES

Content	Playbook pages	Source
5 Circular business models	14	• Accenture – Lacy, P. & Rutqvist, J. (2015). *Waste to Wealth: The Circular Economy Advantage*. 1st ed. English: Palgrave Macmillan. • Accenture – Lacy, P., Long, J. & Spindler, W. (2020). *The Circular Economy Handbook: Realizing the Circular Advantage.* 1st ed. English: Palgrave Macmillian.
4 types of inefficiencies in the linear value chain	12	• Accenture – Lacy, P. & Rutqvist, J. (2015). *Waste to Wealth: The Circular Economy Advantage*. 1st ed. English: Palgrave Macmillan • Accenture presentation, Circular Materials Conference (2018) • Accenture – 3D Printing vs 3D-TV: https://www.accenture.com/no-en/insight-3d-printing-vs-3d-tv
Development of resource demand	24	• Accenture – Lacy, P. & Rutqvist, J. (2015). *Waste to Wealth: The Circular Economy Advantage*. 1st ed. English: Palgrave Macmillan
Circular technology descriptions	93 - 101	• Adapted from Accenture – Lacy, P., Long, J. & Spindler, W. (2020). *The Circular Economy Handbook: Realizing the Circular Advantage.* 1st ed. English: Palgrave Macmillian. • World Economic Forum, in collaboration with Accenture – Driving the Sustainability of Production Systems with Fourth Industrial Revolution Innovation (2018): http://www3.weforum.org/docs/WEF_39558_White_Paper_Driving_the_Sustainability_of_Production_Systems_4IR.pdf
Circular sub-models	15, 18, 21, 24,27, 30	• Adapted from Accenture – Lacy, P., Long, J. & Spindler, W. (2020). *The Circular Economy Handbook: Realizing the Circular Advantage.* 1st ed. English: Palgrave Macmillian. • Accenture presentation, Circular Materials Conference (2018)
The wise pivot	34, 35	• Accenture Point of View – Leading in the NEW: Harness the Power of Disruption (2017): https://www.accenture.com/t00010101T000000Z__w__/jp-ja/_acnmedia/PDF-62/Accenture-Leading-in-the-New-POV.pdf
Circular data flow	44	• Nordic Innovation, Data Sharing for a Circular Economy in the Nordics (2021): https://www.nordicinnovation.org/CEdatasharing