



CIRCULAR BUSINESS MODELS IN THE NORDIC MANUFACTURING INDUSTRY

—

Current Status and Development



Nordic
Innovation

Acknowledgements

We would like to express our appreciation to the companies that have participated in the workshop series between 2019-2022 and who have provided input to this report.

Disclaimer

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About Nordic Innovation

Nordic Innovation is an organization under the Nordic Council of Ministers. Nordic Innovation aims to make the Nordics a pioneering region for sustainable growth and works to promote entrepreneurship, innovation, and competitiveness in Nordic business

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Foreword

The Nordic governments and the Nordic Council of Ministers have a vision to make the Nordics the world's most integrated and sustainable region by 2030, and Nordic companies will be key in realizing this vision. Nordic Innovation is an agency for the Nordic governments and works to promote sustainable development through supporting entrepreneurship, innovation, and competitiveness among Nordic companies.

In 2021, Nordic Innovation launched the Nordic Circular Economy Playbook for Nordic manufacturing industries. The aim of the playbook was to enable manufacturing companies and individuals to start their circular journey, and to serve as inspiration on how to do it. The playbook was well received among Nordic companies looking to transition from a linear to a circular business model. On this basis, Nordic Innovation decided to proceed with a second and updated version of the playbook, the **Nordic Circular Economy Playbook 2 – Transform & Scale**, which is a guidance for companies on how to successfully transform and scale circular business models.

This status of the development in circular business models among Nordic Manufacturing Industries provides definitions of circular economy and an assessment of the maturity level of today's circular business models, just as it highlights the barriers of scaling this kind of business model. Equally, the report unfolds a set of recommendations for inspiring policy levels and organizations to continue and improve the framework and efforts around circular business models in the Nordic countries.

Nordic Innovation December 2022.

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Executive summary

Executive summary

The Nordic region has set ambitious goals to become the most sustainable and integrated region in the world by 2030. Circular economy plays an important role in this transition, and it needs to be a more accessible option for industrial companies across the Nordics.

The Nordic Council of Ministers is set to serve this purpose. Through their suborganization Nordic Innovation, they have initiated a program to support the development and transition to circular business models in the Nordic manufacturing industry.

The program has initiated workshop series that have run three times between 2019-2022, in which more than 140 companies have participated. The series have increased the awareness of and the knowledge level on circular business models, as well as given insights into the development, current maturity, and the barriers companies face when transforming.

The current maturity level of circularity in the Nordics is advancing. Yet, the development is not going fast enough to reach the targets, e.g., the level of circular input material is increasing in a slow pace. Circular transformation is still siloed from the rest of the business, and the connection to CO2 reduction is not fully understood. Inefficiencies occur across the entire manufacturing value chain and most occur at the beginning and end of the value chain. Companies have reduced inefficiencies close to their core business, e.g., taken a stronger responsibility over their own production waste.

There are several barriers identified for scaling and transforming circular business models, which can be divided into four main categories: People and Culture, Collaboration, Financing and Regulations. Barriers connected with people and culture are often linked to internal resistance to change ways of working, internal prioritization, and customer adoption. Collaboration barriers go both for cross functional collaborations and external collaborations. Financing barriers are associated with a lack of willingness to prioritize investments to scale circular business models. Regulative barriers are linked to unclear legislation or lack of incentivizing legislation.

Nordic companies can accelerate the global shift to a circular economy, but incentives and collaborations are necessary. Introducing distinct policies and incentives across the Nordics to make it economically viable for manufacturing companies to choose circular solutions, can be a powerful enabler for the circular transition. Policies and incentives indicate direction, while financing institutes must continue to develop sustainable finance frameworks that support circular economy. Research organizations and industry organizations also have an important role in facilitating and testing new innovations and collaboration solutions.

Report

Introduction

The Nordic countries have set ambitious goals to reduce emissions and live up to the Paris Agreement by 2030, including reducing energy-related emissions, increasing energy efficiency, and reducing the use of fossil fuels.¹ Energy efficiency and switching to renewable energy will only address 55% of the global greenhouse gas emissions. To achieve the UN climate goals, the remaining 45% of emissions that arise from producing the products and food that we use every day need to be addressed.² Circularity must therefore be a tangible and accessible option for consumption and a competitive business strategy for companies.

One of the initiatives to support this vision is the Circular Business Models program. The aim of the program is to accelerate the transition to a circular economy in the Nordics and to develop the Nordics further, as agile frontrunners within circular economy and circular business models.³

As part of this program, Nordic Innovation has together with Accenture and Sitra hosted three workshop series between 2019-2022. The program gathered companies across the manufacturing value chain, so that

barriers and possible solutions could be discussed. Over 140 companies have joined the program, including over 250 participants. The program objective is to make circular business models more accessible to Nordic companies by increasing the awareness, maturity, and skill level of circular business models. This has been done by supporting the development of circular business models, pilots, and collaborative ecosystems within the Nordic manufacturing industry – critical for continued innovation and economic growth.

This report discusses the maturity level of circular business models in the Nordic manufacturing industries, how the maturity level has developed, what barriers companies face when scaling, and recommendations for what enablers can do to support the transformation and scaling of circular business models in the Nordics.

"A great kickstart of a circular journey for a company"
– Hitachi Energy

1. Nordic Co-operation, "Action plan for Vision 2030", 2022, <https://www.norden.org/en/information/action-plan-vision-2030> (accessed 2022-11-07)

2. Ellen Macarthur Foundation, "Completing the Picture: How the Circular Economy Tackles Climate Change", 2021, <https://ellenmacarthurfoundation.org/completing-the-picture> (accessed 2022-11-10)

3. Nordic Innovation, "Circular Business Models", 2022, <https://www.nordicinnovation.org/circularnordic> (accessed 2022-11-07)

Definitions

The following section presents the description of key terms and concepts as they are used in this report.

Circular value chain

The circular value chain includes all steps that create value for a product or a service. The process starts with the design and material sourcing, followed by the manufacturing phase. Next, the product moves into the use phase. Finally, the product is recycled and looped back into the production cycle.

The circular economy

The circular economy aims at decoupling growth from consumption of finite resources and presents an alternative to the traditional linear economy based on a “take, make, waste” approach

to consumption. A circular economy introduces circular loops of materials with the aim of keeping materials and used resources in the value chain for as long as possible. Five inefficiencies can be categorized by scrutinising where to avoid unnecessary wastes, inefficiencies and taking care of resources across the linear value chain. The five inefficiencies are unsustainable materials, underutilized capacities, unoptimized product life cycle length, wasted end-of-life-value, and unexploited customer engagements. Five business models can reduce the inefficiencies and create value. See descriptions of the five circular business models in figure 1.

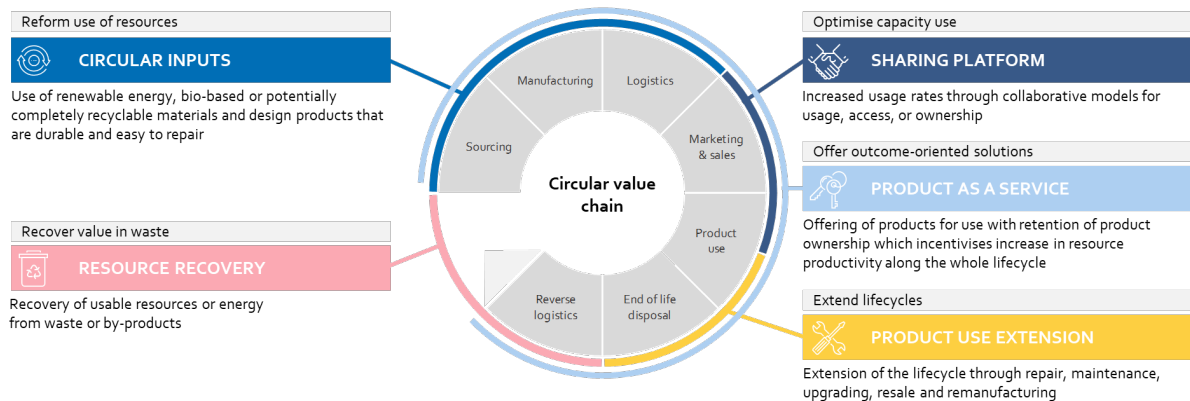


Figure 1: Circular business models⁴

4. Nordic Innovation, 2020 (Circular Economy Playbook)

Maturity of circular business models today

The current maturity level of circularity in the Nordics is increasing. However, the development is not going quickly enough for the Nordic region to be the most sustainable and integrated region in the world by 2030 and to live up to the Paris Agreement.

Circular economy is not a new concept for the Nordic manufacturing industry. Operations such as repairs and maintenance, and increased energy efficiency have long been at the centre for companies as a mean of optimizing the business, however the focus on achieving the sustainability benefits have not sufficiently been addressed.

Through the program series, there have been an advancement of companies' knowledge and awareness on circular economy and circular business models. Previously, participants needed more time to understand the concepts, but now they are more aware and ready to discuss implementation and barriers they are facing. Companies are also more actively looking for support to scale their circular concepts.

The circular transformation is still in large extent siloed from rest of the business, and participants expressed that it is difficult to get prioritization from their company. Over the different workshop series, the focus of the organisations' leadership on sustainability and circular economy has increased. However, the companies described that the main efforts to combat climate change have focused on CO2 reduction by shifting to renewables and increase energy efficiency. They also described that the knowledge on how circular economy can contribute to emission reductions by transforming the way we make and use products, is not fully understood by the organizations. Participants from large established companies also emphasised the difficulties improving and adjusting their linear business model, while in parallel innovate and scale

circular solutions.

To scale circular business models, there needs to be an ecosystem of partners across the value chain. The ecosystem can consist of actors within the value chain such as suppliers, buyers, logistics, recyclers etc., as well as actors outside the typical value chain who are important enablers of the transformation, such as investors, regulators, technology providers, research institutes etc. Throughout the workshop series, there has been a shift in acknowledging the importance of cooperating between all kind of actors, but there is still 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 with external actors.

Outcomes from the workshop programs

Impact assessment from workshop program

The program has targeted five different industry sectors: transport, energy, maritime, machinery & equipment and construction. Participants have been companies ranging from small start-ups to large corporations. Some companies have participated in the program more than once, sending participants from other parts of the company or coming back to further develop a concept.

Based on dialogues with participants and results from feedback surveys, practically all participants have increased their knowledge of circular economy and circular business models and expanded their network during the program. Participants expressed that the program has equipped them with tools and methodologies to move forward with implementing circular principles in their organisation.

"The quality has been top level and we will definitely use the tools provided in the workshops when continuing to explore circular economy and to start up initiatives"
– Aasted

"The workshops covered everything from why to what and how to make it happen" – Scania

During the workshops, participants worked to develop circular business models. Over 200 circular ideas have been discussed, some ideas stayed on an ideation stage, others were taken back and developed further. Some companies have even been able to launch a pilot after participating. Several companies expressed that it is valuable to work alongside other companies and share common challenges and opportunities. Many also found the program helpful for creating contacts with other companies, and for some, this has been the start of a new ecosystem collaboration.

"Collaboration in the value chain is key to developing new circular business models. This program is a great way to meet other companies"
– Norsk Gjenvinning

"What has been good is learning from others. It's discussing with others in the industry and getting different perspectives across the value chain of the problems, the challenges, and the opportunities that the different companies are facing."
– Kongsberg Gruppen

"Two years ago, we oriented ourselves towards circularity through the Nordic Circular Program to learn more, now we are starting the first circular projects"
– Head of sustainability at Veni⁵

Current maturity level and development in the Nordic manufacturing industry

Today inefficiencies occur across the manufacturing value chain; however, most inefficiencies occur at the beginning and end of the value chain, often furthest from companies' core business. In the workshop program taken place in 2022, 25% of companies' inefficiencies and pain points occurred in the design phase, and 51% of inefficiencies and pain points occurred at the logistics, operation/end-use, or decommissioning phase.⁶

Many inefficiencies come from a lack of communication and data sharing across the value chain, e.g., companies pointed out inefficiencies connected to the product design phase, due to a lack of access to sustainable raw material, lack of circular design principles and communication. These inefficiencies become obvious again, especially in the end-use and decommissioning phase, e.g., where lack of data on material composition make dismantling difficult.

Another indication that industries struggle to transition to a circular business model is their limited revenue from add-on sales and after sales services. For companies who are scaling circular business models, add-on sales and after sales services should be a significant part of their revenue. For 60% of the companies in 2022, their share of revenues from add-on sales are less than 10% and for 68% of the companies, revenues from after sales services are less than 20%.⁷

5. Svanhild, B, Smedvig og Veni inngår ombrukssamarbeid, Byggindustrien bygg.no, 2022, 24.04, <https://www.bygg.no/smedvig-og-veni-inngar-ombrukssamarbeid/14969161/>, (accessed 2022-11-09)

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

7. Analysis based on output from Nordic Circular Industries workshops. More detailed information on the output in Appendix 1

The maturity level among the program participants has changed over time. Over the different programs there has been a reduction of inefficiencies in the linear value chain, however in many areas the improvements are small. For example, the average level of input material coming from renewable, recyclable, or reused material has only increased from 34% in 2019 to 37% in 2022.⁸

Still, there are some areas with particularly notable improvements. Products taken back from customers in dedicated return schemes at end-of-life, has increased from 19% to 34%. Companies have also taken a stronger responsibility over their own production waste. In 2019, 33% of the companies recycled over 80% of their waste, today the percentage of companies has increased to 45%.⁹

Nordic manufacturing industries' adoption to circular business models

Circular business models have gained a growing interest over the years for the Nordic manufacturing industries, and the exploration and adoption level among Nordic manufacturing companies have increased.

The current adoption level of circular business models in the Nordic manufacturing industry is highest within the business model circular inputs. Designing efficient and durable products have been part of companies' business model for a long time and can thus explain the high adoption level. However, companies still have a large potential to increase circular design principals such as modular design, circular input materials and design for disassembly.

Comparing the adoption level of the circular business models across the different program series, product as-a-service and product use extension have had the largest increase in interest. The reason for the increase of product as-a-service could be the maturity of understanding that almost every product can be thought of and commercialized as-a-service. Some companies, however,

are finding it challenging to obtain an investment model and achieve a win-win situation for both customers and the company. The participants described that the increase of potential for product use extension is mainly due to raw material scarcity and the current increasing prices.

8. Analysis based on output from Nordic Circular Industries workshops. More detailed information on the output in Appendix 1

9. Analysis based on output from Nordic Circular Industries workshops. More detailed information on the output in Appendix 1

Barriers when scaling circular business models

The program has shown that there are several barriers to scaling and transforming circular business models. The change of maturity level across the Nordic companies have changed over the years, from companies having difficulties in understanding where to start piloting, to now meeting challenges on how to scale pilots.

The barriers can be split into four main categories:

People & Culture

- Internal resistance to change
- Business prioritization
- Customer adaption

Collaborations

- Cross-functional collaborations
- External collaborations

Financing

- Uncertain business case
- Securing funding

Regulations

- Lack clear legislation
- Lack incentivizing legislation

People & Culture

Most of the companies described that their leadership has a strong focus on sustainability today, but struggle with anchoring and prioritizing circular business models in their company. 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.

Companies also mentioned that there is a challenge of insufficient resources when prioritizing new circular innovations. Internal projects are competing for the same resources, and at the same

time sustainability and circular project tasks are often added on top of existing workload.

When changing or altering business model to a more circular model, customer adaption is a barrier. Many companies find it difficult to promote the right value to the customer, to understand how to introduce new solutions, and to make them trust that the new product has the same quality as the old one. Customer adaption could be a bigger challenge for companies trying to shift to an as-a-service model, since the customer is used to owning the product instead of buying it as a service.

Collaborations

Most of the companies expressed that they are working in siloed governance models which results in the sustainability and circular economy agenda not being integrated into the entire business, thus hindering cross-functional collaborations.

Most companies understand the value and need of developing partnerships and networks to fully enable their circular business models. Several of the companies in the program had suggestions for companies they would like to partner with. Yet, challenges such as data sharing and securing mutual value creation were keeping them away from entering new partnerships.

Financing

For several of the organizations there are many uncertainties around the business case of the circular business model they want to implement, and organizations struggle to secure internal and/or external funding.

The companies that expressed their challenges in securing internal funding often emphasize that management is hesitant to pursue circular pilots due to a business case with intangible

benefits or with longer payback time. They also emphasized that management requires a secure business case from the pilot before deciding to scale. To prove circular business models, it often requires economies of scale, and it is therefore difficult to get the mandate to continue from the pilot stage. This results in a narrow view of the opportunities of circular business models and lack of willingness to prioritize the investment of time and finances in scaling.

Sustainable financing is increasingly seen as a lower risk for financial institutions, however external funding can be a barrier for several companies, especially companies exploring as-a-service models. Moving to as-a-service model can make companies more asset heavy, and traditional valuation methods could make funding more difficult.

Regulations

There has been a clear change in how quickly new regulations are developed to drive transformation towards a greener economy, and there are many new updates and directives since the program series started in 2019. However, companies in the program have mentioned regulations as one of the most important drivers and barriers to the circular transition. They said that when regulations are clear and necessary, they can strongly influence the business to get the mandate and momentum to adjust. However, where regulations are unclear, optional, or not yet developed, they can become barriers for change.

The Circular Economy Action Plan is one of the European Union's building blocks for their agenda of sustainable growth, covering the entire value chain and affecting high carbon and resource intense industries.¹⁰

However, initiatives presented in the action plan are mainly recommendations and guidelines on policy frameworks that companies can choose to follow, with few rules that have come into play. Hence, it is up to the company to adapt and integrate the guidelines, which is often

not sufficient motivation to change.

Several companies mentioned that there are no or few incentives of using recyclable materials in their products. Virgin material is often lower priced than recycled material, and companies also described the challenge of meeting the requirements of documenting the material content in the products. Material suppliers often source material through Tier 1 and Tier 2 companies, which do not necessarily trace the level of recycled material in the different outputs from their process, making it more difficult to have an exact overview of material compositions.

10. Circular Economy Action plan, 2020

Recommendations for the Nordic countries

Based on the outcome of our analysis on the program and the ongoing work in the Nordic manufacturing industries, we provide recommendations observed from this report to organisations that can support and enable companies in their circular transformation.

Collaboration between enablers and Nordic manufacturing companies is necessary to transition to a circular economy. In this report, enabling organisations refers to regulatory bodies, industry organisations, finance institutions, and research institutes. The following recommendations are proposed:

- Nordic Governments can introduce more distinct policies and incentives to help the manufacturing industries put circular economy higher up on their business agenda, e.g., incentives for using recyclable materials in production. This could be done by lowering the price of recycled material and demand sourcing companies to document the content of material to trace the level of recycled material.
- Nordic Governments can also introduce policies to extend the manufacturers ownership of the products, making sure they take it back at product end-of-use.
- Nordic Governments can develop standards to enable transparency across the value chain, e.g., establish guidelines to reduce barriers for entering new partnerships and standards for sharing of material data to reduce inefficiencies at end-of-life.
- Research institutes can enter collaborations with manufacturing companies to share knowledge, skills, and trends to support them in continuing developing new innovations and accelerate circular solutions.
- Industry organizations can take a leading role in orchestrating ecosystems, helping companies agree on common value proposition, cost structure, facilitate collaborations and be a sparring partner for the companies within the ecosystem.
- Finance institutions need to continue to develop their sustainable financing investment criteria to include circular economy indicators, to influence future investment objects.

List of references

List of references

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(accessed 2022-11-07)

Appendices

Appendix 1 – Results from circular maturity survey

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

The survey included two reflections:

- 1) Inefficiency assessment
- 2) Current adoption of circular business models

The first reflection focused on understanding the occurrence and level of the five inefficiencies of the linear model:

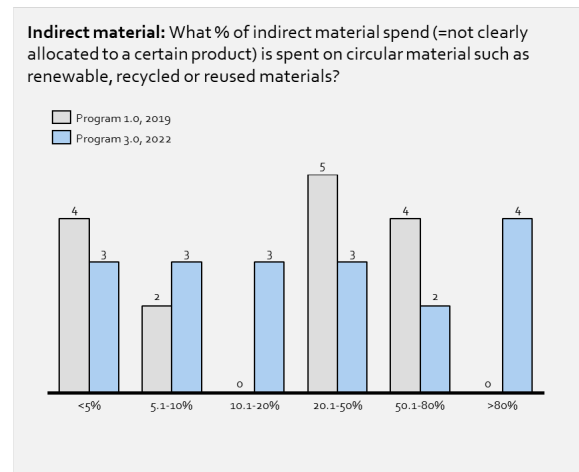
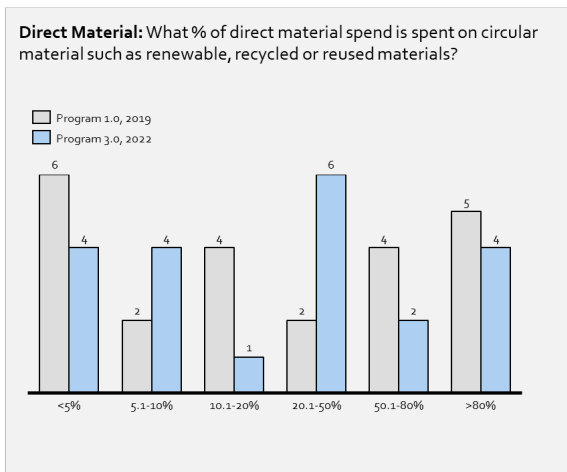
Unsustainable materials, underutilised capacities, premature product lives, wasted end-of-life value, and unexploited customer engagements. In the second reflection, companies were asked to assess their current adoption level of the 11 circular sub-models.

The responses were collected in workshops in 2019 and 2022. In total 28 people from 24 Nordic manufacturing companies replied to the survey in 2022, and 28 Nordic manufacturing companies in 2019.

Inefficiency assessment

1) Unsustainable materials

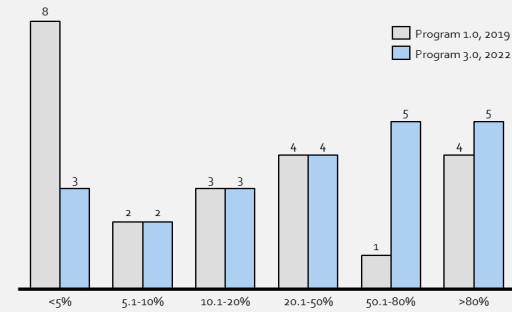
Material and energy that cannot be continually regenerated (e.g. direct and indirect material is not renewable or bio-based)



2) Underutilised capacity

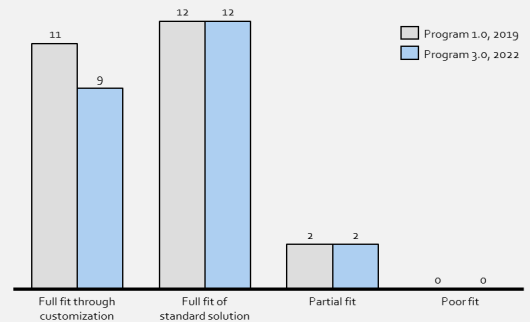
Underutilised or unused products and assets (e.g. products are not operating full hours or full functionality is not used)

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 24 hours x 365 days per year

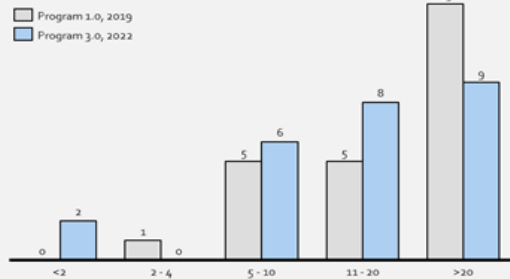
Operational fit: To what extent does the product fit the requirements of the customer e.g. regarding operating efficiency, product operations planning?



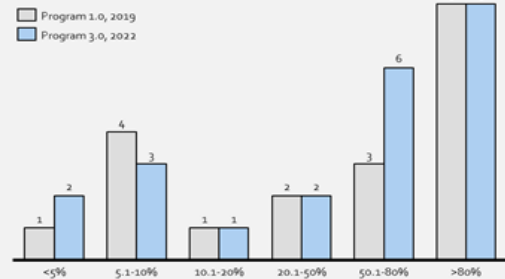
3) Premature product lives

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)?



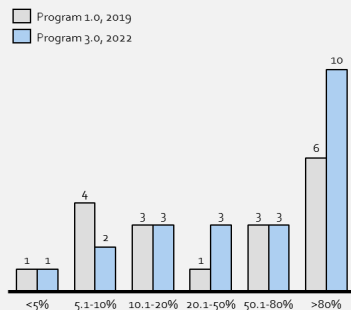
Functionality: % of revenue that comes from products that are designed for a long life e.g. through enhanced reparability, modularity, upgradeability



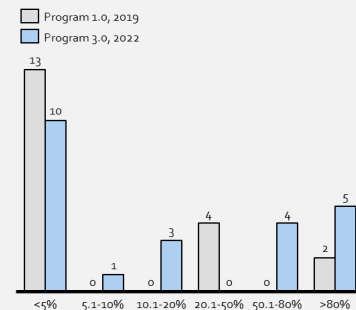
4) Wasted end-of-life value

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

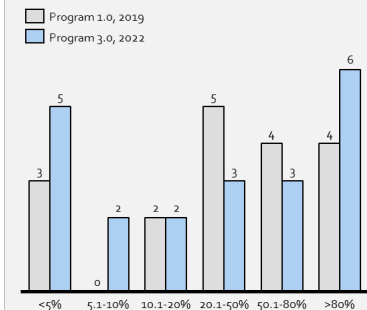
Waste in production: % of waste from production that is recycled (based on weight)



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

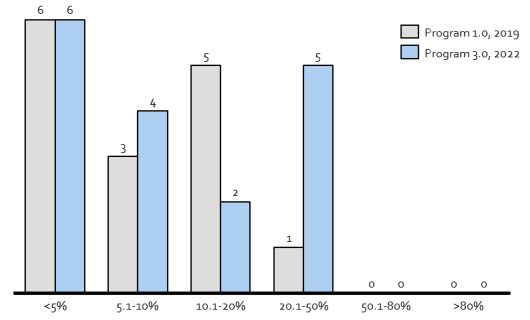
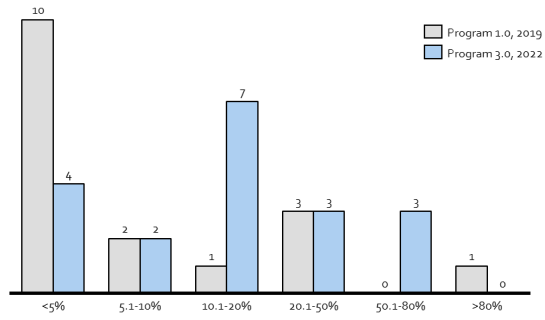


Recycling: % of products recycled at end-of-life



5) Unexploited customer engagements

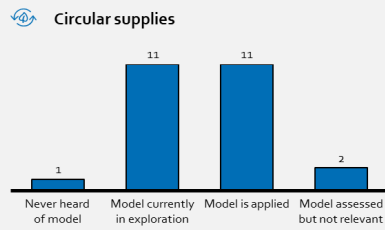
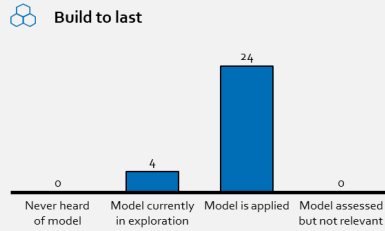
Material and energy that cannot be continually regenerated (e.g. direct and indirect material is not renewable or bio-based)



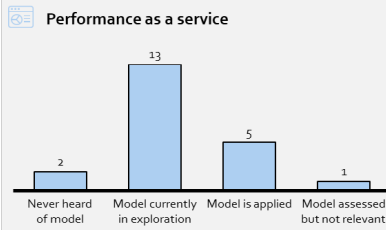
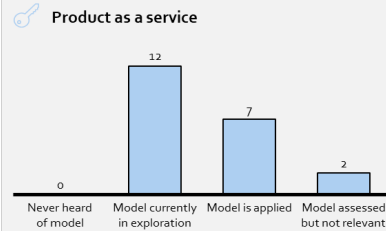
Business Model Adoption

Business model adoption – Results circular maturity survey 2022

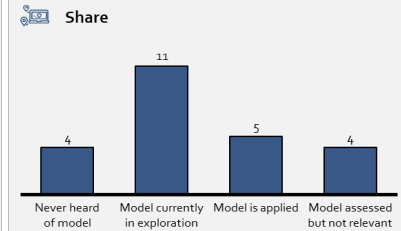
CIRCULAR INPUTS



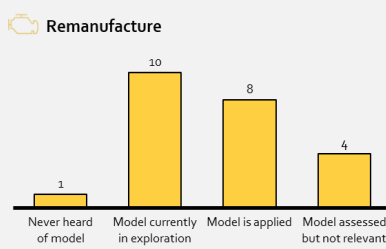
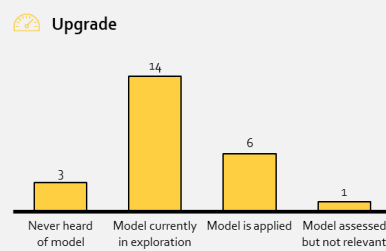
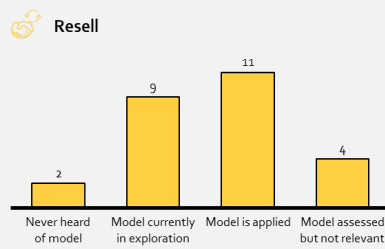
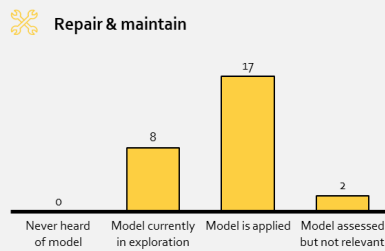
PRODUCT AS A SERVICE



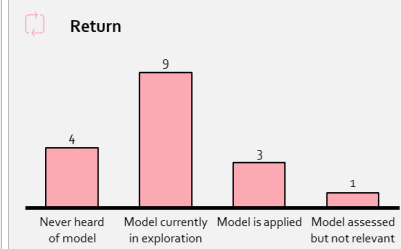
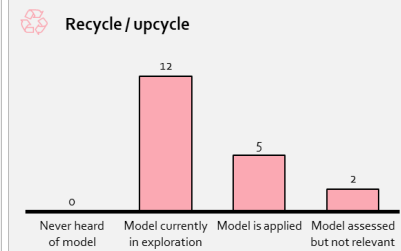
SHARING PLATFORMS



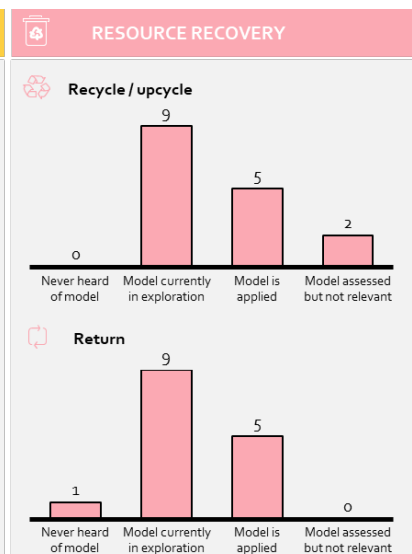
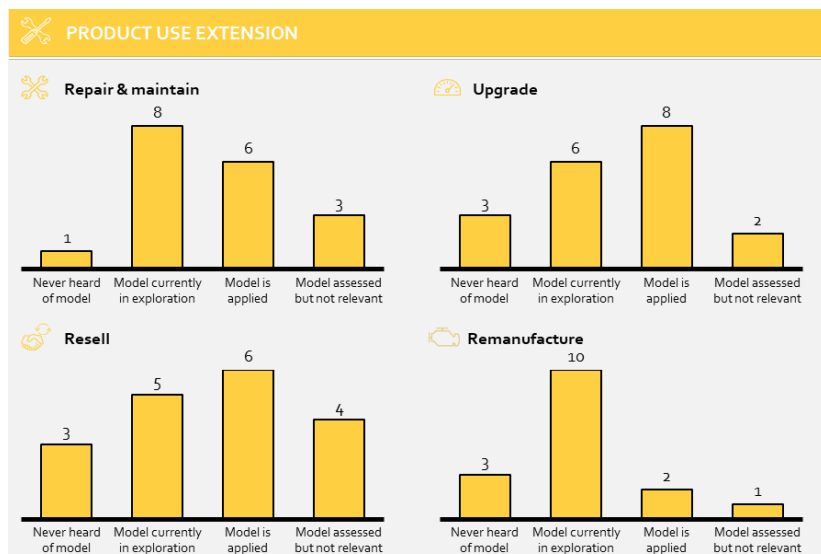
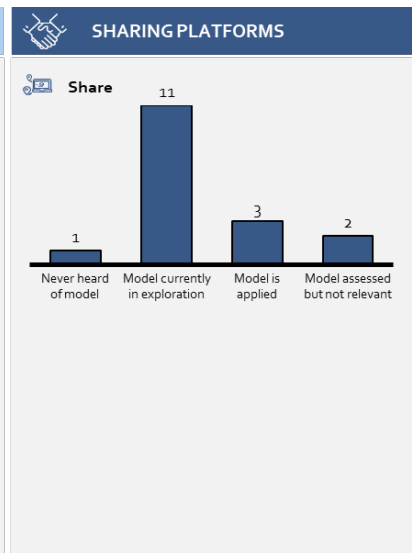
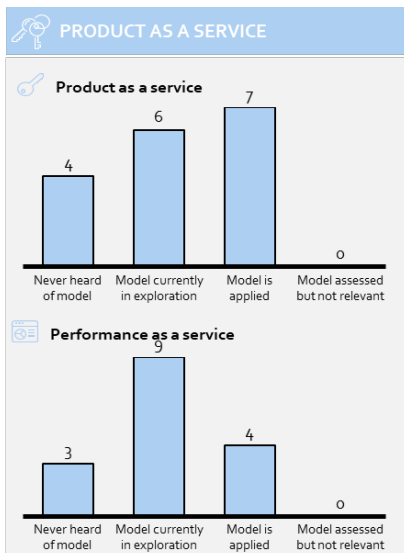
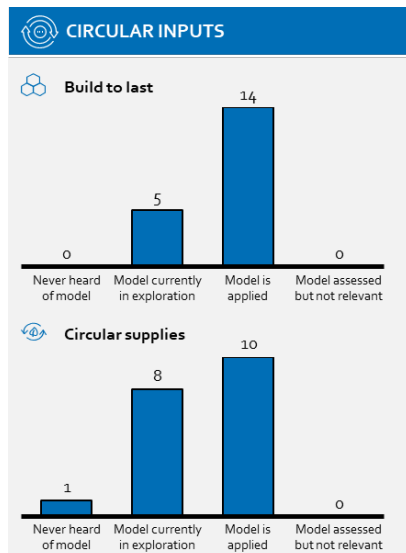
PRODUCT USE EXTENSION



RESOURCE RECOVERY



Business model adoption – Results circular maturity survey 2019



Appendix 2 – Inefficiencies and pain points identified by the program participants

Participants in the three programs from 2019-2022 were asked to identify their top Inefficiencies and pain points across the value chain. The results are illustrated in the graph below.

