Sustainable and circular business models for the chemical industry
Sustainable and circular business models for the chemical industry

Executive summary

- The Chemical Industry Federation of Finland (CIFF) and its 400 member companies have started to work on a carbon neutrality roadmap, that strives to pave the way for a carbon neutral Finnish chemical industry by 2045
- The transition towards sustainability and circular economy is driven by an increased focus on sustainable actions demanded by end consumers, brand owners, investors and regulators alike, and accelerated by the rapid pace of technology development
- Sustainable and circular business models are the foundation of a sustainable transition for the chemical industry, and a crucial element in achieving the ambitious 2045 target
- These models turn inefficiencies and waste streams in traditional linear value chains into business opportunities. This means maximizing the time materials and products are kept in use by continuously feeding them back through the value chain for reuse, and utilizing other inefficiencies like waste energy in the value chain
- The chemical industry plays a key part in enabling more wide-scale sustainability and across industries, as it is heavily interlinked with other industries
- Chemical companies are well equipped to develop materials and methods that enable and speed the adoption of sustainable and circular business models, allowing them to be powerful partners to manufacturers, suppliers and retailers, besides developing their own operations towards sustainability and circularity
- A successful transition to circularity requires a significant shift in operations, culture and organization, product and service development and ecosystem collaboration, supported by relentless focus on customer-centricity and smart application of emerging technologies
- Finnish chemical companies are strongly committed to sustainability and circular economy, and recognize it as a key source of competitive advantage
- A race for “sweet spots” in emerging circular value chains has already begun – we invite chemical companies to use this playbook to embrace this disruption and build a solid foundation for a carbon neutral future
Playbook content

01 Why sustainability and circularity? 
Rationale for Finnish chemical companies to engage in sustainability and circularity

02 What opportunities exist? 
Current state analysis and sustainable and circular opportunities for the chemical industry

03 How to start the transformation journey? 
Key steps for chemical companies to take to start their journey and how to overcome typical barriers along the way
While reading the playbook, use the business model canvas to start developing your sustainable and circular business opportunities

Business model canvas

What is a business model canvas?
The business model canvas is a tool that helps you to crystallize your circular business idea by reflecting on its key building blocks, including your value proposition, infrastructure, customers and financing.

How to use it?
Each chapter of this playbook supports you with filling in the canvas, with activation questions at their end. We also recommend using the tool and questions with your team to support discussion and ideation.

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Financial aspects
Revenue streams: Cost structure: Risks (facing /mitigating): Intangibles:

Enabling companies

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01 Why sustainability and circularity?

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KEMIANTeollisuus SITRA BUSINESS FINLAND accenture
Chapter summary

- Sustainable and circular business models enable companies to deliver value to their stakeholders while minimizing environmental costs
- Six forces accelerate the shift towards sustainability and circular economy in the chemical industry
  1. End consumers are demanding more sustainable products
  2. Brand owners are making voluntary commitments to sustainability
  3. Responsible investments are becoming the new norm
  4. Greenhouse gas reduction is crucial for slowing down global warming
  5. Regulation around sustainability is strongly increasing
  6. New technologies enabling circularity are constantly emerging and advancing
- The value case for sustainable and circular business models in the chemical industry is significant, and expected to increase going forward
- Chemical companies are well equipped to develop materials and methods that enable and speed the adoption of sustainable and circular business models in downstream industries, making them powerful partners to manufacturers, suppliers and retailers

Note: As per the definition of the Chemical Industry Federation of Finland (Kemianteollisuus ry), the chemical industry consists of companies producing basic chemicals, intermediates, chemical products for customers (e.g. fertilizers, paints and coatings), and converters.
Sustainable and circular business models enable companies to deliver value while minimizing environmental costs

Definition of sustainable and circular business models

Sustainable and circular business models enable companies to deliver value to their broader group of stakeholders while minimizing environmental costs.

They help companies to shift from traditionally linear “take, make, waste” approaches of production and consumption into sustainable and circular approaches that source materials responsibly and maximize the time materials and products are kept in use by constantly feeding them back through the value chain for reuse, resulting in less energy and resource consumption.

These new approaches include for example:
- the use of renewable, recycled, bio-based, or other non-fossil raw material inputs
- extension of product lifecycles through repairs and upgrades
- recovery of materials from end-of-life products for reuse

Source: Accenture
Complementary drivers accelerate the shift towards enhanced sustainability and circular economy in the chemical industry

Sustainability and circular economy drivers

<table>
<thead>
<tr>
<th>Force</th>
<th>Description</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer-centricity</td>
<td>End consumer awareness</td>
<td>A growing segment of consumers are seeking sustainable/eco-friendly products and appreciate brands that share and cultivate their sustainability beliefs</td>
</tr>
<tr>
<td>Brand voluntary commitments</td>
<td>In reaction to evolving consumer preferences and increasing number of regulations, brand owners have announced ambitious sustainability targets</td>
<td></td>
</tr>
<tr>
<td>Responsible investments</td>
<td>Investors are increasingly measuring a company’s impact on the society and the environment to determine its worth</td>
<td></td>
</tr>
<tr>
<td>Sustainability</td>
<td>Greenhouse gas (GHG) reduction</td>
<td>Reduction of GHG emissions is crucial for slowing down global warming, and the chemical industry plays a key role in it as an enabler</td>
</tr>
<tr>
<td>Increasing regulatory pressure</td>
<td>Regulation around product/material reuse and recycling has strongly increased over the past years, and is expected to continue</td>
<td></td>
</tr>
<tr>
<td>Technology development</td>
<td>New technologies enabling sustainable and circular business models are constantly emerging and evolving</td>
<td></td>
</tr>
</tbody>
</table>

Source: (1) Accenture Chemicals Global Consumer Sustainability Survey 2019 for 6,000 consumers in 11 countries; (2) Ellen MacArthur Foundation; (3) Finland's Sustainable Investment Forum; (4) European Commission; (5) Suomen Uusiomuovi; (6) FVCA - Pääomasijoittajat & Recycling Startups
Consumers prefer eco-friendly products and consider the chemical industry least concerned about the environment

**Consumer sentiment**

- **81%** of consumers plan to buy more eco-friendly products over the next 5 years.

- **54%** of consumers are willing to pay a premium for more sustainable products.

- **62%** of consumers want companies to take a public and passionate stance on social, cultural, environmental and political issues.

- **72%** have low confidence in chemical manufacturers’ communications concerning the environmental impact of their products and/or services — the lowest of all organizations included in the survey.

**Consumer confidence**

Share of respondents considering an industry being among the least concerned about their environmental impact.

- **Top 1**
  - Chemicals (e.g., plastics, rubber, pesticide, paints, etc.): 26%
  - Construction Materials (e.g., concrete, tools, machinery, etc.): 10%
  - Electronics (e.g., computer, TV, stereo, mobile phone, etc.): 10%
  - Food & Beverage Packaging (e.g., containers, wrappers, etc.): 12%
  - Clothing (e.g., garments, accessories, shoes, etc.): 12%
  - Automotive (e.g., vehicle, vehicle parts, etc.): 9%
  - Personal Care Products (e.g., hair care, skin care, fragrances, etc.): 8%
  - Furnishing (e.g., sofa, bed, chairs, etc.): 7%
  - Children’s Toys (e.g., building blocks, figurines, puzzles, etc.): 7%

- **Within Top 3**
  - Chemicals (e.g., plastics, rubber, pesticide, paints, etc.): 49%
  - Construction Materials (e.g., concrete, tools, machinery, etc.): 35%
  - Electronics (e.g., computer, TV, stereo, mobile phone, etc.): 35%
  - Food & Beverage Packaging (e.g., containers, wrappers, etc.): 34%
  - Clothing (e.g., garments, accessories, shoes, etc.): 32%
  - Automotive (e.g., vehicle, vehicle parts, etc.): 31%
  - Personal Care Products (e.g., hair care, skin care, fragrances, etc.): 29%
  - Furnishing (e.g., sofa, bed, chairs, etc.): 26%
  - Children’s Toys (e.g., building blocks, figurines, puzzles, etc.): 24%

Source: Accenture Chemicals Global Consumer Sustainability Survey 2019 for 6,000 consumers in 11 countries
# Brand owners are committing to sustainability in their operations, products and value chains

## Finnish brand owner reactions

<table>
<thead>
<tr>
<th>Company</th>
<th>Sustainability Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Valio</strong></td>
<td>Valio intends to cut milk’s carbon footprint to zero by 2035</td>
</tr>
<tr>
<td><strong>Fazer</strong></td>
<td>Fazer has set four sustainability goals: 50% less emissions, 50% less food waste, 100% sustainably sourced and more plant-based</td>
</tr>
<tr>
<td><strong>K</strong></td>
<td>Kesko has set a target to be carbon neutral by 2025</td>
</tr>
<tr>
<td><strong>KONE</strong></td>
<td>KONE has a strategic target to be a leader in sustainability, particularly by providing the most sustainable offering</td>
</tr>
<tr>
<td><strong>HKScan</strong></td>
<td>HKScan aims to reduce GHG emissions from its own facilities by 90% by 2030 compared to 2014</td>
</tr>
<tr>
<td><strong>OP</strong></td>
<td>OP is committed to making its own operations carbon neutral by 2025</td>
</tr>
<tr>
<td><strong>S-Group</strong></td>
<td>S-Group aims to recycle 80% of its waste (e.g. cardboard and plastics), to be used as materials or turned into new products by the end of 2025</td>
</tr>
<tr>
<td><strong>Nokia</strong></td>
<td>Nokia is targeting a 75% GHG emission reduction from the use of its products by 2030 compared to 2014 baseline</td>
</tr>
<tr>
<td><strong>UPM</strong></td>
<td>UPM is committed to eliminating process waste going into landfills or to incineration and reducing its CO2 emissions by 65% by 2030</td>
</tr>
<tr>
<td><strong>Fiskars Group</strong></td>
<td>Fiskars aims to have 100% renewable packaging and all waste from own operations recovered or recycled by 2030</td>
</tr>
<tr>
<td><strong>Finnair</strong></td>
<td>Finnair has set a goal to be carbon neutral by 2045, starting by cutting emissions by 50% by 2025 from 2019 level</td>
</tr>
<tr>
<td><strong>Huhtamäki</strong></td>
<td>Huhtamäki continuously innovates for products enabling sustainability and circular economy and aims to use a high degree of renewable materials</td>
</tr>
</tbody>
</table>

Source: Accenture analysis; Company websites

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<table>
<thead>
<tr>
<th>End consumer awareness</th>
<th>Brand voluntary commitments</th>
<th>Responsible investments</th>
<th>GHG reduction</th>
<th>Increasing regulatory pressure</th>
<th>Technology development</th>
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**Ability to offer sustainable and circular solutions to brand owners is becoming a competitive advantage to chemical companies**
Investors demand increasingly responsible business practices and base portfolio decisions on extra-financial performance

Responsible investments

Responsible investment trends

- In the last decade, interest towards responsible investment has grown significantly worldwide
  - Number of PRI signatories (UN Principles for Responsible Investment) has more than tripled since 2010\(^1\)
  - Finsif (Finland’s Sustainable Investment Forum) member base has grown from 18 founding members in 2010 to over 70 members in 2019\(^2\)
- Investors are putting more and more focus on extra-financial KPIs, with 90% confirming to use them as a basis for decisions\(^3\)
  - To be attractive for investors, companies need to properly disclose their extra-financial performance across the value chain
  - Proper reporting also helps companies to meet increasing regulatory requirements (see following page for more information)
- Responsible investment policies are also being introduced with an increasing pace, with over 300 policy instruments supporting investors to consider ESG factors, of which over half were created since 2013\(^4\)
- Companies are also seeing the benefits of investing in sustainable business
  - 90% of 2,200 studies analyzed by Deutsche Asset & Wealth Management display a positive (or at least neutral) correlation between extra-financial and financial performance\(^5\)

\(^1\) Source: PRI, 2019; \(^2\) Finsif Responsible investing in Finland – Market study 2019; \(^3\) State Street, 2017; \(^4\) UNFCCC, 2017; \(^5\) Deutsche Asset & Wealth Management, 2015
The European Green Deal is a roadmap for making **EU the first climate-neutral continent by 2050** through actions that

- boost the efficient use of resources by moving to a clean, circular economy
- restore biodiversity and cut pollution

The *European Green Deal* leverages all policy levers, including regulation and standardization, investment and innovation, national reforms, dialogue with social partners and international cooperation to boost the transition to a more sustainable future.

Source: Accenture analysis; European Commission
The EU Green Deal brings many new business opportunities for Finnish chemical companies

Implications for chemical companies

The European Green Deal creates opportunities for Finnish chemical companies mainly through four policies:

<table>
<thead>
<tr>
<th>Policy name</th>
<th>Description</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobilizing industry for a clean and circular economy</td>
<td>To drive the transition to a carbon neutral and circular economy, the Commission has created - an EU industrial strategy to address the challenge of green and digital transformation - a Circular Economy Action Plan to accelerate the transition towards a regenerative growth model that decouples economic growth from resource use</td>
<td>Policies and measures supporting and guiding towards - circular design of products - use of reusable and recyclable packaging materials - provision of accurate and reliable information on products and services - reduction of waste - innovation with breakthrough technologies See next page for additional details.</td>
</tr>
<tr>
<td>Building and renovating in an energy and resource efficient way</td>
<td>The Commission will enforce the legislation related to the energy performance of buildings, and in parallel to work with stakeholders on a new initiative on resource-efficient renovation in 2020</td>
<td>Increased demand for sustainable building materials and solutions enabling energy efficiency</td>
</tr>
<tr>
<td>Accelerating the shift to sustainable and smart mobility</td>
<td>The Commission will adopt a strategy for sustainable and smart mobility in 2020 that will address high volume of transport-related GHG emissions In parallel, the plan is to ramp-up the production and deployment of sustainable alternative transport fuels, boosted by legislation</td>
<td>Increased demand for sustainable (e.g. bio-based and synthetic) transport fuels and other solutions enabling GHG reduction of different vehicles</td>
</tr>
<tr>
<td>From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system</td>
<td>In Spring 2020, the Commission will present the 'Farm to Fork' strategy to pave the way to creating a more sustainable and circular food chain An objective of the strategy reduce significantly the use and risk of chemical pesticides, as well as the use of fertilizers and antibiotics</td>
<td>Increased demand for alternative agricultural chemicals, i.e. opportunities to innovate and develop new products Additional opportunities to strengthen customer relationships through co-creation</td>
</tr>
</tbody>
</table>

Other policies of the European Green Deal also have implications for chemical companies, e.g. in ensuring use of clean energy in production and replacing hazardous chemicals with more sustainable alternatives to minimize pollution.

Source: Accenture analysis; European Commission
The new Circular Economy Action Plan supports companies to tap into new sustainable business opportunities

The Circular Economy Action Plan

Circular Economy Action Plan
- The Circular Economy Action Plan will introduce a set of initiatives to establish a coherent product policy framework that will make sustainable products, services and business models the norm in the EU, and transform consumption patterns so that no waste is produced in the first place.
- In addition, measures to reduce waste and ensure that there is a functioning market for high quality secondary raw materials will be put in place.

Sustainable product policy framework
- A common set of design principles for all products placed on the EU market regulating the following aspects:
  - extending product lifecycles, addressing hazardous chemicals and increasing energy and resource efficiency of products
  - increasing recycled content in products
  - enabling remanufacturing and high-quality recycling;
  - reducing carbon and other environmental footprints, e.g. microplastics emissions;
  - restricting single-use and countering premature obsolescence;
  - introducing a ban on the destruction of unsold durable goods;
  - incentivizing product-as-a-service models
  - mobilizing the potential of digitalization of product information,
  - rewarding products based on their sustainability performance

- Revision of the EU consumer law to ensure that consumers receive trustworthy and relevant information on products at the point of sale, including information on their lifespan and on the availability of repair services, spare parts and repair manuals.
- Further strengthening consumer protection against green washing and premature obsolescence, setting minimum requirements for sustainability labels/logos and information tools.
- Facilitating industrial symbiosis by developing an industry-led reporting and certification system and enabling the implementation of industrial symbiosis.
- Promoting the use of digital technologies for tracking, tracing and mapping of resources.
- Implementing a new SME Strategy to foster circular industrial collaboration among SMEs building on training, advice, and knowledge transfer.

Key product value chains
- The sustainable product policy will be progressively rolled out starting in 2021, with the following key product value chains identified by the EU Commission being addressed as a matter of priority:

  - Electronics and ICT
  - Batteries and vehicles
  - Packaging
  - Plastics
  - Textiles
  - Construction and buildings
  - Food, water and nutrients
Technologies are developing rapidly, enabling sustainability and circularity

Technology development

Digital, physical and biological technologies

Emerging
New technology comes into existence, but shows little improvement in its performance characteristics

Developing
Technology performance characteristics improve at an accelerating pace

Maturing
Pace of improvement has begun to slow down and technology adoption is widespread

Scaled-up
Further technology improvement is difficult to achieve

Technology types

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

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

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

Want to learn more?
Check out technologies enabling carbon neutral chemistry in the Roadmap to Reach Carbon Neutral Chemistry in Finland 2045 report here.
The value case for sustainable and circular business models in the chemical industry is significant, and expected to increase

Value case

**USD 4 500 billion**
expected additional economic value from circular economy by 2030[^1]

**0.5% GDP growth**
in the EU by 2030 by applying circular economy adoption[^2]

**USD 100 billion**
value of global market for green chemistry by 2020[^4]

**700 000 jobs**
created across the EU by 2030 through circular economy adoption[^2]

**USD 64.1 billion**
value of plastics recycling industry in 2024[^5]

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**EU28 projection of market size evolution for chemical products[^6]**
2018-2030, EUR billion

<table>
<thead>
<tr>
<th>Year</th>
<th>Value (EUR billion)</th>
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<tbody>
<tr>
<td>2018 baseline</td>
<td>246</td>
</tr>
<tr>
<td>2030 regular growth projection</td>
<td>302</td>
</tr>
<tr>
<td>Incremental value potential from enabling downstream circularity</td>
<td>51</td>
</tr>
<tr>
<td>2030 market value with circular growth potential from downstream enablement</td>
<td>353</td>
</tr>
</tbody>
</table>

**Key observations**

- Both the consumption (volume) and average unit value of chemical products is expected to grow, increasing the market size for chemical products by 23% by 2030.
- Circular economy models can unlock an estimated additional EUR 50 billion upside for chemical products, driven e.g. by a price premium that can be expected for more sustainable alternatives.
- The circular growth potential however varies greatly by product and application (see more on next page).

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[^1]: Accenture research
[^2]: European Commission Circular Economy Action Plan
[^3]: Accenture estimate
[^4]: Trucost estimate for the American Sustainable Business Council (ASBC) and the Green Chemistry & Commerce Council (GC3)
[^5]: P&S Intelligence
[^6]: Accenture analysis. Note: Chemical products sold to customers – not counting basic chemicals and intermediates that are further processed within the chemical industry. Also, short-term effects of disruptions (e.g. COVID-19) have not been reflected in the projection.

Helping brand owners meet their commitments and enabling circularity in the downstream value chain offers considerable growth potential for chemical companies.
The circularity-induced growth potential strongly differs by chemical product and application

EU28 chemical consumption across products: projected overall CAGR 2018-2030

Key observations

- Some downstream demand for fossil raw material volumes will be replaced by alternative volumes, like bio-based, recycled or synthetic
- For example, the demand for recycled plastics is increasing as the recyclate is achieving a better environmental record and improving in quality
- Also, alternative raw materials are partially substituting fossil raw material volumes in everyday single-use items such as cups, cans, bottles and cutlery

Note: (1) Sum of base growth and circular economy incremental growth
Source: Accenture research for Winning in a Circular Economy: Practical steps for the chemical industry report, 2020
Chemical companies are well equipped to develop materials and methods that enable and speed the circular transition

Chemical industry as the enabler for sustainability and circularity

Downstream chemical industry customers by sales

EUR million, 2018

- EU chemical industry sales
- Industrial sector
- Rubber and plastics
- Construction
- Pulp, paper, publishing and printing
- Coke, refined petroleum and nuclear fuel
- Textiles
- Food and beverages
- Automotive
- Basic metals
- Fabricated metal products
- Computer, electronic and optical equipment
- Electrical machinery and apparatus
- Other manufacturing
- Other non-metallic mineral products
- Machinery and equipment
- Manufacturing nec; recycling
- Other business activities
- Health and social work
- Services
- Agriculture and forestry
- Wholesale and retail trade
- Mining and utilities
- R&D and other business activities

Observations

- As a supplier of products to a variety of other industries, the chemical industry plays a key role in accelerating the broader transition to sustainable and circular economy
- With increasing pressure from consumers, downstream industries want to find ways to provide more sustainable products and services to their customers, and look for chemical industry for solutions
- Chemical companies are well equipped to develop materials and methods that enable and speed the adoption of sustainable and circular business models, allowing them to be powerful partners to manufacturers, suppliers and retailers that help with fast responses as consumer preferences change
- As technical experts, chemical companies can partner with downstream companies to advise on ingredients and provide information on green and circular chemical alternatives
- At the same time, chemical companies can strengthen their own competitiveness, reduce costs and accelerate growth by adopting sustainable and circular approaches to production and consumption
Why sustainability and circularity?

Activation questions

1. How are the key trends affecting your company?
   - What changes are occurring in end consumer behavior?
   - What kind of sustainability commitments are your customers making?
   - What kind of extra-financial information are your investors or potential investors demanding?
   - Which regulations have an impact on your operations?
   - Which new technologies are relevant for your business?

2. To what extent does your business strategy address all of the six trends and their implications? How could the strategy be updated to make it comprehensive?

3. How are the new trends affecting your customers? In which of your customer industries do you expect to see most demand for sustainable and circular solutions? What opportunities does this increase bring to your company?

Business model canvas

Based on the information learnt in this chapter, fill in the following parts of the business model canvas:

- **Vision** – describe your long-term vision and desired position
- **Market** - reflect on customers, the required customer relationships, the channels you could use to reach them and what competition you will see on the market.
Current state analysis and sustainable and circular opportunities for the chemical industry

Chapter summary

- Conventional models of production and consumption generate waste and inefficiencies across the chemical value chain, limiting growth and increasing exposure to material scarcity
- Five sustainable and circular business models address these waste streams and inefficiencies and turn them into business opportunities
  - Circular Inputs
  - Product as a Service
  - Product Use Extension
  - Sharing Platforms
  - Resource Recovery
- Taking the role of circularity enablers for downstream businesses, e.g. through secondary raw material provision and/or certification, can create significant additional value for chemical companies
- Many inspiring examples on applying sustainable and circular business models exist from leading Finnish and global chemical companies, and serve as concrete evidence of the value potential
The chemical industry is one of the most important industrial sectors globally and in Finland

Chemical industry overview

Global chemical industry

- With global sales of USD 5.68 trillion in 2017, the chemical industry is the second largest manufacturing industry in the world.
- Asia is the largest chemical producing and consuming region, with China only representing 37% of global sales.
  - The European Union is the second largest region with a 16% share.
- The global chemical industry sales are expected to almost double from 2017 to 2030, and the global production value to reach USD 22 trillion in 2060.
  - Future industry growth is expected to be mainly driven by emerging markets where the growth of production volume and production capacity is rapidly increasing.

Chemical industry in Finland

- The chemical industry creates almost EUR 10 billion value added in Finland, accounting for 17% of the total value add of the Finnish manufacturing sector (as of 2017).
  - The direct value add is approximately EUR 5 billion.
  - EUR 1 billion value add in the chemical industry creates a EUR 0.9 billion value add for other sectors.
- The chemical industry accounts for 18% of the Total Industry output and 20% (EUR 12.3 billion) of total exports in Finland.
- The chemical industry provides 34,000 direct jobs in Finland and Finnish chemical industry subsidiaries abroad nearly direct 30,000 jobs.
- The annual sales of the Finnish chemical industry are about EUR 24 billion.

Projected growth in global chemical sales, 2017-2030

Finnish Chemical industry sales by product group, 2018

Note: (1) Includes pharmaceutical sales of USD 2.21 trillion
Source: (2) Cefic, American Chemistry Council and International Labor Organization, 2018; (3) Cefic, 2018, excludes pharmaceutical sales of 2.21 trillion; (4) OECD, 2019; (5) KPMG; (6) Statistics Finland
The chemical industry produces the building blocks for many products in various downstream industries

Chemical industry value chain

**Raw materials / feedstock inputs**
- Chemical industry

**Distributors**
- OEMs / brand owners

**Retailers**
- End users

**Waste managers**

**Basic chemicals**
- Organic/ petrochemicals, e.g. olefins, aromatics, plastic resins, synthetic rubber, fatty acids and alcohols
- Inorganic chemicals, e.g. chlorine, sulfur and industrial gases such as hydrogen and oxygen

**Intermediates**
- Oils
- Pigments and dyes
- Surfactants
- Starches and glues
- Explosives

**Chemical products for customers**
- Agricultural chemicals (fertilizers, crop protection)
- Paints and coatings
- Consumer chemicals (soaps, detergents, perfumers)
- Pharmaceuticals
- Biomass and waste bioconversion (biofuel, biogas)

**Converters**
- Various products created in converting processes such as molding, compounding, coating and printing, e.g. plastic and rubber products

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**Example products**

Note: (1) Distributors and/or retailers are part of some chemical value chains, but not all, depending on the product.
Finnish chemical companies can be divided into five clusters, which are vertically integrated

Chemical company clusters

<table>
<thead>
<tr>
<th>Cluster definitions</th>
<th>Chemical industry value chain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy-intensive chemical industry</strong></td>
<td>Capital intensive large scale infrastructures performing complex processes, inc. e.g. distillation, reforming and polymerization.</td>
</tr>
<tr>
<td><strong>Inorganic chemistry</strong></td>
<td>Cluster of plants specialized in inorganic chemical products, such as minerals, metals and salts.</td>
</tr>
<tr>
<td><strong>Reactive chemistry</strong></td>
<td>Middle scale infrastructure performing complex processes, products including specialty chemicals and advanced materials.</td>
</tr>
<tr>
<td><strong>Formulating</strong></td>
<td>Cluster of plants formulating products by mixing a set of raw materials, including e.g. paints and coatings, pharmaceuticals and detergents.</td>
</tr>
<tr>
<td><strong>Converters</strong></td>
<td>Cluster of plants that manufacture consumer products through molding, compounding, coating and printing, e.g. plastic and rubber products</td>
</tr>
</tbody>
</table>

Chemical industry value chain:

- Raw materials / feedstock inputs
- Chemical industry
- Distributors
- OEMs / brand owners
- Retailers
- End users
- Waste managers

**Chemical industry value chain**

- Basic chemicals
- Intermediates
- Chemical products for customers
- Converters

Note: The classification is inherently flawed to a certain degree, as even a single company may have operations that could be placed in several clusters. Furthermore, the main purpose of the classification is to facilitate generalization.

Adoption level of sustainable and circular business models within the Finnish chemical industry appears to be fairly high

Circular maturity assessment

**Maturity of Finnish chemical industry in adopting sustainable and circular business models**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Low 7%</th>
<th>Moderate 50%</th>
<th>High 40%</th>
<th>Very high 7%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own company</td>
<td>Low 20%</td>
<td>Moderate 33%</td>
<td>High 40%</td>
<td>Very high 7%</td>
</tr>
</tbody>
</table>

"Some companies (big and small) have adopted modern and innovative solutions related to sustainability. On the other hand, there are some companies that are on the other end of the scale."

"Awareness of environmental issues and circular economy opportunities has clearly increased and many Finnish companies have taken it to their agenda."

"Some companies are already far with their plans and actions, others are only getting started, yet everyone has a clear desire to make their operations more sustainable."

"Sustainability and circularity have been well visible in larger companies for some time, but they are still emerging topics in smaller companies. Larger companies usually also dominate discussions in this area. Many companies nowadays see that sustainability and circularity are important topics and talk about them, yet whether or not these topics are placed at the core of the business can be different in reality."

"There is a large variation between the companies in the chemical sector; some companies are really forerunners whereas others beginners."

**Main drivers for adopting sustainable and circular business models**

<table>
<thead>
<tr>
<th>Driver</th>
<th>Selected as driver</th>
<th>Most important driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulation</td>
<td>73%</td>
<td>7%</td>
</tr>
<tr>
<td>Customer expectations</td>
<td>87%</td>
<td>47%</td>
</tr>
<tr>
<td>New technologies</td>
<td>53%</td>
<td>13%</td>
</tr>
<tr>
<td>Supplier expectations</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>53%</td>
<td>33%</td>
</tr>
</tbody>
</table>

"We want to be a forerunner in our industry" (x3)  
"Cost savings" (x2)  
"New market and customer opportunities"  
"Our strategy and mission"

**Note:** The survey was conducted for a limited group of 15 Finnish chemical companies, and therefore the results can only be used as an indication of the current state of the industry

Source: Survey conducted to select companies within the Finnish Chemical Industry in April 2020, n=15
Finnish chemical companies appear to have targets to increase the use of sustainable materials, and have assessed their potential.

### Material efficiency analysis

<table>
<thead>
<tr>
<th>Existing initiatives or targets regarding material flows</th>
<th>Consideration of replacing existing materials with more sustainable ones</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of respondents, n=42</td>
<td>% of companies, n=42</td>
</tr>
<tr>
<td>Reducing waste</td>
<td>n=39</td>
</tr>
<tr>
<td>92% Yes</td>
<td>71% Recycled materials</td>
</tr>
<tr>
<td>8% No</td>
<td>29% No</td>
</tr>
<tr>
<td>Increasing use of renewables</td>
<td>n=38</td>
</tr>
<tr>
<td>47% Yes</td>
<td>60% Renewable materials</td>
</tr>
<tr>
<td>47% Yes</td>
<td>33% No</td>
</tr>
<tr>
<td>5% N/A</td>
<td>8% N/A</td>
</tr>
<tr>
<td>Increasing use of recycled materials</td>
<td>n=39</td>
</tr>
<tr>
<td>44% Yes</td>
<td>50% Materials that are easier to recycle</td>
</tr>
<tr>
<td>46% Yes</td>
<td>44% Yes</td>
</tr>
<tr>
<td>10% N/A</td>
<td>6% No</td>
</tr>
<tr>
<td>Leveraging byproducts from internal operations</td>
<td>n=39</td>
</tr>
<tr>
<td>74% Yes</td>
<td>50% Other</td>
</tr>
<tr>
<td>26% Yes</td>
<td>14% Other</td>
</tr>
<tr>
<td>Overall reduction of material use</td>
<td>n=38</td>
</tr>
<tr>
<td>53% Yes</td>
<td>4% Other</td>
</tr>
<tr>
<td>39% Yes</td>
<td>26% Other</td>
</tr>
<tr>
<td>8% N/A</td>
<td>38% Other</td>
</tr>
<tr>
<td>Other</td>
<td>n=18</td>
</tr>
<tr>
<td>6% Yes</td>
<td>14% Yes</td>
</tr>
<tr>
<td>50% No</td>
<td>57% Yes</td>
</tr>
<tr>
<td>44% N/A</td>
<td>29% No</td>
</tr>
</tbody>
</table>

Source: Material efficiency survey to member companies of Chemical Industry Federation of Finland (2019), n=42

**Observations**

- The majority of survey participants have set some targets concerning waste reduction and increased use of more sustainable material alternatives in their products.
- Many survey respondents have also considered replacing existing materials with recycled or renewable ones, yet only ~25% of them have set percentual targets for material efficiency.
- The majority of survey respondents report that origin information is available on over 80% of their materials.
- In terms of packaging, most survey respondents report having put attention to recyclability and lightness of packaging materials, and some also to labeling (incl. recycling labels).
- Interestingly, most survey participants report that they have not received customer inquiries regarding packaging reuse, recyclability, weight, material composition or protective capability.
Chemical companies participating in the voluntary Responsible Care sustainability programme demonstrate good progress

Responsible Care progress facts and figures

- Responsible Care is a global voluntary sustainability programme for chemical companies that has its origins in 1987 in Canada
  - In Finland the work has been running since 1992 and is coordinated by the Chemical Industry Federation of Finland (Kemianteollisuus ry)
  - 98 companies are committed to the programme representing some 80% of all production and 60% of employees in the chemical industry in Finland

- The central themes of the Responsible Care programme include
  - Sustainable use of natural resources
  - Sustainability and safety of production and products
  - Well-being of the work community
  - Open interaction and co-operation

- Achievements in Finland between 1992-2019:
  -51% water consumption
  -24% energy consumption
  -90% injuries
  -31% GHG emissions

2019 results (2018):
- 39% (32%) of Responsible Care companies use also renewable virgin raw material
- 51% (49%) of Responsible Care companies use recycled materials or side streams
- 13% (14%) of the used material volume is recycled or renewable

2019 results (2018):
- 78% (77%) of the companies report waste to be utilized as material elsewhere
- Less than 2% of the used materials end up in energy recovery, and less than 1% as waste for disposal

Note: (1) Development since the beginning of reporting described as per total production or per million-hours-worked; (2) Calculated amount of water; Reported amounts of waste water might include also runoff waters. Source: Chemical Industry Federation of Finland (Kemianteollisuus ry); Responsible Care indicator data; www.responsiblecare.fi
Conventional business models generate waste across the value chain, limiting growth and increasing exposure to material scarcity.

Typical sources of waste and inefficiencies in chemical value chains globally:

- **Research & Development**: Hazardous waste generated from research, lab tests, and pilot projects.
- **Reverse Logistics**: End of Use - Limited material recovery from consumer product disposal.
- **Product Use**: End-consumer product waste, energy usage in transport.
- **Raw Materials**: Use of non-renewable resources for energy and feedstock.
- **Manufacturing**: High energy intensity, hazardous by-products of manufacturing, limited recovery and recycling of by-products and energy.
- **Customer Industry**: Product manufacturing waste, packaging waste.

**Observations**:

- The chemical industry produces the building blocks for many consumer goods and thus holds immense potential for circularity through innovation, advances in biotechnologies, and digital interventions across the value chain.
- Globally, chemical companies must address three major waste streams:
  - Use of non-renewable resources as feedstock and sources of energy.
  - High energy intensity and hazardous by-products in manufacturing.
  - Waste generated from end-consumer products.

**Level of waste/inefficiencies**:

- Very high
- High
- Medium
- Low
- Not Applicable
The majority of consumed chemical products reaching their EoL point are not accessible with current methods

Mass balance of consumed chemicals to end-of-life materials in EU28 in 2018 (in million tons)

Observations

- Exploration of end-of-life materials as alternative feedstock sources will be crucial in enabling sustainability and circular economy
- However, currently only a small fraction of chemical product based materials are recyclable, and an even smaller fraction are actually being recycled
- The main reason for this is that the materials are inseparable from the products they are contained in
- As a result, opportunities for tapping into these material streams are significant for chemical companies e.g. through advanced material sorting technologies and circular design (improved separability)
Sustainable and circular business models address these inefficiencies and waste streams and turn them into opportunities

Five sustainable and circular business models

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

**Resource Recovery**
Using the embedded materials or energy from disposed products, byproducts or processes and recovering through collection, aggregation, and processing.

**Product as a Service**
Retaining ownership of products and selling benefits like function and quality through a service model, e.g. chemical leasing.

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

**Sharing Platforms**
Optimizing utilization rates of products and assets through shared ownership, access, and usage, e.g. online marketplaces for trading excess inventory.

Business model relevance

Note: (1) All business models are relevant to all chemical companies at least indirectly through downstream enablement, yet business models concerned with product use, i.e. Product Use Extension and Sharing Platforms are most relevant to Converters, who create concrete consumer products. Source: Accenture research
Leading chemical companies have already embraced the opportunity in Finland and abroad

Examples of sustainable and circular business models adopted by chemical industry players

Note: Detailed description of each company example are presented on the following pages.
Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis
Many chemical companies are using bio-based or recycled raw materials in their products, and some are even developing them.

**Case examples – Circular Inputs (1/2)**

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fortum</strong></td>
<td>recycles consumer plastic waste into recycled plastic granulates, which is used to replace virgin materials in plastics production. The Riihimäki plastic refinery recycles ca. 12 000 tons of consumer and industrial plastic waste per year.</td>
<td></td>
</tr>
<tr>
<td><strong>Neste</strong></td>
<td>is using oil and fat waste and residues to produce its renewable traffic fuels, and is planning to expand the NEXBTL technology to other chemical products such as plastic raw materials.</td>
<td></td>
</tr>
<tr>
<td><strong>St1</strong></td>
<td>produces bioproducts from waste and residues from food industry, households and saw mills.</td>
<td></td>
</tr>
<tr>
<td><strong>BASF</strong></td>
<td>developed a biomass balance approach to reduce the use of non-renewable resources. In the approach, renewable resources like bio-naphta ad biomethane derived from agricultural by-products are used together with fossil resources already at the very beginning of chemical production, and then allocated to specific products using a certified method.</td>
<td></td>
</tr>
<tr>
<td><strong>Evonik</strong></td>
<td>and Siemens joint research project Rheticus II aims to develop an efficient and powerful test plant that will use carbon dioxide (CO₂) and water as well as electricity from renewable sources and bacteria to produce specialty chemicals.</td>
<td></td>
</tr>
<tr>
<td><strong>DuPont</strong></td>
<td>is producing xylitol from pulp and paper industry side streams. The carbon footprint of the product is approximately 90% lower than that of xylitol produced using corn cobs as raw material.</td>
<td></td>
</tr>
<tr>
<td><strong>Kiilto</strong></td>
<td>produces wallpaper adhesives from starch, and is also developing biodegradable glue from starch, which would e.g. enable fully compostable hygiene products and takeaway goods.</td>
<td></td>
</tr>
<tr>
<td><strong>Lumene</strong></td>
<td>uses side streams from cloudberries used in the food industry as an ingredient in its skin care products.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis
Many chemical companies are using bio-based or recycled raw materials in their products, and some are even developing them.

### Case examples – Circular Inputs (2/2)

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthex</td>
<td>uses industrial and post-consumer plastic waste in its products. Currently, the share of recycled materials is 15-20% of total production, and e.g. all flower pots and balcony boxes are made of 100% recycled plastic.</td>
<td></td>
</tr>
<tr>
<td>Sulapac</td>
<td>uses industrial side streams and natural binders to produce a wood-based, fully biodegradable alternative for conventional plastics, that leaves no microplastics behind</td>
<td></td>
</tr>
<tr>
<td>FP-Pigments</td>
<td>opacity pigment products can be used to improve the environmental profile of the end product by lowering its carbon footprint by over 75% compared to TiO₂ on a ton for ton basis.</td>
<td></td>
</tr>
<tr>
<td>Borealis</td>
<td>has developed multiple products that are 100% recyclable, such as Daploy HMS PP recyclable foam and PE laminate stand-up pouch to replace difficult-to-recycle service cups.</td>
<td></td>
</tr>
<tr>
<td>Plastiroll</td>
<td>develops and produces biodegradable packaging film for vegetables from starch, which enables longer shelf life for products and thus reduces food waste.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis
Product as a Service models align supplier and customer incentives, creating significant value for both parties

Case examples – Product as a Service

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SafeChem</strong></td>
<td>A chemical leasing provider initially founded by Dow, helps customers decrease the usage of metal cleaning solvents by up to 93% and reduce energy use by up to 50% through its closed-loop, circular system.</td>
<td>Enabler</td>
</tr>
<tr>
<td><strong>Kemira</strong></td>
<td>Offers product-as-a-service models through its Total Chemistry Management and KemConnect solutions, which combine smart technology with payments for performance, aligning incentives with value instead of volume.</td>
<td>Enabler</td>
</tr>
<tr>
<td><strong>Fluid Intelligence</strong></td>
<td>Provides Oil as a Service. The company leases oils to industrial customers and continuously monitors the condition of the oil in critical machinery through remote monitoring, extending the lifecycle of the oil and thus reducing consumption. The customer pays a monthly fee based on the agreed service level.</td>
<td>Enabler</td>
</tr>
<tr>
<td><strong>Ecolab</strong></td>
<td>Provides chemical leasing services, where instead of buying e.g. lubricants for conveyor belts per kilogram, they pay for the working time of the conveyor belt, linking the supplier's profit directly to how little of the lubricant is used. For the customer, the solution allows reduced running costs and improved performance. Ecolab has provided this kind of service e.g. to Coca-Cola.</td>
<td>Enabler</td>
</tr>
</tbody>
</table>

Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis
SusChem is the European technology platform for sustainable chemistry, with a vision to help Europe achieve a sustainable low-carbon economy and avert significant climate change. The platform includes enabling technologies across digital, process and advanced materials.

Polyolefin Circular Economy Platform (PCEP) is a multi-stakeholder group that seeks to identify effective, science-based solutions for ensuring supply of high-quality recycled plastics.

Smart Chemistry Park (SCP) is an innovation platform and cluster for start-ups and SMEs delivering solutions to bio- and circular economy and cleantech. The 14 companies operating in SCP develop their technologies independently, yet in close symbiosis with each other, sharing the infrastructure, equipment and know-how.

Excess Materials Exchange (EME) is a digital marketplace for excess raw materials, industrial by-products and waste streams. The platform provides for example resource passport, track & trace, valuation and matchmaking services.

Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis

Clusters
- Energy-intensive chemical industry
- Inorganic chemistry
- Reactive chemistry
- Formulating
- Converters
Chemicals can help extend the lifecycle of end-consumer products, and the chemicals themselves can also be made more long-lasting.

### Case examples – Product Use Extension

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiilto Clean</td>
<td>Serto products include bio-degradable tensides and bio-based enzymes, and are developed so that a smaller dose of detergent is required to ensure a good washing result, allowing the product to last longer.</td>
<td></td>
</tr>
<tr>
<td>Nokian Tyres</td>
<td>uses bio-based raw materials (e.g. Canola oil) in its rubber compounds to improve the safety and durability of its tyres.</td>
<td></td>
</tr>
<tr>
<td>Chemours</td>
<td>Teflon EcoElite™—a repellent finish made from 60% renewably sourced, plant-based materials that is three times more durable than other non-fluorinated repellents—is used in Colmar skiwear, allowing it to meet the demands of its eco-conscious customer base with high-quality, longer-lasting products, which ultimately became one of its most successful collections.</td>
<td></td>
</tr>
<tr>
<td>Teknos</td>
<td>WOODEX BIOLEUM is a bio-based furniture wood oil, which extends the lifespan of garden furniture and protects them from weather conditions such as rain or sun. Over 80% of the wood oils raw materials are renewable, and as a result, the product has a higher volume solid than conventional wood oil, meaning that a smaller amount of the product is needed to treat a larger surface, making the product itself also last longer.</td>
<td></td>
</tr>
<tr>
<td>Premix</td>
<td>PREXELENT™is an antimicrobial technology that prevents the problems caused by unwanted microbes, such as mold and bacteria, improving e.g. the preservability of food, and thus enabling reduction of food waste. The technology is originally based on pine tree resin, but other active natural agents are also suitable for use. PREXELENT™is compatible with existing production processes, making it a flexible solution to apply.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis
Resource recovery is another strong area for chemical companies, with multiple examples of reusing e.g. industrial by-products

**Case examples – Resource Recovery (1/2)**

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kemira</td>
<td>Kemira performs resource recovery in its operations, with 21% of its raw materials coming from recycled sources or by-products of other industries.</td>
<td></td>
</tr>
<tr>
<td>Dow</td>
<td>Dow has collaborated with the government and local asphalt plants in India to transform 100 tons of collected plastic waste into 40 kilometers of roads. Not only did this divert plastic from landfills, it gave the plastic a second life that will likely last decades.</td>
<td></td>
</tr>
<tr>
<td>Yara</td>
<td>Yara implements resource recovery in its production by reutilizing raw materials, side flows and waste heat. Yara also promotes circular economy by researching and developing recycled nutrient solutions.</td>
<td></td>
</tr>
<tr>
<td>Pramia Plastic</td>
<td>Pramia Plastic leverages plastic waste from used PET bottles to produce 100% recycled rPET, which is comparable to virgin PET material and can be used e.g. as food contact material.</td>
<td></td>
</tr>
<tr>
<td>Molok</td>
<td>Molok enables doubling of recycling rates by bringing sorting stations with 6-10 waste fractions closer to the consumer. The solution also enables reduction of emissions as transportation can be reduced.</td>
<td></td>
</tr>
<tr>
<td>L&amp;T</td>
<td>Lassila &amp; Tikanoja collects waste oils, oil contaminated water and different emulsions from the industry, harbors, workshops and farms, analyzes them at its recycling plant and directs suitable materials for regeneration or purification to partners. Processed oil and emulsions are then reused in the industry.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis

**Clusters**
- Energy-intensive chemical industry
- Inorganic chemistry
- Reactive chemistry
- Formulating
- Converters
Resource recovery is another strong area for chemical companies, with multiple examples of reusing e.g. industrial by-products

Case examples – Resource Recovery (2/2)

<table>
<thead>
<tr>
<th>Company</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teknikum</td>
<td>Uses a closed cooling water circuit in its Vammala production facility, which enables significant reduction of water usage. Heat from production is also recovered, allowing for lower energy consumption.</td>
</tr>
<tr>
<td>Wiitta</td>
<td>Operations are built around plastics recycling: ~20% of the company’s throughput is recycled materials. The company makes continuous efforts to support its customers in increasing their recycling rates, helping e.g. with packaging recycling. For example, Wiitta has produced boxes used in food transport and moving from recycled plastics.</td>
</tr>
<tr>
<td>VTT</td>
<td>BECCU project aims to perform a proof-of-concept for the integrated production of biopower &amp; heat, transportation fuels and specialty chemicals based on utilization of CO₂ from biomass operations and hydrogen from water electrolysis or industrial processes. In addition to VTT, the cooperative consists of Business Finland and 11 other stakeholders.</td>
</tr>
<tr>
<td>Kiilto</td>
<td>Factory in Lempäälä runs with solar power, and excess heat from operations is also recovered for reuse. The Lempäälä factory is the largest rooftop solar power plant in Finland.</td>
</tr>
</tbody>
</table>

Source: Company websites; CIFF Circular Economy and Bioeconomy case studies; Accenture analysis
Each business model can be further broken down into more specific opportunities across the value chain.

Sustainable and circular opportunities across the value chain:

- **Circular design**
- **Sustainable and circular materials**
- **Sustainable energy**
- **Sustainable transport fuel**

**Design** → **Sourcing** → **Manufacturing** → **Logistics** → **Product use** → **End of Use Recycling** → **Reverse logistics**

- **Shared production infrastructure**
- **Energy, water and material recovery**
- **Shared logistics**
- **Packaging recycling**
- **Outcome-based models**
  - **Shared use**
  - **Repair, maintenance & upgrade**
  - **Reselling**

- **Product / material takeback**

Source: Accenture
Chemical companies can act as enablers of circularity for downstream businesses besides reaching circularity within.

Role of chemical companies as enablers of circularity

1. **Sustainability lab as-a-service**
   Offering sustainable lab services (e.g. testing), to customers against a volume-based fee.

2. **Product steward**
   Collaborating directly with downstream value chain partners, such as brand owners to develop sustainable/circular solutions.

3. **Recyclate application specialist**
   Leveraging application and technology expertise by providing application development services for companies interested in providing secondary raw materials to the market.

4. **Secondary raw material provider**
   Integrating capabilities such as waste collection, sorting, reverse assembly, and recycling asset operations to get access to high value material streams, that can be cycled back to the value chain.

5. **Certifier of recycled materials and products**
   Engaging in certifying the sustainable/circular provenance of secondary raw materials and products.

6. **End-of-life stream supply/demand matching platform**
   Acting as a platform operator securing stable waste stream feeds at agreed volumes and specifications by bundling market volumes, clearing demand and supply and optimizing transport routes.

7. **Carbon/molecule manager**
   Offering carbon management services (e.g. reporting & analysis tools and advice) to help downstream customers achieve their GHG reduction targets.

Source: Accenture research
By adopting sustainable and circular business models, companies can create value in four key dimensions

Sustainable value creation framework

**Revenue Generation**
- Increased sales
- Improved market access
- Extended product portfolio

**Brand Enhancement**
- Employer branding
- Employee engagement and retention
- ESG performance and investor attraction

**Cost Savings**
- Resource, energy and CO₂ emissions savings
- Labor cost savings
- Production cost savings
- SG&A cost savings

**Risk Reduction**
- Reputational risk and public perception
- Regulatory and political risk
- Disruption to operations and demand

**Kemira**
- EUR 700 million annual revenue from treating waste water

**NESTE**
- Reduced greenhouse gas emissions by up to 90% compared to fossil fuel over the lifecycle, by collecting and recycling cooking waste fats in order to produce Neste My renewable diesel

Source: Company websites; (1) Atomico 2019 State of European Tech

+529% increase in early stage capital directed towards ESG-oriented companies tackling UN's Sustainable Development Goals through their core business model

Reduced regulatory risk through investments into scalable paper bottle solution (100% bio-based and recyclable), avoiding stricter global legislation on packaging and plastics
Emerging sustainable and circular value chains provide significant opportunities, and the right time to start is now

Key “sweet spots” in future value chains

1. Race for value chain partnerships
2. Race for applications for secondary materials
3. Race for consumers preferring eco-friendly offerings
4. Race for reverse logistics partnerships
5. Race for homogeneous raw materials
6. Race for technologies (waste separation / chemical processes)
7. Race for bio-based chemical value chains
8. Race for innovations and circular solutions

Observations

- Chemical companies need to embrace the disruptive change that is reshaping the industry, and tap into the opportunities emerging throughout the value chain.
- Furthermore, new circular value chains are continuously emerging, and the race to occupy the “sweet spots” in these value chains of the future is already on.

Source: Accenture research
What opportunities exist?

Activation questions

1. What are the key sources of waste/inefficiencies in your company’s value chain?
   - Hazardous R&D
   - Unsustainable raw materials
   - Hazardous manufacturing by-products
   - Unsustainable energy sources / high energy consumption in manufacturing
   - Unrecovered materials from end-of-life products
   - Something else?

2. Which sustainable and circular business models would be the most relevant to address those waste streams and inefficiencies? How?

3. What kind of role could your company take in enabling circularity for downstream customers, if any?

4. What kind of benefits do you expect to get from these new business models? How large are they in quantitative terms?
   - Revenue generation
   - Cost savings
   - Brand enhancement
   - Risk mitigation

---

Business model canvas

Based on the information learnt in this chapter, fill in the following parts of the business model canvas:

- **Offering** - detail what the solution you want to offer could look like, what the concrete value proposition to your customers is and draft an outlook on how it could be developed further or what other solutions could be connected with it.
How to start the transformation journey?

Key steps for chemical companies to take to start their journey and how to overcome typical barriers along the way

Chapter summary

- To succeed in circularity, companies need to mature across four key dimensions
  - Operations
  - Culture & Organization
  - Products & Services
  - Ecosystem
- Success in each dimension is further enhanced through customer-centricity, and smart application of emerging technologies
- Typically, the transformation journey happens in three stages: first companies become circular within, then they enable the circularity of their customers, and finally extend circularity to benefit the entire surrounding ecosystem
- Organizational & cultural, ecosystem-related and financial barriers are common along the journey
- To overcome these barriers, companies need strong leadership, a network of partners and a solid understanding of funding needs and requirements
To succeed in circularity, companies need to mature across four key dimensions

Key capabilities

**Customer-centricity**

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

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

**Culture & Organization**
Embedding circular principles into the fabric of the organization through redefined working practices, policies, and procedures

**Products & Services**
Rethinking the design, lifecycle, and end of use of a product or service to optimize usage, eliminate waste, and closed product loops

Source: Accenture research
Supply chain circularity can be a key driver for competitiveness, reducing waste, emissions, water and energy consumption

### Key capabilities - Operations

<table>
<thead>
<tr>
<th>Key capabilities</th>
<th>Example: Circular supply chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use circular inputs</td>
<td>- <strong>Design</strong> Replacement of hazardous substances in design</td>
</tr>
<tr>
<td></td>
<td>- <strong>Plan</strong> Use of renewable/recycled raw materials</td>
</tr>
<tr>
<td></td>
<td>- <strong>Source</strong> Use of renewable energy</td>
</tr>
<tr>
<td></td>
<td>- <strong>Make</strong> Use of renewable transport fuel</td>
</tr>
<tr>
<td>Build closed loops</td>
<td>- <strong>Design</strong> Water and material recovery &amp; reuse</td>
</tr>
<tr>
<td></td>
<td>- <strong>Plan</strong> Asset repair, upgrade and maintenance</td>
</tr>
<tr>
<td></td>
<td>- <strong>Source</strong> Asset sharing</td>
</tr>
<tr>
<td></td>
<td>- <strong>Make</strong> Material, energy, and water recovery and recycling</td>
</tr>
<tr>
<td>Optimize asset ownership</td>
<td>- <strong>Plan</strong> Packaging recycling</td>
</tr>
<tr>
<td></td>
<td>- <strong>Make</strong> Product/material takeback</td>
</tr>
</tbody>
</table>

#### Key capabilities

- **Use circular inputs**
  - Source and use renewable/recycled/bio-based materials and energy by
    - Integrating circular thinking into the sourcing process e.g. through KPIs
    - Establishing a collection infrastructure for secondary materials or a partnership with a waste company

- **Build closed loops**
  - Design products and processes for circularity, i.e. recyclability, durability and resource-efficiency by considering the entire product lifecycle from production to end-of-life
  - Recover materials, energy and water from operations and cycle them back for reuse
    - Closely monitor material and energy flows on-site with the help of technologies and building treatment capabilities to reprocess and recycle waste and by-products
    - Build/participate in reverse logistics to take back products and materials for reuse and use incentives to facilitate the adoption

- **Optimize asset ownership**
  - Leverage digital technologies to improve supply chain efficiency, optimize asset usage and predict repair and maintenance needs
  - Consider sharing production assets or delivery capacity with other players to maximize usage rates

*Source: Accenture research*
Circularity is rooted deep in Sulapac’s operations – from R&D to end-of-life recycling

Case example: Sulapac

Circularity in the Sulapac value chain

**Sustainable sourcing**
- Primarily plant-based raw materials
- Wood from industrial side streams, originating from sustainably managed forests

**Safe & circular design**
- Made of wood chips and biodegradable binders
- Unique, luxurious look and feel ideal for sustainability-conscious quality-driven brands

**Collaboration with partners**
- Sulapac collaborates with several partners and brands. This includes the whole value chain from co-creation of novel recipes to development of take-back systems and new reuse and recycling routes.

**Flexible manufacturing**
- Sulapac does not own any production facilities
- Its materials are used on customers’ and partners’ existing production lines to replace conventional plastics
- Sulapac materials can be processed with existing plastic converting machinery with only minor adjustments needed

**Shared logistics**
- Sulapac shares the logistics infrastructure with other players, allowing optimized capacity usage

**Optimized usability**
- Sulapac materials have many of the same benefits as traditional plastic, making them fully functional alternatives, yet Sulapac does not leave microplastic behind
- Many Sulapac products (e.g. jars) can be reused for other functions once consumed, thanks to their appealing design

**Full recyclability**
- Sulapac biodegrades fully into CO₂, water and biomass
- Sulapac is recyclable via industrial composting, and other recycling methods are under investigation (e.g. mechanical and chemical recycling)

---

Source: Accenture analysis; Interview and materials provided by Sulapac
Setting a clear sustainability vision, reorganizing for circularity, and building new competences are key for a successful transition

Key capabilities - Culture & Organization

<table>
<thead>
<tr>
<th>Key capabilities</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Define sustainability vision</strong></td>
<td><strong>NESTE</strong></td>
</tr>
<tr>
<td>Define a long-term sustainability strategy with clear targets and milestones, and demonstrate leadership commitment with transparent communication</td>
<td>In 2019, Neste renewed its strategy and set out an ambition to become a global leader in renewable and circular solutions. The company has set an ambitious target to reaching carbon neutral production by 2035 and to reduce its customers’ greenhouse gas emissions by at least 20 million CO₂ tons annually by 2030, and is now developing a detailed action plan. 41.5% of new Neste employees say that its sustainability focus is one of the key reasons for joining the company.¹</td>
</tr>
<tr>
<td><strong>Foster innovation</strong></td>
<td><strong>BOREALIS</strong></td>
</tr>
<tr>
<td>Promote a culture of innovation and motivate employees to ideate new ways to deliver value to stakeholders in a sustainable and circular way, leveraging the power of ecosystem partners</td>
<td>To build sustainability capabilities within the organization, Borealis is engaging senior and mid-level managers in a customized Business Sustainability course, which deepens participants’ skills and understanding in key sustainability topics such as circular economy, materiality identification, marine littering, microplastics and design for recycling. The company also hosts interactive webcasts on current and emerging sustainability issues for its employees throughout the year, and has an internal portal for sharing sustainability insights. Since 2016, 72 Borealis managers have been certified, including 16 in 2019.²</td>
</tr>
<tr>
<td><strong>Develop competence</strong></td>
<td><strong>ELLEN MACARTHUR FOUNDATION</strong></td>
</tr>
<tr>
<td>Systematically develop sustainable and circular capabilities across the entire organization through trainings and cross-functional knowledge sharing, and attract new talent with inspiring purpose</td>
<td></td>
</tr>
<tr>
<td><strong>Reorganize for circularity</strong></td>
<td></td>
</tr>
<tr>
<td>Enhance cross-functional collaboration (e.g. R&amp;D and sourcing) and consider setting-up a sustainability/circularity team to drive the change</td>
<td></td>
</tr>
<tr>
<td><strong>Align governance</strong></td>
<td></td>
</tr>
<tr>
<td>Embed sustainable ways of working in policies, processes and procedures, and develop metrics and tools for tracking progress over time</td>
<td></td>
</tr>
</tbody>
</table>

Source: Accenture research; (1) Neste Annual Report 2019; (2) Borealis Annual Report 2019; (3) Ellen MacArthur Foundation
Kiilto desires to be an environmental leader, and is running a comprehensive programme to achieve the ambition

Case example: Kiilto

Kiilto Promise to The Environment

<table>
<thead>
<tr>
<th>Theme</th>
<th>Promise</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green energy</strong></td>
<td>By 2028, all company operations are carbon neutral</td>
<td>• From 2019 onwards, Kiilto will participate in environmental projects aimed at adding carbon sinks (e.g. planting forests in nearby areas)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• By 2025, we will reduce our energy consumption per ton produced by 20% from the level in 2010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• By 2028, we will only use energy that is fully renewable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Our logistics and business travel will be carbon neutral by 2028</td>
</tr>
<tr>
<td><strong>Green packaging and logistics</strong></td>
<td>A positive environmental impact is the foundation of our packaging solutions</td>
<td>• By 2025, 70% of our packaging materials are reusable, renewable or made from recycled materials</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Kiilto will start a packaging waste collection program by 2019</td>
</tr>
<tr>
<td><strong>Green services</strong></td>
<td>We provide the best circular economy solutions in our industry</td>
<td>• By 2020, all Kiilto trainings will have contents on sustainable development and environment. We train 20 000 people per year in Finland</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All of our customer meetings in 2020 will include the discussion of environmental issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• All Kiilto personnel will receive environmental training in 2020</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• We will reduce our customers’ use of materials. From 2023 onwards, our target is 200 000 kg per year</td>
</tr>
<tr>
<td><strong>Green material choices</strong></td>
<td>We are the leading circular economy company of our industry</td>
<td>• Towards zero waste. We will halve our amount of waste (per produced tons) by 2022</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Circulating materials. We will double the share of renewable and circular raw materials by 2022</td>
</tr>
</tbody>
</table>

Kiilto is a Finnish family-owned company which develops, manufactures and markets chemical industry solutions in four business areas:
- Construction
- Industrial bonding and hygiene solutions
- Professional cleanliness and hygiene
- Consumer business

In 2018, Kiilto started a group-wide Promise to the Environment programme, which consists of four key themes:
- Each theme has a dedicated steering committee consisting of representatives from various functions that meet regularly to track progress
- Kiilto has also set concrete group-level targets for each theme, which guide company- and unit-specific operations
- Programme updates are also given in group-wide townhall meetings, and all new employees are given a sustainability-related training as part of their induction

Kiilto has also set concrete group-level targets for each theme, which guide company- and unit-specific operations.

Programme updates are also given in group-wide townhall meetings, and all new employees are given a sustainability-related training as part of their induction.

Source: Accenture analysis; Interviews with Kiilto representatives; Kiilto website
Customer-centricity and design for circularity enable additional revenues and enhance brand value

Key capabilities - Products & services

<table>
<thead>
<tr>
<th>Key capabilities</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a customer-centric offering</td>
<td>Orthex SmartStore™ Collect is a stylish collect-box for sorting different types of waste, such as plastic packages, glass, metals and cardboard. The product has a modular design which can be tailored to individual needs and wishes, and it is made of 100% recycled materials. What is more, the bamboo-lid of the container enables to use it as a seat, further extending the usability of the solution.</td>
</tr>
<tr>
<td>Re-evaluate product portfolio regularly for expected changes in customer demand patterns, and adjust accordingly&lt;br&gt;Build strong understanding of customer values and pain points and develop outcome/performance-based solutions around them&lt;br&gt;Engage customers throughout the product lifecycle – from design to takeback and recovery&lt;br&gt;Integrate customer-centricity in sales operations</td>
<td></td>
</tr>
<tr>
<td>Design for circularity</td>
<td>In 2020, the SmartStore™ Collect won the German Design Award and Innovation Interior Award.</td>
</tr>
<tr>
<td>Assess methods for using less resources for producing products and for making products last longer&lt;br&gt;Replace existing raw materials with renewable and recycled materials, and substitute hazardous substances with more sustainable alternatives&lt;br&gt;Enhance circularity in the downstream value chain by developing materials that are resource-efficient (e.g. lightweight), durable, separable, sortable and recyclable</td>
<td></td>
</tr>
<tr>
<td>Build trust &amp; transparency</td>
<td></td>
</tr>
<tr>
<td>Communicate openly about sustainability and circularity initiatives, targets and progress within your own organization&lt;br&gt;Provide comprehensive information on products and their environmental impact, incl. e.g. material composition, origin, CO₂ footprint, etc&lt;br&gt; Educate customers and consumers about the advantages of sustainable and circular approaches to production and consumption to drive their behavioral change</td>
<td></td>
</tr>
</tbody>
</table>
Design for circularity is critical for improving access to and supply of secondary raw materials

Deep-dive: Design for circularity

Design for circularity
- Design for circularity is crucial for improving access to the large amount of chemical product-based materials reaching their end-of-life and not being recycled for reuse
- To address this challenge, chemical companies have an opportunity to supply materials that enhance the circularity in the downstream value chain, such as single-layer materials and adhesives that are easy to split up
- Circular design principles will be further promoted in the EU with the Sustainable Product Policy Farmework that supports e.g. product durability, recyclability, reuse, and carbon efficiency
  - The policy will be gradually rolled out across industries starting in 2021

Source: Accenture research
For chemical companies, collaboration across the value chain is vital in order to tap into circular opportunities

Key capabilities - Ecosystem

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Circular economy cannot be achieved by one company alone, but collaboration with financial institutions, governmental organizations, technology players, customers, suppliers, public and societal actors is needed to deliver holistic solutions</td>
</tr>
<tr>
<td>• What differentiates ecosystems from traditional collaboration models is that activities are centered around a joint value proposition, meaning non-competitive, transparent sharing of knowledge, information, and learning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ecosystem development over time</th>
</tr>
</thead>
<tbody>
<tr>
<td>From industry-specific value chains….</td>
</tr>
</tbody>
</table>

...to cross-industry value networks

<table>
<thead>
<tr>
<th>Key capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Secure funding and investment</strong></td>
</tr>
<tr>
<td>Search for funding with an ecosystem mindset and tap into a diverse range of potential investors, e.g. banks, financial institutions, VC-firms, angel investors, and crowdfunding platforms.</td>
</tr>
<tr>
<td><strong>Attract talent and future employees</strong></td>
</tr>
<tr>
<td>Recruit the best possible talent into the team by leveraging personal and professional networks from across the ecosystem.</td>
</tr>
<tr>
<td><strong>Find customers and clients</strong></td>
</tr>
<tr>
<td>Promote products and services through ecosystem players and engage ambassadors to amplify marketing efforts.</td>
</tr>
<tr>
<td><strong>Connect with peers</strong></td>
</tr>
<tr>
<td>Identify and build relationships with other players working on similar challenges, and exchange ideas and learnings to accelerate solutions.</td>
</tr>
<tr>
<td><strong>Identify mentors</strong></td>
</tr>
<tr>
<td>Look for functional and industry experts who can act as mentors and provide valuable guidance and coaching during the innovation journey.</td>
</tr>
<tr>
<td><strong>Involve collaborators, partners and suppliers</strong></td>
</tr>
<tr>
<td>Collaborate with a diverse ecosystem of brand owners, partners, suppliers, and customers and invite them to test new ideas.</td>
</tr>
</tbody>
</table>

Source: Accenture research
Multiple new collaboration models have already emerged in the Finnish chemical ecosystem

Key capabilities - Ecosystem

<table>
<thead>
<tr>
<th>Collaboration model</th>
<th>Chemical value chain</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials</td>
<td>Chemical industry</td>
<td>Kemira and Valmet collaborate to bring significant improvements to wastewater treatment processes.</td>
</tr>
<tr>
<td></td>
<td>OEMs / Brand owner</td>
<td>Borealis acquired plastic recycling companies Ecoplast and mtm plastics to expand its recycling capabilities.</td>
</tr>
<tr>
<td>End user</td>
<td>Waste manager</td>
<td>Neste is collaborating with Ravago and REMONDIS to enable chemical recycling of over 200 000 tons of plastic waste annually.</td>
</tr>
</tbody>
</table>

1. Chemical company & waste manager
2. Chemical company, start-up/innovator & waste manager
3. Chemical company, packaging producer, brand owner & waste manager
4. Chemical company, start-up/innovator, packaging producer, brand owner & waste manager
5. Start-up/innovator, brand owner & waste manager

Source: Company websites; Accenture analysis
## Various players are needed to make an ecosystem flourish

**Key capabilities - Ecosystem**

<table>
<thead>
<tr>
<th>Description</th>
<th>Role</th>
<th>Illustrative examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers and end consumers</td>
<td>Current or potential new customers</td>
<td>Reveal insights on needs and iteratively improve solutions</td>
</tr>
<tr>
<td>Suppliers &amp; delivery partners</td>
<td>Goods and service providers for internal use and collaborative solution delivery (waste/material management, logistics, insurance, payment solutions, circular design …)</td>
<td>Grant access to circular material, partner for joint provision of circular material or partner for service delivery</td>
</tr>
<tr>
<td>Technology providers</td>
<td>Providers of technologies and software enabling circular solution delivery to customers or internal operational improvements</td>
<td>Engage in solution and process design and supply required technologies</td>
</tr>
<tr>
<td>Thought leaders</td>
<td>Universities, networks and peers with extensive sustainability and circular economy knowhow</td>
<td>Serve as source of inspiration, sounding board and learning platform</td>
</tr>
<tr>
<td>Financiers</td>
<td>Public institutions, banks, investment funds and other funding providers</td>
<td>Give access to funding required for delivering sustainable and circular solutions</td>
</tr>
<tr>
<td>Public and societal actors</td>
<td>Governments, associations and other representative organizations</td>
<td>Influence public perception and opinion, and influence or set framework conditions</td>
</tr>
</tbody>
</table>

Source: Accenture research
Rapidly evolving technologies enable increased circularity – right application can unlock tremendous value

**Smart application of emerging and advancing technologies**

<table>
<thead>
<tr>
<th>Emerging</th>
<th>Developing</th>
<th>Maturing</th>
<th>Scaled-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge Computing</td>
<td>Artificial intelligence</td>
<td>Machine Vision</td>
<td>Cloud</td>
</tr>
<tr>
<td>Energy Harvesting</td>
<td>M2M Devices</td>
<td>Machine Learning</td>
<td>Mobile</td>
</tr>
<tr>
<td>Cellular/Tissue Engineering</td>
<td>Digital Twin</td>
<td>Digital Anchors</td>
<td>3D Printing</td>
</tr>
<tr>
<td>Industrial biotechnology</td>
<td>Physical Markers</td>
<td>Energy Storage</td>
<td>Spectroscopy</td>
</tr>
<tr>
<td></td>
<td>DNA Marking</td>
<td>AR/VR</td>
<td>Bio-energy</td>
</tr>
<tr>
<td></td>
<td>Nano-technology</td>
<td>Carbon Capture and Storage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Physical</td>
<td>Hydroponics &amp; Aeroponics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Technology</td>
<td>Genetic Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of technology</td>
<td>Digital</td>
<td>Biological</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Accenture research; Company websites

**Fortum** combines recycled plastic and natural cellulose fiber to create a compound with manufacturing qualities that is fully recyclable

**Solar Foods** develops innovations for food production and enables natural protein production by using air and electricity

**Normet** used digital twin technology in construction chemicals to develop smart concrete spraying systems

**Dupont** uses virtual reality in product design to simulate the process for making plastics.

**Domo**, **Covestro** and **BASF** are piloting blockchain for material tracing to increase the use of recycled inputs

**Remeo** uses smart/AI-based robotics in their waste sorting facilities to increase recycling rates

**CP Kelco** uses heat generated by Metsä Group pulp mill in its production. Other pulp side streams are also used in CP Kelco products.
Cross-functional collaboration is key in capability development – some functions take the lead for each capability and others support

Role of functions in capability development

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Capability</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Design / R&amp;D</td>
</tr>
<tr>
<td>Operations</td>
<td>Use circular inputs</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Build closed loops</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Optimize asset ownership</td>
<td>✓</td>
</tr>
<tr>
<td>Culture &amp; Organization</td>
<td>Define sustainability vision</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Foster innovation</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Develop competence</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Reorganize for circularity</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Align governance</td>
<td>✓</td>
</tr>
<tr>
<td>Products &amp; services</td>
<td>Develop a customer-centric offering</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Design for circularity</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Build trust &amp; transparency</td>
<td>✓</td>
</tr>
<tr>
<td>Ecosystem</td>
<td>Secure funding and investment</td>
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<td></td>
<td>Attract talent and future employees</td>
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<tr>
<td></td>
<td>Involve collaborators, partners and suppliers</td>
<td>✓</td>
</tr>
<tr>
<td>Customer-centricity</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Technology application</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Note: (1) Includes e.g. HR, IT, Finance, Legal
Finnish chemical companies see ecosystem collaboration as the key capability to develop in order to achieve circularity

### Key capabilities

#### Perceived key barriers in transitioning to sustainable and circular business models

<table>
<thead>
<tr>
<th>% of respondents, n=15</th>
<th>Selected as capability to develop</th>
<th>Most important capability to develop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product/service design</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>Culture &amp; leadership</td>
<td>67%</td>
<td>27%</td>
</tr>
<tr>
<td>Supply chain management</td>
<td>67%</td>
<td>7%</td>
</tr>
<tr>
<td>Customer engagement</td>
<td>60%</td>
<td>7%</td>
</tr>
<tr>
<td>Ecosystem collaboration</td>
<td>67%</td>
<td>33%</td>
</tr>
<tr>
<td>Other</td>
<td>13%</td>
<td>7%</td>
</tr>
</tbody>
</table>

"At the moment, many chemical companies are very technology-oriented, and would benefit from a more customer-centric approach."

"Without the right culture and leadership, nothing can truly be adopted in the organization. With the right culture and leadership the whole organization will be driven towards the desired goals."

"To take our sustainability commitments forward, we need to engage the entire organization, including R&D, procurement, operations, logistics and back office personnel. We need to communicate about our targets and plans from the very beginning, and be open for additional development ideas."

"To have a circular system, we cannot work alone. We see that it is utterly important to collaborate with partners in our value chain and outside our value chain."

Note: The survey was conducted for a limited group of 15 Finnish chemical companies, and therefore the results can only be used as an indication of the current state of the industry.

Source: (1) Accenture research; (2) Survey conducted to select companies within the Finnish Chemical industry in April 2020, n=15
The transformation to circularity typically happens in three stages:

**Transformation journey**

### Level 1: Achieve Circular Economy within the company

**Success Factors**
- Customer-centric solutions across the business functions
- Exhaustive metrics applied across the business functions
- Constant testing and refining of sustainable and circular business models

**Barriers**
- Lack of CE solutions connectivity across the business
- Lack of cross-functional collaboration, e.g. shared and holistic metrics
- Inability to disrupt existing business
- Lack of technical skills

### Level 2: Enable Circular Economy with the Customers

**Success Factors**
- Multi-stakeholder collaboration and innovation platforms
- Vertical and horizontal integration
- Adaptable and agile workforce
- Customer education and storytelling
- Ecosystem leadership

**Barriers**
- Lack of strategic CE collaboration
- Ecosystem built on ambition alone
- Slow customer adoption
- Inconsistent regulatory frameworks (lack of multi-level regulatory governance)

### Level 3: Advance the Circular Economy Ecosystem

**Business Transformation**

Source: Accenture research
Four steps can help you get started with the journey

First steps on the circular transformation journey

1. Define sustainability and circular economy vision
   - Assess how the key sustainability and circular economy drivers affect your and your customers' business
   - Define/review your sustainability and circular economy vision and related targets

2. Identify and evaluate opportunities
   - Assess inefficiencies in your value chain and identify potential sustainable and circular business models to address them
   - Consider your key customers, and think what role you might take to support their circularity
   - Assess potential benefits, costs, and investments related to identified business models
   - Prioritize identified business models based on associated benefits and efforts

3. Assess and address capability gaps
   - Assess your company's maturity in the four circular capability dimensions and two enabling capabilities
     - Operations
     - Organization & culture
     - Products & services
     - Ecosystem
     - Customer-centricity
     - Technology application
   - Develop circular academy and systematically build needed capabilities across all functions

4. Design transformation roadmap
   - Define the key actions required to implement the target business model(s)
   - Identify potential barriers along the transformation journey and actions to mitigate them

Tip: You can leverage the circular business model development tools developed for the manufacturing industry to support your work.

Source: Accenture research
Organization & culture, ecosystem and financing are the most typical barriers along the transformation journey

Typical barriers

<table>
<thead>
<tr>
<th>Internal</th>
<th>Ecosystem-related</th>
<th>Financial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational &amp; cultural</td>
<td>Barriers related to required partnerships to leverage the full circular potential of value chains and to shape the framework conditions (e.g. regulation)</td>
<td>Barriers related to different funding requirements, risk and return structures of sustainable and circular business models that lead to challenges in securing funding</td>
</tr>
</tbody>
</table>

Barriers related to required changes in value, mindset and behavior of organizations to enable cross-functional collaboration and customer-centricity

Perceived key barriers in transitioning to sustainable and circular business models

% of respondents, n=15

<table>
<thead>
<tr>
<th>Selected as barrier</th>
<th>Most significant barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financing</td>
<td>60%</td>
</tr>
<tr>
<td>Culture &amp; organization change</td>
<td>47%</td>
</tr>
<tr>
<td>Regulation</td>
<td>53%</td>
</tr>
<tr>
<td>Customer behavior</td>
<td>40%</td>
</tr>
<tr>
<td>Other</td>
<td>13%</td>
</tr>
</tbody>
</table>

Perceived key barriers in transitioning to sustainable and circular business models

Selected as barrier

- Financing
- Culture & organization change
- Regulation
- Customer behavior
- Other

Most significant barrier

- Financing (33%)
- Culture & organization change (20%)
- Regulation (27%)
- Customer behavior (13%)
- Other (7%)

Note: The survey was conducted for a limited group of 15 Finnish chemical companies, and therefore the results can only be used as an indication of the current state of the industry.

Source: (1) Accenture research; (2) Survey conducted to select companies within the Finnish Chemical industry in April 2020, n=15

"Financial investments are required, yet they compete against each other in terms of priority order. Therefore investment needs and expected benefits need to be well articulated.”

"Regulatory inflexibility clearly slows down the transition towards circularity e.g. in terms of leveraging waste/by-product streams, and customers are not necessarily well-informed to consume more eco-friendly products and recycle materials.”

"Some chemical sectors and downstream industries are still quite conservative in their thinking, making culture and mindset change key in the transformation. Changing customer behavior is equally challenging: how do we convince people to select more sustainable alternatives?”
To overcome barriers, companies need strong leadership, a network of partners, and a solid understanding of funding needs

Recommendations on how to overcome typical barriers

**Key challenges**

- Resistance from employees to adopt circular behaviors, mindsets and values, incl. e.g. cross-functional collaboration
- Turning leadership commitments into visible action, i.e. “walking the talk”
- Integrating circular principles and customer-centricity in sales operations
- Low customer and end consumer interest/demand towards more sustainable alternatives
- Lack of clear ecosystem model that clearly identifies customers, markets, channels and a common revenue model
- Unfavorable framework conditions, e.g. uncertainty of upcoming regulations or regulations hindering adoption of sustainable and circular models
- Resistance from employees to adopt circular behaviors, mindsets and values, incl. e.g. cross-functional collaboration
- Turning leadership commitments into visible action, i.e. “walking the talk”
- Integrating circular principles and customer-centricity in sales operations
- Hesitation towards investing in sustainable and circular business models
- Understanding funding requirements and risks of sustainable and circular business models
- Identifying relevant funding sources and instruments

**Recommendations**

- Establish a dedicated change programme and engage employees in defining what circularity means for the organization as a whole and their function and role in specific
- Remove barriers and set incentives for cross-functional collaboration
- Incorporate sustainability and circularity in leadership performance indicators to make leaders accountable for the change
- Put special focus on enabling circularity and customer-centricity of sales organization through capability development, process and tool updates and performance indicators
- Educate customers and end consumers on the benefits of more sustainable alternatives and their viability as a substitute for conventional models
- Determine your own role in the ecosystem first (aggregator / innovator / orchestrator), and only then pick partners. Alternatively, join an existing ecosystem if there is a role that suits your objectives
- Remember that despite differing views and objectives, the key to ecosystem success is a shared vision and value proposition towards the society and environment
- Be aware of framework conditions and actively engage to shape them
- Use the circular value creation framework to holistically assess and demonstrate benefits of circularity and build a detailed business case around it
- Investigate business model specific funding requirements and related risks, e.g. investments to equipment and process development and balance sheet extension (relevant for Product as a Service)
- Research different funding sources and instruments and assess their suitability for your business needs (see next page for an overview of potential alternatives)

Source: Accenture research
Various funding sources are available for development of sustainable and circular business models

**Potential funding sources**

### Public funding

#### Finnish

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FInnvera</td>
<td>Provides guarantees against political or commercial risks associated with the financing of exports.</td>
</tr>
<tr>
<td>Vake</td>
<td>Provides capital and accelerates new technology solutions addressing climate change with an over EUR 100 million annual investment.</td>
</tr>
<tr>
<td>TESI</td>
<td>Offers funds and direct investments to support growth and has started a programme where it will invest EUR 75 million in CE companies by 2021.</td>
</tr>
</tbody>
</table>

#### European

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETS Innovation Fund</td>
<td>Provides EUR 10 billion funding for innovative low-carbon technologies and solutions that enable emission reductions. The first call will be launched in 2020, followed by regular calls until 2030.</td>
</tr>
<tr>
<td>Joint Initiative on Circular Economy (JICE)</td>
<td>Is a partnership between EU's five largest national promotional banks and the European Investment Bank to invest at least EUR 10 billion in 2019-2023 to circular economy projects in the EU.</td>
</tr>
</tbody>
</table>

### Private funding

#### Finnish

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taaleri</td>
<td>Is a financing company that operates the world's first Private Equity Circular Economy Fund.</td>
</tr>
<tr>
<td>Grannenfelt Finance</td>
<td>Is an independent provider of financial solutions for growth companies, drawing on different sorts of funding solutions (equity, debt, EU and government funding), and is particularly focused on funding ‘product as a service’ models.</td>
</tr>
<tr>
<td>Korona Invest</td>
<td>Is a private equity firm specialized in small and medium-sized growth companies. The firm invests in companies with a turnover of EUR 2-20 million that have a solid growth plan, and currently has 2 circular economy focused companies in their portfolio of 10 companies.</td>
</tr>
<tr>
<td>Voima Ventures</td>
<td>Invests in promising early-stage technology companies with a strong scientific foundation and global ambition. Its strategic partner is VTT and its portfolio includes many circular economy pioneers such as Solar Foods, Paptic, and Infinite Fiber company.</td>
</tr>
</tbody>
</table>

#### International

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circularity Capital</td>
<td>Is a specialized private equity firm investing in European Growth SMEs that operate in the circular economy.</td>
</tr>
<tr>
<td>Closed Loop</td>
<td>Is a fund that invests in sustainable consumer goods companies, advanced recycling technologies and services related to the circular economy.</td>
</tr>
</tbody>
</table>

Source: Organization websites; Accenture analysis
How to start the transformation journey?

Activation questions

1. Considering the four key capability dimensions that companies need to mature in to succeed in circularity, what kind of development initiatives your company should start around
   - Operations
   - Culture & organization
   - Products & services
   - Ecosystem
   - Customer-centricity
   - Technology application?

2. What are the key actions required to make these initiatives happen?

3. Who are the key partners you need to collaborate with?

4. What technologies can be used to support the initiatives?

5. What barriers might you encounter when implementing the initiatives? How can you mitigate them?

Business model canvas

Based on the information learnt in this chapter, fill in the following parts of the business model canvas:

- **Financial aspects** — make a high-level estimate on revenues, costs, and required investments
- **Operating model** — reflect on key partners, capabilities, resources and digital technologies needed to operate your circular business idea
- **Enabling companies** — list companies that can support the development of your circular business model, such as financiers and technology providers
Concluding remarks

You should now have a good understanding of...

- The importance of the chemical industry in accelerating the broader transition to sustainable and circular economy across industries.
- The competitive advantage that sustainable and circular business models can create for chemical companies through operations optimization, accelerated growth and enablement of downstream circularity.
- The key capabilities that your company needs to develop to succeed in circularity.
- The potential barriers that you may encounter on your transformation journey and ways to mitigate them.

As first steps, we advise you to...

- Gather a cross-functional team and
  - Review your business strategy and see whether it sufficiently addresses the trends driving sustainability and circularity.
  - Make a list of potential new sustainable and circular opportunities across your value chain.
  - Draft a high-level plan on how you intend to take the identified initiatives forward.
- Engage your organization, customers and partners more broadly to validate and complement your ideas, and get started!
### Want to learn more?

#### Additional resources

<table>
<thead>
<tr>
<th>Publisher</th>
<th>Resource</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kemiateollisuus ry / Chemical Industry Federation of Finland</td>
<td><strong>Carbon Neutral Chemistry 2045</strong></td>
<td>Target set by the Chemical Industry Federation of Finland (Kemiateollisuus ry) in the beginning of 2019 to make the industry carbon neutral in Finland by 2045 by both reducing carbon footprint and increasing handprint.</td>
</tr>
<tr>
<td>Kemiateollisuus ry / Chemical Industry Federation of Finland</td>
<td><strong>Responsible Care programme</strong></td>
<td>International voluntary sustainability programme of the chemical industry. Operated in Finland since 1992.</td>
</tr>
<tr>
<td>Kemiateollisuus ry / Chemical Industry Federation of Finland</td>
<td><strong>Circular Economy case examples</strong> <strong>Bioeconomy case examples</strong></td>
<td>Circular economy and bioeconomy case examples from the Chemical Industry in Finland.</td>
</tr>
<tr>
<td>Sitra, Technology Industries of Finland &amp; Accenture</td>
<td><strong>Circular Economy Playbook and Tools for the Manufacturing Industry</strong></td>
<td>Comprehensive overview of circular economy opportunities in key manufacturing sectors: Machinery &amp; Equipment, Marine, Energy, Transportation. Set of tools to start developing company-specific CE opportunities further, e.g. value case tool, business model canvas, and capability assessment tool.</td>
</tr>
<tr>
<td>Accenture</td>
<td><strong>The Circular Economy Handbook</strong></td>
<td>Book featuring insights gained from years of experience and an analysis of 1 500 case studies, offering a practical view on how organizations can take transformative steps towards circularity and create new opportunities for competitiveness and sustainable prosperity.</td>
</tr>
</tbody>
</table>
Finnish chemical companies contributing to the development of this playbook

FP-Pigments Oy
Kiilto Oy
Molok Oy
Orthex Group Oy Ab
Smart Chemistry Park / Turku Science Park Oy
St1 Oy
Sulapac Oy
Teknikum Oy
Teknos Oy
Wiitta Oy