



econsense

Germany's Transition to a Circular Economy

How to Unlock the Potential of
Cross-Industry Collaboration

 **accenture**



**Wuppertal
Institut**

Foreword

The current decade will show whether we can achieve our common goal of living sustainably on a healthy planet. This requires reducing the emissions of greenhouse gases (GHG), using up fewer resources, and decreasing land use, soil degradation, and the leakage of harmful substances. Those actions are interdependent as increasing resource efficiency and effectiveness are key to limiting climate change. Addressing the current linear value chains and the inefficiencies linked to them and moving toward a Circular Economy – an economic system aimed at the continual use of resources and at minimizing waste – is essential and urgent.

For this transition to be successful, companies must embrace circularity in their strategy and corporate set-up; at the same time, a supportive ecosystem is needed. As more and more companies realize the importance and opportunities of Circular Economy business models, they require dedicated knowledge, tools, and an enabling environment. However, no company, and indeed almost no industry, can achieve circularity on its own. This report provides guidance for companies wishing to set up collaborations which will support their individual journey.

Cross-industry collaboration is imperative. Companies can learn from each other and join efforts in research and development. Solutions can be adopted across industries and along supply chains. Collaboration will also gain Circular Economy strategies like refurbishment, remanufacturing, or recycling much wider acceptance. Cross-cutting industries like finance, waste management, and IT and communication technologies (ICT) can accelerate the transition and enable actors in different industries to pursue Circular Economy goals and activities.

This report has two focal points. First, with the support of leading German corporates, we have identified factors both at the eco-system and the business level that can support the transition to a

Circular Economy. Together, they form a target picture which we have compared to the status-quo. Second, we have analyzed the potential for cross-industry collaborations in Germany, which can foster a more Circular Economy. Based on these findings, we conclude with a call to action to companies to accelerate the transformation to a Circular Economy.

We wish you an enjoyable and fruitful read.



Birgit Klesper

Chair of the Executive Board
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Alexander Holst

Managing Director
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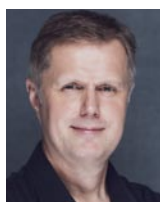
Manfred Fischedick

Scientific Managing Director
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Executive Statements

“Circular economy is an essential and integral part of our sustainability and business strategy, because it is the best way to unlock growth potential while reducing our use of scarce resources. That's why we are constantly working together with our suppliers, customers, and industry partners to increase the circularity of our packages. We support deposit and EPR schemes to enable and engage consumers to give back empty packages for refilling and recycling and use recycled material for the production of new packages.



Bjorn Jensen

Managing Director
Coca-Cola GmbH

“The circular economy is key to addressing many of the most urgent global challenges we are currently facing. While the concept is gaining awareness and going mainstream, we as a bank can help promote a common understanding by facilitating stakeholder dialogues together with our clients. To foster the shift from a linear to circular economy, banks can provide sustainable financing instruments and climate solutions which will drive the concept. To help manage these shifts in the economy, the calls-to-action in this study highlight the importance of cross-industry collaboration for scaling up circularity.



Nicolo Salsano

Chief Executive Officer
HSBC Germany

“The fight against climate change, resource depletion, and environmental pollution brooks no delay. We must act now, and we know the direction we must take: to make the circular economy a global guiding principle. But we will only succeed if all stakeholders close ranks. The chemical industry and we at Covestro are firmly committed to playing our part. Together we can create outstanding innovative solutions: spread the use of alternative raw materials and green energy, improve materials and waste management and recycling, and bring more and more truly sustainable products based on circular business models to the market. However, we need the right framework conditions marked by a culture of support rather than bans.



Dr. Markus Steilemann

Chief Executive Officer
Covestro AG

“At BASF, we are convinced that we need to shift towards more circularity to decouple growth from resource consumption. The global challenges we are currently facing – from climate change to biodiversity loss – underscore the need for a transformation. The potential of the circular economy can only be fully leveraged if all relevant stakeholders team up. The study sets the direction by delivering a strong narrative for business to engage in cross-industry collaboration to accelerate the transition towards more circularity.



Dr. Christoph Jäkel

Vice President
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Executive Summary

Moving to a Circular Economy¹ means decoupling economic activities and human well-being from resource consumption and environmental degradation. Circular Economy is a central lever in the fight against global warming. By 2030, circular activities can achieve 23 billion tons of CO₂ emission reductions, while creating USD 4.5 trillion (EUR 3.75 trillion) of additional value. This offers many opportunities to companies which implement Circular Economy business models. In all of this, one element is crucial: **Cross-industry collaboration is the key to overcoming barriers and unlocking circular value.**

From an economic perspective, a Circular Economy system offers opportunities for increasing profitability and improving resilience, planning, and growth. In addition, it fosters innovation based on new business models and consumption patterns. In this paper, we have identified **four corporate approaches: closing the material cycle; increasing product and material efficiency; using products more efficiently; and substituting resources** (see chapter 1).

Individual efforts toward circularity need to be embedded in a more generally supportive environment. Based on a workshop, a survey, and interviews with leading German companies, we identified **three important factors at company level and four factors at an ecosystem level** that can enable or hinder the transition to a Circular Economy (chapter 2).

Companies need to understand the value of Circular Economy for business and society and integrate it into their business strategy and governance. Business models as well as product and service portfolios need to be adapted to circular thinking. The same is true for operational processes. At the ecosystem level, enabling factors are regulation and standardization; customer demand and awareness; technology and research; and financing.

At both company and ecosystem level, our analysis shows gaps in circularity that need to be addressed. In many cases, collaborations between different industries are the best way forward. To date, companies in Germany do not yet leverage the full potential for cross-industry collaboration.

To understand where we stand today, we analyzed **nine key industries** with a high resource intensity (chapter 3). We also looked at **three cross-cutting industries** (recycling and waste management, finance, and information and communication technologies) which play a key role in the Circular Economy transition in Germany. We developed a **matrix representing the current situation of cross-industry collaborations as well as opportunities to expand these collaborations and to develop Circular Economy measures**. Individual matrices for each of the industries we analyzed were added in the appendix.

Regardless of the original motivation, all cross-industry collaborations contribute to at least one of the four Circular Economy approaches. But the differences between industries are considerable. Our analysis shows that the automotive and aircraft construction industry, for instance, has already established numerous important collaborations with other sectors, whereas the food and agricultural industry or the industry for household and electronic devices have entered relatively few collaborations. Overall, **we found that 64 percent of all possible cross-industry collaborations have a high potential to develop measures for a Circular Economy, but only 43 percent of them (and 28 percent of the total) are already established on a large scale.**

Having analyzed the nature and scope of the transformation, we move to recommendations for action (chapter 4). As innovation and change begin with

¹ The EU has defined Circular Economy as an economy that “aims to maintain the value of products, materials, and resources for as long as possible by returning them into the product cycle at the end of their use, while minimizing the generation of waste.”

the individual company, we first present a **step-by-step guide for managers and entrepreneurs on integrating circularity into their business practices**. Three questions – and the answers to them – can help companies define a systematic approach:

- **How do you start your company on the path to circularity?**
- **How do you identify and adopt circular business models?**
- **How do you find the right partners for collaboration?**

We then address the wider stakeholder network and highlight three urgent actions to promote the transformation:

- **Standardize, standardize, standardize:**
Businesses should engage with policymakers and industry consortia to set standards around materials, data, and processes as a prerequisite for any system solutions to work at scale.
- **Encourage Circular Economy policies and provide Circular Economy incentives:**
To promote circular solutions, businesses should start discussions with policy makers to define clear targets and a rigorous roadmap for the Circular Economy transition. Incentives to invest in circularity and to encourage changes in customer behavior are also required.
- **Collaborate on technology and finance:**
Further joint research and Circular Economy-focused investment involving all stakeholders are required to improve technologies and scale their application?

The paper concludes (chapter 5) with an appeal to our readers: We invite you to join us in the journey to a new, sustainable Circular Economy and look forward to sharing that road with you.

The background of the slide features a large, circular opening in a metallic, woven structure. The structure is composed of many thin, curved metal strips that create a complex, mesh-like pattern. The opening reveals a clear, bright blue sky. The overall aesthetic is modern and industrial.

1. The Circular Economy in Germany and the Relevance of Cross-Industry Collaboration

Cross-industry collaborations can help to establish a Circular Economy-enabling ecosystem by bringing together stakeholders from different industries. Collaboration forms range from open dialogue forums to contracted joint ventures or research consortiums [...].

1. The Circular Economy in Germany and the Relevance of Cross-Industry Collaboration

Moving to a Circular Economy means decoupling economic activities and human well-being from resource consumption and environmental degradation. By 2030, global emissions could drop by additional 23 billion tons², while USD 4.5 trillion (EUR 3.75 trillion)³ of additional value could be created. This offers many opportunities to companies which implement Circular Economy business models.

A key indicator when discussing circularity concerns waste. At first sight, Germany's Circular Economy performance looks promising in this regard. In 2018, the recovery rate of municipal waste amounted to 98 percent⁴. At a closer look, however, only 67 percent of waste actually gets recycled. The rest is processed through energy recovery in which the value bound in the materials is lost. Especially for commercial waste, recycling rates are very low: Apart from waste that gets collected separately, six million tons of mixed municipal waste of commercial origin (including mixed packaging) are generated every year, of which 55 percent are sent to energy recovery. Only 7 percent make it through pre-treatment into recycling processes to remain in the system⁵.

Input indicators reveal a similar picture. In 2019, only 10 percent of production materials in Germany consisted of recovered resources. With a current annual circularity growth rate of 0.1 percent, Germany will reach a 50 percent circularity as late as 2215⁶. Currently, humanity uses up resources corresponding to 1.78 Earths per year. If everybody in the world lived like the average German, we would need three planets to support us⁷. Thus, the pace of transition in Germany needs to be enormously accelerated to reverse the trend toward consuming ever more resources.

The economic benefits of circularity have not yet been fully exploited. The economic value of the German Circular Economy in the narrower sense (i.e. waste management and related (plant) technology) represented EUR 28 billion of gross value added in 2017⁸, accounting for only one percent of the total gross value added (EUR 2.7 trillion) that same year⁹.

Cross-industry collaboration can support the Circular Economy transformation and overcome small scale, siloed action. A growing number of business leaders recognize that moving toward a Circular Economy is necessary and important, especially in view of megatrends such as demographic change, digitalization, and resource scarcity. Companies should focus on enabling transformative progress toward truly circular value propositions by reducing consumption and extending the life cycle of products through measures such as sharing or re-using materials. It is there that the biggest gains in cost-efficiency and emission reductions can be realized¹⁰.

Cross-industry collaborations can help to establish a Circular Economy-enabling ecosystem by bringing together stakeholders from different industries. Collaboration forms range from open dialogue forums to contracted joint ventures or research consortiums, connecting partners with complementary types of knowledge and capabilities. Cross-industry approaches help managers gain new insights and break out of the habitual linear patterns of thinking and acting common to their companies and industries. Moreover, competition can be disrupted and transformed into cooperation or cooptation¹¹ in a circular manner¹². The importance of sharing knowledge, expertise, and technology between multiple stakeholders has been described by member states of the United Nations (UN) as a path to achieve the Sustainable Development Goals (SDG) and is specifically highlighted in Goal No. 17, which calls for "Partnerships for the Goals"¹³.

2 (Circle Economy, 2021)

3 (Lacy, Long, and Spindler, 2020)

4 (UBA, 2020)

5 (BMU, 2018)

6 (Rubel, Meyer zum Felde, Oltmanns, Lanfer, & Bayer, 2020)

7 (The World Counts, 2021)

8 (Statusbericht Initiative, 2021)

9 (The World Bank, 2021)

10 (Material Economics, 2018)

11 Cooptation defines the act of working together with business competitors in a way that benefits both parties (cf. Cambridge Dictionary, n.d.).

12 (Brennan and Saccani, 2017)

13 (Wilts et al. 2020)

Circular Economy definition and opportunities

In this report, we define Circular Economy in line with the EU's definition as an economy that *"aims to maintain the value of products, materials, and resources for as long as possible by returning them into the product cycle at the end of their use, while minimizing the generation of waste"¹⁴*.

To be sustainable, economic growth must go hand in hand with social progress and avoid ecological damage. The Circular Economy makes it possible to balance these three aspects. In a Circular Economy system, production and consumption leave less of an ecological footprint. GHG emissions are reduced, and the overall environmental performance is improved. From an economic perspective, a Circular Economy system offers opportunities for increasing profitability, reducing costs, improving resilience¹⁵, and delivering more data transparency, better predictive planning and additional gross domestic product (GDP) growth. The Circular Economy also fosters economic innovation, growth, and improvements through the emergence of new business models and consumption patterns. On the social dimension, the benefits include, for example, cleaner air, fewer human rights violations along the value chain, and the creation of new and meaningful jobs.

We have identified four corporate approaches to reducing resource intensity, based on the existing Circular Economy strategies in literature (e. g. Butterfly model¹⁶, 9R model¹⁷, ReSOLVE framework¹⁸ etc.):

- 1. Closing the material cycle:** This approach covers strategies such as recycling, improved collection, and recovery options as well as the use of "waste materials" as alternative fuel.
- 2. Increasing product and material efficiency:** This approach focuses on the production process. By optimizing for example process steps and product design, the production process uses as few resources as possible.
- 3. Extending the lifetime and using products more efficiently:** Products are used intensively and for as long as possible through actions like refurbishing, remanufacturing, repairing, or sharing.
- 4. Substituting resources:** This approach aims at reducing or even avoiding the negative impact of using resources, materials, or products by for instance replacing hazardous substances with ecologically sound input.

¹⁴ (Eurostat, n.d.)

¹⁵ The United Nations Office for Disaster Risk Reduction defines resilience as "the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, adapt to, transform, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management."

¹⁶ The Butterfly model was developed by the Ellen MacArthur Foundation and illustrates the continuous flow of technical and biological materials through the value cycle (Ellen MacArthur Foundation, 2019).

¹⁷ The 9R model includes nine concepts to increase circularity: Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, and Recover (Kirchherr, Reike and Hekkert, 2017).

¹⁸ The ReSOLVE framework was developed by the Ellen MacArthur Foundation and includes six actions that are necessary to move towards a Circular Economy: To regenerate, share, optimize, loop, virtualize, and exchange (Ellen MacArthur Foundation, 2015).



2. Enabling Factors for a Circular Economy in Germany

Four ecosystem elements are crucial for the successful transformation of companies: regulation and standardization; customer demand and awareness; technology and research; as well as financing.

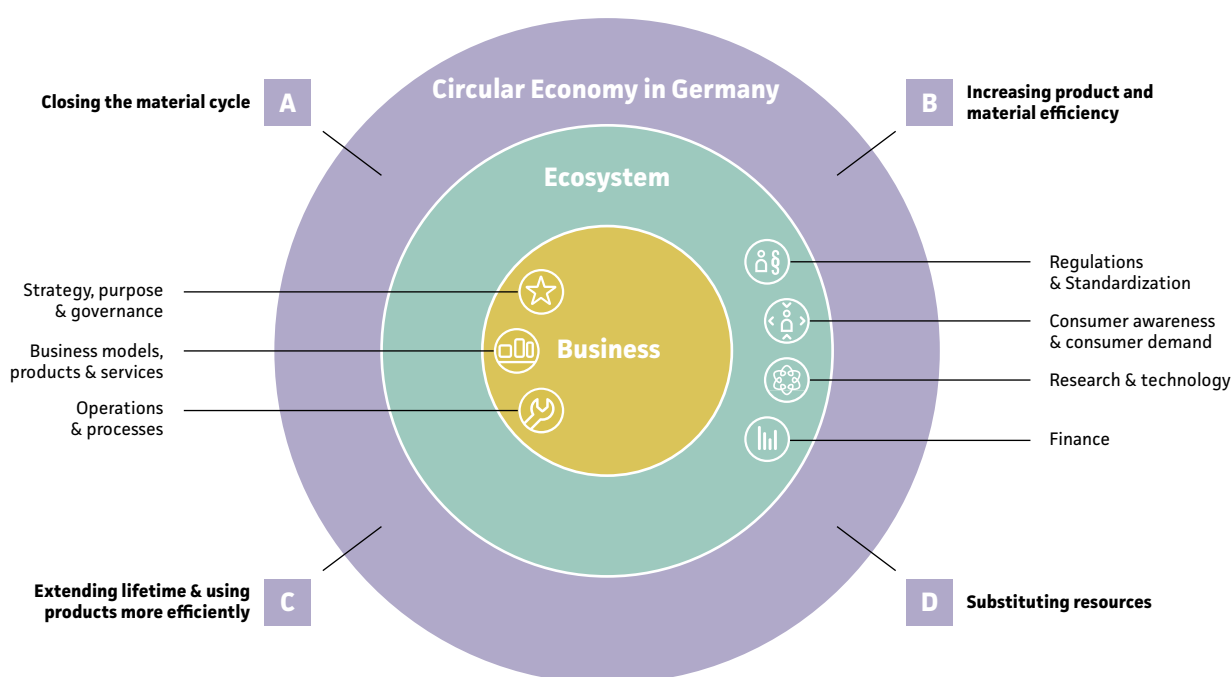
2. Enabling Factors for a Circular Economy in Germany

To derive a clear perspective of what companies and other stakeholders need to work on to promote a Circular Economy, we will now focus on relevant factors on company and ecosystem level in Germany. In a second step, we will draw up target pictures and describe how companies and their environment need to change to accelerate the transformation. This will allow us to explore gaps in circularity that need to be addressed.

Corporate Strategy, Purpose, and Governance

Circular Economy is part of the agenda of most interviewed companies, but the level of integration into strategy varies. Overall, respondents of the survey rated the integration of Circular Economy aspects into their company's corporate strategy, purpose, and governance at an average of 5,5 (on a scale from 0 to 10, with 10 being fully integrated). As part of their environmental program, companies

Figure 1: Circular Economy Promoting Factors on the Business and the Ecosystem Level



2.1 Moving Toward a Circular Economy at the Company Level

It is important for companies to understand the value of Circular Economy for business and society and to integrate it into their business strategy and governance. Business models as well as product and service portfolios need to be adapted to circular thinking. The same is true for operational processes. Over the following pages, we describe the current state of affairs and define the target picture of mature circular businesses along those three elements: strategy, portfolio, and operational processes.

are aiming to use resources more efficiently and reduce waste. But often, they do not yet have a comprehensive circular strategy.

Interviewees pointed out two specific challenges: The first relates to the lack of appropriate Circular Economy definitions and their operationalization for the industry. The second challenge has to do with competing priorities. Some respondents pointed out that climate action – which competes for the same resources – currently outshines Circular Economy issues. A possible solution here is to link Circular Economy to the climate strategy and

emphasize that resource efficiency simultaneously reduces a company's carbon footprint.

Governance structures often do not yet specifically address Circular Economy objectives. The lack of a clear vision means that Circular Economy is often driven bottom-up in different projects across the organization instead of being approached systematically through a formalized top-down approach. Furthermore, Circular Economy activities are often not included in performance metrics. In several companies, according to the interviewees, management incentive schemes include references to comprehensive sustainability metrics or carbon dioxide (CO₂) performance. But only two (out of 13) have also integrated Circular Economy indicators.

A key barrier is lack of integration of Circular Economy considerations into decision-making processes. Interviewees pointed out that the focus on short-term financial value and neglecting externalized costs sometimes leads to decisions that promote inefficient resource use.

Business Models, Products, and Services

As of now, circular business models are not yet widely applied, but some have more uptake than others. Business models define how companies create, deliver, and capture value. To ensure circularity, the whole value chain should be considered when defining them. Just under half of survey respondents (seven out of 16) said that their companies sell only a small percentage – if at all – of their products and services based on circular business models. Only one respondent answered that all of his/her company's products and services are sold based on circular business models. Among those respondents, the most common business model to date is based on circular inputs.

The reason for the limited uptake is a lack of capabilities. Adapting the design of products and services toward circularity is often a foundational step. Without clear guidance, product developers lack the mandate for prioritizing circularity criteria. Too little communication (e.g., internally between the design and manufacturing departments of a company or externally along the value chain) hampers efforts to find designs that are optimal for the entire sys-

tem. For example, designers rarely consult recyclers when selecting the materials for their products, so they do not take life cycle thinking and recovery strategies sufficiently into account. As a result, innovations that would incorporate remanufacturing technologies (improving disassembly, disposal, high quality component recovery, and effective refurbishing) fail to materialize.

Companies often do not provide customers proactively with information about the Circular Economy impact of their products. Yet more information at point of sale would help customers take informed decisions and promote demand for Circular Economy products.

Operational Processes and Technology Integration

Today's business operations and processes are still mostly focused on linear value chains. Two particularly relevant examples are procurement and the recovery of material when a product has reached its end-of-use.

For Circular Economy-aligned procurement, it is key to have reliable sources of secondary materials. Uncertainty about supply lines and forecasts discourage manufacturers from turning to secondary resources for long-term sourcing decisions¹⁹. Assessing suppliers and their products is difficult because there are no standards for measuring and reporting circularity performance.

Material recovery is an important enabler for closing the material cycle and for high-value refurbishment or recycling. Still, companies struggle to establish the relevant processes and develop profitable business cases. Often, they have no information about where end-of-use products are to be found. Also, there is a lack of incentive schemes to get consumers to use return schemes. In some cases, complex and ambiguous regulatory processes connected to the shipment of end-of-use products make recovery unattractive.

To promote circular processes more broadly, new skills and capabilities are needed. Across all functions, aiming for circularity can lead to more re-

19 (PACE Accenture and Circle Economy, 2021)

source efficiency. In order to make use of opportunities, more know-how is required, for instance concerning circular design criteria, life cycle costing, or remanufacturing.

One concept for increasing resource efficiency – and cutting costs – is the reduction of idle time for assets, for example by using sharing platforms. According to the survey, seven of the 16 respondents do not share assets in production or logistics. Five respondents share some assets. Only two respondents said they share technology with other stakeholders to a large extent.

A Target Picture for Circular Companies

We envision businesses that incorporate Circular Economy principles into their purpose, strategy, and governance because they understand the business value of doing so.

A mature circular business reflects the intent to contribute to a more sustainable and resource efficient world in its purpose and integrates circular principles into its strategy, for instance KPIs, targets, and milestones. These targets combine ecological goals with productivity and innovation. The foundation of the strategy is to understand the business opportunities connected to circularity.

The governance ensures a clear definition of responsibilities and accountability for circularity and enables and incentivizes the organization to take the right decisions. Mindset and values lived at the company lead to a culture that promotes disruptive change in favor of a Circular Economy and fosters collaboration, eliminating silo-thinking.

We envision businesses that implement circular business models, decoupling resource consumption from revenues and promoting resource efficiency along the value chain.

Mature circular businesses understand the inefficiencies of linear business models and find solutions to replace them in their own operations and for their customers. The five business models – circular inputs, sharing platforms, product as a service, product use extension, and resource recovery²⁰ – are commonly used.




Companies prioritize value and functionality over sales of material goods. Product design and development processes are geared toward sustainability over the product's life cycle and involve stakeholders from different departments and parts of the value chain. The sustainability impact of a product or service is communicated to customers to inform their decisions.

We envision business operations and processes that promote Circular Economy principles and new technologies that support circular material flows.

Mature circular businesses have adapted their procurement and their operations to promote circularity and resource efficiency. Procurement focuses on sourcing recycled or renewable materials and locating suppliers with sustainable production processes. Operations optimize the resource consumption and explore ways of bringing their own „wasted“ resources into material cycles of similar or higher value at other industries and companies. This is supported by dedicated platforms and industrial symbiosis concepts.

New technologies help companies to become more circular, for example by providing transparency on the use phase through sensors. Collaborative use of technologies, such as open-source software or digital passport data platforms, accelerate the transformation. Data privacy and protection ensure sensitive data is secure and trust in the system is established.

Figure 2: Business Level – Overview of Current Situation and Target Picture

Element	Current Situation	Target picture
 Business purpose, strategy and governance	<ul style="list-style-type: none"> • Circular Economy is on agenda of most companies. • But level of integration into strategy varies. • Governance structures often fail to promote Circular Economy sufficiently. 	<p>Companies incorporate Circular Economy principles into their purpose, strategy, and governance because they understand the business value of doing so.</p>
 Business models, products and services	<ul style="list-style-type: none"> • Circular business models are not yet widely applied. • The reasons are both lack of capabilities and of communication. 	<p>Companies have circular business models which decouple resource consumption from revenues and promote resource efficiency along the value chain.</p>
 Operational services and technology integration	<ul style="list-style-type: none"> • Operations and processes focused on linear value chains. • Circular Economy aligned activities often only serve as lighthouse projects. • Need for new skills and capabilities for adaptation of processes. 	<p>Business operations and processes promote Circular Economy principles. New technologies support circular material flows.</p>

2.2. Moving Toward a Supportive Ecosystem for a Circular Economy

Four ecosystem elements are crucial for the successful transformation of companies: regulation and standardization; customer demand and awareness; technology and research; as well as financing.

Regulation and Standardization Relating to Circular Economy

Some of the regulations at EU and German level support a Circular Economy, but specific Circular Economy targets are missing. Regulations have a clear impact on corporate action and can support the move toward circularity. The European Green Deal includes the Circular Economy 2.0 Action Plan²¹ which provides an overall framework for companies. In addition, the EU has passed industry specific directives.

Regulations are not supportive of cross-industry collaboration. In the survey we conducted with in-

dustry leaders across Germany, 15 out of 16 respondents indicated that regulations incentivize collaboration in and across industries only partially or not at all. Anti-trust laws, while important for competition, can make it difficult for companies to cooperate and form alliances. Also, regulations on material requirements and qualities that differ between industries as well as an inconsistent use of terminologies make it difficult for companies from different industries to exchange materials²². Given that supply chains are global, an international harmonization of regulations is required for a holistic transition.

In many areas, definitions and standards that facilitate circularity and collaboration still need to be developed or substantiated. Also, accounting standards for depreciation favor new products, thereby incentivizing businesses to regularly replace used products. They also create disadvantages for the balance sheet and earnings before interest and taxes (EBIT) reporting. Furthermore, external costs currently do not have to be accounted for, which indirectly favors unsustainable practices.

²¹ (European Commission, 2019)

²² (PACE, Accenture and Circle Economy, 2021)

Customer Awareness

Customers have the power to shift the market, but awareness, understanding, and demand for circular products and services are so far limited. Customer needs are at the center of product development processes. In line with this, companies participating in the interviews agreed that Business-to-Business (B2B) and Business-to-Consumer (B2C) customers are key to driving circular innovation. While studies show that private customers are becoming more conscious of sustainability and say that it matters for their buying decisions²³, this does not yet apply everywhere²⁴. In the survey, only two out of 16 respondents said that more than 50 percent of their customers insist on Circular Economy solutions.

For both B2B and B2C customers, there are two key barriers which keep them from making more circular buying decisions:

- **Lack of understanding and information around impact:** For B2B customers, buying decisions are often distorted by a lack of performance data (e.g., environmental data may not be available for all purchasing alternatives). For B2C customers, either a lack of information or else too much, partly irrelevant, and often non-comparable information makes decisions for sustainable options difficult.
- **Cost considerations:** Some more circular products or services come with a higher price, as new technologies need to be financed or economies of scale do not yet apply. Sensitivity for this varies greatly among industries and B2B customer segments. Public sector tenders (Business-to-Government, B2G) also often indirectly exclude Circular Economy-favorable projects and products due to criteria such as costs and risk.

Consumer action is also key to closing the loop at a product's end of use. The responsibility to reintroduce a product into a (circular) material flow lies with consumers. Currently, the return systems are not tailored to their habits. Reasons for low recovery rates often cited are missing return options, lack

of information about the options and available locations, data security concerns (e.g., for electronics), connected costs, or convenience²⁵.

Research and Technology

Several technologies needed to transition into a Circular Economy are already available. Digital, physical, chemical, and biological technologies have every potential to move society from a linear take-make-waste model toward sustainable, circular solutions. According to the interviews, there are key technologies which promote collaboration: improved supply chain communication; traceability of products and packaging; and digital platforms for trading secondary resources.

Eight out of 16 survey respondents said that their company had access to some of the technologies which enable circularity. Five out of 16 even said they had access to all essential technologies. However, as mainly large corporates were invited to participate, this result might be distorted compared to the overall situation of German companies.

One challenge for scaling technological solutions is the fact that **public funding often focuses on early-stage development and does not support commercialization.** The *Alliance to End Plastic Waste* – a diverse network of 80 members from technical leaders to scientists and practitioners – provides a positive example for how to bridge this gap. It is making USD 1.5 billion available over five years to develop and promote solutions around the reuse, recycling, and recovery of plastics²⁶.

More pre-competitive collaborative research efforts would be useful. Only a few interviewees said their company was engaged in any kind of a pre-competitive research and development project. Yet joint development can support uptake in the market and creation of de-facto standards. However, obstacles remain: According to the interviews, companies shy away from joint research because they may be unwilling to share data, have IP-related concerns, or do not see the business case.

23 (Accenture, 2019)

24 (NYU Stern, 2020)

25 (Circle Economy and PACE, 2020)

26 (Alliance to End Plastic Waste, 2019)

Financing

Companies rely on internal financing for Circular Economy activities to avoid the lengthy processes and bureaucracy connected to public funding.

Almost all interviewees said that their companies – being publicly listed – finance their Circular Economy related activities, including cross-industry collaborations, in-house. They do this because the processes required to apply for public funding are too cumbersome. Also, public funding is focused on early-stage research and not the commercialization of technologies. As a result, according to the survey, there is not enough money available for the Circular Economy transition.

As for private funding from financial institutions, there seem to be few Circular Economy-specific options.

With few exceptions, financial institutions do not yet offer loans that are tailored to circular business models and activities. This hampers the circular transition especially of smaller companies which rely on banks for their financing. Also, while environmental, social, and governance (ESG) aspects are becoming increasingly important for investment processes, the current focus is on climate-related topics. As a result, a company's climate performance and action to address climate risks may be considered, but Circular Economy seldom is. Adapting risk assessments to circular business models – considering the product's end-of-life value, for instance – could lead to more positive valuations²⁷.

New investment criteria and guidance aim to facilitate financing of Circular Economy activities.

For example, the European Investment Bank (EIB) published a Circular Economy guide to promote a common understanding of Circular Economy, raise awareness, and promote circular solutions by describing EIB's own position on this topic²⁸. The European Commission set up a classification system, the taxonomy for sustainable activities. It aims to direct capital flows toward sustainable projects and activities by setting out conditions an economic activity must meet in order to qualify as environmentally sustainable²⁹.

A Target Picture for a Circular Ecosystem

We envision a regulatory framework that promotes Circular Economy-oriented market mechanisms, target setting, clear roadmaps, and holistic standard definitions.

In a mature Circular Economy, regulations will promote product lifetime extension, usage intensification, and the sourcing of circular inputs rather than the exploitation of virgin resources and inefficient product-consumptions systems. Regulations also foster cooperation in various forms in and across industries – from dialogue forums to partnerships and joint ventures. They create an interface between industrial corporates and small and medium enterprises (SMEs), based on adapted anti-trust regulations that allow Circular Economy collaboration while protecting markets and customers.

The government sets quantifiable targets and target dates on circularity. A strong foundation is set by standards for circular products and secondary resources. Also, resource tracking and labeling is standardized. True-cost accounting standards are integrated that allocate appropriate value to natural and social capital. Regulations and standards enable global collaboration.

We envision customers (companies, private consumers, and governments) who are aware of climate urgency and planetary boundaries and who translate this awareness into consumption patterns and expectations toward businesses.

In a mature Circular Economy, customers are informed about a product's sustainability impact. They expect businesses to take full responsibility for their actions and choose products with optimized life cycles and repair and upgrade options.

²⁷ (ING, 2015)

²⁸ (EIB, 2020)

²⁹ (European Commission, 2020)

Customers also consider sharing and reusing (which includes repurposing, remanufacturing, and recycling). Convenient return options and incentives enable consumers to close material loops.

We envision an economy where technologies (digital, physical, chemical, and biological) that can enable fully circular value networks are researched, implemented, and scaled up.

In the envisioned future, new digital, physical, chemical, and biological technologies that promote the Circular Economy are available and used at scale. Every company across all industries can obtain the necessary technologies, knowledge, and skills.





Public and private actors conduct Circular Economy research. Recycling, for instance, can be made more effective by using artificial intelligence for waste sorting. Innovative materials include vegan substitutes for leather which are made from fungi. Cross-industry collaboration ensures holistic problem-solving which can overcome silo thinking and lead to comprehensive life cycle solutions.

We envision a society and economy in which financial resources are designed to support circular business models.

In the mature economy, sufficient financial resources for the transition to a Circular Economy are available and accessible, coming from both public and private actors. Risk assessment and investment decisions take the specific nature of Circular Economy-related investments into account. Financing is tailored to the specific needs of the borrower and the project (e.g., the project's scale, maturity, and position in the value chain).

Financial institutions promote long-term thinking and include externalities in their investment considerations. When lending money, banks broaden their focus to consider circular value chains in their due diligence processes.

Figure 3: Ecosystem Level – Overview of Current Situation and Target Picture

Element	Current Situation	Target picture
 Regulations and standardization	<p>→</p> <ul style="list-style-type: none"> • Some Circular Economy supportive regulations exist at EU and national level. • Cross-industry collaboration is not explicitly supported. • Definitions and standards need to be developed and strengthened. • There is a need for more international harmonization. 	<p>→</p> <p>Regulatory framework that promotes Circular Economy-oriented market mechanisms, target setting, clear roadmaps, and holistic standard definitions.</p>
 Customer demand and awareness	<p>→</p> <ul style="list-style-type: none"> • Awareness, understanding, and demand for circular products and services are limited. • Engagement of customers to close the loop at end of use with much open potential. 	<p>→</p> <p>Customers (companies, private consumers, and governments) who are aware of climate urgency and planetary boundaries and who translate this awareness into consumption patterns and expectations toward businesses.</p>
 Research and technology	<p>→</p> <ul style="list-style-type: none"> • Most of the technologies for the Circular Economy transformation are available. • Many companies have access to relevant technologies. • Potential of pre-competitive collaborative research is not yet fully exploited. 	<p>→</p> <p>Economy where technologies (digital, physical, biological) that can enable fully circular value networks are researched, implemented, and scaled up.</p>
 Financing	<p>→</p> <ul style="list-style-type: none"> • Circular Economy activities are mostly financed internally. • Lengthy and bureaucratic processes keep companies from applying for public funding. • Financial institutions offer only very limited Circular Economy finance products for private funding. • Some new investment criteria and improved guidance exist to help finance industry to integrate Circular Economy aspects. 	<p>→</p> <p>Society and economy in which financial resources are designed to support circular business models.</p>

3. Current Cross-Industry Collaboration and Collaboration Potential

Overall, we found that 64 percent of all possible cross-industry collaborations have a high potential to develop measures for a Circular Economy, but only 43 percent of them (and 28 percent of the total) are already established on a large scale.

3. Current Cross-Industry Collaboration and Collaboration Potential

The survey and interviews show how companies are improving their Circular Economy performance, and the more Circular Economy topics are integrated into corporate strategy, purpose, and governance, the better their performance will be. And the more companies have access to resources such as technologies and financing, the more they will use circular business models and circular resources. What emerges is a picture in which cross-industry collaborations are key to accelerating the transformation of the German economy.

To understand the current state and the future of cross-industry collaborations, we analyzed nine key industries with high resource intensity. We also looked at three cross-cutting industries (recycling and waste management, finance, and information and communication technologies) which play a key role in the Circular Economy transition in Germany³⁰. In addition, we did research on about 50 initiatives and joint projects and used data from our interviews. Based on these inputs, we developed a matrix representing the current situation of cross-industry collaborations as well as opportunities to expand collaborations and develop Circular Economy measures (see figure 4)³¹. Individual matrices for each of the industries we analyzed can be found in the appendix.

Regardless of the original motivation, all cross-industry collaborations contribute to at least one of the four Circular Economy approaches³². But the differences between industries are considerable. Our analysis shows that the automotive and aircraft construction industry, for instance, has already established numerous important collaborations with other sectors, whereas the food and agricultural industry or the industry for household and electronic devices have entered into relatively few collaborations. For some industries, such as construction and steel, cross-industry collaboration has traditionally been driven by regulations and the optimization of internal cost-efficiency. In contrast, the energy industry seems to have been inspired by research into energy-efficient production options.

3.1. Existing Cross-Industry Collaborations and Their Circular Economy Effect

Cross-industry collaborations foster circularity because they help companies make progress in one or more of four Circular Economy approaches:

1. Closing the material cycles: The automotive and aircraft construction industry and the retail and logistics industry collaborate on end-of-life vehicles. Car manufacturers are obliged to take back and recycle all vehicles they manufacture³³. By cooperating with car dealers, they have enabled a huge infrastructure for take-back programs. Another example is provided by construction and steel companies. Together, they ensure the closing of a material cycle by returning steel obtained during the demolition of buildings to the steel companies.

2. Increasing product and material efficiency: The ICT and the construction industry collaborate on a 3D model-based process which provides architects and engineers with information and tools for efficient planning, design, and management of buildings³⁴. As the relevant information is provided, each step of the construction process can be estimated more accurately. As a result, the life cycle can be modelled more easily.

3. Extending the lifetime and using products more efficiently: The textile and apparel industry closely collaborates with retail and logistics to distribute and donate clothes that were not sold during the season. One example is the opening of outlet centers by retailers to sell leftover clothes. Another typical example for the third Circular Economy approach is the development of car sharing. The ICT industry enabled the automotive industry to offer cars that can be used by several customers, reducing the time when they sit idle.

4. Substituting resources: As fossil resources are finite and have a high carbon intensity, many companies are working on alternatives. For example, given the high carbon emissions of cement production, the agricultural and the construction industry are jointly doing research on plant-based materials such as hemp concrete.

³⁰ Please find a more detailed description of each industry in the appendix.

³¹ Please find more information about the method in the appendix.

³² See chapter 1 for an overview of the four Circular Economy approaches.

³³ (European Parliament and Council, 2000)

³⁴ (Autodesk, n. d.)

Figure 4: Overview of Status Quo and Potential of Cross-Industry Collaborations

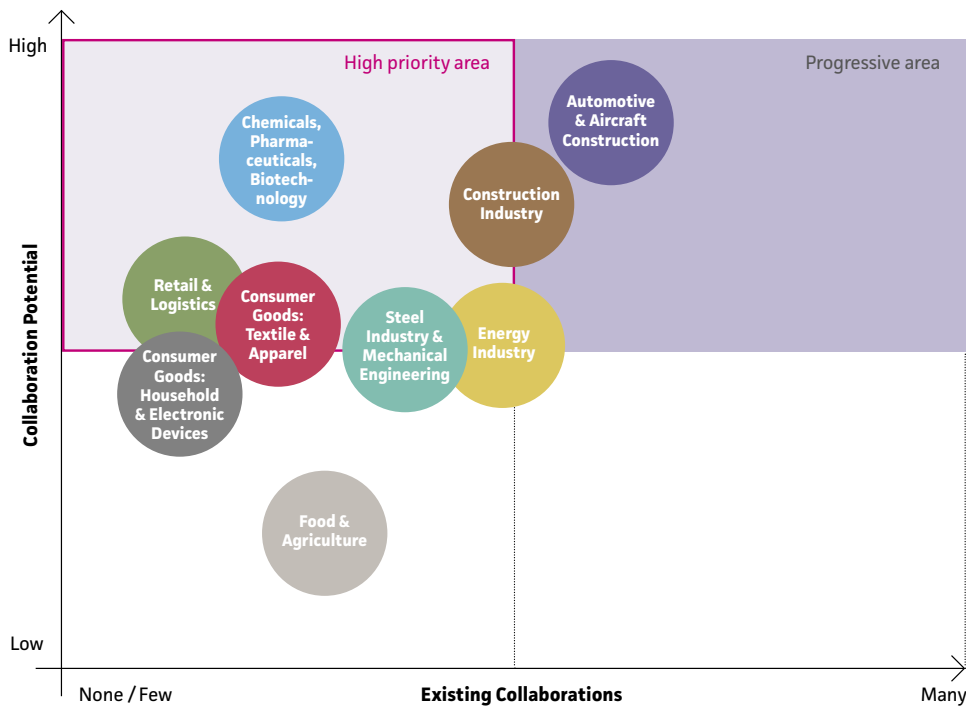


Figure 4 illustrates the main findings of our research. The x-axis represents the scale of existing collaborations, while the y-axis represents the level of collaboration potential. The high priority area (on the upper left) highlights industries with a high potential to expand and benefit from additional cross-industry collaborations. The progressive area on the upper right includes industries that already have a high number of collaborations driving the transition towards a Circular Economy. Each circle represents one key industry and illustrates where the majority of their respective cross-industry collaborations is located. For a more detailed view, please refer to the industry-specific matrices in the appendix.

Cross-cutting industries – recycling and waste management, information and communication technologies, and finance – play a major role in the development of Circular Economy-related collaborations. Such collaborations are often classified within the progressive area, indicating that they are important enablers for Circular Economy business models. Especially the ICT and the recycling industry have established numerous collaborations with other industries.

Collaborations with the recycling and waste management industry were often triggered by German or European laws touching on Circular Economy such as the EU packaging law, the end-of-life vehicles directive, or the German Circular Economy Act (Kreislaufwirtschaftsgesetz). Manufacturers of packaging, for example, are obliged to take back and recycle certain packaging materials. Therefore, many of them collaborate with recycling companies

to learn from their expertise. Car manufacturers collaborate with recycling companies (in addition to the retailers) to fulfill their obligations under the end-of-life vehicles directive.

In the age of industry 4.0 and digitalization, cooperation with ICT companies offers benefits like gaining access to customized IT solutions and expertise. Regarding the development of Circular Economy business models, the ICT industry can help to increase transparency about ingredients and their recyclability by providing tools for data collection (such as RFID chips).

The finance industry is an important enabler for Circular Economy business models, as these business models require new and innovative financing. Especially small and medium sized enterprises need the finance industry to cover residual risks when they

apply new Circular Economy business models. However, dedicated products still require further development in order to be used on a large scale.

3.2. Future Cross-Industry Collaborations and Their Circular Economy Potential

The current level of cross-industry collaboration shows that much potential is still untapped. Figure 4 highlights the considerable differences between industries. Many industries are located on the left side, indicating that more collaboration is possible. Overall, we found that 64 percent of all possible cross-industry collaborations have a high potential to develop measures for a Circular Economy, but only 43 percent of them (and 28 percent of the total) are already established on a large scale.

When analyzing the industry-specific matrices (for details, please see appendix), we found that 36 percent of all possible cross-industry collaborations fall within the high-priority area. This result emphasizes the large potential which can be unlocked. Three industries – chemical, retail and logistics, textile and apparel – were identified as having the greatest untapped potential. We thus want to highlight their potential as illustrative examples.

The chemical industry is a key industry for non-metal material development. It has already established a number of cross-industry collaborations, and there is potential for more. Material loops can be closed by developing recyclable materials, introducing tracking and tracing to improve collection, or by substituting materials and resources alternatives which meet the same quality and safety requirements but are more resource and energy efficient. The development of such innovative materials requires cross-industry collaborations. The most discussed technology within this industry is chemical recycling³⁵, which may in future provide a solution regarding quality issues requested by several industries, since plastic waste can be re-converted, e. g., into monomers which then can be used as multi-purpose feedstock (instead of single use from me-

chanical recycling). Since chemical recycling is still an emergent technology, some of its issues might better be solved by collaboration³⁶.

The retail and logistics industry plays a central role in closing material loops by organizing the recirculation of products not covered in the disposal industry. In many cases, industries have been required by law to establish take-back schemes. In other cases, the industry has taken the initiative, such as the in-store take-back programs set up by companies in the textile or ICT industry to allow customers to return old products, which are then used to produce new goods. If large retail platforms and stores joined with manufacturers, such programs could be taken to a new level.

The steel industry provides another example of an important partnership with the retail and logistics industry. Steel is an essential raw material for infrastructure projects and has a high circularity, meaning that it can be recycled multiple times without a significant loss of quality. The *Responsible Steel Initiative*³⁷ engages in the connection of all players along the steel supply chain. Companies from the retail and logistics industry could become part of or build up such an initiative to engage in collaborations with other industries.

The consumer goods industry of textile and apparel is an industry where recycling rates are still rather low – only twelve percent in 2015³⁸. In this area, few Circular Economy business models or cross-industry collaborations have been established. Textile and apparel manufacturers would do well to search out collaboration opportunities, especially since the EU Commission will soon publish a European strategy for sustainable textiles which will include Circular Economy principles³⁹.

Our analysis reveals a high potential for cross-industry collaborations, for example with the chemical industry to develop recyclable plastic fibers or with the retail and logistics as well as the recycling industry to improve collection and separation processes.

35 Chemical recycling refers to the conversion of plastic polymers into their monomers or basic chemicals by means of (thermo-)chemical processes. (cf. UBA, 2020)

36 (In4Climate AG, 2020)

37 The Responsible Steel Initiative is dedicated to defining and promoting responsible practice by i. a. jointly developing an independent certification standard or leading discussions on ESG issues along the steel supply chain. (Responsible Steel Initiative, n. d.)

38 (Ellen MacArthur Foundation, 2017)

39 (European Commission, 2021)

A high-angle, close-up photograph of a light-colored wooden table. The table's surface is composed of several large, curved wooden panels separated by thin, dark lines. A circular, dark-colored light fixture is mounted on the table, casting a soft glow. The background is a continuation of the wooden surface, creating a sense of depth and texture.

4. How to Take Action

Collaboration can serve two purposes: It can support circular solutions, for instance by bringing together complementary capabilities; and it can lead to improvements of the ecosystem, for instance by joining forces to influence the regulatory landscape.

4. How to Take Action

Moving toward a Circular Economy is necessary because the environment and society are calling for a more sustainable approach to production and consumption. At the same time, new business models open up new opportunities for companies. Having analyzed the nature and scope of the transformation, we move to recommendations for action.

4.1. A Step-by-Step Guide to Integrating Circularity into Business Action

As innovation and change begin with the individual company, we first present a step-by-step guide for managers and entrepreneurs on integrating circularity into their business practices. Three questions – and the answers to them – can help companies define a systematic approach: how to get started; how to create new business models; and how to identify partners for collaboration.

Question 1: How Do You Start Your Company on the Path to Circularity?

The first step is to become familiar with the four approaches of Circular Economy we detailed in chapter 1. Based on an understanding of the Circular Economy fundamentals, companies can then map their resource flows along the value chain to identify inefficiencies and challenges. They might, for example, discover that they are wasting capacities during the use phase of a product or that they are wasting value at the end-of-use period.

Once a company has identified possible inefficiencies along the value chain, the next step is to define appropriate solutions to make progress toward circularity. At this point, companies should think about the stakeholders they need to engage with. Collaboration can help to close capability gaps or increase scale. The overall process is depicted in figure 5.

Question 2: How Do You Identify and Adopt Circular Business Models?

There are many businesses that understand the relevance and urgency of circularity and have set Circular Economy-specific targets but struggle to turn this transformation into a business case⁴⁰.

To move from a linear economy to a circular, regenerative, and restorative economy, businesses need to adopt new business models. There are five circular business models that can be mapped along the value chain and provide a framework for a circular transformation (see figure 6)⁴¹:

- 1. Circular Inputs:** Use renewable sources, bio-based materials, and man-made materials that are recycled or highly recyclable to enable partial or total elimination of waste
- 2. Product as a Service:** Retain ownership of products and sell benefits through a service model.
- 3. Product Use Extension:** Lengthen product life cycles through altered design, repairs, reconditioning, upgrades, and resale for second use.
- 4. Sharing Platforms:** Optimize utilization rates of products and assets through shared ownership, access, and usage.
- 5. Resource Recovery:** Reuse embedded materials or energy at the end of a product's life and recover them through collection, aggregation, and processing.

To achieve scale and impact, each of these models should be considered. A company can also combine several or all of them to increase the impact and create maximum value⁴².

Adopting new business models can be highly challenging. Collaboration with companies both within and across industries can help companies to build up required know-how and capabilities.

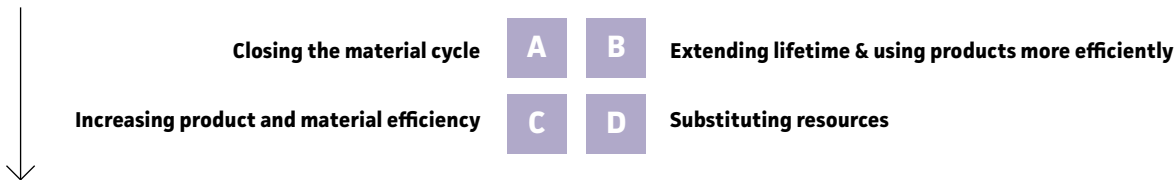
40 (CEID, 2020)

41 (Lacy, Long and Spindler, 2020)

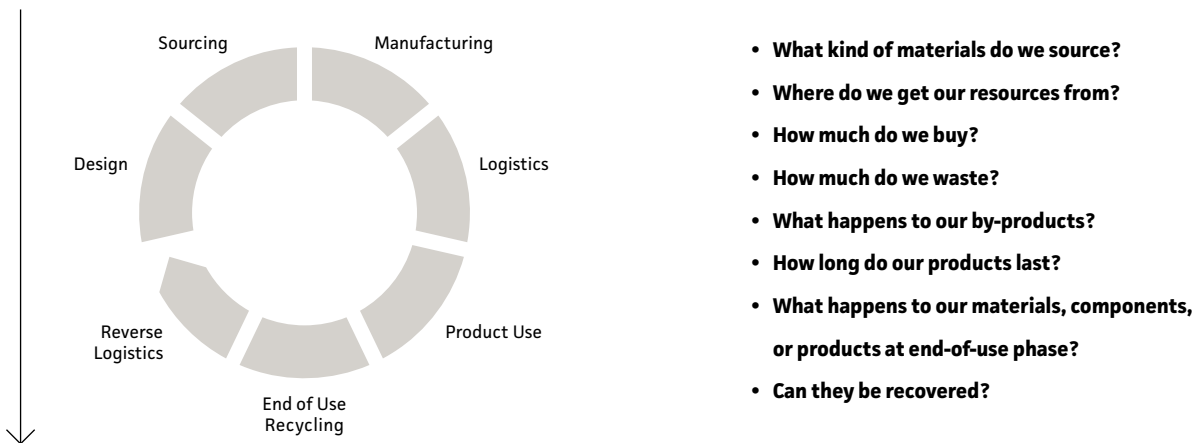
42 (Lacy, Long and Spindler, 2020)

Figure 5: Initial Steps Toward Circular Economy Action

1. Understand what the four Circular Economy approaches are about:



2. Map your resource flows along the value chain to identify bottlenecks:



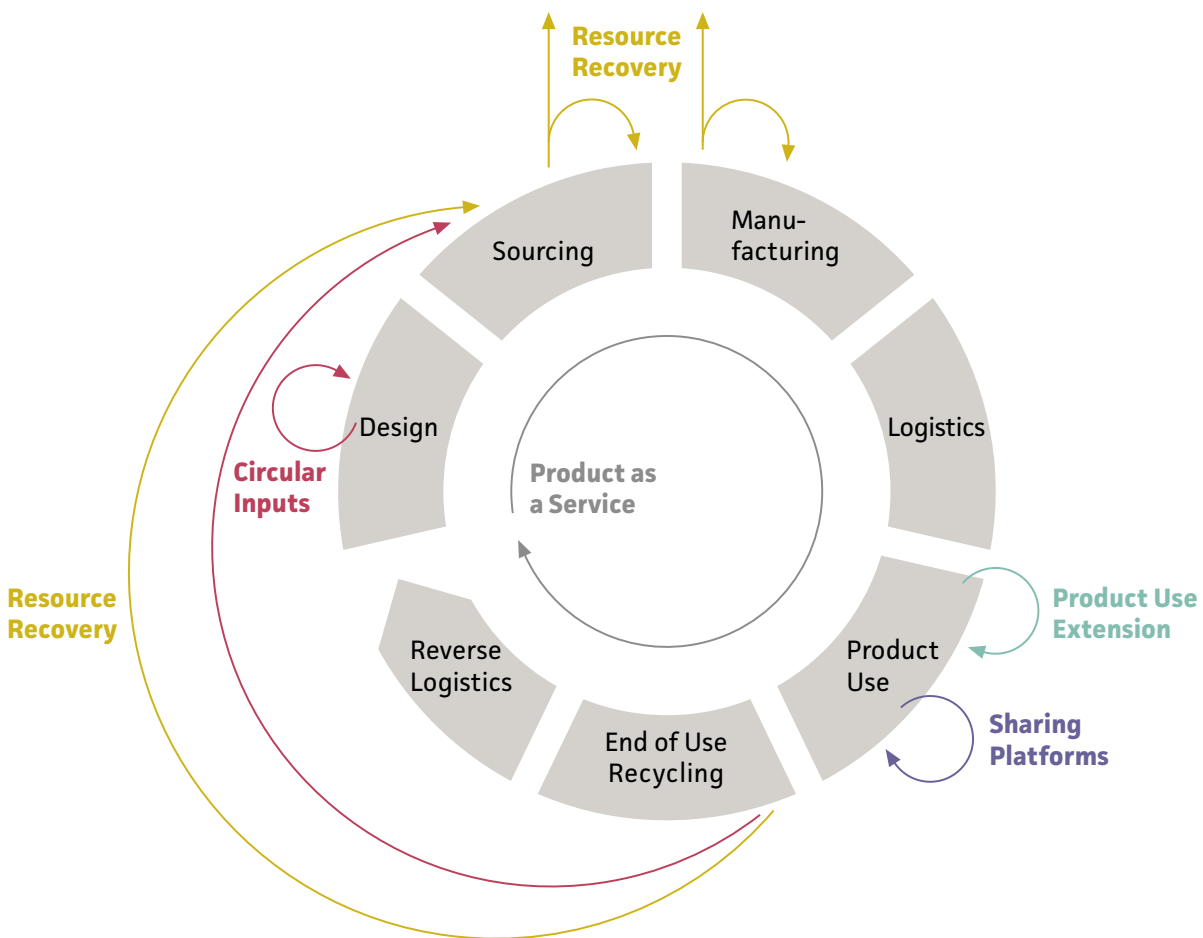
3. Define company-specific action based on step 1 and 2:



4. Identify stakeholders that can help you take action in a cross-industry collaboration:



Figure 6: The Five Circular Business Models ⁴³



Question 3: How Do You Identify the Right Partners for Collaboration?

Once a company has identified promising areas of action which can lead to Circular Economy business models, it needs to work out the details. In which areas can collaboration be useful? Who should the company partner with? Collaboration can serve two purposes: It can support circular solutions, for instance by bringing together complementary capabilities; and it can lead to improvements of the ecosystem, for instance by joining forces to influence the regulatory landscape.

To structure the identification of partners, questions along the four ecosystem elements (regulations and standards; customer demand and awareness; technology and research; and financing, see chapter 2 for detail) should be considered.

The first two elements – regulation and customer awareness – drive innovation by defining requirements and demand. Companies can collaborate to [a] generate more demand through influencing policy or consumer acceptance or [b] to answer to existing needs and deliver solutions.

⁴³ (Lacy, Long and Spindler, 2020)

Case Studies for Circular Business Models:

Circular Inputs: Frosch⁴⁴ – a cleaning and care product manufacturer – has designed its use of packaging as a closed loop for recycled materials. As early as 2012, an alliance of industry partners developed an innovative process to obtain high-quality recycled material (recyclates or recycled plastic) from plastic waste. Today, most of Frosch's bottles consist of up to 100 percent recycled plastic.

Product as a Service: BSH Home Alliances⁴⁵ started to offer household appliances via an as-a-service model. Outdated appliances are replaced with new, efficient equipment. The appliances are rented out for a period of ten years for around EUR 9 per month. The service also includes delivery, installation, product introduction, and a take-back guarantee at the end of the rental period.

Product Use Extension: Caterpillar⁴⁶, an equipment manufacturer, introduced its

program Cat Reman[®] to provide customers with lower-cost products, shorter downtime, and quick, dependable service options. In doing so, the company stops products from being discarded when they can be repaired or modified and resells them as remanufactured equipment.

Sharing Platforms: ShareNow⁴⁷ is a carsharing platform initiated by Daimler and BMW. Via an app, customers can book a car on demand at any time. Thus, fewer people need to buy cars.

Resource Recovery: REDUX Recycling⁴⁸ focuses on battery recycling. With patented processes, the company achieves recycling efficiencies of over 90 percent for portable and household batteries. It also obtains peak values of over 60 percent for lithium-ion batteries – and that with a purity of more than 99 percent.

The other two ecosystem elements – technology and research on the one hand, finance on the other hand – directly influence the scope and the impact of a company's actions. Here, businesses should consider collaboration [a] to develop innovations and capabilities and [b] to secure funding for Circular Economy projects and products (see figure 7).

4.2. Actions to Shape the Ecosystem

Having looked at what the transformation means for individual companies, we then address the wider stakeholder network. We have identified three are-

as where action is needed to foster this transformation. Collaboration, again, is essential to implement these actions successfully.

Action 1 – Standardize, Standardize, Standardize

Businesses should engage with policy makers and industry consortia to set Circular Economy-compatible standards regarding materials, data, and processes. This is a prerequisite for any system solution to work at scale. Circular systems, where material and information flows run in parallel, need to connect many stakeholders in complex global value

44 (Frosch, 2021)

45 (Bosch, 2021)

46 (Caterpillar, 2021)

47 (ShareNow, 2021)

48 (Redux, 2021)

Figure 7: How to Identify Collaboration Partners



chains. To reduce technical challenges and enable economies of scale, standards for circular material classification (e.g., types, composition, and quality), data (e.g., communication protocols, product anchoring, product classifications, shipping codes) and common methods and procedures (e.g., procurement, tracing, labelling, sorting and treatment, quality assurance, and true-cost accounting) are needed. Once industry standards have been set in areas like product design and material marking, other solutions become feasible on a global scale, including an index for rating product circularity or recyclability and global material traceability. The required standards should be set through instruments such as legal frameworks as well as voluntary industry commitments (e.g., voluntary ERP adoption) – at a local and global level. Some standards can only be fully implemented and accepted when they are recognized across borders, such as the Basel convention.

Example: In 2009, a global group of stakeholders from the aluminum industry published a report that described ESG risks and opportunities for the aluminum value chain and emphasized the need for an international stakeholder approach. In response, the *Aluminium Stewardship Initiative* was founded to facilitate a common standardization process for responsibly sourced aluminum⁴⁹.

Action 2 – Encourage Circular Economy Policies and Provide Circular Economy Incentives

Businesses should start discussions with policy makers to define clear, long-term framework conditions for Circular Economy such as national targets, quo-

tas, or links between Circular Economy and climate targets. Starting points could be e. g. primary raw material reduction goals, secondary raw material input rates, or the reduction of economic waste intensity. Clear targets and a rigorous roadmap will give industry collaboration an additional push as companies will follow the same orientation. Furthermore, it is essential to create a level playing field for producers and recyclers through legislation.

Policy makers have the responsibility to support the creation of Circular Economy enabling markets. Measures can include creating tax incentives to encourage waste collection and prioritize secondary over primary resources. A balanced policy mix should be applied to ensure that every value chain player acts in accordance with the system.

Incentives to invest in circularity and to encourage changes in customer behavior are also required. Businesses can play a major role in triggering change in consumer behavior. They can boost demand for circular products through transparent information, pricing, and return incentives. Especially the latter needs collaboration along the value chain. Joint action is also needed to clearly define how each stakeholder will be held accountable for waste and negative externalities of products.

Example: Within the framework of the *Circular Economy Initiative Deutschland* (CEID), around 130 experts from business, science and civil society have summarized the findings from interdisciplinary and cross-industry working groups engaged in the “Circular Economy Roadmap for Germany”. The aim of this roadmap is to shape a common vision for a Circular Economy in 2030 and formulate concrete recommendations for action. The plan will be published in May 2021.

Action 3 – Collaborate on Technology and Finance

In theory, much of the required technology for circular solutions is already available. But further joint research and investment are required to improve each measure and scale its application. In areas where technology is less developed, in particular concerning the collection, sorting, and recycling of waste, new systems need to be set up. There, businesses and public institutions are key stakeholders, but private funding can also help to close the gap. Furthermore, financial institutions should collaborate with companies to define and integrate Circular Economy specificities (e.g., longer-term thinking, different risk profiles) into financial products. Appropriate financing instruments will make it possible to address the specific requirements of Circular Economy projects and fully harness their potential.

Example: The *Circulate Capital Ocean Fund* brings together the public and private sector and is dedicated to eliminating ocean plastics. The aim is to invest in companies that drive the Circular Economy and to catalyze significant capital into the solutions⁵⁰.

49 (Aluminium Stewardship Initiative, n. d.)

50 (Circulate Capital, n. d.)

5. Over to You (Conclusion)

Now it's over to you:

*We invite you to join us on the journey to a new, sustainable
Circular Economy and look forward to sharing that road with you.*

5. Over to You (Conclusion)

Moving to a Circular Economy offers companies many opportunities to reduce GHG emissions and tackle resource scarcity. It is a new and promising way to combat climate change and stay within the planetary boundaries as it addresses all dimensions of sustainability: the environment, as circularity cuts energy consumption and material losses; the social realm, as waste and toxic substances are reduced; and the economy, as the Circular Economy is projected to lead to more jobs and growth.

However, a Circular Economy requires a different way of thinking. It is tied to new business models and requires us to leave linear thinking behind. We can no longer think within a single supply chain, where it was often sufficient to know your direct supplier and customer. In the Circular Economy, we move from supply chains to value networks, where products and materials run up and down the system, seamlessly moving from one industry to another. Therefore, the development of a Circular Economy within your company can greatly benefit from new ways of collaboration and learning from others.

In this paper, we have illustrated ways how to think about and implement Circular Economy within and beyond your company. We have described the tools of Circular Economy and highlighted chances for high potential cross-industry collaboration. Now it's over to you: We invite you to join us in the journey to a new, sustainable Circular Economy and look forward to sharing that road with you.

Appendix

A. Source References

For this paper, we screened recent literature and articles regarding Circular Economy-related cross-industry collaborations. In March 2021, we conducted a survey with 16 respondents and in-depth interviews with 13 German industry leaders⁵¹. Furthermore, we used our own expertise and insight into various industries to assess where Germany stands concerning the seven enabling factors for a Circular Economy. Our analysis on existing collaborations as well as the collaboration potential is also based on our original research and expertise.

B. Classification of Industries

The table below was drawn up to give companies an orientation in which industry we would place them in the context of this study. Please note that the companies listed below are just a selection. This listing does not claim to be complete.

C. Matrices for Key Industries

In chapter 3, we presented an overview matrix comparing industries and their collaboration potential. On the following pages, we present a matrix for each of the key industries to provide detail. Each matrix shows the status quo and the potential for collaboration of a specific industry vis-à-vis other key industries. In these matrices, the x-axis is also used to describe the scope of existing collaborations, but it is divided into four broad areas: none, few, several, and many. Similarly, the y-axis represents the level of collaboration potential (i.e., the scope for expanding collaboration and developing Circular Economy measures), but is also divided into four areas: none, low, medium and high potential. Our estimations of existing collaborations and collaboration potential are based on desk research, interviews, and expert judgement.

Table 1: Definition of Industries

Cross-cutting industries	Companies included
Recycling and Waste Management	Public disposal and recycling companies
Finance	Banks, funding companies
Information and Communication Technology	Service providers of digital and communication technologies
Key industries	Companies included
Energy	Electricity producers and services
Chemical, Pharmaceuticals and Biotechnology	Chemical and pharmaceutical companies, chemical recycling companies, research centers
Construction	Architects, building companies, material producers and providers
Steel Industry and Mechanical Engineering	Steel manufacturers, mechanical engineering companies
Automotive and Aircraft Construction	Original equipment manufacturers (OEMs), automotive and aircraft suppliers
Consumer Goods: Household and Electronic Devices	Manufacturers of electronical household products, e. g. washing machines
Consumer Goods: Textile and Apparel	Manufacturers of clothing and other textiles
Retail and Logistics	Retailers, parcel services, online traders and companies that are part of the infrastructure
Food and Agriculture	Farming companies, food production companies

⁵¹ The survey was done between March 1 and March 12, 2021, and the interviews took place from March 15 to March 31, 2021. All the members of the econsense task force „Circular Economy“ were asked to contribute.

Table 2: Legend of the Industry Matrixes

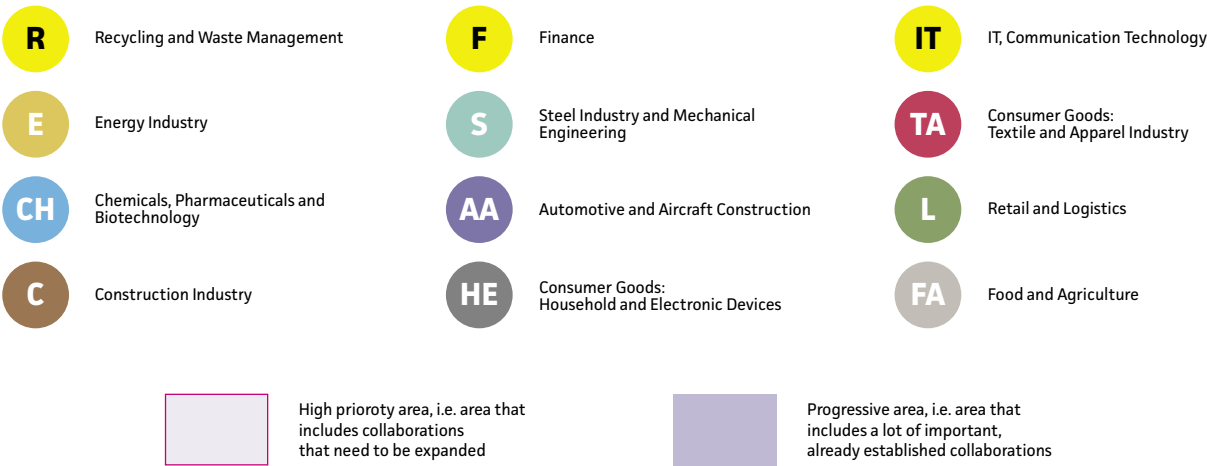
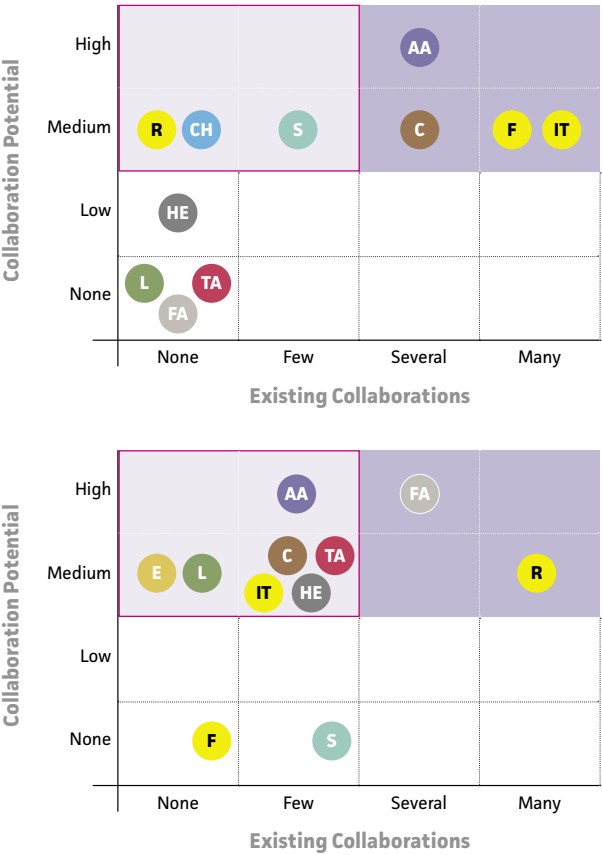


Figure 8: Cross-Industry Collaborations in Nine Key Industries

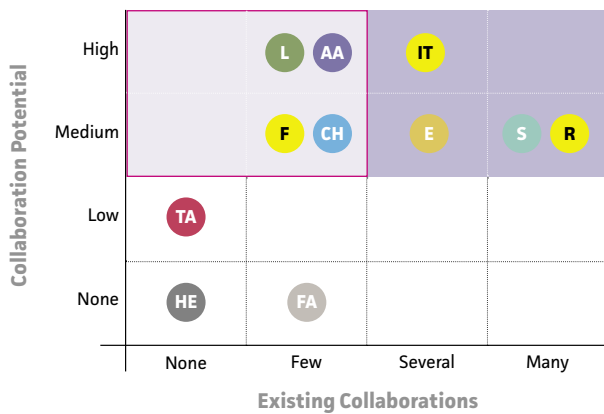


Energy Industry

- Well established collaboration with the automotive industry regarding battery reuse.
- There is room for more cross-industry collaborations, e.g., with the recycling sector regarding the processing of solar cells, or with the chemical industry regarding energy efficient chemical production.

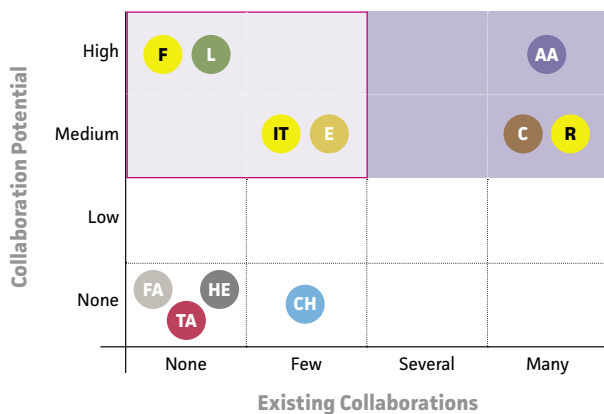
Chemicals, Pharmaceuticals, and Biotechnology

- Around two thirds of all industries fall in the high priority area; many show potential for R&D collaboration on more sustainable materials.
- Established collaborations with the recycling industry regarding for example chemical recycling.



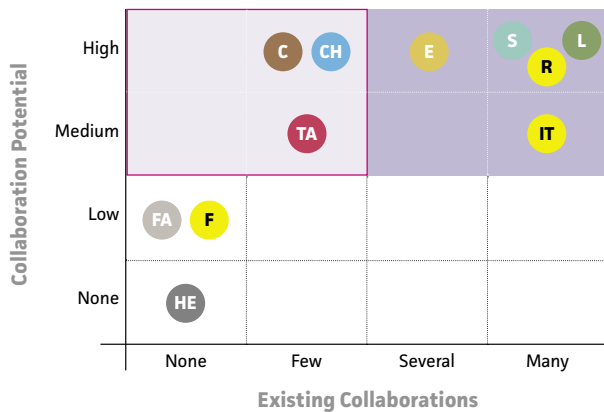
Construction Industry

- Many established (and crucial) collaborations, e.g., with the energy industry regarding energy efficient buildings.
- Potential for further collaboration with the finance industry on loans for sustainable construction or with the automotive industry on joint research for alternative materials (e.g., flax fiber instead of plastics).



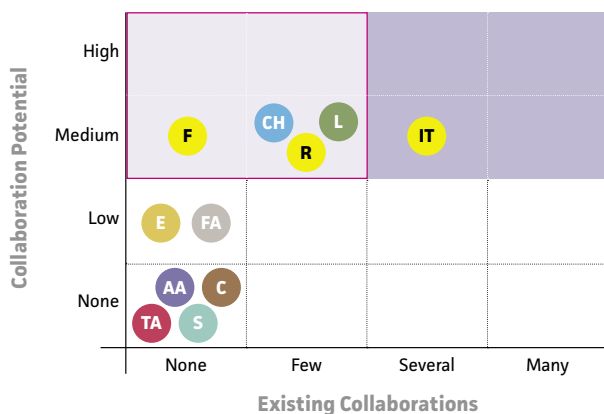
Steel Industry and Mechanical Engineering

- Established collaborations with the automotive industry to close the material cycle of steel.
- Potential for collaborations with finance and retail & logistics regarding financial support for climate-friendly steel production and the recirculation of leftover steel.



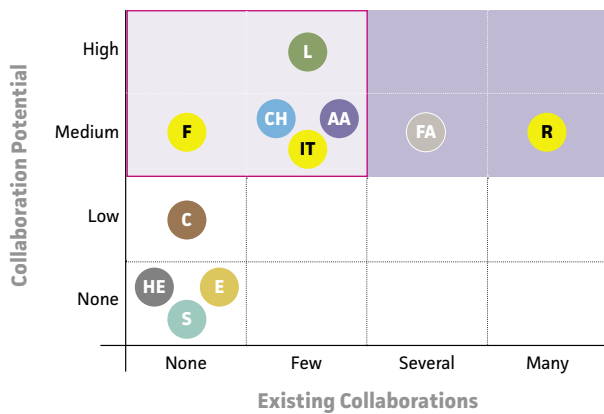
Automotive and Aircraft Construction

- The industry with the highest number of collaborations in the progressive area.
- Additional collaboration potential with the chemical industry regarding alternative fuels.
- Also, additional collaboration potential with the textile industry on sustainable seat covers.



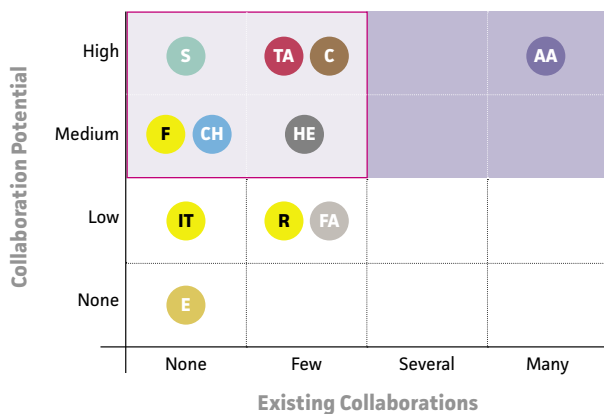
Consumer Goods: Household & Electronic Devices

- Established collaborations exist with ICT industry, e.g., based on the Circular Electronic Partnership.
- Role of cross-cutting industries is very important for efficient recycling of used electronic devices or to provide financial incentives for product-as-a-service models.
- Collaboration with retailers regarding return options of used products can be expanded.



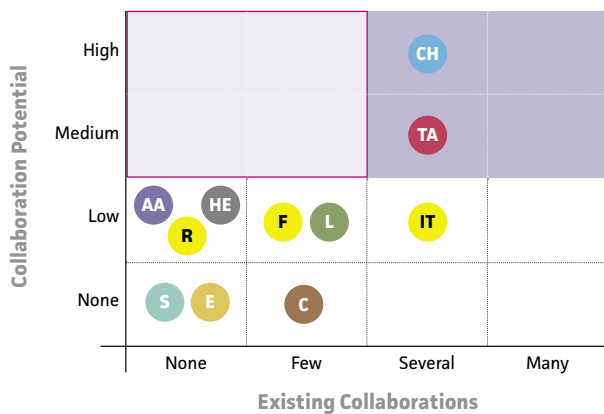
Consumer Goods: Textile & Apparel

- Existing collaborations include the food and agriculture industry on sustainable cultivation of fabrics.
- Additional potential regarding collaborations with retailers to establish global take-back programs
- Additional collaboration with the ICT industry could deliver more transparent information on clothing (e.g. RFID chips).



Retail and Logistics

- Most important collaboration partner is the automotive and aircraft industry due to mandatory take-back programs for manufacturers.
- Further potential for collaborations with e.g., the chemical industry on sustainable packaging materials.



Food and Agriculture

- Collaborations with the chemical industry exist to avoid toxic ingredients.
- Many collaborations only have „low potential“ because of a perceived lack of relevant interfaces for establishing a Circular Economy.

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List of Abbreviations

B2B	Business-to-Business
B2C	Business-to-Consumer
B2G	Business-to-Government
CEID	Circular Economy Initiative Deutschland
CO₂	Carbon dioxide
EBIT	Earnings before interest and taxes
ESG	Environmental, Social, Governance
EU	European Union
GDP	Gross domestic product
GHG	Greenhouse gas
ICT	IT and communication technology
NGO	Non-governmental organization
RFID	Radio Frequency Identification
SDGs	Sustainable Development Goals
SME	Small and medium enterprises
UN	United Nations

About econsense

econsense is a network of internationally operating companies which share a common goal: They want to actively shape the change to a more sustainable economy and society. We support our members in anchoring sustainability in operational practice, in strategy, and along the supply chain. We track and analyze all relevant issues from environmental protection to human rights – always with a focus on the business case for sustainability. In exchange with business, politics, and civil society, we proactively address sustainability challenges and advocate frameworks and policies that enable innovation and competitiveness. This makes econsense a valued thought leader, advisor, and partner in matters of sustainability.

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The Wuppertal Institute undertakes research and develops models, strategies, and instruments for transitions to sustainable development at local, national, and international level. Sustainability research at the Wuppertal Institute focuses on resources, climate, and energy related challenges and their links with the economy and society. Special emphasis is placed on analyzing and stimulating innovations that decouple economic growth and wealth from natural resource use. Research focuses on transitional processes toward sustainable development. Based on findings from various scientific disciplines, the research work conducted takes a combined approach to generate practice-based, stakeholder-oriented solutions. Problems, solutions, and networks are equally focused on global, national, and regional/local levels.

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