MAKE IT CIRCULAR!

A playful gamified introduction to circular business models in a corporate setting

The content of this strategy game **"Make it circular! A playful gamified introduction to circular business models in a corporate setting"** is based on the business model typology in the report of the Circular Business Models working group within the framework of the Circular Economy Initiative Deutschland of acatech - National Academy of Science and Engineering (duration 2019-2021). The original model of the business model typology was developed by the scientific lead of the working group, Prof. Dr. Erik G. Hansen (Institute for Integrated Quality Design (IQD), Johannes Kepler University Linz), together with the task force leads Prof. Dr. Florian Lüdeke-Freund (ESCP Business School Berlin) and Prof. Dr. Klaus Fichter (Borderstep Institute for Innovation and Sustainability/ Carl von Ossietzky University Oldenburg) and refined in working group meetings with other members.

Using funding from Deutsche Bundesstiftung Umwelt (DBU), acatech and WWF Germany, the business model typology has now been developed into a strategy game for (medium-sized) companies (main target group) and any other interested parties (e.g. individuals, consultants or institutions). Having formerly been the scientific lead of the "Circular Business Models" working group, Prof. Dr. Erik G. Hansen assisted with the development of this strategy game in an advisory capacity. During game development, five companies participated in an agile feedback process (design thinking) and tested the beta version of the game before it was finalised. We would like to thank everyone for their contribution to the project.

Now, before you start playing the strategy game, please allow us to make two important comments:

By the very nature of any research process, there is a possibility that new findings may make current content outdated tomorrow, in a few months or after some years. We are nevertheless convinced that the logic of the game will still set you effectively on the pathway towards a circular business model.

The use of gender-sensitive language is important and has been implemented in the project as far as possible. One exception is the playing cards (and some of the associated glossary entries) for reasons of space.

Our aim is for you to gain useful insight, have some stimulating discussions and, ultimately, identify some clear starting points for your own circular business model for your company. We wish you lots of fun!

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gefördert durch
DBU
Deutsche Bundesstiftung Umwelt
www.dbu.de

[1] acatech - Deutsche Akademie der Technikwissenschaften e.V., Circular Economy Initiative Deutschland & SYSTEMIQ (2021). *Circular Business Models: Overcoming Barriers, Unleashing Potentials.* Final Report of the Working Group on Circular Business Models, Munich, Germany. Online: https://en.acatech.de/publication/circular-business-models-overcoming-barriers-unleashing-potentials/.

[2] Hansen, E.G., Lüdeke Freund, F. & Fichter, K. (2020). *Circular Business Model Typology: Actor, Circular Strategy and Service Level (IQD Research Papers: 2020-1).* Linz, Austria: Institute for Integrated Quality Design (IQD), Johannes Kepler University Linz (JKU). Online: https://doi.org/10.35011/iqd.2020-01.

Envelope – round 6

INSPIRATION:
Digital technologies for the Circular Economy

As inspiration for overcoming the barriers, here is a selection of key digital technologies and their potential contribution to a circular economy.*

INTERNET OF THINGS (IOT)

What is it?

The internet of things is 'a paradigm where everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with one another and with other devices and services over the Internet to achieve some useful objective'.

How does it enable a smart Circular Economy?

The internet of things is the infrastructure that enables the creation of connected products and resources. It is the foundation for the monitoring, tracking, and tracing of products and resources in their journey through the different loops of the Circular Economy.

BIG DATA

What is it?

Big data are large and complex datasets and more advanced analysis methods are needed for processing such data compared to smaller datasets (smaller datasets can be easily processed using traditional tools). Big data analytics deploys advanced techniques to extract information from data that may be structured in different ways, formats, and sizes.

How does it enable a smart Circular Economy?

Big data analytics makes it possible to identify patterns and trends about product usage or performance. This information can influence the design of future product generations or the offer of after-sale services, thus extending the useful life of products and resources and enabling preservation of the highest possible value.

CONTROL & EMBEDDED SYSTEMS

What is it?

Control and embedded systems, typically found in more complex products, allow these products to control their own performance, through built-in feedback mechanisms.

How does it enable a smart Circular Economy?

Control and embedded systems allow product and component performance to be adjusted. This means that wear-and-tear can be reduced, and its influence on a product's or component's lifetime managed better.

ANALYTICS AND RELIABILITY ANALYSIS

What is it?

Analytics and reliability analysis are at the core of any advanced 'smart' strategy. Together, they are used to assess the likelihood and certainty of an event occurring.

How does it enable a smart Circular Economy?

With these approaches, predictions can be made with regards to when and where products and resources will become available, as well as what the expected quality levels are. This information can be used when planning matters such as which circular strategies will be used (think of recycling versus cascading for materials, and refurbishment versus remanufacturing for products and components) and where they will will be carried out.

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

What is it?

Artificial intelligence (or AI) simulates the cognitive processes of humans, such as reasoning and learning, to turn data into information and insights. To do so, it uses example data sets – or training data – to learn what the desired outcomes are and to apply this knowledge to new cases. Machine learning and deep learning are approaches that enable machines to perform tasks relying on patterns and inference without specific human instructions.

How does it enable a smart Circular Economy?

Machine learning and the related approach of deep learning allow a machine to perform a specific task without requiring explicit instructions. As a result, machines can autonomously manage a range of factors that improve their longevity. For instance, AI solutions could generate objective and cost-effective analyses to differentiate failures from cosmetic issues. In addition, cameras and sensors could feed information for robots to make autonomous decisions with when recovering recyclables from waste.

CLOUD COMPUTING

What is it?

Cloud computing can be seen as an advanced technique for processing, storing, distributing and managing data through the internet. It enables the usage of technology any time and anywhere by separating the applications and the related information from the physical infrastructure typically required for it (e.g. servers, databases, applications). Users have access to a shared pool of computing resources that can be rapidly activated with minimal management effort and interaction with the provider of the resources.

How does it enable a smart Circular Economy?

Through collecting and analysing more data, new patterns can be found that influence how products and resources are used, thus allowing for interventions that extend the useful life of these products and resources. Cloud computing may offer organisations computing capabilities on-demand. Thus, it may allow organisations to execute data collection and analysis processes more efficiently and without the need for large investments in data centres. Cloud computing is especially attractive to small and medium enterprises that do not have extensive financial resources to make such investments.

DISTRIBUTED LEDGER TECHNOLOGY & BLOCKCHAIN

What is it?

Distributed ledger technology (DLT) is essentially a database shared across multiple actors, geographies or organisations. All participants within the network can have an identical copy of this database, and changes are replicated to all copies of the ledger in a matter of minutes or seconds, allowing for decentralised transaction and data management. Blockchain is a type of DLT and is a chain of blocks linked with each other with cryptographic security. Transactions in the blockchain are immutable and make it impossible for an entity to manipulate, replace, or falsify data stored on the ledger.

How does it enable a smart Circular Economy?

Together, these two technologies allow for changes in location and changes in status of resources – whether 'health status', quality, quantity or ownership – to be collected and shared in value chains over time. The trusted nature of these technologies enables decentralised and secure data management. A major application of these technologies for the Circular Economy lies in the potential traceability of products, components and materials along the value chain.

ONLINEPLATFORMS

What is it?

Online platforms cover a range of services available on the internet, for instance, search engines, social media, and marketplaces. They can be seen as 'a digital service that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through the service via the Internet'.

How does it enable a smart Circular Economy?

Online platforms may connect manufacturers directly with their customers, providing them with means to better understand customer needs and offer additional services to their customers. In addition, online platforms have the capacity to connect the supply of resources – whether secondary materials, or used components and products – with actors who have a need for them. Finally, online platforms enable new circular business models based on access instead of ownership, such as sharing, renting and leasing.

DIGITAL PASSPORTS & DIGITAL TWINS

What is it?

Digital passports are electronic data sets that collect the characteristics of products, components and materials. A digital twin is a virtual counterpart of a product that can be used to carry out simulations of its operations.

How does it enable a smart Circular Economy?

Digital passports – containing information about formulation, manufacturing technologies, additives and alternations that were made during use – enable suppliers, designers, users, service providers and other value chain actors to retain the highest possible value of the products or resources by allowing for the most adequate treatment for each circular strategy (e.g. repair). Digital twins may use the information stored on digital passports to run simulations and analyse the future performance of the product during the use phase. Digital twins enable predictions to be made about remaining useful life and the best moment to perform maintenance before failure, remanufacturing or any other circular strategy.

* Note: These digital key technologies are part of the report "Circular Business Models: Overcoming Barriers, Unleashing Potentials" by the Circular Business Models working group of the Circular Economy Initiative Deutschland. The report gives the sources for each key technology. Report citation: Circular Economy Initiative Deutschland (Ed.): Circular Business Models: Overcoming Barriers, Unleashing Potentials, acatech/SYSTEMIQ, Munich/London 2020. DOI: https://doi.org/10.48669/ceid_2021-7

Envelope – ROUND 7

INSPIRATION: List of barriers

The following list contains **68 barriers to the Circular Economy**. They were identified and compiled as part of the report by the Circular Business Models Working Group of the Circular Economy Initiative Deutschland.*

You can use the barriers as inspiration for your task in round 7 if you wish.

Financial barriers

- High capital or pre•financing demand, e.g. for leasing models
- Difficult access to funds
- High transaction costs
- Uncertain return on investment and profit
- Pricing issues and liquidity risks
- The difficulty, high cost and long duration of obtaining 'secondary material' status versus 'waste' status under the existing environmental permit system
- Possible increase in the cost of capital, as assets remain on the balance sheet, increasing financing needs and reducing the overall liquidity of the company
- Risk of not achieving cost•effective repair, reuse or refurbishment
- High costs associated with the take•back of products and high labour costs associated with product dismantling and separation of material fractions
- Difficulties in internalising legal risks (e.g. from longer warranties) beyond the extension of responsibility beyond the point of sale
- Declining sales of new products due to increased sales of repaired, refurbished and reconditioned products ('perceived' market cannibalisation)
- Lack of supply (or quality) of returned products or resources
- Uncertainties about the residual value of the new products, i.e. repaired, reused, updated or refurbished
- Unpredictability of the volume of returned products can make it difficult to plan and financially forecast
- Risks in product performance, increased liabilities for reprocessed products or materials reprocessed products or materials

Organisational barriers

- Hesitant corporate culture and predominant linear thinking
- Lack of support from the top management and increasingly from mid management
- Lack of fit of circular business models with existing corporate strategy
- Lack of internal strategic positioning of circular business models (e.g. sales of new vs. used goods)
- Lack of operational incentives for investment decisions, focus on profit maximisation
- Little evidence of financial and environmental benefits
- Technical path dependency (lock•in) through long•term investments
- ROI and similar requirements for new business projects
- Lack of expertise and knowledge within the organisation, e.g. on CE business models
- Lack of willingness to cooperate in the value chain
- Difficulty in establishing cross•functional or cross•organisational cooperation
- Unclear internal responsibilities
- Difficult to organise take•back logistics and lack of take•back processes
- Cannibalisation concerns
- Uncertainty about legislation in this area

Consumption-related barriers

- Lack of consumer awareness of and interest in circularity and longevity
- Lack of and/or uncertainty about consumer acceptance
- Misunderstandings regarding refurbishment, reuse, servicising, performance sales, etc.
- Linear thinking patterns
- Lack of knowledge about CE
- Rigidity of consumer behaviour and routines
- Lack of consumer information and education
- Lack of willingness to participate in ‘re•‘activities
- Expectations for low prices
- Customer perception that sustainability is a trade•off for price/performance
- Prefabricated opinions that reprocessed products are inferior to new products or lack the attraction of the ‘new‘.
- Mishandling of products by customers
- Customer concerns about data security

Value chain barriers

- Lack of market incentives (e.g. low raw material prices, high quality materials not competitive in price)
- Lack of acceptance and transparency (e.g. costs and value of repair services)
- Market demand and market development unclear
- Dependencies in the supply chain prevent circularity, OEMs may risk damaging relationships with their dealers by offering repair or refurbishment services
- More risks from dependence on unstable suppliers compared to dependence on traditional global commodity markets for new materials
- Component manufacturers and other non OEMs can only establish circular business models to a limited extent due to their position in the value chain
- Lack of networks and/or supply chains for dismantled products and components and recycled materials (reverse logistics)
- Lack of standardisation and incorrect quality standards (e.g. best before date of food)
- Lack of cooperation along the value chain, takes time to build new partnerships and mutual trust
- Lack of exchange of information
- Low quality of recycled material flows
- Rapid innovation cycles and corresponding consumer expectations (especially regarding repair, maintenance)
- Increasing individualisation
- Lack of a clear system of key figures comparable to the economic annual balance sheet
- High labour costs

Technical barriers

- Lack of standards and design requirements (materials: non toxic ingredients, material substitution; products: modularity, design for repair/remanufacturing/ recycling)
- Lack of design tools for CE and circular products
- Lack of data availability (material composition, ingredients, product life cycle)
- Lack of digital tools
- Lack of demonstration projects for industrial symbioses
- Lack of treatment and recycling structures in countries (incl. Germany)
- Lack of ability to deliver high• quality remanufactured products
- Too few large• scale demonstration projects
- Duration between design and diffusion
- Lack of technical assistance and training

* Note: The barriers listed are part of the report "Circular Business Models: Overcoming Barriers, Unleashing Potentials" by the Circular Business Models working group of the Circular Economy Initiative Deutschland. The report gives the sources for each barrier. Report citation: Circular Economy Initiative Deutschland (Ed.): Circular Business Models: Overcoming Barriers, Unleashing Potentials, acatech/SYSTEMIQ, Munich/London 2020. DOI: https://doi.org/10.48669/ceid_2021-7

Envelope – round 9

TRANSFER INTO EVERYDAY BUSINESS

Step1

WHAT DO WE WANT TO DO? _____

_____

WHO DO WE WANT TO INCLUDE (INTERNAL/EXTERNAL)? _____

_____

TO BE COMPLETED BY WHEN? _____

_____

Step 2

WHAT DO WE WANT TO DO? _____

_____

WHO DO WE WANT TO INCLUDE (INTERNAL/EXTERNAL)? _____

_____

TO BE COMPLETED BY WHEN? _____

_____

Step 3

WHAT DO WE WANT TO DO? _____

_____

WHO DO WE WANT TO INCLUDE (INTERNAL/EXTERNAL)? _____

_____

TO BE COMPLETED BY WHEN? _____

_____