Introduction to LINCIT project

SLF BACK TO COLLEGE | 18-09-2025

Néomie Raassens

Industrial Engineering and Innovation Sciences,
Innovation Technology Entrepreneurship & Marketing (ITEM)

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Nice to meet you!

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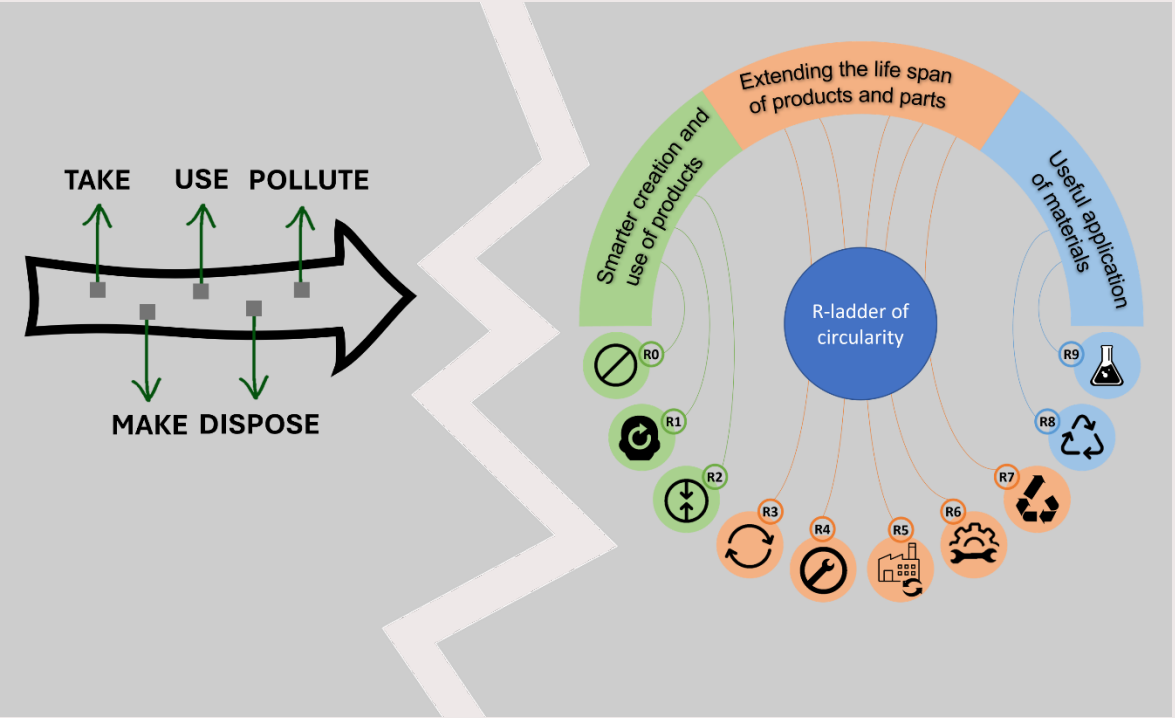
Servitization
Circular economy
Retailing

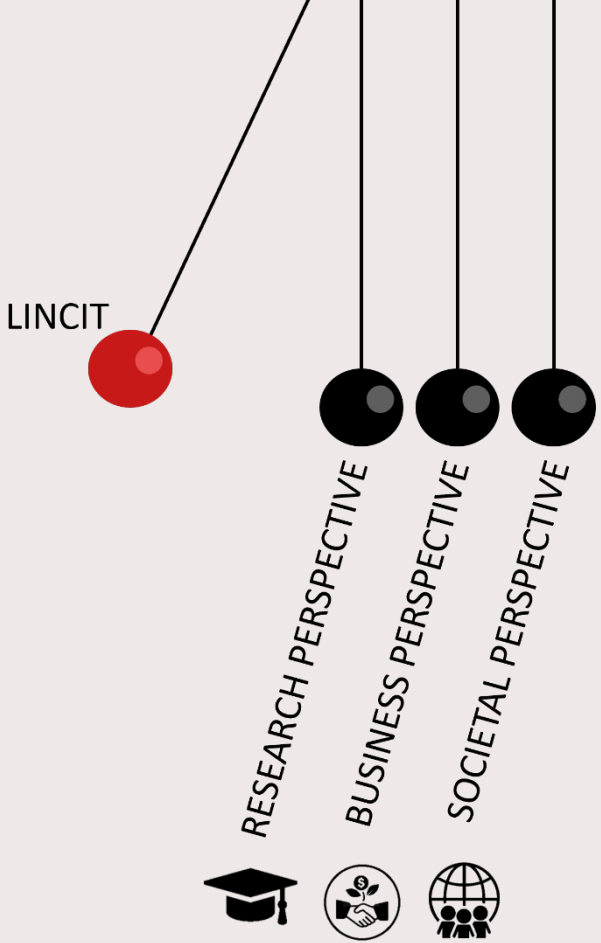
(Board) games
Soccer
Quizzes

EMAC McKinsey
Marketing Dissertation
Award

Enjoy the little
things in life!

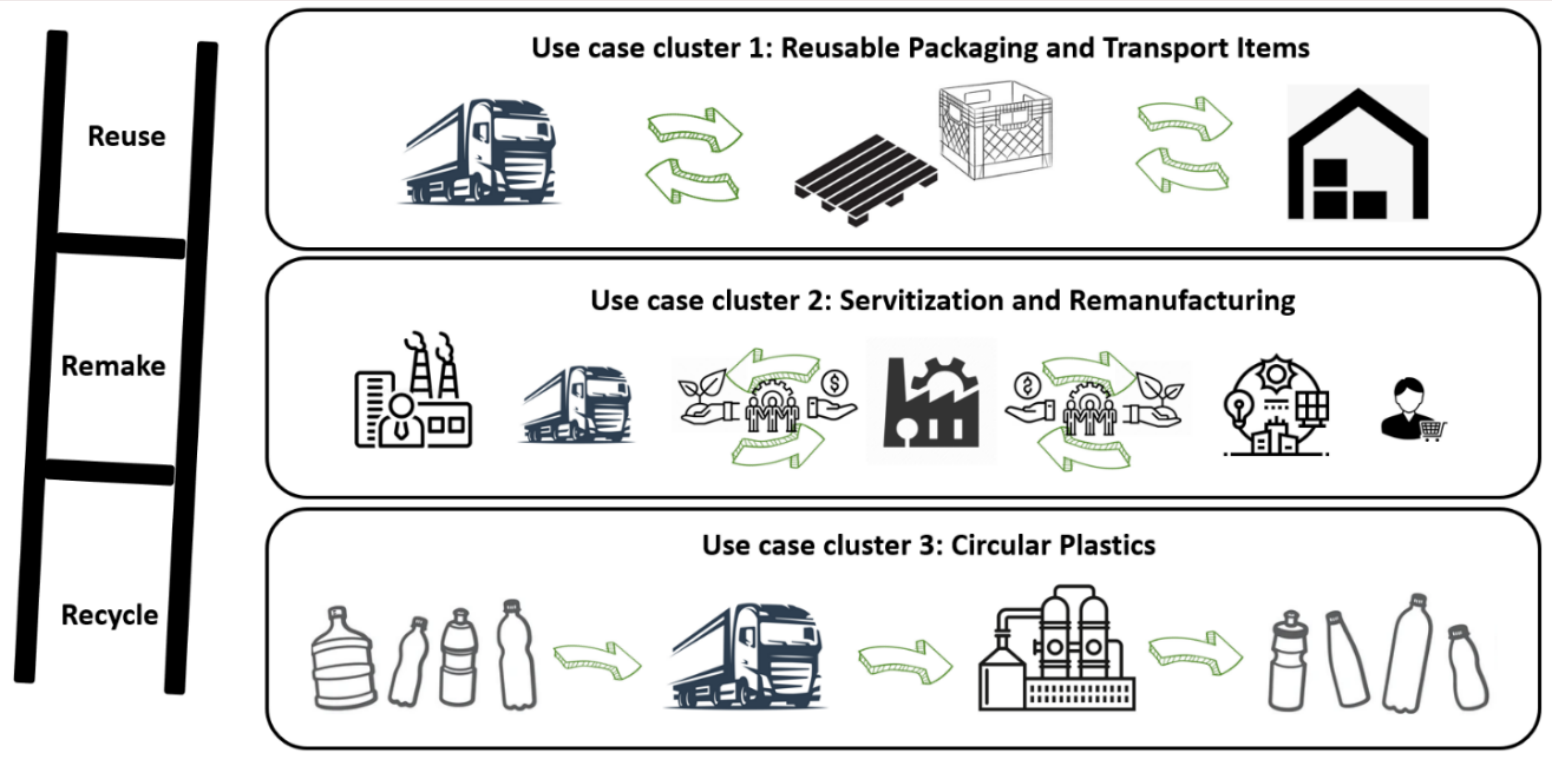
LINCIT | LINear to Circular Transition





LINCIT | Who is who?

LINCIT | Sectoral focus



LINCIT | Who is who?

TU/e

LINCIT | Mission

Guide companies operating a linear supply chain to transition to a circular business ecosystem, and organize the associated logistics and operations

- Starting small
- Redrawing partnerships
- Scaling the ecosystem
- Measuring

LINCIT | Main research questions

STARTING SMALL

How should companies rethink their business models and run two models in parallel?

Keywords: business model innovation, learning, digitalization

REDRAWING PARTNERSHIPS

How should companies set up partnerships to build a minimum viable ecosystem?

Keywords: partner selection, coordination mechanisms, tradeoffs

SCALING THE ECOSYSTEM

How should companies manage and scale their operations, and involve different stakeholders?

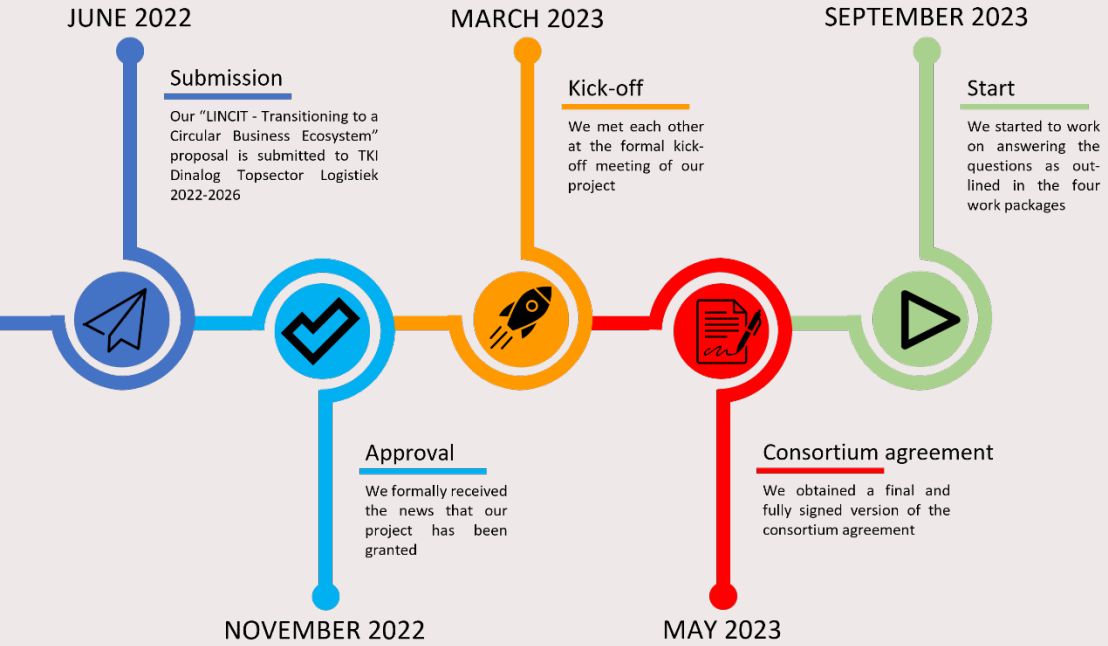
Keywords: ecosystem growth, governance mechanisms, institution

MEASURING

What interventions are possible to support companies in reaching circular objectives?

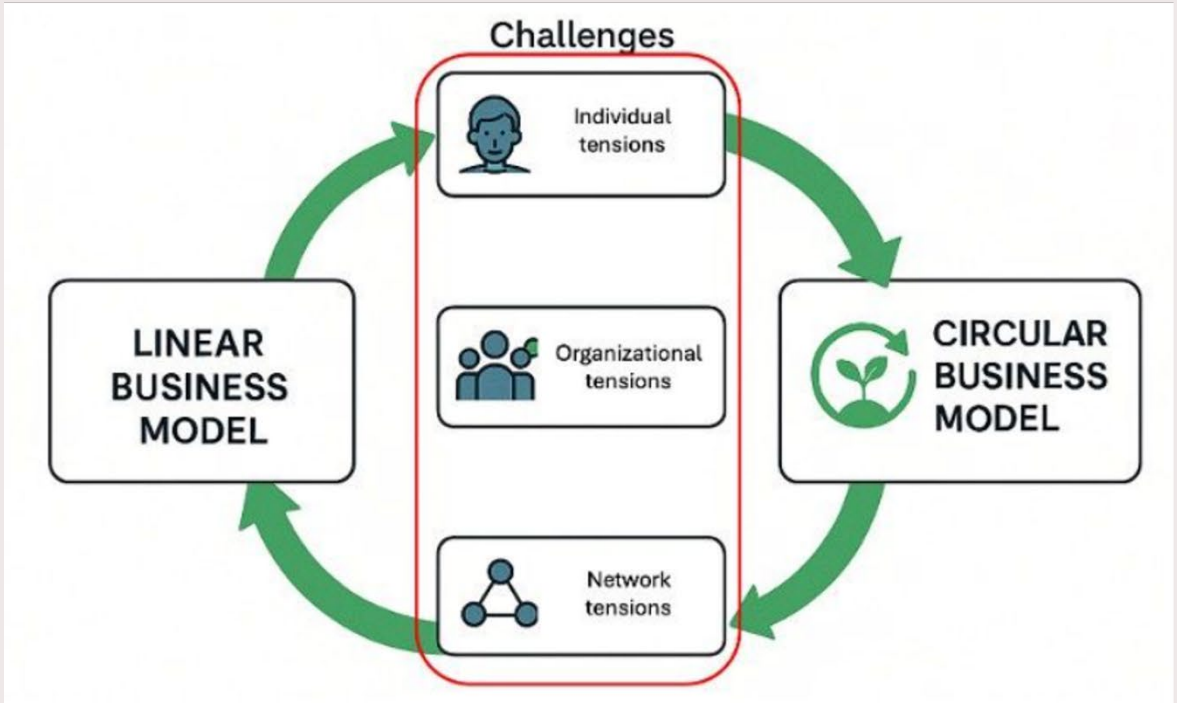
Keywords: KPI, dynamic performance management system

LINCIT | Approach



LINCIT | Starting small

Apply learning-based practices at the individual, organizational, and network levels



Unlearn whatever hinders developing the CBM

Keep **experimenting** continuously with the CBM

Co-learn with value-chain partners

LINCIT | Redrawing partnerships

Remanufacturing can be harmful to the environment, depending on the business model

(a) Remanufacture by the original manufacturer

Manufacturer

New product

Remanufactured product

If the remanufacturer is

an original manufacturer, new products are less attractive

a third-party, new products will be more attractive

(b) Remanufacture by third-party remanufacturer

Manufacturer

Authorization

Third-party Remanufacturer

New product

Remanufactured product

LINCIT | Scaling the ecosystem

Collaborate with organizations beyond your (linear) horizon

- Task analyzability
- Task capability
- Culture

Task uncertainty

- Availability
- Accessibility
- Reliability
- Variety

Data uncertainty

- Concentration capacity
- Relational specificity
- Trust

Product lifecycle uncertainty

What is the fit between uncertainties and mechanisms in inter-organizational information processing to improve CE performance?

Structural mechanisms

- Rules and procedures
- Professionalism by education
- Creation of lateral roles

Relational mechanisms

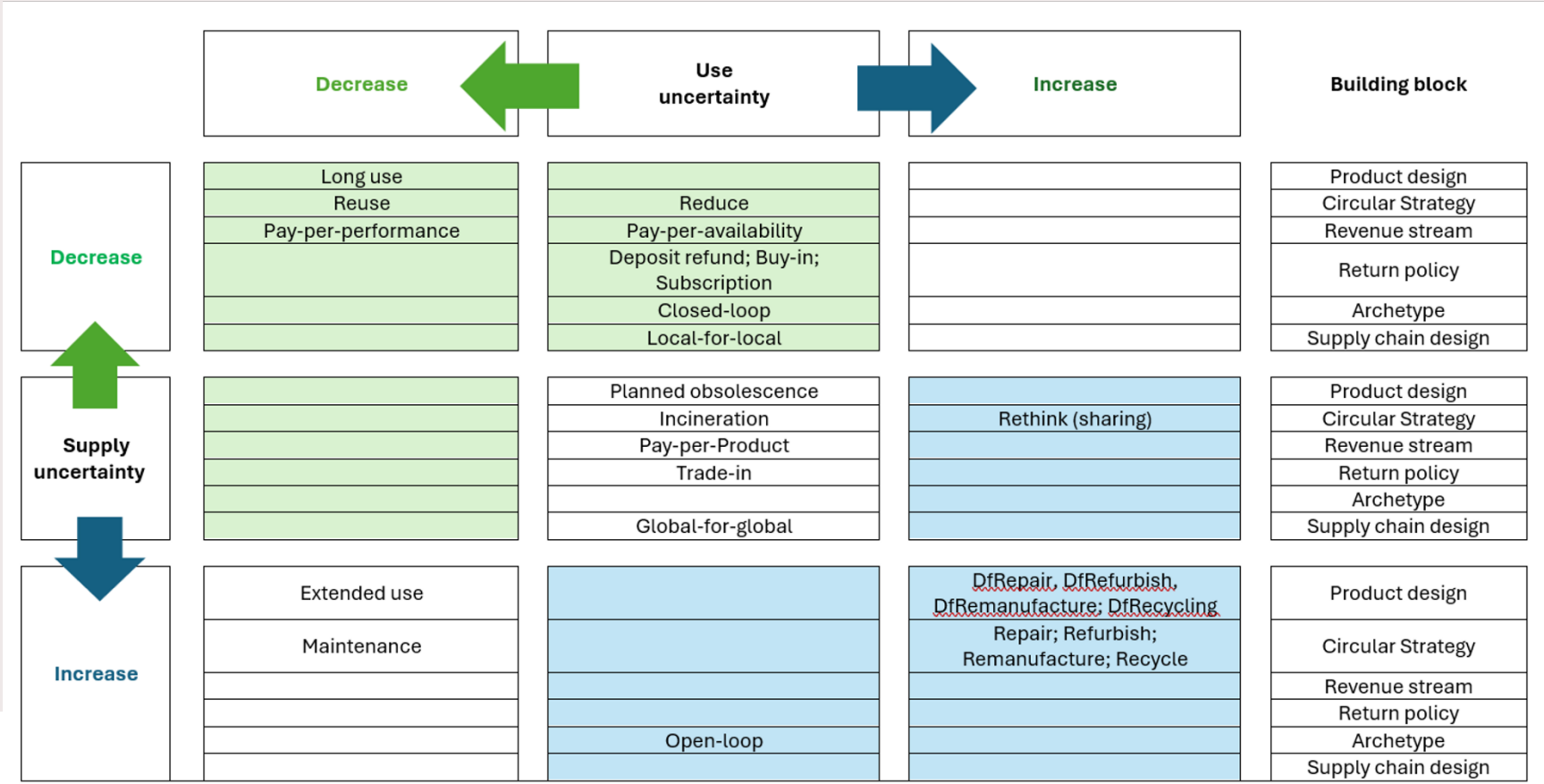
- Commitment
- Cooperation
- Contract
- Incentives

Technological mechanisms

- Scope
- Technology integration
- Data formalization
- Technology formalization
- Identity & Access Management
- Ownership

LINCIT | Measuring

Circularity and competitiveness: arch enemies or best friends together?



Sustainable Servitization

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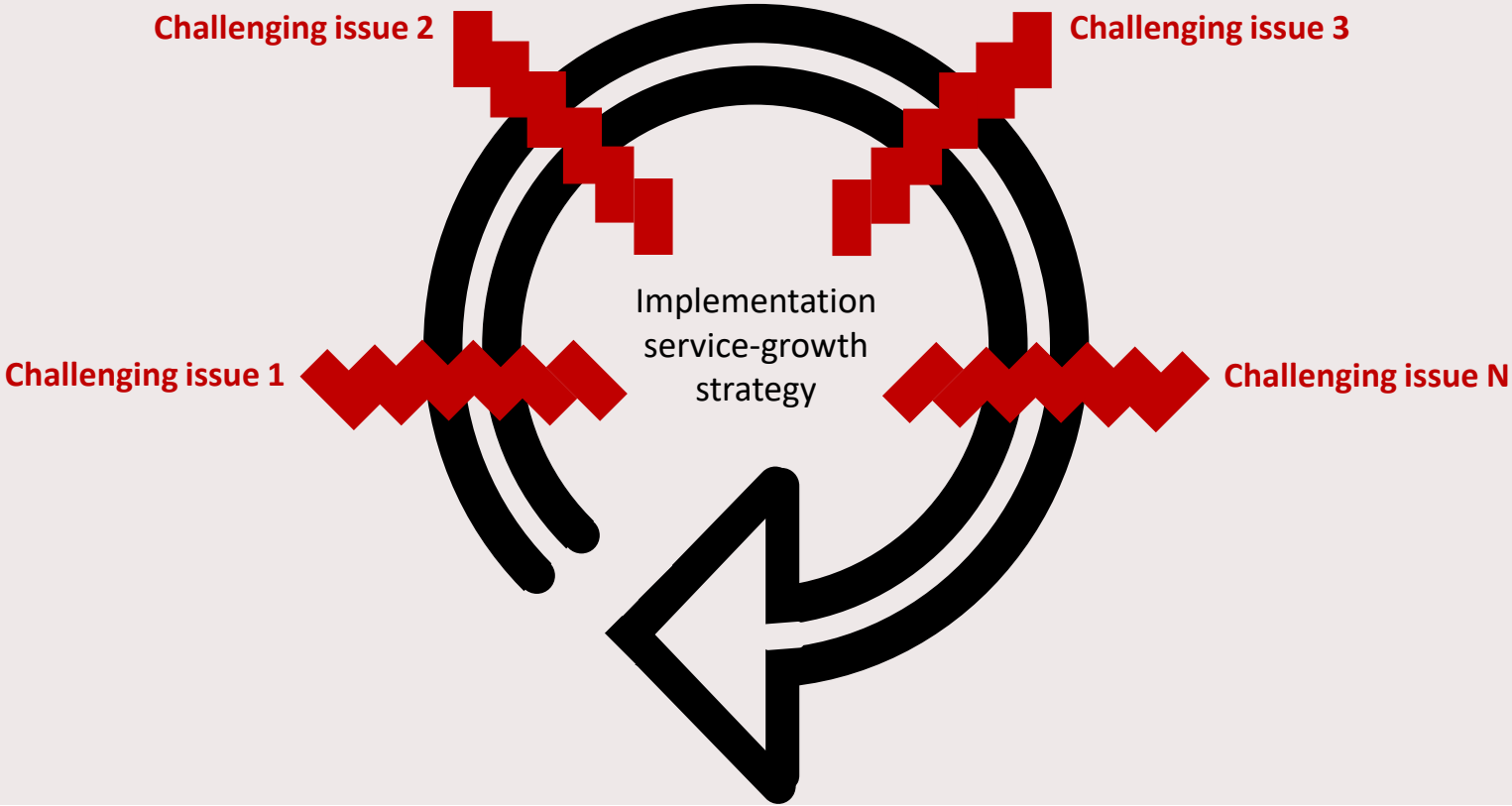
Industry trends of today

Servitization

The addition of services to core product offerings to create additional customer value **[sərvətəˈzāSH(ə)n]**

It is challenging to transform business operations



Research interests

Predictive maintenance	Process-based view	Circular economy
Keywords: Basic services Maintenance Value proposition	Keywords: Organizational change Implementation steps Performance impact	Keywords: Business model innovation Change management R-ladder

Sustainability | Economic, Environmental, Social



Focus of today

1 **Predictive maintenance**

How do we keep complex machines running: smartly and sustainably?

2 **Process-based view**

What is the impact of strategically emphasizing advanced services?

3 **Circular economy**

How to manage linear and circular business models in parallel?

Sustainable maintenance strategies for multi-component systems

Industrial Engineering and Innovation Sciences,
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Research team

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Maintenance

Dr. Claudia Fecarotti

Resilient Asset Management and Maintenance

Prof. dr. Geert-Jan van Houtum

Maintenance and Reliability

Dr. Néomie Raassens

Servitization

Why maintenance is the backbone of business

It is the process of keeping systems running properly and preventing breakdowns.

🧩 Complex machines → More parts, higher risks
💼 Economic pressure → High costs of downtime
👷 Labor shortages → Fewer technicians, more stress
🤖 Smart technologies → New tools, new expectations

Traditional maintenance = reactive (fix after breakdown) → costly downtime

How to ensure reliability, affordability, and sustainability?

The shift to sustainable maintenance

Economic
- High failure costs
- Poor coordination

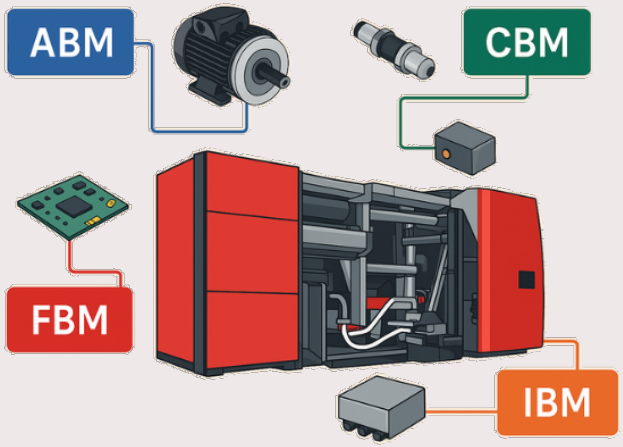
Environmental
- Unnecessary replacements
- High maintenance travels

Social
- Technician stress
- Poor work-life balance

Comparison maintenance strategies

Strategy	Approach	Pros	Cons
Failure-based maintenance (FBM)	After failure	✓Simple	✗ Costly, downtime
Age-based maintenance (ABM)	On schedule	✓ Avoids surprises	✗ Waste functioning components ✗ Ignores actual condition
Condition-based maintenance – Continuous (CBM)	Real-time	✓ Efficient, less waste	✗ Needs sensors/data
Condition-based inspection (IBM)	Regular checks	✓ Cheaper	✗ Misses sudden failures

Complex system challenge: Many components, many needs



- Original Equipment Manufacturer partnership for agri-equipment
- Many heterogeneous components with diverse needs
- Varying criticality levels
- Finite lifespan

How can we manage all of this efficiently?

Develop a scalable, flexible maintenance concept to schedule and group maintenance over the system's lifespan

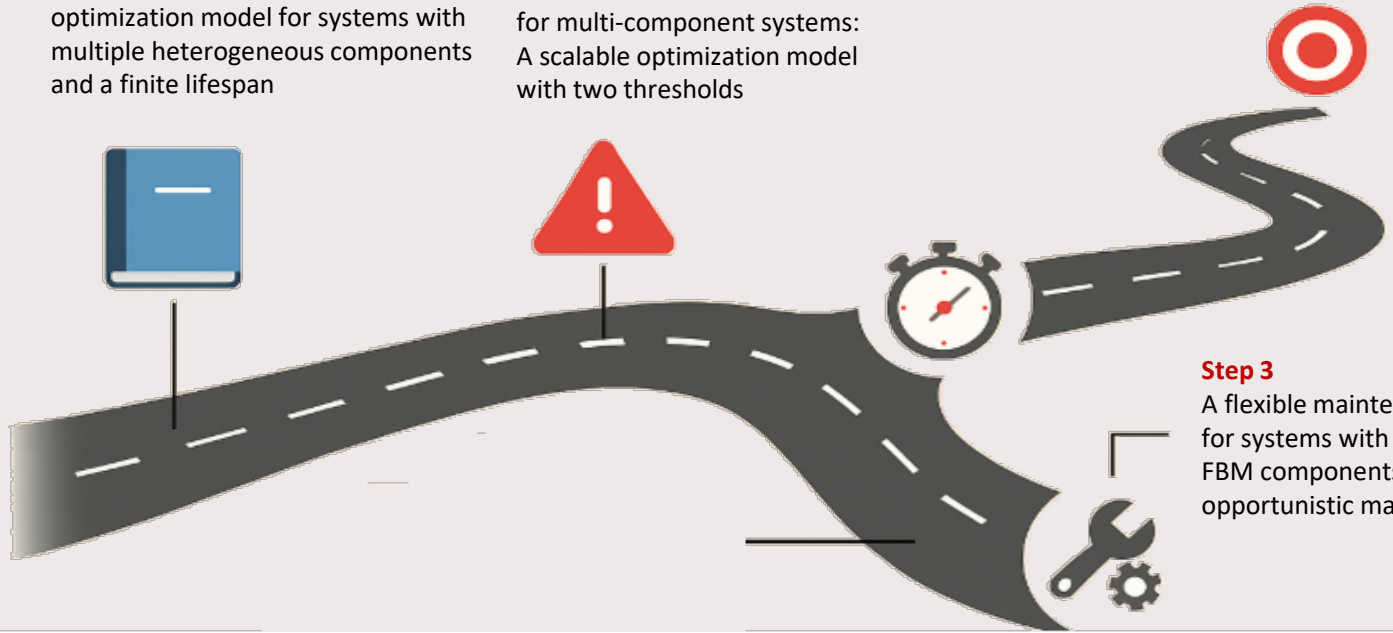
Road to a unified maintenance strategy

Each step marks a key step on the journey to a smarter, more sustainable maintenance strategy.

Step 1
A scalable bi-objective maintenance optimization model for systems with multiple heterogeneous components and a finite lifespan

Step 2
Condition-based maintenance for multi-component systems: A scalable optimization model with two thresholds

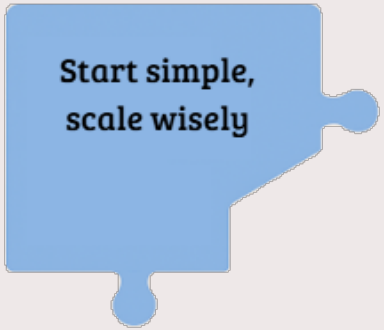
Step 4
Sustainable maintenance scheduling: reducing urgent interventions



Step 3
A flexible maintenance policy for systems with CBM and FBM components: leveraging opportunistic maintenance

Step 1: A scalable bi-objective maintenance model

Balancing cost and downtime for complex systems

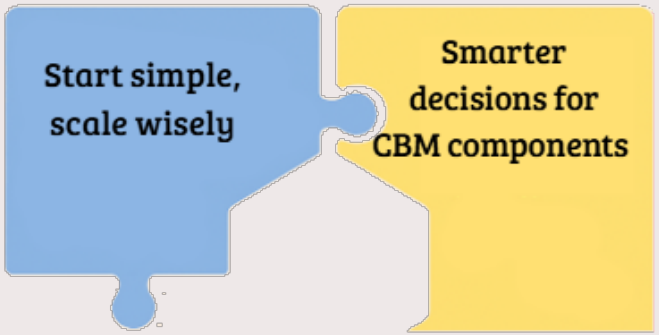


- ABM, CBM, and FBM components
- Cost and downtime minimization
- Serial configuration
- Scheduled and urgent visits
- Decomposition approach
- Optimize: When to replace, when to visit

📊 **Reduced cost by 26%, downtime by 21%**

Step 2: Two-threshold policy for CBM

Making condition-based maintenance more flexible

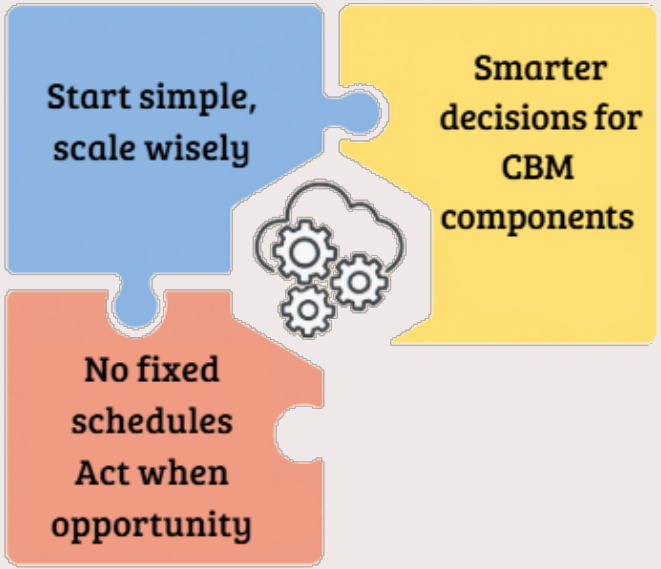


- CBM components only
- Semi-urgent maintenance before failure
- Scheduled, semi-urgent & urgent visits
- Decomposition approach
- Two thresholds: scheduled vs semi-urgent

📊 **15% cost reduction vs one-threshold**

Step 3: Opportunistic maintenance without fixed schedules

A more flexible strategy for real-time maintenance



- CBM and FBM components
- No fixed schedules
- Semi-urgent & urgent visits
- Opportunistic maintenance
- Scalable heuristics

📉 **Optimality gap: 0.4% to 2.9%**

Step 4: A unified framework for all components

Handling critical and semi-critical components together

- ABM, CBM, FBM, and IBM
- Critical & semi-critical components
- Opportunistic maintenance
- Scheduled, semi-urgent & urgent visits
- Four policies evolving in complexity

📉 **Policy 3: 16.5% lower costs with fewer urgent visits compared to Policy 0**

Conclusions

🏛️ Economic

- Fewer failures → lower long-term costs
- Combined actions → reduced setup costs

🌿 Environmental

- Maintenance only when needed → less waste
- Fewer visits → lower energy consumption

👥 Social

- Smarter planning → less stress for technicians
- Fewer urgent visits→ better work-life balance

Implementing advanced services and resource allocation decisions

Industrial Engineering and Innovation Sciences,
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Research team

Patricia Roost

Servitization

Dr. Néomie Raassens

Servitization

Prof. dr. Ed Nijssen

Strategic Sales and (Entrepreneurial) Marketing

Dr. Shantanu Mullick

Data Science

Key drivers of servitization success

(Benedettini and Kowalkowski, 2022; Heirati, Leischnig, and Henneberg, 2023)

Alignment between a manufacturer's organization architecture for servitization with its servitization approach may be important for achieving superior performance

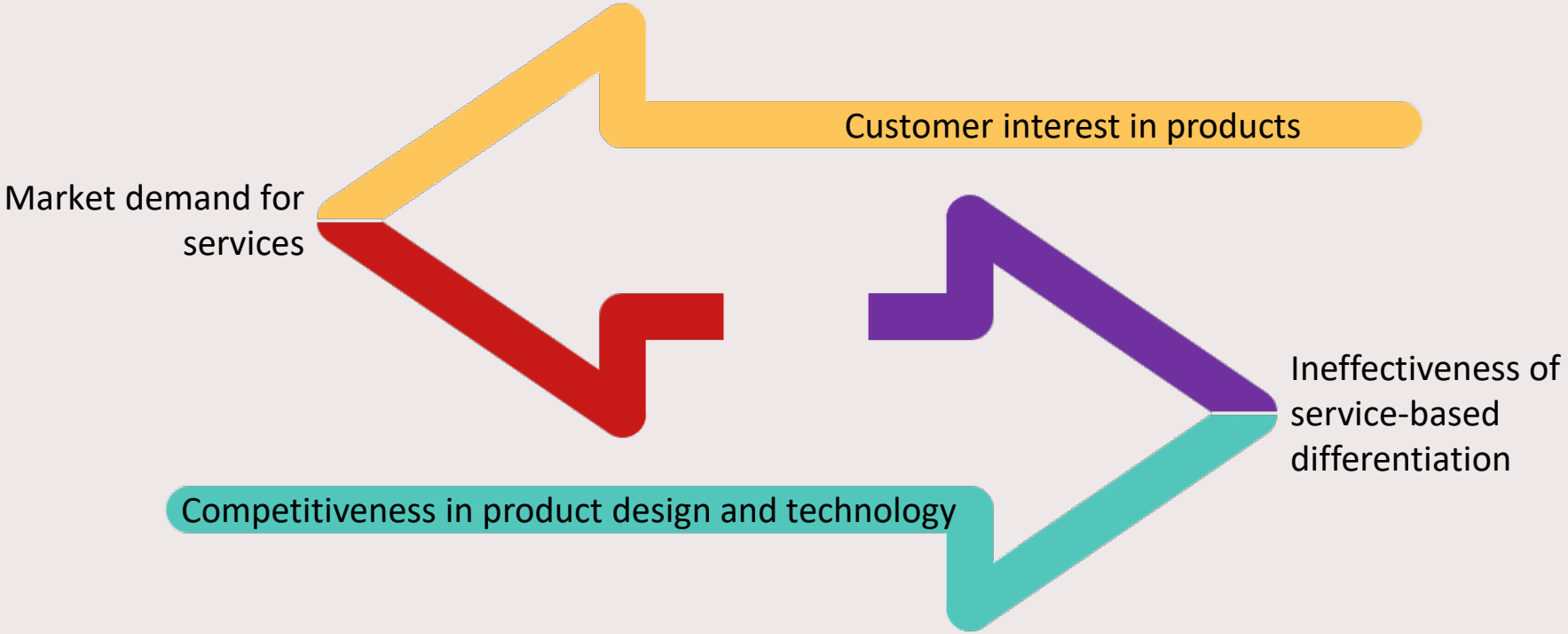
Product-based knowledge is too often treated as a stable, unproblema-tic element

Innovation within traditional and servitized companies

	Traditional approach	Servitization approach
Innovation strategy	Investing in technological R&D to gain competitive advantage through product innovation	Embedding products in a value proposition of product-service systems to enhance the ability to fulfil customer needs
Competitive drivers	Product excellence and technology leadership	Service-based value concepts connected to customer experience and functional needs
Sources of customer value	Technical product features that address customer needs	Utility provided to the customers through a total offer including combined products and services
Focus of innovation	Value-creating product technology	Specific modes of value proposition, value creation, and value capture (i.e., business model)

(Benedettini and Kowalkowski, 2022)

Product remains key



(Benedettini and Kowalkowski, 2022)

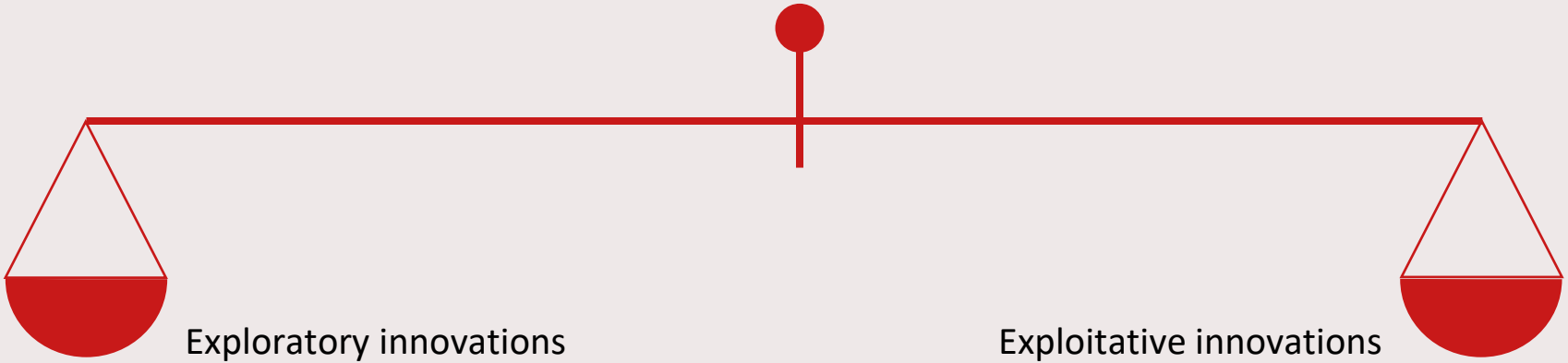
The real managerial issue is resource allocation

It is too simplistic to argue that servitized companies can simply substitute product innovation with value innovation and business model innovation

While manufacturing companies should leverage service-based value concepts to create innovative market offerings, they should also be careful to maintain an adequate level of investment in product innovation to protect the core R&D-based competences

(Benedettini and Kowalkowski, 2022; Roost et al., 2025)

Finding a balance



Exploratory innovations
(in support of new solutions)

Exploitative innovations
(in support of their product business)

(Benedettini, 2024; Kohtamäki, Einola, & Rabetino, 2020; Kowalkowski, Windahl, Kindström, & Gebauer, 2015)

Value appropriation versus value creation

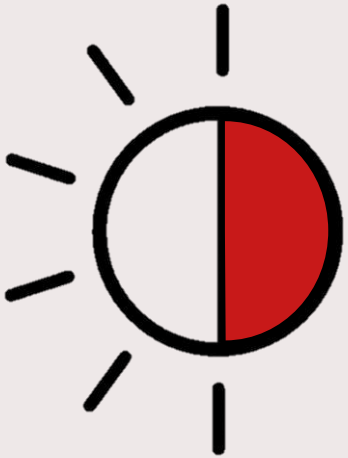
Although both processes are important, resource limitations force managers to place a relatively bigger emphasis on either value appropriation or value creation

(Gensler et al., 2024; Han et al., 2017)

Value appropriation is necessary but …

Showcase the advantages of the current offering

Long-term engagements



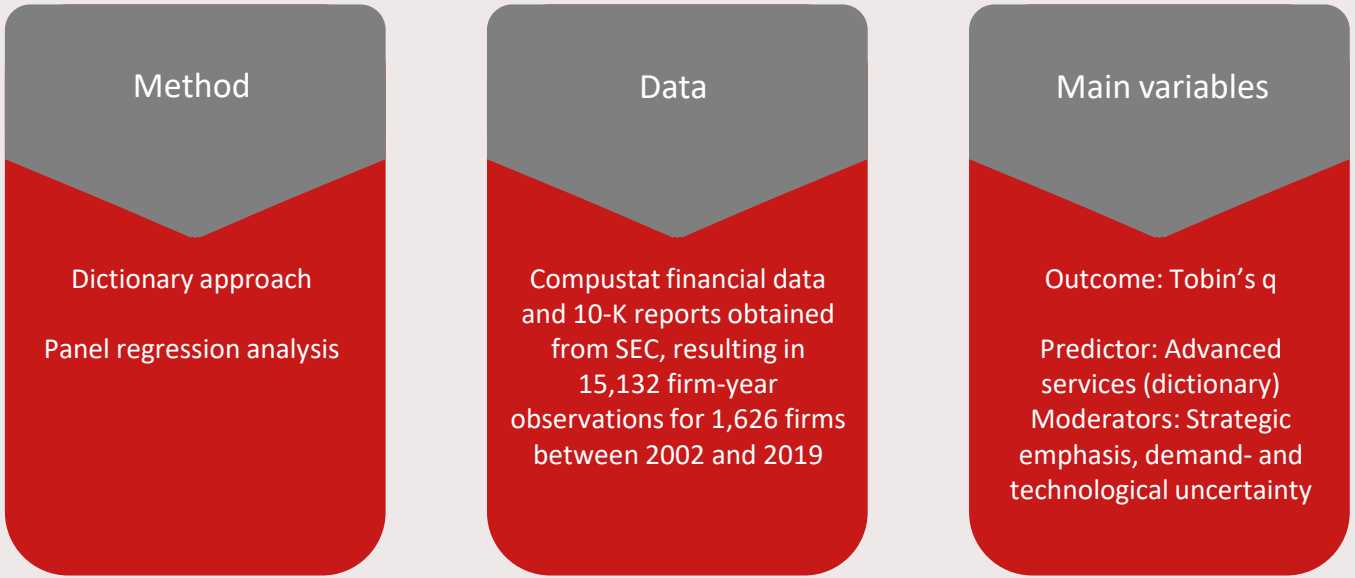
Know how it was built, know how to keep it operational

Developing and implementing technologies

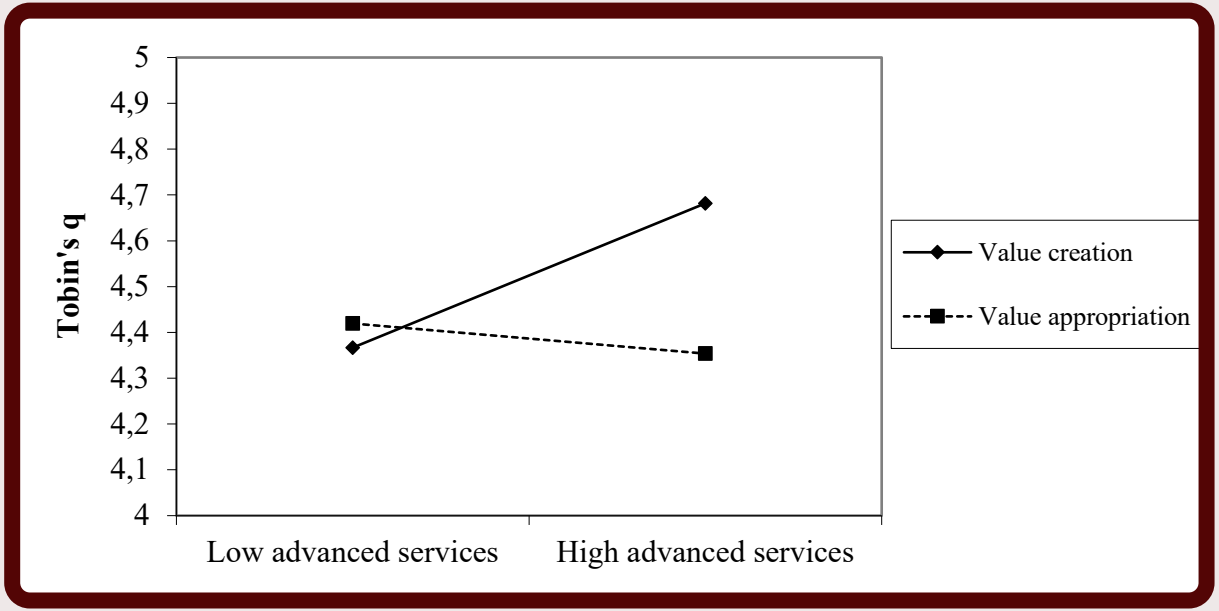
Commitment to improving offerings for customers' latent needs through innovation

… a stronger emphasis on value creation compared to value appropriation is most beneficial

Method and data

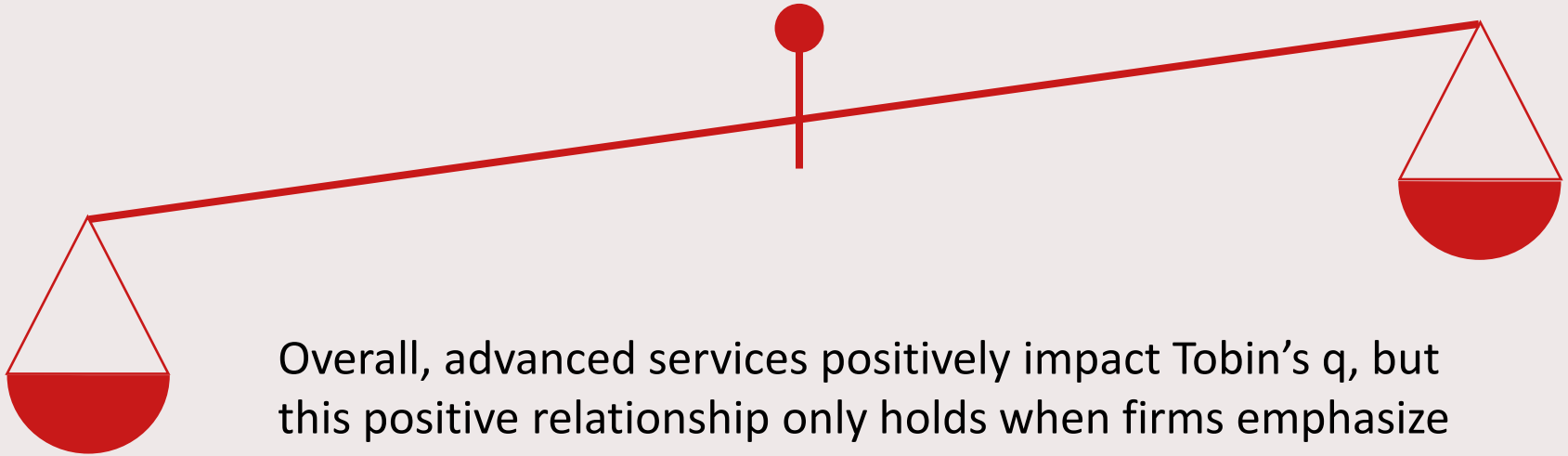


Main result



Roost et al. (2025)

Conclusion



Overall, advanced services positively impact Tobin's q, but this positive relationship only holds when firms emphasize value creation (as opposed to value appropriation)

Managing linear and circular business models in parallel

Industrial Engineering and Innovation Sciences,
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Research team

Seyedhassan Hajiakbari

Business Model Innovation & Circular Transition

Dr. Alex Alblas

Accelerating Innovation

Dr. Néomie Raassens

Servitization

Prof. dr. Marcel Bogers

Open & Collaborative Innovation

Today, circular economy is high on the agenda

Linear Business Model

Circular Business Model

(Circular Economy Foundation, 2024; Graessler et al., 2024; Hofmann & Jaeger-Erben, 2020)

The circular transition is as sailing against the current

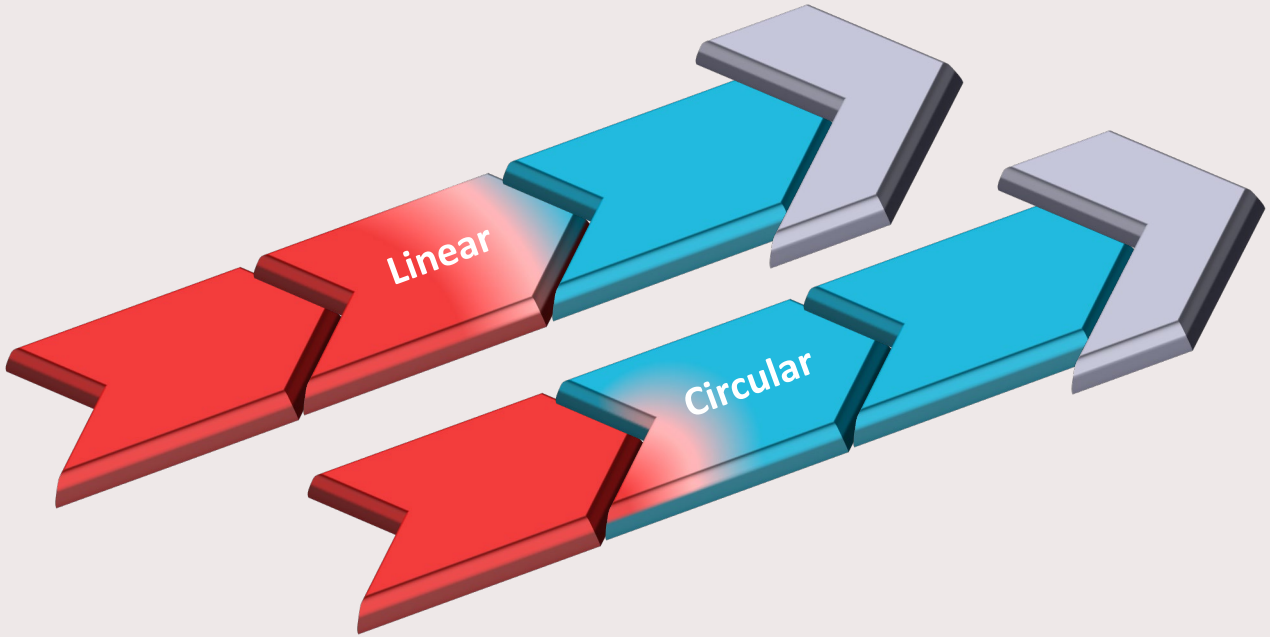
Linear Business Model

Transition

Circular Business Model

(Circular Economy Foundation, 2024; Graessler et al., 2024; Hofmann & Jaeger-Erben, 2020)

The circular transition will not happen overnight



(Geissdoerfer et al., 2020; Linder & Williander, 2017; Lütjen et al., 2017)

The circular transition will not happen overnight

Literature on managing parallel business models is growing, but limited attention has been given to the *dynamic interplay* of simultaneously managing *two contradictory business models* throughout a transition

How can firms effectively navigate the CBM transition?

The CBM transition is an iterative and multi-level learning process: How can firms manage the inherent contradictory business logics of exploring circular initiatives while exploiting the linear business model?

(Centobelli et al., 2020; Fehrer & Wieland, 2021; Graessler et al., 2024; Hofmann & Jaeger-Erben, 2020; Foss & Saebi, 2018; Markides, 2013; Spanjol et al., 2024; Zott & Amit, 2010)

Practical and theoretical contributions

Practical

Unfolding the transition's tensions and the role of learning in managing two business models in parallel throughout the circular transition

Transition

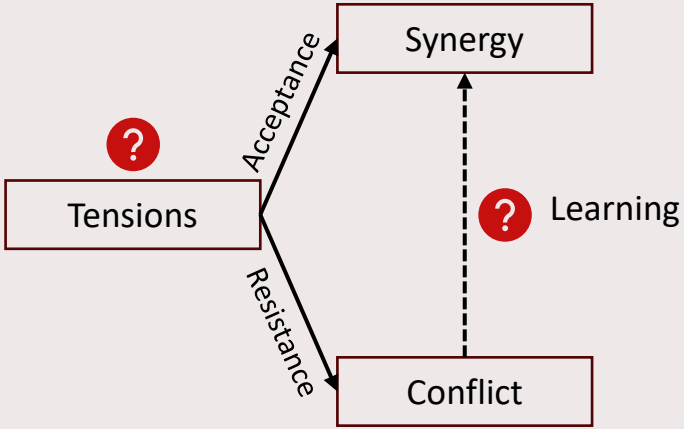
Theoretical

Integrating and synthesizing intra- and interdisciplinary perspectives on facilitating the circular transition

(Dagilienė & Varaniūtė, 2023; Fehrer & Wieland, 2021; Frishammar & Parida, 2019; Graessler et al., 2024; Spanjol et al., 2024; Visnjic et al., 2022)

The aim of this study is

to synthesize knowledge across various (sub-)disciplines to understand circular transition's tensions and manage them by fostering synergies through learning-based practices



What are the inherent tensions of running linear to circular business models, and How can organizations manage the inherent tensions over time by leveraging learning strategies?

(Hargrave & Van de Ven, 2017; Smith & Lewis, 2011)

Systematic Literature Review

First Stage: Search in the Dataset

Identification of Articles

Clarivate Web of Science™

N1 = 416

Scopus®

N2 = 555

Screening Phases

- Subject area
- Document type & language
- Duplication check

Second Stage: Manual Filtering

Eligibility Check

- Abstract check
- Full-text assessment for quality and relevancy

Literature Supplementation

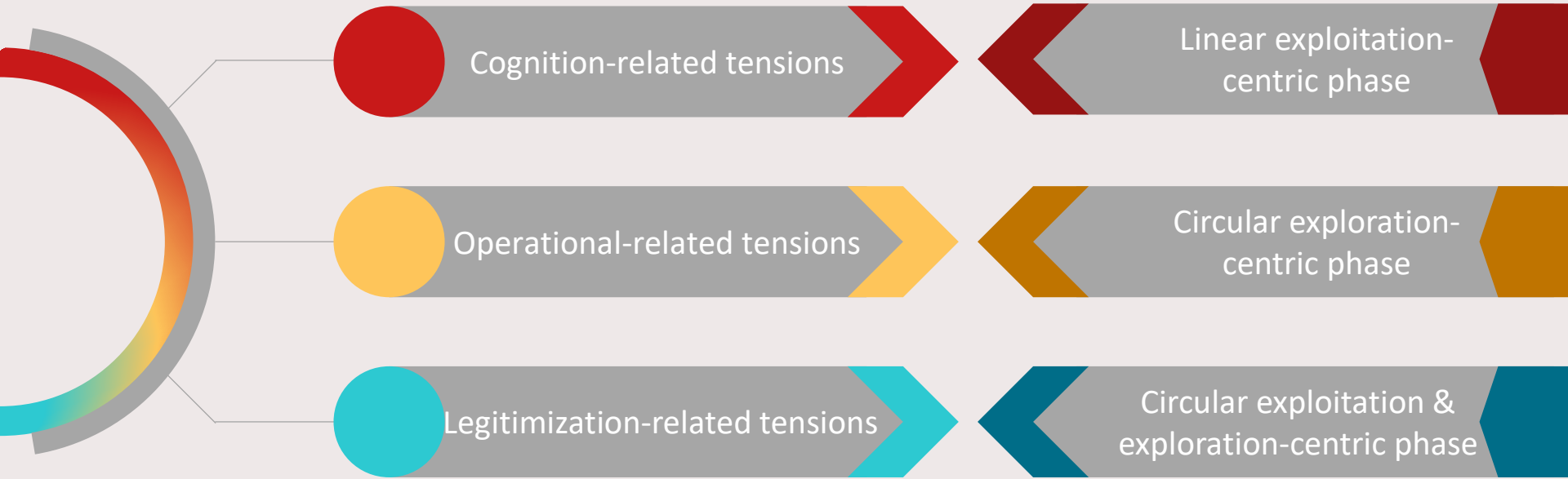
- Backward and forward snowballing

(Kunish et al., 2023; Siddaway et al., 2019)

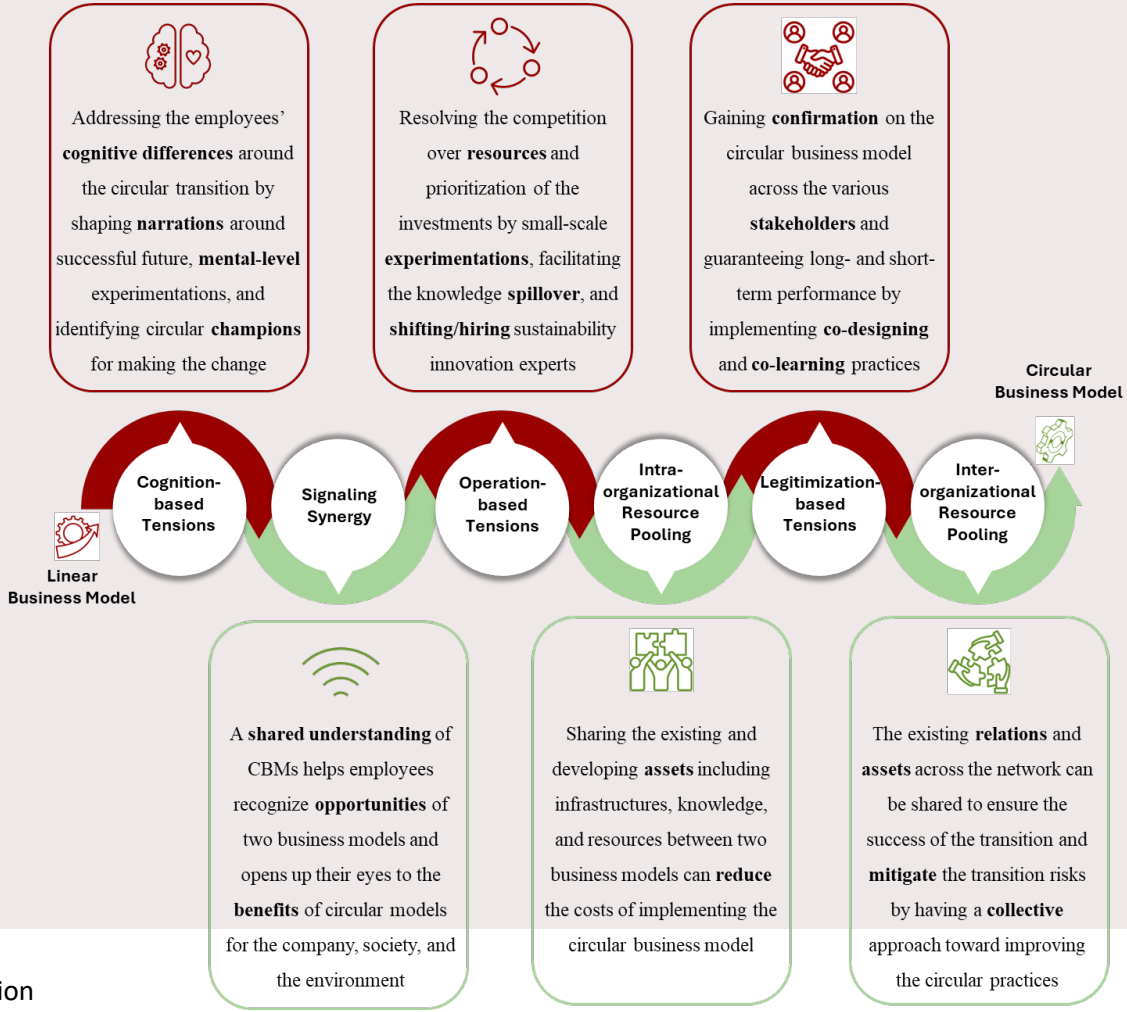
Number of Papers = 72

TU/e

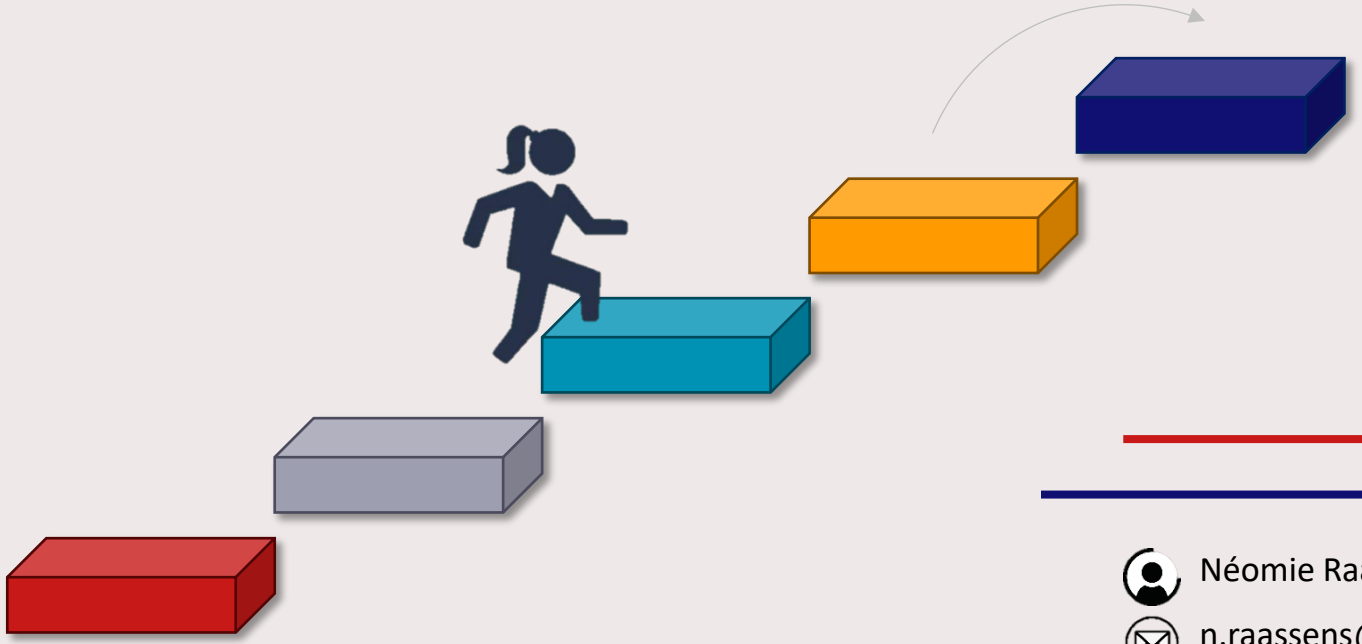
Findings


Cognition-related tensions
Operational-related tensions
Legitimization-related tensions
Linear exploitation-centric phase
Circular exploration-centric phase
Circular exploitation & exploration-centric phase

Findings


Addressing the employees' **cognitive differences** around the circular transition by shaping **narrations** around successful future, **mental-level** experimentations, and identifying circular **champions** for making the change
Resolving the competition over **resources** and prioritization of the investments by small-scale **experimentations**, facilitating the knowledge **spillover**, and **shifting/hiring** sustainability innovation experts
Gaining **confirmation** on the circular business model across the various **stakeholders** and guaranteeing long- and short-term performance by implementing **co-designing** and **co-learning** practices
Circular Business Model
Linear Business Model
Cognition-based Tensions
Signaling Synergy
Operation-based Tensions
Intra-organizational Resource Pooling
Legitimization-based Tensions
Inter-organizational Resource Pooling
A **shared understanding** of CBMs helps employees recognize **opportunities** of two business models and opens up their eyes to the **benefits** of circular models for the company, society, and the environment
Sharing the existing and developing **assets** including infrastructures, knowledge, and resources between two business models can **reduce** the costs of implementing the circular business model
The existing **relations** and **assets** across the network can be shared to ensure the success of the transition and **mitigate** the transition risks by having a **collective** approach toward improving the circular practices

Thank you!



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