

## RESEARCH

# Artificial Intelligence for Business Model Innovation in Digital Sustainability Companies: Multiple Cases from the Netherlands

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## ABSTRACT

**PURPOSE:** We explore how sustainability companies deliver Artificial Intelligence powered (AI-Powered) solutions for Business Model Innovation (BMI) and how they balance between ecological, economic, and social value across diverse industries and company sizes.

**DESIGN/METHODOLOGY/APPROACH:** We adopt qualitative semi-structured interviews with the top 20 sustainability executives and founders in the Netherlands as a unique context of sustainability.

**FINDINGS:** We found differences between large and small sustainability companies from the Technological, Organisational, and Environmental (TOE) perspectives. Technically AI is instrumental for operational efficiency, real-time environmental monitoring, and supply chain traceability. Organisationally, sustainability companies focus on design-led approaches, bottom-up innovation, and AI–strategy alignment. Environmentally, they face challenges such as supply chain collaboration resistance, the impact of regulation, and market readiness.

**ORIGINALITY/VALUE OF THE PAPER:** This study offers original multi-case evidence from the Netherlands, providing a systemic framework based on the TOE theory to reconceptualise AI not just as a facilitator but as a foundational input shaping sustainable BMI.

**PRACTICAL IMPLICATIONS:** It guides sustainability executives and SMEs' founders to embed AI efficiently to align with client values.

**KEYWORDS:** *Artificial Intelligence; Business Model Innovation; Technological, Organisational, and Environmental Theory; Digital Sustainability; Multiple Case Studies.*

## INTRODUCTION

The ongoing climate challenges and rapid technological advancements have led to the integration of Artificial Intelligence (AI) into a wide range of industries, economies, and societies. Sustainability-driven Business Models (BMs) have emerged as a critical avenue for AI-powered innovation. To address this phenomenon, we explore “*how sustainability-focused companies adopt AI to reshape their BMs for long-term ecological, economic, and social value.*” The evidence is collected from the Netherlands, due to its progressive environmental policies, technological readiness, and entrepreneurial ecosystem.

Our study investigates twenty top-performing Dutch companies across vital sectors, including *forestry and climate planning, 3D digital fashion, plastic waste management, organic food production, sustainable supply chains, heating grid optimisation, energy analytics, Agritech, green mobility, and automation.* These companies, ranging from multinational corporations to agile Small



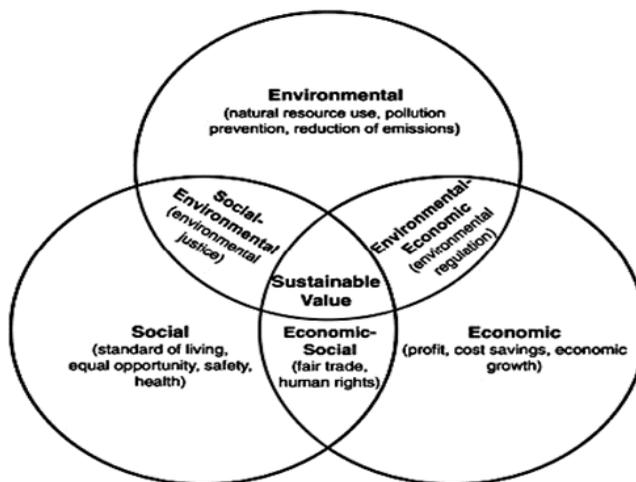
and Medium Enterprises (SMEs), are united by a commitment to sustainability and the strategic use of AI to power their services (Dutch Review, 2025).

There is a lack of systemic understanding of how AI helps develop business model innovation (BMI) in the sustainability sector (Sjödin *et al.*, 2023). Our review of the literature refers to a few attempts to adopt systems thinking theories, such as multiple perspective theory (See Mohamad *et al.*, 2020; Jorzik *et al.*, 2024; Mohamad *et al.*, 2025), but this theory lacks the ecological and regulatory perspective of sustainable business. Accordingly, we adopted the technological, organisational, and environmental (TOE) theory (Georgieva, 2022) to explore the interplay between five layers of AI-powered BMI in sustainability (See Figure 3).

## LITERATURE REVIEW

### Sustainability: The Necessity for Digitalised Business Model Innovation

Sustainability has triple perspectives: economic, social, and environmental (Bocken and Geradts, 2020) (See Figure 1). The economic perspective impedes the adoption of BMIs and leads to sacrificing the two bottom lines of social and environmental sustainability. Mohamad and Anuge (2016) argued that the digitisation of sustainability business helps balance the trio by enhancing their competitive positions while reducing negative environmental and social impacts across the business value chain (Bocken and Geradts, 2020). BMI could then be defined as the unique balance between the triple lines of sustainability business (Evans *et al.*, 2017). Sustainability studies, such as Bocken *et al.* (2019), set eight archetypes that firms can use as a framework to develop innovative BMs to tackle sustainability challenges. These archetypes could be categorised into technical, organisational, and social to meet long-term sustainability (See Table 2).



**Figure 1: Three Pillars of Sustainability**

Source: Adopted from Yang *et al.* (2017; 10)

De Giacomo and Bleischwitz (2020) argue that a systemic development of business modelling is important to have a competitive advantage and maintain sustainability in the long run, yet the elements of BMI are subject to different sustainability areas such as energy efficiency, water management, zero-carbon, green manufacturing, and sustainable e-commerce (Bocken *et al.*, 2019). Bocken and Geradts (2020) argue that sustainability companies need to understand how the elements of BMI affect their supply chain and future rebound effects (e.g., increased consumption negating impact reduction), which remains challenging. Large corporation develop their BMI from an economic and social perspective, while SMEs seem to adopt technological solutions to generate an innovative BM (Ancillai *et al.*, 2023).

The role of digitisation in developing BMI in the sustainability sector has not yet been explored. Rather, how differently large corporations versus SMEs rely on digitisation to develop their sustainable BM (see Table 1) (Shaik *et al.*, 2024).

**Table 1: An examination of eight distinct sustainable BM archetypes**

Group	Archetypes
Technological	1. Optimises the efficient use of resources.
	2. Converts waste into a value-added activity.
	3. Replace with sustainable and organic methods.
Social	4. Provide usefulness instead of acquiring ownership.
	5. Embrace a position of stewardship.
	6. Promote self-sufficiency.
Organisational	7. Reallocate for the betterment of society.
	Create and implement strategies for expanding operations.

Source: Adapted from Bocken *et al.* (2019)

Reim *et al.* (2022) offer insights into how digitalisation enables SMEs to navigate BM challenges during international expansion. obstacles such as limited resources, insufficient market knowledge, and coordination issues, which were found significant. Reim’s team found that digitisation enhances SMEs’ operational efficiency, agility, and scalability. Their study provides practical recommendations for owners to leverage digitalisation for effective international growth. Similar to our study, they relied on qualitative interviews with supply chain sustainability SMEs to draw their findings. However, there is no guidance on how corporate executives follow different processes for digitising their BMI for international expansion in major services such as sustainable fashion (Mohamad *et al.*, 2025).

Sjödin *et al.* (2023) investigated the influence of digital transformation on BMI from the regulator’s perspective and how public policy encourages digitally enabled innovation for companies. They shed light on “*how companies can use governmental support and public policy guidance to cultivate innovation capabilities and boost their competitiveness,*” but provides limited guidance on how SMEs can access such support.

## AI for Sustainability Business Model Innovation

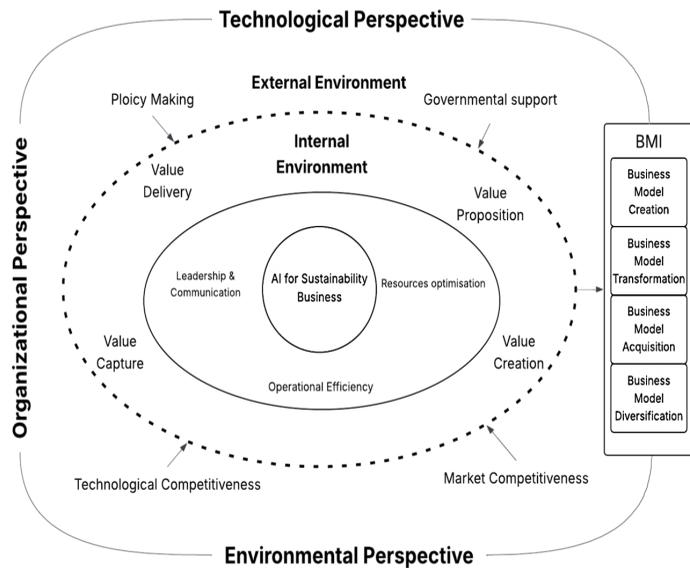
The adoption of AI for industrial operations offers accelerated business model innovation (Nagalakshmi and Reddy, 2024). The literature documents how AI optimises complex systems, automates the use of big data for decision-making, and enhances the competitive advantage by improving operational efficiency and customer engagement (Astawa and Arsha, 2024). The AI applications range from revolutionising impact in manufacturing sectors (such as automotives that require predictive analytics) to the gradual impact in service sectors (such as e-commerce and supply chain that require hyper-personalisation) (Sheth *et al.*, 2022).

Yet, there is limited empirical research that address “*how AI catalyses sustainable and innovative business growth*” (Jorzik *et al.*, 2024). Some scholarly attempts explored “*how AI enhances customer value through personalisation, transparency, and ethical guarantees in metaverse businesses*” (Kanbach *et al.*, 2024). Despite explaining how co-creation takes place in the “*AI-powered immersive reality*,” it was no sustainability context. Shahin *et al.* (2024) is another attempt that explored how AI enhances value delivery by decoupling service delivery from physical infrastructure, allowing for leaner operations and global scalability. That paper provided an AI-powered lean management model that reduces waste in manufacturing, which is an initial attempt at a sustainability business. Later, Manikandan *et al.* (2025) conducted a review on studies that addressed the role of AI in “*value capturing*” with extensive case evidence on Tokenisation and digital asset creation (e.g., NFTs) that introduce new revenue streams while reinforcing brand equity linked to sustainability narratives. The abovementioned studies attempted to conceptualise the process, but from fragmented perspectives rather than from a systemic multiple perspective (Sipola *et al.*, 2023). The literature is replete with studies on what AI can achieve for the bottom line, but it is strikingly sparse on how AI affects BMIs in sustainability.

## Theoretical Framework

To conceptualise the process of adopting AI-powered BMI for sustainability, the researchers developed a theoretical framework based on the systemic TOE theory (See Figure 2). Saunila (2020) conducted a review on digital sustainability to address the common factors in systemic conceptualisation attempts, including internal factors (such as organisational culture, leadership, resource management), and external factors (such as policy making, technological, economic, and political issues).

Mohamad *et al.* (2020) suggested the multiple perspectives theory as a systemic lens to understand BMI in sustainable finance. But that was not fit for an AI-powered sustainability business. In this research, we propose TOE to address “*how AI is shaping BMI in the sustainability business*.” According to Georgieva (2022), TOE examine the “*technological*” context through AI’s perceived benefits and operational fit. It also addresses how sustainability companies recognise the “*organisational*” context through the persistent challenges of change management, ethical governance, and the urgent need for new workforce skills (Astawa and Arsha, 2024).



**Figure 2: Theoretical Framework for AI for BMI in Sustainability**

Source: Developed by the authors

The “*environmental*” landscape in the sustainability business is evolving based on the first two dimensions and presents a system with boundaries, resource scarcity, and profound societal expectations for corporate responsibility.

Our framework is moving beyond documenting AI’s role in perfecting existing business paradigms and beginning to theorise and empirically test its capacity to propose values (Rodríguez and Calvario, 2024). This framework has five layers of analysis: In the core, it addresses leadership and communication, resource optimisation, operational Efficiency as internal capabilities. Then, the establishment of a “*sustainability BM,*” which includes the value proposition, creation, capturing, and delivery to achieve competitive advantage as suggested by Geissdoerfer *et al.* (2018). The output of BM elements can lead to different levels of innovation, including BM creation, transformation, acquisition, or diversification as suggested by Pieroni *et al.* (2019). In doing so, our framework examines the interplay between BM elements and the BMI to draw a balanced or systemic sustainability from the TOE perspectives. (Evans *et al.*, 2017).

## RESEARCH METHODOLOGY

We explore how sustainability companies adopt AI to develop BMI in the Netherlands. The Dutch context has a rich intersection between sustainability and technological innovation, because of its long-standing environmental stewardship, progressive policy frameworks, and digital readiness



(Tolentino-Zondervan and DiVito, 2024). The Netherlands sets sustainability measures in its economic and social planning, often driven by the country's unique geographical vulnerability to climate change (Pata *et al.*, 2024). They are open to innovation via a collaborative governance model and robust digital infrastructure, setting it apart from more centralised or slower-moving sustainability efforts in other European Union (EU) nations (European Commission, 2022).

To address this unique context of digital sustainability, we adopt interpretative philosophy and qualitative semi-structured interviews with executives and founders of the top 20 sustainability companies in the country (according to *eroleads.com*, 2025). This approach helps obtain a deep insight into the process of adoption and BMI (Polit and Beck, 2010).

All our cases developed AI-powered sustainability service/product in major Dutch sectors, including forestry and climate planning, 3D sustainable fashion, plastic waste management, organic production, supply chain transparency, heating grid optimisation, energy analytics, Agritech, sustainable automation, electric vehicles and green transportation (see Table 2).

**Table 2: Top 20 Digital Sustainability Companies in the Netherlands**

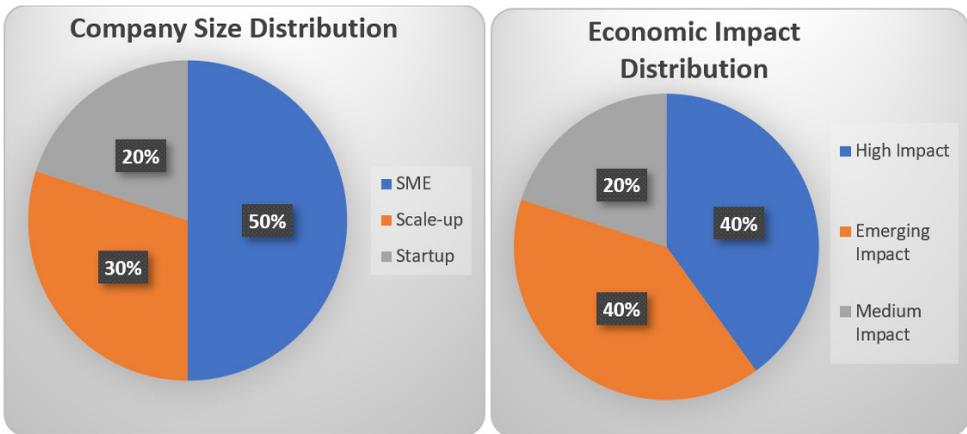
Company Code	Position of Participant	Digital Sustainability Initiative	Business Model Innovation
A	Business Development Manager	AI-driven satellite monitoring for forest health and infrastructure risk reduction.	SaaS-based platform offering real-time environmental intelligence to utilities and infrastructure firms.
B	Founder and CEO	Metaverse-only 3D fashion design.	Digital-only fashion brand eliminating physical production through NFTs and virtual assets.
C	Head of Product Innovation	Edge AI chips for energy-efficient local computing.	B2B chip provider supporting green AI applications in robotics and smart devices.
D	Director of Energy and Residues	AI-generated virtual fashion models.	Digital e-commerce support for fashion brands, promoting inclusion and reducing photoshoot waste.
E	Manager of corporate sponsoring	AI and blockchain for tracking plastic waste.	Marketplace model connecting brands with certified plastic offsetting projects.
F	Business Development Manager for sustainability	Remote sensing and AI for forestry and climate planning.	Impact-focused geospatial analytics service for governments and NGOs.
G	Sustainability Manager	QR-code based supply chain transparency for organic products.	Retail traceability system promoting consumer trust and product sustainability.
H	Chief Executive Officer (CEO)	AI-powered digital twins for heating grid optimisation.	Energy-as-a-service platform for utilities to reduce energy waste.
I	Director of Supply Chain and Procurement	SmartSkin sensor windows with energy analytics.	Green building tech combining IoT hardware with AI-powered analytics.
J	Sustainability Coordinator	AI forecasting for renewable energy grid balancing.	B2B AI SaaS platform for utilities managing variable energy inputs.
K	Business Development Manager.	Autonomous electric agri-bots and AI-driven planning.	Agri-tech-as-a-service enabling precision farming with reduced emissions.

<i>Company Code</i>	<i>Position of Participant</i>	<i>Digital Sustainability Initiative</i>	<i>Business Model Innovation</i>
L	Chief Executive Officer (CEO).	AI-based validation of fashion sustainability claims.	Digital database and SaaS tools for brands to verify ESG credentials.
M	Head of Product Management and Innovation for the region.	AI-enabled e-waste tracking and offset platform.	Circular economy model offering waste-neutral IT procurement.
N	Director of Energy	AI for protein design in bio-based materials.	Biotech SaaS for sustainable materials development.
O	Manager of corporate Finance	Custom AI solutions for sustainable automation.	Digital innovation agency providing AI tools to optimise supply chains.
P	Business Development Manager sustainability	Decentralised AI protocol for collaborative development.	Blockchain-enabled open AI marketplace for sustainability.
Q	Sector manager public and manager technical department	AI + robotics for autonomous blood sampling.	Health-tech device model reducing resource needs in diagnostics.
R	Chief Executive Officer (CEO)	Collaborative robots for repetitive tasks.	Robotics-as-a-service for flexible, sustainable manufacturing.
S	Director of Supply Chain and Procurement	AI with satellite imagery for ecological monitoring.	Platform model serving environmental agencies.
T	Sustainability Coordinator	IoT and analytics for smart, sustainable workplaces.	Prop-tech solution combining sensors and analytics to optimise energy use.

Source: Analysed by the authors (Based on the rank listed in [aeroleads.com](https://aeroleads.com))

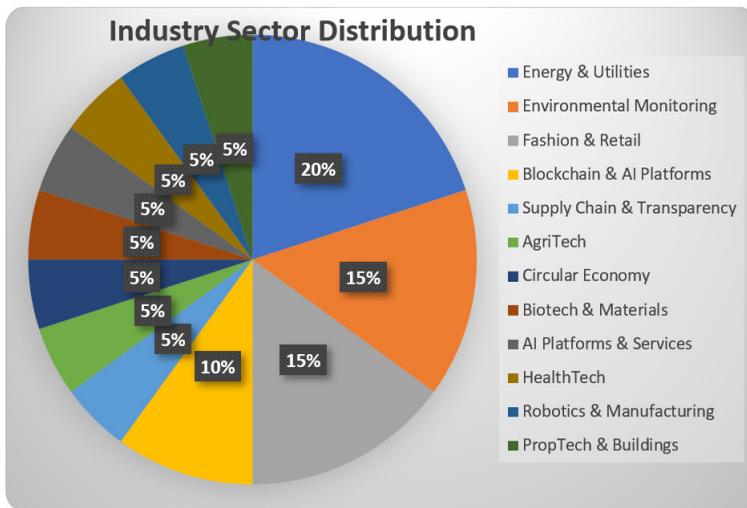
To address the epistemological nature of the TOE theory, a purposeful sample of interviewees has been selected from different backgrounds and confirmed their involvement in leading BMI for their companies. We analysed the interview transcript following an abductive thematic analysis (Christou, 2024).

As explained in Figure 3 and 4, our sample includes 40% large corporations and 60% SMEs. The sample has companies equally distributed into 10 areas of sustainability. 30% of the companies included in the sample achieved  $\geq 100$  m/\$, 55% of the companies achieved middle range economic impact between 99m/\$-1m/\$, and 15% of them achieved  $1m/\$ \leq$ .



**Figure 3: Categorisation of the Research Sample for Company Size and Economic Impact Distribution**

Source: Analysed by the authors



**Figure 4: Categorisation of the Research Sample for Industry Sector Distribution**

Source: Analysed by the authors

## FINDINGS

### Technological Perspective

**Theme 1 - AI for Operational Efficiency and Optimisation:** Many of our interviews confirmed the use of AI for digital monitoring and optimisation as key steps to explore and create BMI. For instance, Company H’s CTO confirmed, “Our digital twin system is not just a tool, it’s the core

of how we optimise heating networks, cut emissions, and remain economically viable in a high-cost energy market.” Similarly, *Company J* employs AI-forecasting to balance energy supply and demand, improving energy grid reliability and reducing waste. “Such precision that we can help utilities prevent overproduction and inefficiency, it’s a game-changer for clean energy grids,” said Director of Innovation, *Company J*.

**Theme 2 - Real-Time Environmental Monitoring and Risk Mitigation:** *Company A* uses AI to monitor remote sensing applications for sustainability. They developed AI-powered satellite monitoring software to enable proactive forest health management, reducing both environmental degradation and operational risks for utility partners. “For us, AI means understanding forest health from orbit, space data helps us stop deforestation before it even begins”, emphasised CEO, *Company A*.

**Theme 3 - Immersive Reality and Virtual Imaginary:** Some of our participants confirmed that AI helps create BM transformation based on the deployment of immersive metaverse platforms. For example, *Company K*, a Dutch NGO turned social enterprise, has adopted blockchain and AI technologies to enable supply chain transparency via a metaverse station for agri-food systems. Their “Trace” platform uses machine learning to verify supplier data and support fair labour practices, linking sustainability impact with consumer engagement. Similarly, *Company B*, a pioneering digital fashion house based in Amsterdam, operates entirely within the metaverse, creating digital-only clothing and fashion NFTs.

Our interpretations of the technical perspective refer to AI-powered technological applications as essential to embed sustainability into their operations, moving beyond traditional eco-efficiency measures. So, “we can argue that the technological part of AI-powered sustainability comes first before the BM elements.” This argument supports the ongoing debate on whether innovation arises from the technological solution or from the transformative value creation, value capture, or value delivery in the BM (Teece and Linden, 2017; Ferlito and Faraci, 2022).

## Organisational Perspective

**Theme 1- Design-Led, Inclusive Leadership Cultures:** Our participants reflected on diverse organisational culture, leadership, and internal collaboration at the core of their AI-powered sustainability transformation. SMEs reflected on the project-based approaches to innovate incrementally rather than via wholesale BM overhaul. This required agile leadership, less control over the project outcomes and a more risk-taking culture. As mentioned by *Company B*’s Creative Director, “We don’t just hire designers, we hire technologists who believe fashion can be zero-waste through AI and metaverse design.” In a large organisation, the founder of *Company D* reflected a companywide communication with a 360-degree approach across departments as well as stakeholders. He said, “Inclusion, sustainability, and innovation aren’t separate things at *Company D*. Our virtual model platform was built by listening to diverse voices, both internally and from the market.”



Our team found out that sustainability SMEs tend to recruit across technological and creative disciplines, supporting the development of digital-first, zero-waste solutions in fashion. Large companies, however, develop training for their IT staff to develop AI agents to run their sustainability solutions in the future.

In large companies, leadership commitment was placed at a higher importance, as highlighted by the Manager of corporate sponsoring at *Company O*. He repeated, “*Our leadership makes sure that AI ventures are aligned with both economic performance and sustainability goals, including B2B procurement innovations for companies like HEINEKEN*”.

In SMEs, the leadership comes from internal champions, as mentioned by the founder of *Company L*, “*the role of cross-functional teams and internal champions for sustainability, consistent with the actions of our company. Such champions tend to bridge between data scientists, system developers, and sustainability practitioners to help us build credibility.*”

**Theme 2 - Bottom-Up Innovation and Agility:** Companies that develop smart robotics showcase how organisational agility and staff empowerment fuel innovation. Internal initiatives led by technical staff resulted in adoption of AI in manufacturing processes, enhancing efficiency. Our participants emphasised that their source of value creation comes from the grassroots front office staff who have direct contact with customers. “*Sustainability solutions were not imposed top-down from Research and Development (R & D), it came from engineers saying, ‘why not automate this and save resources?’* said COO, *Company R*.

Participants from *Company B and D* also asserted their reliance on inclusive, design-led innovation cultures to redefine value creation in digital fashion. Their leadership embraces experimentation and bottom-up innovation to eliminate waste and increase inclusion. These findings uncover the grassroots innovation in sustainability versus the dominant, replicable, top-down approach led by the United Nations, as confirmed by Adisa *et al.* (2024).

**Theme 3-AI Alignment with Business Strategy:** Our participants addressed how companies’ leadership operationalise AI-powered solutions for sustainability by aligning internal tools with client sustainability priorities to reinforce the integrity of their offerings while advancing data-driven innovation. Product Lead at *Company L* clarified that, “*We help fashion brands verify their sustainability claims. But internally, we apply the same rigour, data-driven benchmarks guide how we innovate as a team.*” So, AI-powered solutions need to align with the company’s business strategies as well as strategies for the firms they serve.

The perspective of large companies seemed similar as Managing Partner from *Company O* confirmed, “*Our AI ventures must do more than scale, they must align with our clients’ values. That is why we embed sustainability metrics into all our procurement AI tools.*”

Our interpretation of the organisational perspective shows that both SMEs and large sustainability companies orchestrate their internal capabilities in resource optimisation and communication, amplified by AI.

## Environmental Perspective

**Theme 1 - Supply Chain Collaboration and Resistance:** Our participants pointed out the challenges faced when they develop cross-sector collaboration to extend the sustainability supply chain. Sometimes, they face resistance and different (sometimes conflicting) measures of environmental sustainability (e.g. Zero-carbon versus carbon league table). The CEO of *Company K* said, “*Our biggest challenge isn’t the tech, it’s getting every link in the supply chain to care about data transparency and unified reporting techniques in the first place.*” For sustainability SMEs, the Founder of *Company M* said “*We have proven circularity is possible, but many device manufacturers are still reluctant to take responsibility for their waste. That slows down everything.*” Our findings confirm that supply chain transparency and cooperation in environmental measures remain fragile.

**Theme 2 - Regulatory Influence and Market Readiness:** Our research participants used the iterative push-pull approach of designing environmental regulation. Despite the spread of AI-powered solutions for sustainability, limited initiatives have been reported at a national policy level. Despite the open-door regulations to sustainable innovation, meeting client habits and risk aversion remain barriers and work on a case-by-case basis.

Head of Business Development at *Company I*, confirms that, “*Working with municipalities is complex, but it is where we see real environmental gains. Our smart glass can cut energy consumption in public buildings by 30%*”. To explain the case-by-case principle, Strategy Lead, *Company T* said that “*Our environmental analytics platform helps facility managers make greener choices, but convincing conservative clients to adopt AI is still a tough sell.*”

**Theme 3 - Ecosystem-Level Collaboration and Ecological Impact:** Our participants reflected that the Dutch regulators impose eco-conscious consumption rules in sustainability projects. In *Company N*, “*We design bioplastics with AI, yes, but it’s the changing consumer preferences towards biodegradable goods that push us to market faster,*” said the CTO. They also adopt MX3D’s metal printing to drastically reduce material waste and enable adaptive reuse of resources, aligning with circular economy principles. The company’s technology allows on-demand fabrication, reducing the carbon footprint of logistics and overproduction. In doing so, they create a more advanced ecosystem and generate customers’ preferences and behaviour of sustainability. To have national level ecosystem and wider ecological impact, large companies such as *Company P* asserted that, “*The beauty of decentralised AI is collaboration. We are building a marketplace where sustainability innovators can tap into shared intelligence, not work in silos,*” said the Research Director. Our findings confirm that AI-powered BMI helps companies of all sizes contribute to a national platform for eco-conscious consumption (Dwivedi *et al.*, 2023).



## CONCLUSIONS

In terms of theoretical contribution, our research “*reconceptualises* the interplay between AI and sustainable BMI. It demonstrates how AI, often serve not merely as subsequent enablers but as antecedent forces that actively shape the constituent elements of BMs. This work puts forward the proposition that AI transcends its role as a mere facilitator, emerging instead as a foundational input that informs and structures sustainable value propositions.

In terms of empirical contribution, we offer actionable implications for sustainability executives, company founders, and policymakers. For Sustainability Executives in large corporations, our findings underscore the profound imperative of strategic alignment when integrating AI into sustainability initiatives. The endeavour might transcend the pursuit of mere efficiency gains, necessitating a comprehensive congruence with prevailing client values, evolving regulatory expectations, and clearly defined internal sustainability metrics. As the experiences of leaders at *Company O and I* vividly illustrate, for AI-driven innovations to secure essential stakeholder trust and achieve meaningful market traction, they must be demonstrably measurable, inherently scalable, and deeply interwoven with the organisation’s core mission and values.

For founders of sustainability-focused SMEs, we offer a map for bottom-up innovation and organisational agility based on observations from pioneering firms such as *Company D and L*, effectively leverage the dynamism of cross-functional teams to co-develop sophisticated AI-driven solutions. These solutions are often tailored to meet burgeoning market demands for enhanced traceability, transparency, and inclusivity within value chains.

For policymakers, our research conveys the need for the accelerating of national strategies pertaining to the application of AI in the sustainability domain. While Dutch regulatory frameworks are commendably encouraging eco-conscious innovation, firms continue to encounter significant adoption barriers in a similar context in the region. And the gap is expanding in developing contexts that do not have nationwide legislation for AI-powered sustainability.

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