

The Role of AI in the Transition towards Sustainable Business Modelling

Ivaylo BONEV

Sofia University "St. Kliment Ohridski"

ibbonev@uni-sofia.bg

Abstract. *Based on the growing influence which companies have on environmental challenges, rising social inequality and economic development, the dialogue towards companies' sustainable business model (SBM) transition has risen.*

Largely enabled by the development and availability of big data in line with exponential computational power growth, AI is altering the way companies develop their business models. From machine learning, through autonomous systems, generative AI and big data analysis there are various instruments and applications under the AI umbrella, which represent vast new business possibilities.

The study aims to give a better structure and deeper understanding on the leading AI applications by examining 35 articles on the different roles of AI in companies' transition towards more sustainable business modeling.

As a main contribution, based on the qualitative literature review, this paper generates an integrative framework and classifies the main AI applications in the context of business model innovation. The paper maps each application in 3 directions: SBM dimension (ESG); typical business application relevant to SBM and potential BM role.

This research acknowledges significant limitations based on limited literature and fragmented work in this field despite the importance and widespread application of AI, but also opens vast possibilities for future scientific work in the area of AI application towards SBM transition.

Key words: Artificial intelligence, sustainability, business model, transition, application, innovation.

Introduction

The first structured definition of sustainability defined by the United Nations' World Commission for Environment and Development in the well known Brundtland Report and the topic "Our common future". Published in 1987, the report gives one of the first clear definitions for sustainable development - "*Humanity can make development sustainable to ensure that it meets the needs of the present without compromising the ability of the future generations to meet their own needs*".

In the beginning of the 90s' with the Rio conference (1992) and Kyoto Protocol (1997), the conversation on sustainability reached a pivotal moment with the signing of the Paris Agreement in 2015 and the launch of 17 Sustainable Development Goals, part of the Global Sustainability Agenda 2030.

As a next step towards sustainable development, the European Commission and Council introduced the *Environmental, Social and Governance* (ESG) factors as founding principles for companies to make their transition towards a more sustainable way of doing business. Widely recognised by organisations and examined by researchers (Martiny et al., 2025; Bond et al., 2025; Edmans 2024; Giglio et al., 2025), the ESG factors, brought a clear message to how companies conduct business in relation to the: Environment (how business decisions reflect on the environment), Social (addressing working conditions, rights and well being of the employees) and Governance (how decisions affect vast circle of shareholders and business development in general).

With the fast development of AI technologies in the last decade, many researchers, government and business organizations find great opportunities which AI will unlock towards a more sustainable future (Al-Emran et al., 2025; Kanbach 2024; Sjodin et al., 2023) . This article is developing a critical view on the AI's potential roles towards companies' sustainable business model transitions. Rather than assuming AI as a leading force of sustainability, it gives a broader perspective on the potential which AI might bring. Such an approach allows for a more realistic assessment of AI's potential and limitations, particularly in the context of business operations.

Business model innovation

Morris et al. (2005) describe business model (BM) as “*related set of decision variables in the areas of business strategy, architecture and economics are addressed to create a sustainable competitive advantage in defined markets*”. A business model gives a company the structure and the processes on which the strategy is based and the actions evolve towards creating and delivering value for its customers Osterwalder et al. (2005). Widely recognised framework for business modeling developed by Osterwalder and Pigneur focuses on 9 main segments (figure 1 below).

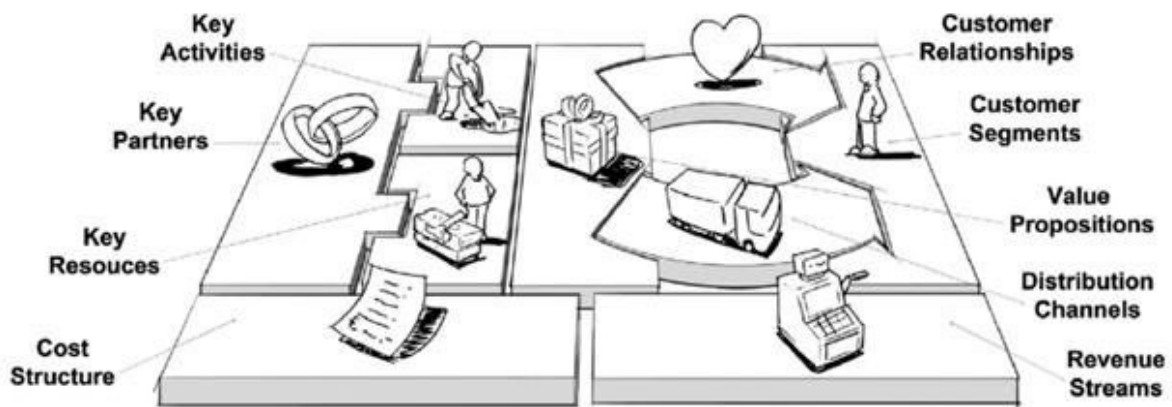


Figure 1. Business Model Canvas

Source: Osterwalder & Pigneur 2009.

Geissdoerfer et al. (2018) created a detailed description of a sustainable business model “*we define sustainable business models as business models that incorporate pro-active multi-stakeholder management, the creation of monetary and non-monetary value for a broad range of stakeholders, and hold a long-term perspective.*”. Elaborating further the researchers also stressed on the important fact that pushing companies towards altering their business models and developing new processes based on analysing big data, implementing new instruments and taking under consideration various factors, can lead to failure of an already working system.

With the rapid development of more narrow AI instruments in the last 5 years, many organizations recognise the vast pool of opportunities which this technology can bring and support their business operations “*creates competitive advantage through superior customer value and contributes to the sustainable development of the company and society*” (Lüdeke-Feund 2010).

Creating a sustainable business model that can not only serve for creation of wealth but also create value for the society and environment (Bocken et al., 2013) is already not only possible but imperative for companies to move forward in the rapidly changing and competitive business environment.

Artificial Intelligence development

With the paced development of general Artificial Intelligence (AI) based technologies in the last decade AI might bring a pivotal change for a new way of structuring the whole process of doing business. AI technology already disrupts the whole value chain from marketing, through communication, production, delivery and customer relations. However, despite increasing enthusiasm surrounding AI applications for sustainability, the literature remains fragmented, and the actual role of AI in facilitating sustainable business model transitions remains unclear. As presented in table 1 below, AI has three main development stages towards human-like capabilities and task performance.

Table 1. Development stages of Artificial Intelligence

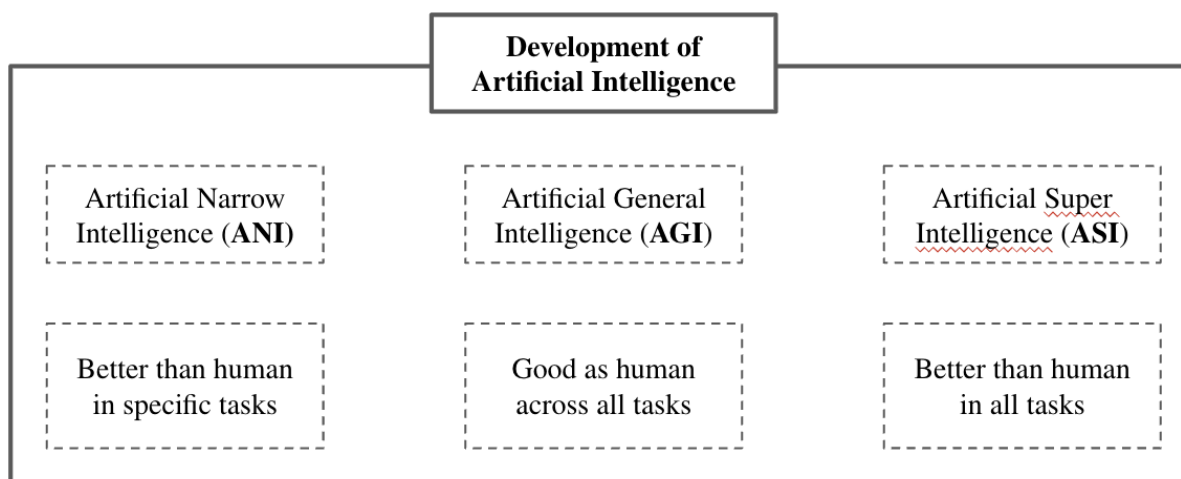


Table 1: Authors' own work.

The rapid progression of AI in terms of performing capabilities is surprising and the last annual AI index report by Stanford University (figure 2 below) shows a much faster closing gap from ANI stage of development towards AGI stage than anticipated.

Select AI Index technical performance benchmarks vs. human performance

Source: AI Index, 2025 | Chart: 2025 AI Index report

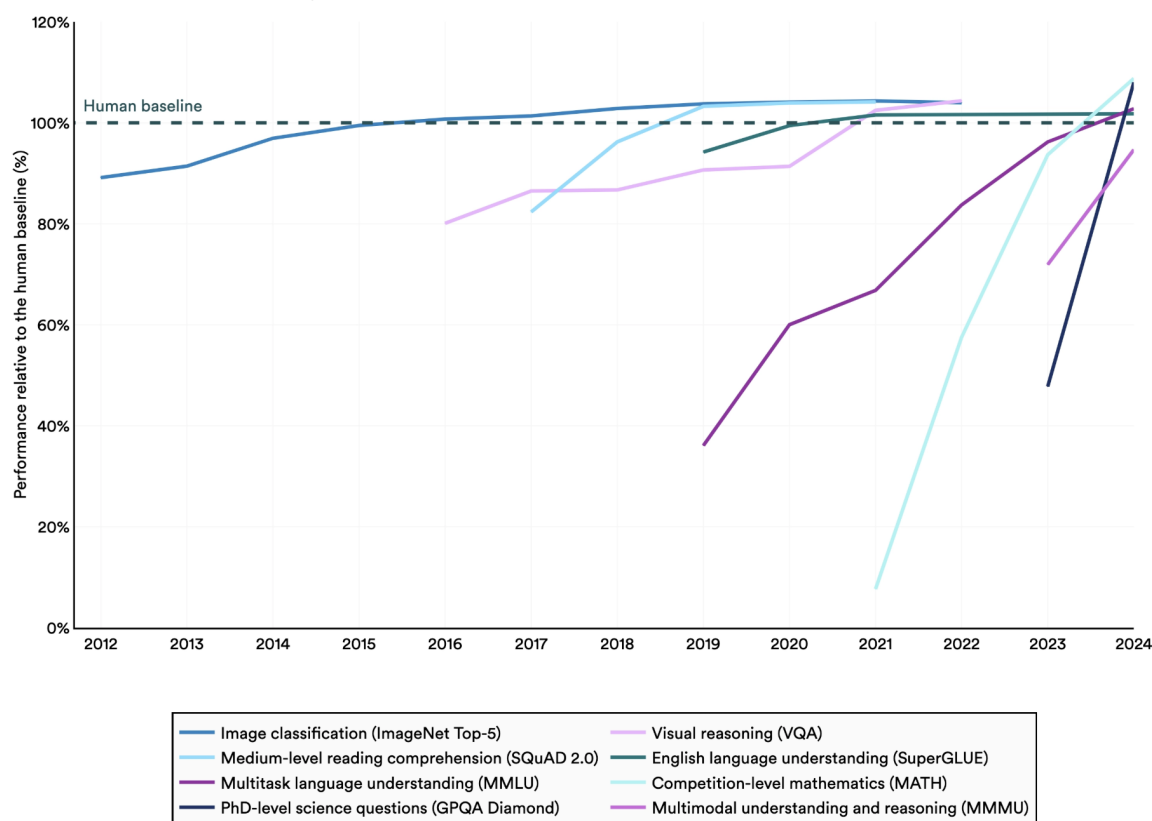


Figure 2: AI performance benchmark vs. human performance capabilities

Source: Annual AI Index Report 2025, Stanford University.

Unlike the huge pace in AI applications' advancement many concerns have been addressed in relation to safety and applicability of AI tools. Various initiatives such as the last annual AI Safety Index Report (2025) issued by Future of Life Institute give warning evidence that most companies underperform in terms of risk assessment, safety framework regulations and essential safety. These safety issues led to active governance legislation work and emerging initiatives towards regulation documents such as: *The EU AI Code of Practice* and *California's SB53 Act*. The EU AI Code of Practice consists of three separately authored chapters: Transparency, Copyright, Safety and Security, originally developed by independent experts as a voluntary tool with the general goal to support industry with the AI Act's obligations for providers of AI general purpose models. Meanwhile, at the end of 2025, California ratified the first US AI law. The law introduces "protections for whistleblowers inside AI labs, mandatory reporting of certain safety incidents, and requirements that large developers... manage to explain how they plan to mitigate catastrophic risks."

Artificial intelligence is a complicated technology with various applications and vast possibilities for business entities. Based on the qualitative literature review, the first part of this paper gives a better understanding on the importance of sustainable transition and richness of AI applications with the main goal to bring clearance and better understanding for the possibilities which companies could explore towards transforming their business models. The second part

summarizes main results and acknowledges major limitations of the paper with possible opportunities for future research.

The research paper tries to answer two main research questions:

RQ1: *What roles can different AI technologies have for companies towards their SBM transition identified in the literature review?*

RQ2: *Based on the qualitative synthesis to what extent does AI appear as a transformational tool versus a supportive tool?*

In order to answer the research questions, in the *Results and discussion* section, this paper creates two tables with focus on AI technologies and their potential implementation in business entities towards sustainable business transition. Table 3 gives a better understanding on the general AI capabilities and BM application, while table 4 introduces an integrative framework in relation to ESG. Lastly, the paper tries to give rather experimental labeling on the potential which different AI applications have for a companies' business transformation.

Literature review

As mentioned above, the early conceptualization of sustainable business models focuses on the integration of environmental, social and governance value creation as a leading fundamental instead of purely CSR activity. Building on the Triple Bottom Line perspective (Zechiel et al., 2024; Bahaw 2025;), SBMs are commonly understood as configurations of value proposition, value creation, and value capture that generate positive or reduced negative impacts across multiple stakeholder dimensions (Lüdeke-Freund (2010); Bocken et al. (2014); Geissdoerfer et al. (2018).

Di Vaio et al. (2020) made a deep research on the intersection between AI and sustainable business modeling by gathering data from 73 publications. The paper tries to measure the influence AI applications such as Machine Learning and Deep Learning can have in relation to the Sustainable Development Goals (SDGs) outlined in the UN Agenda 2030, particularly SDG 12 on responsible consumption and production. The authors argue that AI can enhance sustainability by improving data availability, predictive and decision-making accuracy across logistics, and resource management. At that time the researchers underlined the fact that many articles are being conceptual rather on practical company level.

Focusing on the development of AI and sustainable business models, Sharma et al. (2025), made a systematic review of over 170 academic publications, identifying a rapid expansion of research on AI-driven sustainable business model innovation. Their findings underline the issue of fragmented literature and focus mainly on the linkage between AI and business models, while sustainability being relegated to a secondary position. In addition the paper offers an integrated view of AI and SBMs representing main triggers, restraints and management organisational issues for application of AI in companies BMs. Furthermore, the authors highlight persistent gaps in understanding the mechanisms through which AI contributes to sustainability outcomes, as well as a lack of contextual sensitivity, regarding small and medium-sized enterprises (SMEs).

Similarly, Khan et al. (2025) synthesize research on AI-driven business models for sustainability, suggesting that such applications (*Machine Learning; Deep Learning*) mainly find their best fit in data-centric business operations where collection and analysis of big databases are pivotal. Personalisation, resource optimisation and automation support mostly retail industries and could have an essential impact. Marking the importance of *Multi-Agent Systems* in real time decision making towards the enhancement of SBMs. The paper raises awareness that this type of literature often presents AI as a general-purpose technology capable of generating efficiency gains

that indirectly support environmental objectives. Yet, such efficiency-oriented AI' application risk mixing operational optimization with genuine business model transformation, thereby overstating AI's transformative potential.

A growing body of empirical research explores how AI contributes to sustainable business model innovation in specific organizational contexts (Corcoran et al. 2024; Lee et al., 2019; Atkova et al., 2025; Das 2023). Jorzik et al. (2024), investigates how green technology startups apply AI applications altering their business model towards more sustainable and environmental impact. Developing a three-element framework with focus on archetypal connection between AI application, BMs and environmental impact, the paper brings to light 9 cases of startup companies based on semi-structured interview and open ended questions, which give a valuable perspective. However, this line of research primarily focuses on only 9 technology-driven startups, which limits its generalizability to more traditional SMEs operating under tighter financial and organizational constraints.

This research paper extracts information from important AI reports developed by Stanford University and The Future of Life Institute with focus on AI safety and development. Both reports prove to be valuable sources of up to date knowledge following the latest AI trends in 2025, however used with a critical view, perceived as gray literature.

The SLR (summarised in table 2 below) mostly opens the perspective that AI's contribution to sustainable business models depends on many additional factors in a company such as: managerial capabilities, organizational culture and governance structures. In many cases ethical considerations also play a role and many decision makers still have massive reserves. AI is thus positioned not as a deterministic factor for sustainability, but as a contingent factor whose effects vary depending on context and implementation.

Table 2. Qualitative narrative literature review

Paper	AI use application	Application Category	SBM Relevance/Role
4, 16, 22, 27, 35, 36, 37	<i>Machine Learning</i>	Solving complex problems Improve efficiency Forecasting	Predictive maintenance for resource efficiency Supply chain risk analytics
1, 25, 2, 35	<i>Deep Learning</i>	Work with large datasets Complex pattern extraction	Smart grid optimization Industrial process optimization
8, 24, 37	<i>Generative AI</i>	Content generation (text, design, simulation) Design optimization	ESG report drafting Building brand identity Lowering content production costs
25, 27, 36	<i>NLP</i>	Text analysis Information extraction Automated reporting	Regulatory Compliance monitoring
22, 25, 37	<i>Computer Vision</i>	Image recognition Object detection Real-time monitoring	Infrastructure monitoring Quality inspection to waste sorting & reduction

Table 2: Authors' own work.

Methodology

The research was conducted through qualitative methods accessing scientific articles at ScienceDirect and structured search of information through databases: Scopus and Google Scholar, with the main goal to accomplish qualitative synthesis of the reviewed papers.

The main key words combined for gathering the information were: *sustainability* (OR *sustainable*); *business model* (OR *business modeling*); *artificial intelligence* (OR *AI*); *sustainable transformation* (OR *transition*); *business model innovation*; *AI application*;

Many research papers focus on particular domains such as: electric vehicles; coal industry or circular economy, which makes it more complicated to clearly use the papers in a general perspective. An overall poll of 92 articles were under revision, with 57 articles not represented in this research, after reviewing the abstract and full paper. These articles were not included mainly due to either narrow article topic, repetition, local out-of-scope focus or not good correlation between SBM & AI. Table 2 below represents the PRISMA flowchart towards chosen literature.

Table 2 The PRISMA flowchart

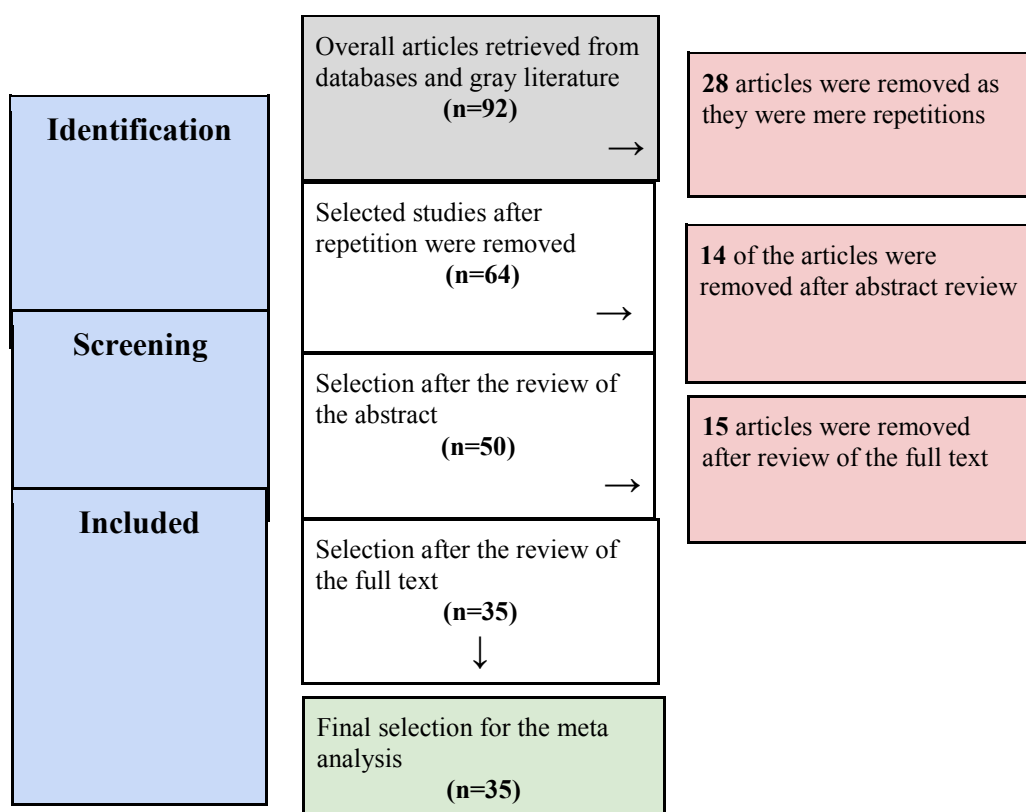


Table 2: Authors' own work.

After the revision, 35 articles become a subject of this research, separated in three main groups:

- 6 articles with focus on sustainability (more broad time frame of articles 2000-2025)
- 13 articles on business model innovation/transition (less broad time frame 2010-2025)
- 16 articles on AI applications and implementation (only articles in the last 10 years - after 2015)

Based on the research, the paper was structured in three section:

- presenting the context and importance of sustainability and BM transformation
- the possible roles of AI towards business model transformation
- structuring the main AI application and their potential implementation in companies' sustainable business models

Two major reports, both published in 2025, were used as additional information for mapping of trends in AI usability, development and safety but with the clear understanding that these reports might be biased and should only be applied with a critical view:

- AI Index Report created by Stanford University (Human-centric AI department)
- AI Safety Index Report by Future of Life Institute

Research limitations

Conducted on the SLR of 35 articles, this research opens the discussion and suggests that future research should explore AI's role in BM more deeply by integrating interdisciplinary perspectives. It highlights the need for more empirical studies on AI-driven innovation and its long-term effects on business strategies, particularly in emerging areas such as generative AI and circular economy models. The SLR exposes further need for deeper research and information on the unrepresented micro and SMEs companies.

3. Results and discussions

With all the excitement and optimistic perspectives which AI technology brings in the last years, the implementation of AI technologies is neither easy nor only positive in the business context.

With many opportunities available for companies the biggest challenge is the lack of internal knowledge base. Many business leaders already see the potential of the technology but stay hesitant on the implementation of AI applications, mostly seeing it as a “*key barrier...the widespread lack of expertise needed to deploy AI technologies effectively*”. (Sharma et al., 2025)

In order to address such hesitation towards AI applicability in many business leaders, this study employs a qualitative content analysis and tries to give a better understanding on the AI technologies and their potential towards business model application. Table 3 below clarifies the taxonomy based on the literature review and represents 5 AI technologies in the context of business model innovation. Displaying the AI technologies in 3 main levels: *General capability; SBM application and BM mechanism*.

Table 3. AI Technology mapping related to SBM

AI Technology	Machine Learning	Deep Learning	Generative AI	NLP	Computer Vision
<i>General Capability</i>	Pattern recognition & forecasting Anomaly detection Data-driven optimization	Data processing Complex pattern extraction Autonomous feature learning Image data interpretation	Content generation (text, design, simulation) Design optimization Knowledge synthesis/visuals Lowering content production costs	Text analysis Information extraction Automated reporting Customer engagement	Image recognition Object detection Real-time monitoring

AI Technology	Machine Learning	Deep Learning	Generative AI	NLP	Computer Vision
<i>SBM Application</i>	Energy demand forecasting Emissions prediction Predictive maintenance for resource efficiency Supply chain risk analytics	Smart grid optimization Climate modelling Industrial process optimization Satellite-based environmental monitoring	Sustainable product design (eco-design support) Decarbonization pathway simulation SG report drafting Building brand identity	ESG disclosure automation Regulatory compliance monitoring Stakeholder sentiment tracking	Automated waste sorting Deforestation tracking Infrastructure monitoring Quality inspection to reduce waste
<i>BM Mechanism</i>	Supports efficiency-oriented sustainability, mainly by pattern recognition, optimal energy use, and operational inefficiencies.	Environmental monitoring, emissions tracking. Smart grids, energy optimization and big data analysis.	Sustainable product design Innovation ideation. Simulation of sustainability scenarios.	ESG and sustainability report analysis Stakeholder communication Regulatory monitoring.	Pollution detection Recycling optimization Safety and compliance monitoring.

Table 3: Authors' own work.

Machine Learning and Deep Learning find their best application within working with a big set of data and not only find patterns but also learn from the information in the data set without specifically being programmed. Deep learning as a subset of machine learning is based on multiple neural networks on multiple levels very efficiently with big databases and complex pattern extraction. These applications are very good with energy consumption prediction, predictive maintenance and complex anomaly detection. Both applications have massive relevance to full business model redesign and business model structure, optimisation processes and efficiency.

Generative AI (GenAI) is an application capable of generating pictures, videos and design materials. Mostly applied as a supportive tool in terms of generating creative materials. In relation to SBM application mostly applicable towards enhancing brand identity and sustainable product design.

Natural Language Processing (NLP) is an application vastly known by users and smart-talking gadgets such as Alexa, Siri and Echo or chatbot assistants, an application which can understand, analyze and perform human language. This application still has a supportive role in the SBM transition for companies enhancing transparency and reporting, but nevertheless very useful in terms of sustainability report analysis, ESG disclosure automation and regulatory compliance monitoring.

Computer Vision (CV) has already altered business context in terms of safety, regulations, environmental monitoring and waste control. An application which interprets visual data and in relevance to SBM transition has the potential to enhance efficiency, quality inspection, waste management and safety.

In order to create real practical value the paper tries to give further practical information on the possibilities for companies to implement AI technologies in their BM transition towards sustainability. Table 4 below introduces an integrative framework in the context of business model

innovation. It maps each application in 3 dimensions: *SBM dimension (ESG)*; *BM component (Value: Preposition / Creation / Capture)* and *potential BM role (supportive vs transformational)*.

Table 4: Integrative framework - AI Applications related to SBM

	Machine Learning	Deep Learning	Generative AI	NLP	Computer Vision
<i>SBM Dimension (E/S/G)</i>	(E) Better waste management and carbon footprint reduction (E) Production planning as circular economy (E) Measuring environmental impact and resources allocation (S) Enhancing operational efficiencies - supply chain (S) Maximizing profitability in business - collaboration across departments	(S) Analysis of customers' behaviour - leads to engagement and personalisation (purchasing habits, demographics) (S) Analysis of customers' feedback and product usage (S) Building brand loyalty (G) Complex pattern detection in financial misconduct (G) Advanced risk scenario modelling	(E/G) ESG reporting & scenario simulation (S) Stakeholder communication visuals (S) Building brand identity	(S) Employee feedback analytics (E) Automated extraction of emissions data from reports	(E) Automated waste sorting (E) Smart agriculture monitoring (S/G) Workplace safety monitoring (S/G) Crowd risk detection (S/G) Infrastructure quality control (E/G) Environmental violation detection
<i>BM Component (Value: Preposition / Creation / Capture)</i>	Value creation	Value creation/capture	Value preposition capture	Value capture	Value preposition creation
<i>BM Role</i>	Often linked with efficiency enhancement and processes. Potential to significant business model redesign.	Optimization of processes and efficiency based on big data analysis. Potential for a big impact on business model structuring.	Mostly supportive role in terms of brand enhancement, improved design and cutting time frame.	Mostly supportive or symbolic, enhancing transparency and reporting rather than transforming core value creation.	Primarily operational, supporting monitoring and control for better process efficiency and safety.
<i>transformative vs supportive</i>	<i>transformative</i>	<i>transformative</i>	<i>supportive</i>	<i>supportive</i>	<i>supportive</i>

Table 4: Authors' own work.

Transformative vs Supportive role of AI

The “Transformational vs. Supportive” label was derived from the analysis of the articles and the fundamental structure which each AI application brings for business entities. While (Di Vaio et al., 2020; Sharma et al., 2025; Khan et al., 2025) acknowledge the fact that ML and DL might have transformative role in their research papers, it is important to be stated that operational efficiency however possible to be mistaken as transformational in a company, nevertheless have the potential to be considered as such due to high potential for better planning and BM redesign.

On the other hand, (Corcoran et al., 2024; Lee et al., 2019; Das 2023) argue that even though AI roles can vary, GenAI, NLP and Computer Vision have mostly supportive role based on the level of application and unfolded potential in the last 5 years. Nevertheless, these applications might unlock much broader applications in the near future based on developing internal capabilities in companies. Furthermore, based on table 3 classification of SBM application ML and DL show greater potential to have rather transformational roles vs GenAI, NLP and CV in terms of task execution and level of impact which these potential applications might have on the companies’ business model.

Nevertheless, it is important to be stated that such labeling is rather experimental and mostly a first step towards much more detailed and data based research on AI application and their impact towards business model transformation in companies.

4. Conclusion

Artificial intelligence represents a variety of technology applications from machine learning and natural language processing to multi-agent systems and generative systems. While these technologies can support companies’ transition towards sustainable business models, their contribution to sustainable business model transformation remains largely indirect.

This research determines 5 main AI technologies and gives a better understanding on their main capabilities and application possibilities in relation to SBM transition. In order to give a practical tool for decision makers, the paper creates an integrative framework for better understanding and application in business context.

In relation to the ESG framework, AI technologies have the potential to address production planning, better waste management, carbon footprint reduction and support measurement and analysis of customer behaviour and product usage in relation to Environmental dimension. From a Social perspective AI could optimize operational efficiencies, production and storage, build brand identity and support workplace safety monitoring, while in Governance dimension AI could add value through detecting complex patterns and environmental violations.

Various external and internal factors such as: organisational structure, strategic readiness, regulatory papers and market tendencies, play a pivotal role towards sustainable business modeling transition and confirm that it is a complicated process with a need for a more holistic approach. As the research displays, AI technology has mainly a supportive role in the SBM transition and it is to be shown in the near future how this process will change with the advancement of the AI technologies.

The literature review made by this paper brought as a key takeaway that many of the existing research papers focus on digital platforms, big industry firms or tech-startups, leaving SMEs underrepresented despite their central role in most economies, which could be seen as a certain limitation and needs to be addressed in future research.

There is a need for more context-sensitive research that examines AI application at companies in co-existence to additional internal and external factors, but not as a dominant driver of sustainable business model transformation.

As already mentioned above, safety and environmental issues are being addressed by researchers (Safety and AI Reports) within AI infrastructure questioning the narrative for “green AI” and highlighting potential issues with the implementation of AI technologies for a better sustainability business model opening the field for future research.

With considering the limitations stated above and the mostly theoretical work, this paper attempts to provide a practical framework for decision makers in order to better understand the possibilities which AI could bring for their companies in transition towards SBM without undermining the surrounding factors in business perspective.

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