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Uncertain Supply Chain Management

homepage: www.GrowingScience.com/uscm

Developing brand sustainability strategy using AI as a powerful tool in auto industry

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A B S T R A C T

Manufacturers employ AI for monitoring vehicle mileage, inspecting components, and scheduling maintenance. Past studies underscore the need for auto-related plans to prioritize environmental protection, concentrating on AI-driven environmental solutions promoted by AI for Good. AI enhances brand success by improving investment, technology, and promotional capabilities. This study emphasizes consistency in AI application across the automotive value chain for brand sustainability. A web-based poll surveyed 120 AI users in marketing, HR, sustainability, as well as 180 sustainability specialists and regulators. The primary goal is to assess, via structural model evaluation, how extraneous variables affect the development of AI-powered brand sustainability strategies. The study highlights AI's sustainability benefits in the automotive industry improving transportation safety, forecasting maintenance, and creating eco-friendly vehicles. However, challenges involve over-reliance on AI, predicting human behavior, and addressing sustainability threats. AI development should consider regional differences, prioritizing openness, policy harmony, and consumer agency. These findings aid marketing and HR professionals in devising customer-centric long-term plans.

Article history:
Received June 22, 2024
Received in revised format July 26, 2024
Accepted September 30 2024
Available online
October 5 2024

Keywords:
Brand
Innovations
Behavior
Artificial intelligence
Manufacturing
Automotive
Sustainability
Predictive maintenance
Customer engagement
Industry

1. Introduction

Virtual sensor technology in the automotive industry is transforming production, reducing costs, and promoting sustainability. By 2030, automotive value will largely consist of software and content. The advent of AI has marked a watershed moment for the automotive sector. Supply chain management enhanced expenses decreased. Production efficiencies are increased. Regarding improving road safety and increasing productivity, nothing beats using artificial intelligence (AI) to power self-driving machines and sophisticated driver assistance systems. The technology enables data collection that would be impossible with a standard automobile. A digital sensor might evaluate the tire's tread depth. A second digital sensor to predict when a certain pair of tires must be replaced can then use this data. Predictive maintenance adoption will be aided by technological advancements, resulting in a win-win situation for both the service provider and the customer (Adwan & Aladwan, 2022). AI-based brand-sustainable techniques offer considerable prospects in brand management, including precise consumer demand capturing and ethical obligations consideration. However, the tried-and-true methods that have been the subject of so many studies have become outmoded, and more investigation into the pros and cons of AI development in brand marketing is required. Artificial intelligence can help the car sector build long-term plans for success, resulting in more eco-friendly practices and higher output. However, implementing an AI-driven brand sustainability strategy in the automotive business can take time and effort. The Automotive Sustainability Assessment Model can be used to encourage environmentally sound decision-making and achieve concrete sustainability targets set by the industry. With the help of the Automotive Sustainability Assessment Model, major automakers may make nuanced and numeric decisions on sustainability. There is a need for strategies to improve energy efficiency in automotive manufacturing plants because energy and emissions are the most critical sustainability problems. To develop an AI-driven brand sustainability strategy, research on AI and sustainability practices

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ISSN 2291-6830 (Online) - ISSN 2291-6822 (Print)

doi: 10.5267/j.uscm.2024.10.008

must analyze the effect of and relationship between key components. This calls for further, more precise research. The study aims to fill this gap (Al Adwan & Altrjman, 2023).

Recent studies on the application of AI in the car industry have focused chiefly on finding ways to improve the sector's environmental footprint (Wagh, 2021). There is still a need for improvement in the automotive industry's use of AI to create brand sustainability strategies. Recent research and newly released auto industry solutions demonstrate that AI has become deeply embedded in the automotive sector, from R&D to manufacturing to quality control to the assurance of environmentally responsible business practices. However, artificial intelligence's role in developing a long-term strategy for the automotive sector must be considered. Companies should prioritize environmental protection. Employees, investors, communities, legislators, and clients all necessitate this. To do this, businesses invest in data-driven solutions, technology, and strategies for reducing their adverse effects on ecosystems and people. The so-called Data for Good or AI for Good movement emerged in response. Because of the growing importance of environmental responsibility, artificial intelligence (AI) and data-driven projects will comprise a sizable portion of most firms' IT budgets shortly. Using the word "crucial" because if the business world does not progress toward (profitable) sustainability, it will face strategic, operational, financial, and reputational threats. However, advancements have made more work needed to adequately address, quantify, and report on successes. The question of whether artificial intelligence and data can assist in establishing a brand sustainability strategy utilizing AI as a potent tool in the auto sector needs more detail. This question is broken down into sub questions that the study aims to address.

1. How can the automotive industry respond to sustainability challenges?

2. What segments and essential areas help establish a viable automotive AI strategy?

3. What role can AI play in developing sustainable strategy, its implementation and monitoring?

An evaluation of the influence of variables on AI-powered brand sustainability strategies is conducted through a survey of 120 AI users in the automotive sector using structural model assessment, with benefits like improved safety and eco-friendly vehicles, and also highlights sustainability and policy challenges.

2. Literature review

Several key distinctions between AI-based brand-sustainable strategy and established brand-sustainable strategy have emerged from the research. Artificial intelligence can improve brand marketing and long-term plans by accurately capturing consumer demand and portraying consumer groups (Cui et al., 2022). AI offers tremendous opportunities in Brand Management. Various AI technologies, such as intelligent ads and automated customer support, which can be presented through a model, might aid brand management (Wasiq et al., 2023). Not only that, the model can help consider a company's ethical obligations while employing AI for marketing and sustainability. This demonstrates that incorporating AI into company strategy formulation will need more than simply some time. However, to get ahead of the competition and keep your Brand's reputation intact, remember that traditional approaches are obsolete (Păvăloaia & Necula, 2023). This allows the researcher to focus more on the effects of artificial intelligence on brand marketing and sustainability. In particular, for women and items aimed at adults, it found that AI-enhanced products with autonomous environmental advantages could affect purchase intent (Frank, 2021). Therefore, the benefits and drawbacks of AI advancement in brand marketing must be further examined in future studies, along with the necessity of investment, core technology, and marketing skills (Păvăloaia & Necula, 2023). As a whole, the potential for improved brand marketing precision using AI-based brand sustainability strategies is obvious. Businesses must adjust to the evolving nature of marketing to stay competitive. Therefore, researchers need to study how AI-improved brand marketing management can help brands grow sustainably at the end. In the auto business, AI can create long-term plans for success. According to Lukin's research, top automakers successfully implement sustainability initiatives and reach most of the United Nations' sustainable development objectives (Lukin et al., 2022). A framework for a fully automated intelligent automobile manufacturing industry, which makes use of Federated learning intelligence (FAI) for decision-making and Smart Contract (SC) policies for process execution and control, can play a significant role in sustainability (Farisyi et al., 2022). Introducing artificial intelligence (AI) can lead to significant improvements in maintenance and fleet management systems (Menyhárt, 2019). Menyhárt's articles imply that AI can create environmentally friendly methods and boost productivity and dependability in the automotive sector. However, the auto industry's need for a brand sustainability plan powered by artificial intelligence can be challenging and requires further study for a more practical plan to be forwarded. Multiple considerations require attention. Current research lacks determining what considerations should be made when creating an AI-powered brand sustainability strategy, despite its rising applicability in the automotive industry for building sustainable practices. The impact and connection of the most essential and relevant elements in creating an automotive sustainability plan must also be examined. To improve its sustainability performance, the automotive industry must establish concrete sustainability targets. The Automotive Sustainability Assessment Model can create to promote environmentally responsible decision-making in the automotive industry (Uemura Reche et al., 2020). The model can convert a wide range of non-economic impacts into dollar figures. Making complicated and diverse sustainability decisions is possible for large automakers by evaluating possibilities, identifying win-wins, and optimizing trade-offs (Uemura Reche et al., 2020). Following government policies, researchers in another study (Rubio et al., 2020) provided an algorithm to improve

the efficiency of internal combustion engine automobiles. Lukin surveyed the top five automotive companies and found that industry leaders are successfully adjusting their operations to meet the demands of the modern business environment and achieving many of the United Nations' sustainable development goals through their sustainability initiatives. Energy and emissions listed as the most pressing sustainability challenges (Kørnøv et al., 2020), (Johnstone et al., 2021). UK rules and ISO standards related to the automotive sector describe methods to boost energy efficiency in the sector's production facilities to reduce carbon output and create automobiles with minimal or no emissions (Johnstone et al., 2021).

Numerous advantages can accrue to businesses because of sustainable branding. There exists a market gap and a potential for sustainability positioning for container shipping companies that position their businesses closer to social sustainability (Ashrafi et al., 2020). Sustainability reporting positively correlates with brand value, implying that more transparency results in a more valuable brand (Farisyi et al., 2022). CSR also found to benefit a company's reputation and brand image, affecting consumers' perceptions of satisfaction and the spread of favorable reviews (Chiang et al., 2021). As a result, sustainable branding can boost a company's credibility, its standing in the market, and the loyalty of its patrons. Brand co-creation, CSR, good communication, and CRM are all strategies the research proposes to integrate sustainability into a company's identity. There are two routes to consumer brand commitment: utilitarian and symbolic connotations of social responsibility (Ferramosca & Verona, 2019). A business-to-business manufacturer's brand reputation and financial success might benefit from adopting environmentally sustainable practices, as shown by Vesal et al. (2021), especially when combined with efficient customer relationship management and cooperating with business clients with favorable environmental attitudes. Embedding sustainability into a company's identity calls for a comprehensive strategy that considers the Brand, the consumer, and the industry.

There are opportunities and risks in incorporating sustainability into an automotive company's brand identity. The shift to sustainable businesses needs to be improved by a lack of consensus on sustainability, a failure to delegate responsibilities, and an absence of quantifiable sustainability goals (Wolff et al., 2020). According to a study, eco-friendly car companies can benefit from consumers' reverence for the natural world and their environmental assets (Timokhina et al., 2020). To help the car industry become a sustainable leader, a sustainable supply chain management (SSCM) implementation methodology can help (Chiang et al., 2021). The papers all point to the need for a thorough comprehension of sustainability, quantifiable goals, and a concentration on SSCM to guarantee supply chain transparency and sustainability as essential elements in integrating sustainability into a vehicle company's brand identity. Firms must spread the word about their sustainable efforts. Although there are some obstacles and restrictions, AI can help spread the word about sustainable efforts. While artificial intelligence (AI) can help derive sustainable practices and environmental governance (Nishant et al., 2020), this study needs to be improved on its reliance on historical data and the unpredictability of human behavioral responses. However, research shows that AI has the potential to achieve several SDGs. However, transparency, safety, and ethical standards must be maintained, and this is where regulatory knowledge and monitoring come in (Vinuesa et al., 2020). According to research, AI has the potential to change people's implicit knowledge of cooperative dynamics, leading to greater collaboration on public benefit projects (Nikitas et al., 2020). Putting scientific findings in the context of the audience's values and goals makes them more applicable. The research analyzed here shows that AI can help spread the word about sustainability efforts. However, it must be utilized openly, in a way that is meaningful to the audience, and in a way that is consistent with the values and goals of that audience.

Using AI, companies may boost their client retention rates. To improve the results of their online customer engagement behaviors, businesses and their clients can use information-processing systems powered by artificial intelligence, as proposed by Perez-Vega's research (Perez-Vega et al., 2021). Customers still choose to talk to a natural person when they need help, but AI can improve their experience (Prentice & Nguyen, 2020). Integrative suggestions for consumer participation in automated service encounters offered in a study investigating the overlap between artificial intelligence and human contact (Hollebeek et al., 2021). Information quality and customer happiness are related. However, the choice of AI services moderates this link (Prentice & Nguyen, 2020). When used correctly, AI may help organizations better engage with their customers. Researchers stress the importance of combining this technology with human connection to deliver the best possible service to customers. Customer loyalty can foster and enhance through the application of AI in several ways (Adwan et al., 2021). These include data analysis, service quality enhancement, and empathetic service recovery (Mustak et al., 2020; Chen et al., 2021). AI may also increase the personalization of services and information, increasing customer satisfaction and support throughout the customer journey (Moura et al., 2021; He & Zhang, 2022). Empathetic brand-consumer relationships facilitated by AI can boost the efficiency of one-on-one brand communications (Haleem et al., 2022). Artificial intelligence (AI) can make negotiating price cuts in procurement easier through mechanism design. The studies propose that AI can improve the consumer experience and negotiate better car prices (Schulze-Horn et al., 2020). When the auto sector collaborates with AI-powered mobility systems, it can help the planet. To reduce carbon footprints, Cruz and Sarmento (2020) proposed Mobility-as-a-Service (MaaS) as a potential option. Sharing autonomous electric vehicles has the potential to save costs and maintain service levels, according to another study (Dlugosch et al., 2022). Nikitas presents a theoretical framework that locates the integration of automation, connectivity, electric conveyance, collaborating, and multiple mediums confluence (Nikitas et al., 2021) for car automation to realize its environmentally friendly and resource-saving potential. The research summarizes that by encouraging MaaS, shared, autonomous electric vehicles, and clean engine fuel sources, the auto industry and AI-driven mobility platforms may improve sustainability. Based on the analysis of vast volumes

of sensor data, the studies conclude that AI can aid in predictive maintenance in the automotive industry. Pech presents a survey of the research on predictive maintenance in the automotive industry, covering statistical inference methods, stochastic approaches, and AI tools. He concludes that automakers' enhanced capacity to detect abnormal conditions and estimate the remaining service life of deteriorating components through AI for predictive maintenance benefits the environment, the vehicle's performance, and the driver's safety (Pech et al., 2021). Machine learning on a dataset can be used to give the maintenance department access to new insights and tools and prove the important role of AI in predictive maintenance (Fernandes et al., 2022). Kamel demonstrates how AI may be used to build a model that accurately predicts a machine's state and the likelihood of failure. Predictive maintenance using AI, he concluded, is a costly and time-consuming endeavor that necessitates high-quality data. However, its implementation can yield monetary gains and long-term viability (Kamel, 2022). Păvăloaia developed an AI-assisted distributed system for predictive maintenance across an entire factory to corroborate Kamel's findings. Using AI to boost system availability, lower maintenance costs, boost operational performance, and aid decision-making discussed in several recent academic publications relevant to the automotive sector. Predictive maintenance using AI in the auto sector can have a beneficial effect on the environment. The importance of predictive maintenance in environmentally friendly production systems has been demonstrated through a survey of literature on techniques and tools for intelligent predictive maintenance models. Using AI for predictive maintenance can help the auto sector adopt greener procedures. According to literature analysis, using AI for automotive R&D has many advantages, especially regarding sustainability. Nti et al. discuss the possibilities of artificial intelligence in the automotive sector, from onboard measuring systems to customer satisfaction research and demand forecasting (Nti et al., 2021). Artificial intelligence (AI), especially in the form of self-driving cars or automated vehicles with novel characteristics, has decreased the number of accidents caused by human error in the automotive industry (Farisyi et al., 2022). Improvements to development processes and methods are necessary to fully exploit artificial intelligence's benefits to the automobile sector (Demlehner et al., 2021). Combining Smart Contract (SC) rules for process administration and oversight with Federated learning artificial intelligence (FAI) for the selection process with an entirely robotic, intelligent vehicle production industry can promote sustainability (Farisyi et al., 2022). He learns that enhanced data collecting, processing, and control techniques help effectively manage the data produced by industrial processes. The studies collectively argue that AI has the potential to make roads safer, develop more accurate method predictive maintenance, and create a more advanced automobile manufacturing facility of the future. Inductive learning, specific AI test methodologies, and good data management are just a few examples of how AI may advance the development of greener automotive technology. To enable sustainable green mobility, AI may enhance vehicle performance, control, and decision-making for ECAS cars that are electric-connected, autonomous, and shared (Paiva et al., 2021). Natural resource and energy intensity can lower with the help of AI by deriving culturally suitable organizational processes and individual habits (Nishant et al., 2020). Research with a real-world Industry 5.0 use scenario highlights the many principles discussed throughout the article (Fraga-Lamas et al., 2021). A sustainable digital transformation towards a more innovative ecological economy is possible with the help of green IoT and Edge AI. Artificial intelligence has great potential to contribute to creating environmentally friendly vehicle systems. Proper data management, sustainability threats, and the effect of AI applications on sustainability are just a few of the obstacles that must be overcome. In addition, there needs to be an extensive study on how integrating AI in the car sector affects the most crucial variables in creating brand sustainability strategies.

The automotive sector may become more environmentally friendly with artificial intelligence, which can design culturally appropriate organizational procedures and individual behaviors to reduce the use of natural resources and electricity (Nishant, 2020). However, there are obstacles to utilizing AI for sustainability: machine-learning models' dependence on historical data, the unknown nature of people's reactions to AI-based treatments, heightened sustainability threats, the unintended consequences of AI use cases, and the challenge of assessing the efficacy of various intervention tactics are all examples. It is crucial to increase information transparency among stakeholders, harmonize multiple regulations and programs, and provide consumers with more agency to foster sustainable AI development (Rosário & Dias, 2022). A favorable and robust association exists between digitization and sustainability in the automotive industry (Et. al., 2021). This is because digitization aids organizations in achieving sustainability in their operations, supply chain, and other elements of the business. Stakeholder pressure, corporate culture, and government legislation affect how multi-tier car manufacturers approach social sustainability (Mathiyazhagan et al., 2021).

3. Hypothesis

The literature review regarding the use of AI in developing Brand sustainable strategy in the auto industry has led to the formation of the following hypotheses.

H_1: *Incorporating AI in vehicle manufacturing can boost dependability and sustainability.*

H2: *Incorporating AI in vehicle manufacturing can increase market position and customer loyalty.*

H_3: *Sustainability reporting positively influences brand value.*

H_4: *AI-enabled consumer contact raises awareness of sustainable products.*

H_5: *The automotive sector and AI-driven mobility platforms may help create innovations as new technical and organizational solutions.*

H_6: *Automotive AI-based predictive maintenance may improve operating performance.*

H_7: *AI for automotive R&D has increased sustainability*.

H_8: *AI can construct culturally relevant business procedures and behavior patterns to support the automotive industry*.

4. Research Methodology

This study laid the groundwork for establishing an AI-powered brand sustainability strategy in the automotive sector. As a result, several methods were employed to guarantee that all pertinent data shared throughout all stages of model development for in-depth discussions. The study statistically examined through structural equation modelling the indicators and essential aspects to consider for the successful development of a sustainable brand system utilizing AI in the auto industry by analyzing overall research articles related to the development of sustainability strategy and literature specific to the auto industry. A web-based poll used to compile the quantitative data. The automotive industry has made sustainability a top strategic objective. Automotive companies are pressured to alter their processes, values, and output by governments, consumers, and investors. This study aimed to assess how the auto sector deals with the difficulty. The automotive industry's 120 AI-using marketers and HR professionals were selected for the survey as well as 180 sustainability specialists and regulators also surveyed, totaling the sample size to 300. In order to build sustainable business practices and direct strategy, the poll asked respondents to choose among the primary factors of developing brand sustainability using artificial intelligence. Sustainability activities, such as sustainable research and development (R&D) and sustainable manufacturing, are closer to the industry's core expertise; therefore, each question is linked to a distinct stage or scenario. Examples of the questions included in the survey are:

Sustainability in the Environment: Essential Questions

- For long-term brand sustainable growth, a computationally demanding AI solution outperforms traditional digital methods.
- The positive effects on the environment outweigh the time and money required to teach AI to set and measure sustainability goals.
- AI helps cut energy and fuel pollution.
- Is it possible for AI to use autonomously and effectively?
- In terms of sustainability, the AI solution is impartial.
- AI applications can more accurately inform future R&D priorities and plans.
- It is simple clear how the AI program works and makes decisions.
- Indicators of the AI app's functionality and performance aid in preventative upkeep.
- Applications built with AI are trustworthy and sturdy, making them ideal for communicating openly with customers and others.

The poll also evaluated the extent to which sustainability measures, such as sustainable sales, marketing, after-sales, mobility services, and vehicle utilization, were consistent across the value chain. The study also inquired as to the extent to which organizations have a central sustainability governance body and whether or not they believe in creating sustainability targets for their top executives. In addition to the current investment in EVs, AVs, and digital mobility services, as well as the efforts to guarantee that EVs are genuinely sustainable, the survey estimated a funds requirement over the next five years that may be required to meet the sustainability targets. Expert opinion and assessment, essential to the model's success, formed using a combination of indirect observation and polling. The statistical methodology of the study would only be helpful with data analysis. In statistical analysis, looking for patterns in data to help make decisions. Procedures typical of between-subjects research used to assemble the sample. Non-probabilistic purposeful sampling employed to compile the sample. This allowed a subset of the population to select. This study aimed to lay the groundwork for incorporating AI into automotive marketing strategies for brand longevity. The principal method of data collecting involved asking questions of the participants. This poll examined how businesses use AI to help them create sustainable strategies and make better decisions. The survey results were made more reliable by evaluating the five options' frequency of use and importance in developing a sustainable strategy for the auto industry through a series of scenarios and situational questions. The survey questions all employed a Likert scale with five points, ranging from "strongly disapprove" to "completely agree," to determine how respondents felt about various topics. Using the concept of the Likert scale [1 = strongly disapprove, 5 = firmly accept], may break down the total responses into component numbers. Independent factors crucial in sustainability strategy development statistically examined to help firms make informed decisions. This research aims to assess how the factors mentioned above in the hypothesis section influence the development of brand sustainability strategies using AI in the auto industry. The questionnaire is the backbone of the research. The researcher decided on a Sample size of 300 after considering all of the responses that would be useful to the study.

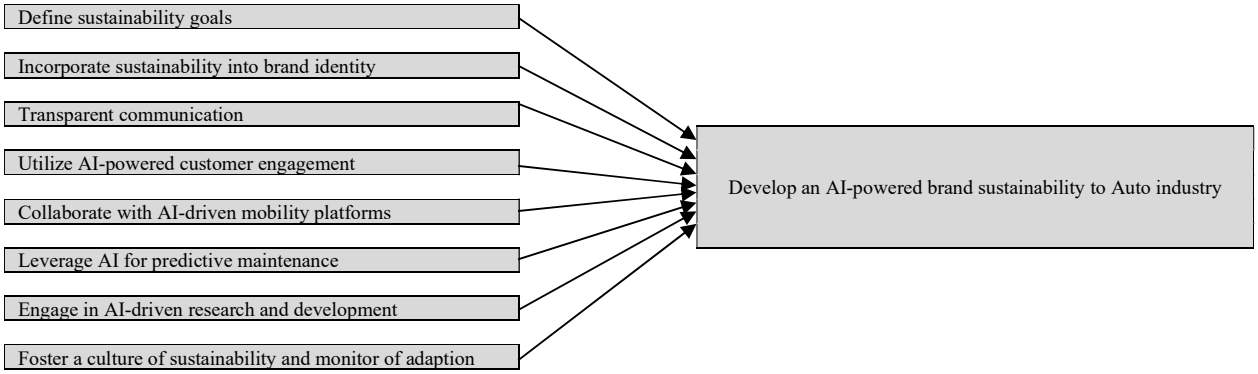

Fig. 1. Hypothesis model

5. Results

First-order approaches like those that percentage, correlation, and structural equation modelling (SEM) used in this part to conduct a comprehensive analysis of the study data and results. The demographic information of the respondents shown in Table 1. There were 300 viable questionnaires. The demographic and sectoral distribution of two groups: sustainability experts and regulators (60%) and marketers and HRM professionals (40%). Males dominate both groups, with 65% in the former and 85% in the latter. Age-wise, the largest proportions fall within the 36-40 range for both groups (42% and 45%, respectively). Among marketers and HRM, marketing professionals represent 52%, and HRM 48%. Experience levels show a relatively even spread, with the highest proportion having more than 15 years of experience (31%).

Table 1
Demographic analysis

	Sustainability experts and regulators	%	Marketers and HRM	%
Sample Ratio	180	60%	120	40%
Gender				
Male	117	65%	102	85%
Female	63	35%	18	15%
Age				
30-35	45	25%	36	30%
36-40	76	42%	54	45%
> 40	59	33%	30	25%
		Sector		
		Marketing	62	52%
		HRM	58	48%
Experience				
1-3			9	8%
4-8			19	16%
9-11			27	23%
12-15			28	23%
Above 15			37	31%

Variable Path Loadings Table

Table 2 displays the results of the measurement model. For the Cronbach alpha results, they monitored the defining sustainability objectives, scoring 0.852; communicated openly, and scored 0.841; engaged customers via AI, scoring 0.883; and incorporated sustainability into the company identity, scoring 0.781. Moreover, 0.741 for promoting sustainability culture and its monitoring, 0.821 for working with AI-driven mobility platforms, 0.692 for using AI for predictive maintenance, and 0.813 for using AI to aid research and development. Meanwhile, the values of the Composite Reliability are as follows: using AI-powered customer engagement (0.894), including sustainability in brand identity (0.873), working with AI-driven mobility platforms (0.868), defining a sustainability goal (0.893), communicating openly (0.888), using AI for predictive maintenance (0.964), conducting AI-driven R&D, and fostering a culture of sustainability and monitoring adaptation (0.963). All used variables may assume reliability due to the abundance of supporting data. The extreme loading values in Table 4 show that this indication is reliable. The external loadings of an indicator must be more than or equal to 0.708% for it to be considered reliable. Since AVE, item reliability, and concept reliability (CR) all corroborate the findings, the results have convergent validity (Hair et al., 2017). The CR, which evaluates how sound indicators of the underlying concept reflect the construct itself, was more than 0.708, falling between 0.873 and 0.894. The AVE was statistically significant. Hence, this framework should be employed. The standard deviation of the AVE was 0.913%. The notions have convergent validity if the AVE is more significant than 0.5. The results support the idea that the measurement model is very valid regarding convergent measurement.

Table 2
Analysis of the Measuring Model

Variable	Item	Path Loadings	Avg. Variance Extracted	Composite Reliability	Cronbach Alpha
Define sustainability goals	E9	0.775	0.625	0.893	0.852
	E10	0.865			
	E11	0.774			
	E12	0.795			
	E13	0.740			
Incorporate sustainability into brand identity	E6	0.773	0.697	0.873	0.781
	E7	0.876			
	E8	0.852			
Transparent communication	E14	0.755	0.613	0.888	0.841
	E15	0.760			
	E16	0.725			
	E17	0.840			
	E18	0.829			
Utilize AI-powered customer engagement	E1	0.798	0.681	0.894	0.883
	E2	0.856			
	E3	0.744			
	E4	0.905			
	E5	0.843			
Collaborate with AI-driven mobility platforms	E19	0.860	0.669	0.868	0.821
	E20	0.771			
	E21	0.843			
	E22	0.852			
Leverage AI for predictive maintenance	E23	0.838	0.737	0.964	0.692
	E24	0.903			
	E25	0.769			
Engage in AI-driven research and development	E26	0.869	0.771	0.963	0.813
	E27	0.829			
	E28	0.875			
	E29	0.919			
Foster a culture of sustainability and monitor adaptation	E30	0.904	0.678	0.963	0.741
	E31	0.866			
	E32	0.869			
	E33	0.782			

Furthermore, the evaluation (R^2) of the structural model performed using the estimated route loadings and the values from Table 4. The R^2 value quantifies the structural models' ability to track the independent variables, while the path loadings reveal the strength of the correlations between the independent and dependent variables. In a multiple regression study, R^2 reveals how much of the variation can be attributed to the exogenous variables. Given the significant degree of correlation (more remarkable than the product of their AVE's square roots), there is a need for greater distinguishability between the constructs.

6. Results and Discussion

As seen in Table 3 the data supports H1, indicating that setting sustainability goals favors the creation of AI-powered sustainable strategies. The automotive model explains how setting sustainability goals could help businesses evaluate options, identify win-wins, and optimize trade-offs when making complex and multidisciplinary sustainability decisions (Uemura Reche et al., 2020), which correlates with the findings. The model also instructs the auto sector on how to deal with sustainability issues. Adhering to a model that considers potential future issues and helps identify appropriate sustainability initiatives is helpful. In addition, Lukin showed in his research that top automakers successfully implement sustainability strategies to satisfy most of the United Nations' sustainable development objectives (Lukin et al., 2022). Therefore, the auto sector must boost its performance by adopting concrete sustainability targets.

Table 3
Hypotheses results

Path	T statistics	Original sample (β)	Sample mean	Standard deviation	p-Value	Hypothesis
H1. Define sustainability goals	2.828	0.353	0.329	0.117	0.005	Accepted
H2. Incorporate sustainability into brand identity	4.07	0.354	0.352	0.075	0.001	Accepted
H3. Transparent communication	2.943	0.352	0.355	0.118	0.003	Accepted
H4. Utilize AI-powered customer engagement	0.928	0.072	-0.056	0.076	0.369	Not significant
H5. Collaborate with AI-driven mobility platforms	2.987	0.343	0.278	0.078	0.001	Accepted
H6. Leverage AI for predictive maintenance	2.37	0.323	0.353	0.113	0.0	Accepted
H7. Engage in AI-driven research and development	4.48	0.334	0.325	0.118	0.001	Accepted
H8. Foster a culture of sustainability and Monitor of adaption	2.403	0.371	0.737	0.015	0.0	Accepted

T value=4.07, ß=0.354, p0.001; supporting evidence for Hypothesis 2; including sustainability into brand identity greatly influenced the creation of AI-powered sustainable strategy. The findings endorse that understanding the importance of CSR can help companies incorporate sustainability into their brand (Ferramosca & Verona, 2019). It also agrees with the findings that a brand's worth rises after it becomes well-known for being socially responsible and embedding sustainability with its identity (Farisyi et al., 2022; Lukin et al., 2022). Vesal's research concludes that a B2B manufacturer's brand image and market performance improve when applied sustainability practices are applied (Vesal et al., 2021). This is especially true when customer relationship management is strong, and the company works with businesses with positive environmental attitudes.

Hypothesis 3 is supported by the findings that open reporting on sustainability efforts is essential for firms and has a beneficial effect on developing AI-powered sustainable strategies (T value=2.943, ß=0.352, p0.003).Reiterated support is given to the prior research findings concerning the value and significance of communicating sustainability strategy and practices to the business (Farisyi et al., 2022). This study also confirms that artificial intelligence can achieve many Sustainable Development Goals (Vinuesa et al., 2020). This is one of the important segments to develop a viable AI strategy. Transparency is essential for safety and ethical standards to follow accordingly. The automotive sector urgently needs and benefits from AI's ability to aid in developing environmentally friendly practices and regulatory frameworks. When enacting and disseminating the sustainable practices established by the organization's authorities and the local area government, the automobile sector must prioritize incorporating AI-supported programs and tactics. Designing, executing, monitoring and promoting sustainability policies can all benefit from using AI in two-way consumer communication.

For H4, the analysis found no support (T value = 0.928, ß = 0.072, p>0.369) for the hypothesis of a connection between AI-powered client engagement and AI-powered sustainable strategy creation. These findings counter the findings of previous studies that found a link between AI-powered consumer interaction and AI-powered sustainable strategy formulation (Perez-Vega et al., 2021; Prentice & Nguyen, 2020). Previous studies have endorsed the utility and importance of AI-powered consumer engagement, but they have not supported the usage of AI on its own. By analyzing client data, enhancing service quality, and supplying empathic service recovery, AI can improve the customer experience and personalization, hence creating loyal customers (Mustak et al., 2020; Chen et al., 2021; Chen et al., 2023). Live consumer engagement, however, requires human monitoring of AI-generated content and human coordination and interference (Hollebeek et al., 2021; Perez-Vega et al., 2021). This can help in developing new sustainable strategies as well.

The fifth hypothesis proposed that there is potential for the automotive sector and AI-driven mobility platforms to collaborate to improve environmental outcomes. Statistical analysis (T Value=2.987, b=0.343, p= 0.001) confirms this. This is another area of concentration for AI incorporation in the auto industry. In discussing Mobility-as-a-Service (MaaS) as a viable, sustainable approach powered by AI (Cruz & Sarmento, 2020), they drew connections between this study's findings and his work. Dlugosch's research found that pooled autonomous electric vehicles might cut costs and maintain service levels. Therefore, the findings align with his (Dlugosch et al., 2022). This research supports previous findings from a literature review that the automotive industry and AI-driven mobility platforms can improve sustainability by promoting MaaS, shared, autonomous electric vehicles, and clean engine fuel sources.

Using AI for predictive maintenance improves sustainability, vehicle performance, and vehicle safety by allowing manufacturers to recognize complicated problems accurately (Pech et al., 2021) and assist in responding to sustainability challenges. Using machine learning to a dataset to offer the maintenance team better information and resources will aid the automobile sector in responding to sustainability concerns. It validated AI's essential function in preventative upkeep. Research supports null hypothesis 4 (T=2.370, ß=0.323, p=0.000). Pech and Fernandes (Fernandes et al., 2022), who promote the use of AI for prediction emphasis on sustainability in the automotive industry, find results congruent with their own.

The literature review indicates that AI has multiple applications in the automobile industry and has the potential to make the industry more sustainable. AI provides many advantages for automotive R&D, as evidenced by its widespread application for sustainability research and development in the automobile sector. The results of this study agree with the seventh hypothesis and are consistent with those of Nti and Farisyi. Nti showed the potential of AI in creating an intelligent automotive industry, from in-car measuring devices to customer satisfaction surveys and demand projections. Smart Contract (SC) standards are for process management and monitoring, and federated learning-artificial intelligence (FAI) for weighing possibilities form the basis of Farisyi's innovative design paradigm. The articles propose that AI could improve transportation safety, lead to more accurate predictive maintenance procedures, and help build an intelligent automotive production facility of the future. There are many ways in which artificial intelligence (AI) could be applied to developing environmentally friendly automobiles, such as inductive learning, specialized AI test methodologies, and good data management. To advance eco-friendly transportation, AI has the potential to enhance the efficiency, command, and decision-making of electric-connected autonomous and sharing cars (Paiva et al., 2021). With the support of green IoT and Edge AI, a sustainable digital transition towards an intelligent circular economy is conceivable. MANY HURDLES MUST BE CLEARED before AI can play a significant role in creating more sustainable transportation technologies (Adwan et al., 2023).

To lessen the burden on the planet's finite energy and natural resource reserves, the automotive industry can look to AI to design culturally sensitive organizational processes and individual practices (Nishant, 2020). However, there are also limitations to using AI for sustainability, such as the challenge of counting entirely on past information in machine learning

models, the unknown human behavioral reactions to AI-based measures, the increase in risks related to sustainability, the adverse effects of AI programmers, and the challenges of counting merely on AI. This study's findings (T value=2.40, ß=0.37, p=0.000) support the eight hypotheses and are consistent with those of other studies (Rosário & Dias, 2022), (et al., 2021) and (Mathiyazhagan et al., 2021). These findings support the theory that employing AI to promote sustainability, evaluate adaption, and build a sustainable brand is beneficial. Sustainable AI development requires transparency on the part of stakeholders, policy alignment, and consumer agency (Rosário & Dias, 2022). Digitization makes sustainability in operations, supply chains, and other domains possible (Wagh, 2021). Social sustainability in the automotive industry affected by stakeholder pressure, corporate culture, and government regulation (Mathiyazhagan et al., 2021).

The research has shed light on the most critical considerations and their implications for creating long-term AI-powered plans in the automotive sector. As the auto, industry moves from traditional practices to those supported by AI, marketers and policymakers must strike a delicate balance between several competing goals, including lowering greenhouse gas emissions, increasing energy security, and bolstering auto manufacturers' ability to compete. They should also make concerted efforts concurrently invest in new automobiles, better batteries, and AI driven mobility platforms. The research opens the path for a car model to create that can explain how to establish sustainability targets. When making complicated and diverse sustainability decisions, setting sustainability goals can help firms, evaluate options, discover win-wins, and optimize trade-offs. In addition, the discovery of two-way AI-powered client involvement necessitates additional study into the processing of incoming data and the dissemination of knowledge.

Only responses from automotive sales, HR, and marketing professionals about the impact of AI have used to compile this report. Professionals in AI and ML engineers' thoughts on AI's current function in sustainability management and planning in the automobile sector still need to be included. This is a flaw in the research. Second limitation is that the regional considerations, such as local norms and laws and political and environmental situations of various areas and nations where automakers operate, should take into account in the study, which is a weakness of the research. Considering these aspects is essential for creating a sustainable plan of action. These considerations guide future research towards more precise conclusions and recommendations.

7. Conclusion

AI is gaining prominence in the automobile industry for its ability to improve measuring tools, monitor wear and tear, and enable predictive maintenance. Businesses should invest in eco-friendly technologies to prioritize environmental protection. AI can enhance brand promotion and longevity, but developing an AI-driven sustainability plan may be challenging. A holistic approach considering brand, customer, and industry is necessary. Artificial intelligence (AI) can elevate the brand-consumer connection by enhancing the personalization of services and data and fostering empathy. It has the potential to boost sustainability and cut down on carbon emissions as well. Predictive maintenance is another area where AI can help the car industry. Predictive maintenance using AI can improve air quality, vehicle efficiency, and motorist security. Although it is an expensive and time-consuming venture, it is financially rewarding and sustainable in the end. Using AI in transportation might improve road safety, predictive maintenance practices, and a more technologically sophisticated vehicle production facility. Data management, sustainability risks, and the impact of AI applications all stand in the way of using AI for sustainability.

This research examined the metrics and crucial components for formulating an AI-driven brand sustainability plan in the car industry. Quantitative information collected using an online survey. Indirect observation and polls used to develop expert opinions and evaluations. This research investigated how firms may utilize AI to develop long-term plans and improve their brand sustainability strategy. In the survey, participants ranked the frequency and significance of the five choices on a Likert scale. A wide range of ages, sexes, and years in the automotive industry represented among the respondents. Sustainability in corporate identity, transparent reporting on sustainability initiatives and AI's capacity to fulfil Sustainable Development Objectives are just some AI-powered sustainability tactics that benefit from having a clear set of sustainability objectives to work towards.

Consumer interaction enabled by AI has the potential to enhance user experience and personalization, with human’s supervision. Through the promotion of Mobility as a Service (MaaS), shared, autonomous electric cars, and clean engine fuel sources, AI-driven mobility platforms may help enhance sustainability. There are benefits to using AI in automotive R&D. The use of artificial intelligence (AI) can enhance transportation safety, lead to more precise predictive maintenance processes, and facilitate the development of an intelligent automobile manufacturing plant. However, there are obstacles to employing AI for sustainability, including reliance on historical data, sustainability concerns, unintended consequences, and over-reliance on AI. The framework for future artificial intelligence strategies to deal with climate change, air quality, energy security, and competitiveness has been established with this research.

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