



A Study on Automakers' Use of SIMS to Build Competitive Advantage: From Net-Zero Transition and ESG Governance to Consumer Guidance for Low-Carbon Use

Wu Chun Yu¹, Shen Hui Ping², and Hsieh Cheng Hung³

¹Guangzhou Institute of Science and Technology, Guangzhou, Guangdong, China

Email: asir.wu@qq.com

²Chinese Vocational Education Research Association

Email: ariel.shen@outlook.com

³I-Shou University College of Intelligent Technology Ph.D. Candidate

Email: alanhsieh@gmail.com

Received: 02 Nov 2025; Received in revised form: 05 Dec 2025; Accepted: 08 Jan 2026; Available online: 15 Feb 2026

Abstract— Amid tightening net-zero and ESG requirements, automotive competition is shifting from a product focus to an integration of digitalization, sustainability, and servitization. This study explores how automakers use Smart Information Management Systems (SIMS) to integrate net-zero transition, ESG governance, and low-carbon use guidance to build competitive advantage. Given the complex factors involved in SIMS implementation – technological, organizational, informational, and stakeholder-related – this study uses a qualitative method. A multiple case study with semi-structured interviews captures perceptions of automakers, service systems, and experts on SIMS value. Findings show SIMS is not just an IT tool but a dynamic capability linking data governance, sustainability strategy, and customer interaction. First, it enhances carbon management and ESG governance via information integration and real-time analysis. Second, it guides consumer low-carbon behavior through digital services and feedback. Finally, collaboration among enterprises, service systems, and consumers fosters differentiated service capabilities and sustainable competitive advantage. The study proposes a framework of 'data integration → sustainability governance → consumer collaboration → competitive advantage,' addressing the prior research focus on manufacturing and supply chain rather than use-phase and consumer roles. The findings offer theoretical and managerial insights for automakers' digital sustainability transformation, ESG governance, and low-carbon service innovation.

Keywords— Smart Information Management Systems (SIMS), automaker, net-zero transition, ESG governance, competitive advantage.

I. INTRODUCTION

1.1 Research Background

Against the background of rapidly deepening global requirements for net-zero transition and ESG sustainability governance, the automotive industry is facing a new challenge that shifts from traditional manufacturing competition toward the integration of

digitalization and sustainability. Recent research indicates that although automakers have actively proposed carbon reduction targets, strategic gaps still exist in Scope 1–3 emissions management, value chain decarbonization, and long-term transformation pathways, demonstrating that the automotive industry's net-zero transition can no longer rely solely on improvements at the manufacturing end

but must extend further to the product life cycle and use phase [1].

On the other hand, ESG has gradually become a crucial governance framework for measuring corporate sustainability competitiveness. Automotive industry ESG research points out that corporate governance, environmental emission control, and sustainable product development are important factors influencing corporate sustainability performance [2]. However, existing research has mostly concentrated on internal corporate governance, supply chain management, and sustainability disclosure, with less exploration of how enterprises extend ESG responsibility to the consumer use phase through information systems [3].

With the rapid development of smart technologies, Smart Information Management Systems (SIMS) have gradually become an important tool for enterprises to promote sustainability transformation. Information systems research indicates that the core of smart sustainable mobility lies in promoting collaborative interaction among enterprises, service providers, and users through real-time information, data analytics, and decision support mechanisms [4]. Moreover, digital transformation has also been proven to enhance corporate ESG performance and sustainability governance capabilities [5,6].

Nevertheless, significant gaps remain in existing automotive industry research: on the one hand, digital transformation research focuses largely on improving corporate efficiency and less on analyzing how this is transformed into sustainable competitive advantage; on the other hand, consumer-related research mostly concentrates on the adoption or purchase intention of new energy vehicles, with less exploration of how automakers provide low-carbon information through SIMS to guide consumers toward sustainable use behaviors [7,8].

Therefore, this study posits that the future competitive advantage of automakers arises not only from product performance and cost control but also from whether the enterprise possesses the capability to integrate data governance, ESG management, and consumer collaboration. SIMS should not be viewed simply as an information tool but rather as an

important strategic capability that links net-zero transition, ESG governance, and customer value co-creation.

1.2 Research Purpose

Based on the above research background, this study aims to explore how automakers employ SIMS to build competitive advantage and to analyze the mechanisms through which SIMS functions in net-zero transition, ESG governance, and guiding consumers toward low-carbon use.

The primary objectives of this study include:

First, to explore the strategic context and core driving factors behind automakers' implementation of SIMS, and to understand how enterprises shift from a traditional information management model to a digital sustainability governance model.

Second, to analyze how SIMS supports corporate net-zero transition and ESG governance, including carbon emissions information integration, data transparency, decision support, and cross-departmental collaboration.

Third, to explore how automakers connect with consumers through SIMS and service systems to guide low-carbon use behavior, thus forming a sustainability governance model involving joint participation by enterprises and consumers.

Fourth, to construct an analytical framework explaining how automakers use SIMS to form competitive advantage, illustrating how digital capabilities can be transformed into sustainability governance capability and market differentiation advantages.

1.3 Research Contributions

This study offers three main contributions. First, at the theoretical level, it supplements the deficiency in past automotive sustainability research that has emphasized internal corporate governance and supply chain management by proposing SIMS as a collaborative governance mechanism connecting manufacturers, service systems, and consumers.

Second, at the information management level, this study broadens the research scope of SIMS by explaining how information systems transform from operational support tools into important capabilities for corporate sustainability transformation and competitive advantage formation.

Finally, at the managerial practice level, this study can provide strategic references for automakers to promote net-zero transition, ESG governance, and digital service innovation, helping enterprises to establish new models of value creation in a sustainability-oriented competitive environment.

II. LITERATURE REVIEW

2.1 SIMS and Automakers' Competitive Advantage

Smart Information Management Systems (SIMS) have become a crucial foundation for enterprises to promote digital transformation and sustainability governance. Compared with traditional information systems that emphasize process efficiency and data management, SIMS place greater emphasis on enhancing corporate decision-making and organizational collaboration capabilities through the Internet of Things, big data analytics, artificial intelligence, and real-time information integration. In the automotive industry, with the rapid development of smart vehicles, connected services, and digital platforms, corporate competitive advantage has gradually shifted from product performance toward data capability, service capability, and ecosystem integration capability [9].

Thus, SIMS should not be regarded merely as an information technology tool but should be understood as an important strategic resource that enables enterprises to integrate resources, enhance organizational agility, and cultivate differentiation capabilities. Digital transformation research also indicates that if enterprises can effectively integrate digital capabilities with sustainability strategies, it will contribute to improving ESG performance and long-term competitiveness [5,6].

2.2 Net-Zero Transition and ESG Governance in the Automotive Industry

Net-zero transition has become an important direction for the future development of the automotive industry. Because the life cycle of automotive products involves multiple-stage emissions—including manufacturing, supply chain, energy use, and recycling—corporate carbon reduction strategies have shifted from singular production improvements toward full life cycle management. Fugger et al. [1] noted that although

automakers have proposed Scope 1–3 carbon reduction targets, differences still exist among enterprises in terms of the scope of emissions management, timeline planning, and intensity of carbon reduction, indicating that the automotive industry still requires a more complete governance mechanism.

On the other hand, ESG has become an important framework for measuring corporate sustainability capabilities. Vijaya et al. [2] pointed out that the core ESG factors in the automotive industry include corporate governance, environmental emission control, and sustainable product development, showing that enterprises' future competitiveness depends not only on financial performance but also on their sustainability governance capability. Related research also indicates that intelligent manufacturing and digital capabilities can enhance corporate ESG performance, allowing enterprises to strengthen their sustainability performance through information transparency and governance capabilities [10].

2.3 SIMS, Consumer Low-Carbon Use, and Collaborative Governance

Past automotive industry sustainability research has largely concentrated on internal corporate carbon reduction and supply chain management, with less exploration of the impact of the consumer use phase on corporate ESG objectives. However, the majority of a vehicle's environmental impact occurs during the use phase; therefore, how to guide consumers toward low-carbon use behaviors has become a critical issue in automotive enterprises' sustainability transformation.

Choi and Lowry [7] noted that the development of smart connected vehicles presents consumers with a trade-off relationship among sustainability value, information disclosure, and privacy protection. This suggests that future automotive enterprises must build consumer trust through digital information services to promote participation in sustainable behaviors. In addition, information sharing and smart digital platforms can also enhance carbon management transparency and cross-organizational collaboration capabilities [11,12].

Therefore, the value of SIMS lies not only in internal corporate management but in establishing a

collaborative governance mechanism among manufacturers, service systems, and consumers.

2.4 Literature Critique

Synthesizing the above literature reveals that existing studies have separately explored net-zero strategies, ESG governance, digital transformation, and consumer sustainable behaviors in the automotive industry, yet three deficiencies remain. First, past research has predominantly focused on internal corporate governance and supply chain management, with less exploration of consumer participation during the use phase. Second, although information systems research emphasizes digital platforms and decision support functions, it has rarely analyzed them within the context of automakers' ESG and competitive advantage formation. Third, consumer research has mostly focused on purchase intention, with less investigation into how enterprises guide low-carbon use through information mechanisms.

Therefore, this study takes SIMS as its core and explores how automakers integrate net-zero transition, ESG governance, and consumer collaborative participation through digital capabilities to further build sustainable competitive advantage.

III. RESEARCH METHOD

This study aims to explore how automakers use Smart Information Management Systems (SIMS) to integrate net-zero transition, ESG governance, and guidance for low-carbon use by consumers, thereby forming corporate competitive advantage. Because the implementation of SIMS is not merely a matter of technology adoption but involves multiple factors such as organizational strategy, information governance, sustainability management, and stakeholder interaction, this study adopts a qualitative research method to gain a deeper understanding of the practical logic and formation mechanisms of enterprises in the process of digital sustainability transformation.

This study employs a multiple case study design, conducting an in-depth analysis of automakers and their related service systems to explore the common characteristics and differences among different enterprises regarding SIMS implementation, ESG governance, and consumer

interaction models. Compared with quantitative research, which focuses on verifying relationships between variables, qualitative research is more suitable for analyzing management phenomena that are still emerging and can reveal how enterprises integrate resources, adjust strategies, and build competitive advantage in complex environments.

This study uses purposive sampling to select interviewees with relevant experience, primarily including senior managers of automakers, directors of information and digital transformation, personnel involved in sustainability governance, and managers of dealership and after-sales service systems. Furthermore, to enhance the comprehensiveness of the research perspective, experts in ESG, sustainability management, and the automotive industry were also included to gain an understanding of the application value and future development directions of SIMS from different roles. Data collection was primarily conducted through semi-structured in-depth interviews, with the interview content focusing on topics such as the enterprises' motivations for implementing SIMS, how the system supports net-zero and ESG governance, how digital services guide consumers toward low-carbon use, and how SIMS is transformed into competitive advantage.

For data analysis, this study adopts thematic analysis to organize and interpret the data. The researchers first engaged in repeated reading of the interview transcripts and related documents to grasp the overall context of the enterprises' SIMS implementation. Subsequently, based on the research questions, key concepts were identified, and content with common meanings was grouped together to form research themes. Through cross-case comparative analysis, this study further explores the similarities and differences among different enterprises in terms of SIMS application models, ESG governance approaches, and consumer low-carbon interaction strategies, and constructs a theoretical framework explaining how automakers employ SIMS to form competitive advantage.

To ensure research quality, this study adopts data triangulation, cross-validating corporate interview data, expert opinions, and publicly available documents to enhance the credibility and

completeness of the research findings. At the same time, records of data organization and analysis were retained throughout the research process to establish the traceability of the research process. Regarding research ethics, all interviewees participated in the interviews after fully understanding the research purpose, and all research data were processed anonymously to ensure the security of the information of both interviewees and enterprises.

In summary, through a qualitative multiple case study method, this research conducts an in-depth analysis of how automakers transform SIMS from an information management tool into a mechanism for sustainability governance and competitive advantage formation, thereby supplementing the deficiencies in existing research on digital transformation, ESG governance, and consumer low-carbon participation in the automotive industry.

IV. RESEARCH FINDINGS AND ANALYSIS

4.1 The Strategic Background and Value Reconstruction of Automakers' SIMS Implementation

Through in-depth interviews and document analysis, this study found that the main purpose of automakers implementing Smart Information Management Systems (SIMS) has gradually shifted from traditional IT applications to corporate sustainability governance and competitive advantage building. Interviewees generally agreed that automotive industry competition in the past focused mainly on product performance, production efficiency, and market price. However, after the requirements for net-zero emissions and ESG governance gradually deepened, corporate competitive advantage has begun to shift toward data capability, sustainability governance capability, and customer relationship management capability.

The research results indicate that the core driving factors for SIMS implementation mainly stem from three aspects. First, external environmental pressure urges enterprises to re-examine their existing operational models. With increasing carbon management regulations, ESG rating requirements, and rising consumer sustainability awareness, automakers must establish more precise carbon emission monitoring and information disclosure

capabilities. Second, internal management needs also drive the development of SIMS, especially in contexts where information related to manufacturing, energy management, after-sales service, and customer data is highly fragmented. How to enhance decision-making efficiency through system integration has become a critical issue in corporate digital transformation. Finally, enterprises are gradually recognizing that SIMS is not merely a tool for reducing operational costs but an important strategic resource that helps enterprises build long-term competitive advantage.

Therefore, this study found that the essence of automakers' SIMS implementation is not simply a technological upgrade but a process of transforming "information management capability" into "strategic governance capability."

4.2 The Mechanism of SIMS in Driving Net-Zero Transition and ESG Governance

Further findings reveal that SIMS primarily plays three functions in the sustainability transformation process of automakers: data integration, decision support, and governance transparency.

First, regarding data integration, the automotive industry involves multiple aspects such as R&D, production, supply chain, sales, and after-sales service. Traditional information systems tend to create information silos, making it difficult for enterprises to grasp complete life cycle carbon emission information. Through the integration of the Internet of Things, big data analytics, and smart platforms, SIMS enables enterprises to establish an information chain from product manufacturing to the use phase, thus improving the completeness of carbon management.

Second, in terms of decision support, SIMS can transform large volumes of operational data into managerial information, allowing enterprises to more quickly identify energy consumption, carbon emission sources, and improvement opportunities. Interviewees pointed out that the key to future competition among automotive enterprises lies not merely in whether they possess data but in whether they have the capability to transform data into strategic actions.

Third, concerning ESG governance, SIMS enhances the transparency of corporate sustainability

information, enabling enterprises to respond more effectively to the demands of external stakeholders. The research found that ESG is no longer just content disclosed in annual corporate reports; it is gradually becoming an important basis for daily management and decision-making.

Therefore, this study argues that the value of SIMS in net-zero and ESG governance does not stem from the technology itself but from whether it can help enterprises establish a closed-loop governance model of “data–decision–action.”

4.3 The Collaborative Governance Model of SIMS Extending to Consumer Low-Carbon Use

Another important finding of this study is that the formation of automakers’ sustainable competitiveness cannot remain solely within the enterprise but must be extended to the consumer use phase.

In the past, the relationship between automotive enterprises and consumers was primarily established on product sales and after-sales service. However, with the development of smart vehicles and digital services, the interaction between enterprises and consumers has gradually transformed into an ongoing information exchange relationship. Through SIMS, automakers can convert vehicle energy use, driving behavior, maintenance needs, and low-carbon use suggestions into information that consumers can understand.

The study found that consumer low-carbon participation is mainly influenced by three factors. The first is information comprehensibility. If the information provided by the system is too technical, it is difficult for consumers to translate it into concrete actions. The second is information credibility. Consumers must believe that the purpose of the information provided by the enterprise is to help them reduce their environmental impact, rather than merely for marketing. The third is interaction value. When low-carbon suggestions can simultaneously enhance usage convenience, reduce costs, or improve the service experience, consumers are more likely to form participation intentions.

Thus, this study proposes that the important value of SIMS lies in breaking through the traditional corporate ESG model, transforming sustainability governance from an internal corporate responsibility

into a collaborative governance model involving the joint participation of “enterprise–service system–consumer.”

4.4 The Formation Model of Automakers’ Competitive Advantage Constructed by SIMS

Synthesizing the above findings, this study further constructs the formation model of automakers’ competitive advantage through the use of SIMS.

The study found that the impact of SIMS on automakers’ competitiveness is not generated directly but is formed gradually through three stages.

The first stage is “data capability formation.” Through SIMS, enterprises integrate manufacturing, production, service, and usage information, establishing the data foundation required for sustainability governance.

The second stage is “governance capability transformation.” Enterprises utilize data analysis and decision support functions to enhance net-zero management, ESG execution, and organizational collaboration capabilities.

The third stage is “competitive advantage formation.” When enterprises can further establish interactive relationships with consumers through SIMS, they can develop service differentiation, brand trust, and customer value co-creation capabilities.

Thus, this study proposes: SIMS is not merely a digital tool for automakers but a strategic capability linking net-zero transition, ESG governance, and collaborative use with consumers.

This finding supplements prior automotive industry research that focused primarily on the manufacturing and supply chain ends, further proposing that the use phase and consumer participation are also important sources of sustainable competitive advantage for automotive enterprises.

V. CONCLUSION AND DISCUSSION

5.1 Research Conclusions

This study aimed to explore how automakers use Smart Information Management Systems (SIMS) to integrate net-zero transition, ESG governance, and guidance for low-carbon use by consumers, thereby building corporate competitive advantage. Through a

qualitative research method, this study found that SIMS is not merely an information technology tool but a strategic capability combining data governance, sustainability management, and stakeholder interaction.

The research findings reveal that the main purpose of automakers' SIMS implementation has shifted from traditional efficiency improvement toward the construction of sustainability governance capabilities. Through SIMS, enterprises can integrate information from the manufacturing, service, and use phases, enhancing carbon emission management transparency, strengthening ESG decision-making capability, and reducing governance constraints caused by information silos.

Furthermore, this study found that the contribution of SIMS to automotive enterprises' competitive advantage formation does not come solely from internal management improvements but extends further through consumer collaboration mechanisms. Enterprises can provide energy use information, maintenance suggestions, and low-carbon use feedback through digital services, guiding consumers to participate in sustainable behaviors and forming a low-carbon governance model involving the joint participation of "enterprise-service system-consumer."

Therefore, this study proposes the formation path of SIMS-enabled competitive advantage: Data integration capability → ESG governance capability → Consumer collaboration capability → Sustainable competitive advantage.

5.2 Theoretical Contributions

This study has three theoretical contributions.

First, it supplements the deficiency in automotive industry sustainability research, which has traditionally overemphasized the manufacturing end, supply chain, and corporate governance, by proposing that the use phase and consumer participation are also important factors in forming corporate ESG competitiveness.

Second, this study broadens the perspective of information management research by elevating SIMS from a traditional information support tool to a sustainability governance capability, explaining how

digital capabilities can be transformed into corporate strategic capabilities.

Third, by integrating the perspectives of net-zero transition, ESG governance, and customer value co-creation, this study proposes a new model for the formation of automakers' future competitive advantage, supplementing research related to digital sustainability transformation.

5.3 Managerial Implications

This study provides three managerial insights for automakers.

First, enterprises should reposition the role of SIMS, not viewing it merely as an IT department project but elevating it to the level of corporate sustainability strategy, enhancing governance effectiveness through cross-departmental collaboration.

Second, enterprises should shift from traditional manufacturing-end carbon reduction to full life cycle management, incorporating production, service, and consumer use phases into the scope of sustainability management.

Third, enterprises should strengthen their interactive relationships with consumers through SIMS, so that low-carbon information is not merely corporate disclosure content but becomes an important service tool that helps consumers change their usage behaviors, thereby further enhancing brand trust and market differentiation capabilities.

5.4 Research Limitations and Future Directions

This study adopted a qualitative research method and primarily analyzed the mechanisms through which SIMS builds competitive advantage via case studies and in-depth interviews. Therefore, the research findings mainly reflect the experiences and organizational contexts of the interviewees, without further quantitative verification of their impact on corporate performance and carbon reduction outcomes.

Future research can further integrate quantitative methods, such as structural equation modeling, longitudinal tracking studies, or cross-national comparative analyses, to verify the impact of SIMS on ESG performance and competitive advantage. Moreover, future studies can also delve deeper from the consumer perspective into the

acceptance levels of low-carbon information services among different demographic groups, so as to establish a more complete model of sustainable collaborative governance in the automotive industry.

REFERENCES

- [1] Fugger, T., Poligkeit, J., & Herrmann, C. (2025). Decarbonization in the automotive sector: A scenario-based analysis of original equipment manufacturer pathways. *Cleaner Environmental Systems*, 19, 100336. <https://doi.org/10.1016/j.cesys.2025.100336>
- [2] Vijaya, A., Meisterknecht, J. P. S., Angreani, L. S., & Wicaksono, H. (2025). Advancing sustainability in the automotive sector: A critical analysis of environmental, social, and governance performance indicators. *Cleaner Environmental Systems*, 16, 100248. <https://doi.org/10.1016/j.cesys.2024.100248>
- [3] Alioğulları, E., Topal, B., Altuntaş, G., & Kabak, M. (2024). Evaluation of risk strategies for supply chain sustainability in the automotive industry. *Heliyon*, 10(17), e37693. <https://doi.org/10.1016/j.heliyon.2024.e37693>
- [4] Ketter, W., Schroer, K., & Valogianni, K. (2023). Information systems research for smart sustainable mobility: A framework and call for action. *Information Systems Research*, 34(3), 1045–1065. <https://doi.org/10.1287/isre.2022.1167>
- [5] Aguiar, M., & Amaral, A. (2024). Digital transformation as a driver of corporate sustainability: A systematic literature review. In J. Reis, G. Marín-Raventós, & P. Isaias (Eds.), *Digital transformation and organizational resilience* (pp. 165–181). Springer. https://doi.org/10.1007/978-3-031-55779-8_12
- [6] Qian, J., Lin, H., & Chen, C. (2025). Digital transformation and ESG performance: Evidence from China's carbon-intensive firms. *Applied Economics*, 57(29), 3569–3582. <https://doi.org/10.1080/00036846.2025.2488529>
- [7] Choi, D. D., & Lowry, P. B. (2024). Balancing the commitment to the common good and the protection of personal privacy: Consumer adoption of sustainable, smart connected cars. *Information & Management*, 61(1), 103876. <https://doi.org/10.1016/j.im.2023.103876>
- [8] Kim, J., Im, E., & Gim, G. (2025). The impact of ESG management by automobile companies on consumer purchase intention. *Sustainability*, 17(19), 8733. <https://doi.org/10.3390/su17198733>
- [9] Pérez-Moure, H., Lampón, J. F., Velando-Rodríguez, M.-E., & Rodríguez-Comesaña, L. (2023). Revolutionizing the road: How sustainable, autonomous, and connected vehicles are changing digital mobility business models. *European Research on Management and Business Economics*, 29(3), 100230. <https://doi.org/10.1016/j.iedeen.2023.100230>
- [10] Sun, L., & Saat, N. A. M. (2023). How does intelligent manufacturing affect the ESG performance of manufacturing firms? Evidence from China. *Sustainability*, 15(4), 2898. <https://doi.org/10.3390/su15042898>
- [11] Li, Z., Xu, X., Bai, Q., Chen, C., Wang, H., & Xia, P. (2023). Implications of information sharing on blockchain adoption in reducing carbon emissions: A mean-variance analysis. *Transportation Research Part E: Logistics and Transportation Review*, 178, 103254. <https://doi.org/10.1016/j.tre.2023.103254>
- [12] Liao, H.-T., Pan, C.-L., & Zhang, Y. (2023). Smart digital platforms for carbon neutral management and services: Business models based on ITU standards for green digital transformation. *Frontiers in Ecology and Evolution*, 11, 1134381. <https://doi.org/10.3389/fevo.2023.1134381>