ISSN 2409-2665
Journal of Logistics, Informatics and Service Science
Vol. 12 (2025) No. 3, pp. 163-186
DOI:10.33168/JLISS.2025.0311

How Supply Chain Integration Mediates the Impact of Digital Leadership on Sustainable Innovation: A Case Study of Enlight Media

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Abstract. This study investigates how digital leadership (DL) influences sustainable innovation performance (SIP) through the mediating role of supply chain integration (SCI), using Enlight Media as a case study. Using structural equation modeling (SEM) on 472 survey responses from employees and managers, the results reveal that while DL significantly enhances SCI ($\beta = 0.614$, $p < 0.001$), it exhibits an unexpected adverse direct effect on SIP ($\beta = –0.426$, $p < 0.001$). However, SCI shows a substantial positive impact on SIP ($\beta = 0.739$, $p < 0.001$) and fully mediates the DL–SIP relationship, rendering the total effect statistically non-significant ($\beta = 0.028$, $p = 0.544$). These findings suggest that digital leadership alone may hinder innovation outcomes unless supported by effective supply chain collaboration. The study contributes to the literature by highlighting SCI as a critical organizational mechanism linking strategic leadership to sustainable innovation in creative industries.

Keywords: Digital Leadership, Supply Chain Integration, Sustainable Innovation Performance, Creative Industries, Enlight Media.

1. Introduction

In the context of ongoing digital transformation and increasing emphasis on sustainable development, the cultural and creative industries face two key pressures: adapting to rapid technological advancements while meeting growing societal demands for environmental responsibility and long-term viability. Chinese cultural enterprises, represented by Enlight Media, are exploring integrating supply chain resources under the impetus of digital leadership to realize innovation performance oriented towards sustainable goals.

Sustainable Innovation Performance (SIP), as an emerging concept in recent years in corporate research, no longer focuses solely on the output of new products or tech-nologies, but emphasizes the quality of innovation in the dimensions of environmental friendliness, resource conservation, and social responsibility （Calik & Bardudeen, 2016； Khurana et al., 2023）. This concept is particularly in line with the development aspirations of the cultural industry, spreading green ideas and building social impact while creating economic value has become one of the core objectives of the industry.

Digital Leadership (DL) is a crucial strategic driver in this process. Leaders with a digital mindset can drive structural adjustments in their organizations and guide their employees to adopt digital tools to achieve the deep integration of content creation, operations management, and green practices (Zeike et al., 2019). At the same time, supply chain integration (SCI) is essential in improving the ability of organizations to synergize upstream content supply with downstream platform distribution, providing data support and resource integration for sustainable innovation (Dubey et al., 2023).

Although studies have focused on the role of digital leadership and supply chain integration in manufacturing and service industries, there is a lack of systematic research on the relationship between the three in the cultural and creative industries, which are highly dependent on intellectual capital and digital platforms. Especially in the Chinese context, there is a lack of quantitative empirical support from typical cases on how cultural enterprises can synergize DL and SCI to enhance SIP.

It is worth noting that Enlight Media has demonstrated strong system integration and strategic leadership in digital content production, collaborative development processes, and sustainable brand extension in recent years through the creation of series such as "The Descent of Nezha" and "New Gods: Rebirth of Nezha". The Ne Zha series has demonstrated strong system integration and strategic leadership in digital content production, collaborative development processes, and sustainable brand extension. The Nezha series has not only achieved significant results at the box office but has also realized continuous innovation in cultural value and social influence. This representative case demonstrates that cultural enterprises have the practical foundation and space to realize sustainable innovation through digital leadership and supply chain integration (Chen, W. 2020; Whyke et al., 2021; Huang, X., and Wu, J. 2023).

To fill the theoretical gaps in the current research and the empirical foundation of the industry, this study takes Enlight Media as the research object. It constructs structural equation modeling (SEM) based on the questionnaire data of 472 frontline employees and middle and senior managers, systematically explores the influence path of digital leadership and supply chain integration on sustainable innovation performance, and further examines the mediating effect of SCI in the process. This study provides theoretical support for the sustainable transformation of the cultural industry and puts forward actionable suggestions on how to reconfigure the innovation ecology through organizational digitalization in practice.

2. Literature Review and Hypotheses Development

2.1. The Direct Impact of Digital Leadership on Sustainable Innovation Performance

Against the backdrop of the dual pressures of digital transformation and green development in today's organizations, Digital Leadership (DL) has become a key driver of Sustainable Innovation Performance (SIP). Digital leadership refers to a leader’s capacity to understand emerging technological trends, make

forward-looking strategic decisions, and foster organizational change while encouraging employees to engage in innovative practices. Leaders ' digital orientation is crucial to realizing green, high-quality innovation output, especially in the cultural and creative industries, where creative production is highly dependent on digital content platforms and multiple collaborative mechanisms.

El-Kassar and Singh (2019) point out that digital leaders can effectively optimize resource allocation and process efficiency with the help of big data, artificial intelligence, and information systems, thus promoting green process design and sustainable product development. Larbi-Siaw et al.'s (2023) study further suggests that digitally-driven eco-innovation helps companies realize synergistic improvements in business performance and environmental performance under eco-regulatory pressures and market volatility. Digital leaders play a vital role in strengthening an organization's capacity for sustainable innovation by promoting and adopting environmentally friendly technologies, reshaping operational processes, and fostering more integrated stakeholder engagement.

In addition, Zeike et al. (2019) emphasize that digital leadership involves not only technology adoption capability but also organizational leadership traits such as shaping a positive psychological atmosphere and enhancing employees' subjective initiative, which is particularly critical in cultural enterprises. Zhang et al. (2024) suggest that digital capability supports exploitative and exploratory innovation by facilitating organizational learning, thereby underscoring the strategic importance of digital leadership in enhancing innovation outcomes. In a related study, Demir et al. (2025) provided empirical evidence linking green leadership practices to improved innovation performance, highlighting the leadership’s pivotal role in advancing green innovation.

Overall, digital leadership enhances the ability of enterprises to sustain innovation and green transformation in uncertain environments through the triple path of "technology-culture-strategy". Therefore, this study proposes the following hypotheses:

H1. Digital leadership has a positive impact on sustainable innovation performance. (Hussein et al., 2024)

2.2. Digital Leadership and Supply Chain Integration

Against the backdrop of the wave of digitalization sweeping the world, Digital Leadership (DL) has become an indispensable strategic capability in enterprise digital transformation. Digital leaders not only have the organizational and decision-making capabilities of traditional leaders, but also emphasize the understanding of digital technology, strategic integration capabilities, and the ability to promote organizational culture transformation (Zeike et al., 2019). Especially in the cultural and creative industries, enterprises face the challenges of rapid content iteration and multi-platform distribution. Leaders' digital vision and action play a key role in the digital synergy of the overall enterprise system.

Supply Chain Integration (SCI) refers to a high degree of collaboration in information sharing, process synergy, and resource allocation among an enterprise's departments, suppliers, and customers (Flynn et al., 2010). With the deepening application of technologies such as big data, cloud computing, and blockchain, enterprises have put forward higher requirements for supply chain integration capabilities, and digital leadership is considered a key factor in driving this integration process (Prajogo & Olhager, 2012).

It has been pointed out that digital leaders can effectively break down organizational boundaries through strategic planning, system implementation, and cross-functional coordination (Alos-Simo, Verdu-Jover, & Gomez-Gras, 2017). These actions facilitate internal process alignment and information system adoption, further promoting the development of data-sharing platforms and collaborative mechanisms with customers and suppliers to enhance supply chain integration. For example, in the manufacturing and retail industries, digital leadership is significantly and positively correlated with the degree of information integration, process transparency, and willingness to collaborate (Birasnav et al., 2019). Dubey (2018), through an empirical study of the Indian automotive parts industry, also found

that digital management drove higher supply chain agility and adaptability, strengthening the integration mechanisms.

In addition, Atieh et al. (2025) state that digital technology, automation, and data integration significantly impact supply chain performance, in which digital transformation moderates overall integration capabilities. Ning and Yao (2023) further found that digital strategy significantly promotes supply chain capability, indirectly enhancing firms' competitive performance, illustrating the important transmission path of digital leadership.

Prior studies have shown that firms in the cultural and creative sectors increasingly rely on digital integration across platforms to enhance innovation and supply chain responsiveness (Ortiz-Ospino et al., 2025). For instance, creative enterprises must coordinate content production, distribution, and audience engagement through unified digital systems, highlighting the growing importance of managerial capabilities in driving supply chain performance

Based on the above discussion, this study proposes the following hypotheses:

H2. Digital leadership has a positive impact on supply chain integration.

2.3. Supply Chain Integration and Sustainable Innovation Performance

In the context of sustainable development strategy increasingly emphasized by enterprises, Supply Chain Integration (SCI) not only serves as a key means to enhance the operational efficiency of enterprises, but also plays an important role in promoting green innovation and sustainable innovation performance (Wang et al., 2022). Specifically, SCI promotes enterprises to realize green transformation and sustainable development in multiple dimensions by enhancing resource utilization efficiency, strengthening information sharing, and promoting cooperative innovation (Feng, L. and Yao, D. 2024; Gao et al., 2025).

First, effective supply chain integration significantly improves resource allocation and utilization efficiency. By integrating suppliers, manufacturers, and distribution channels, enterprises can optimize resource allocation, minimize redundant inputs and material waste, and reduce production costs and environmental impact. Moreover, implementing resource-sharing practices and coordinated scheduling mechanisms contributes to more effective production planning and inventory control, helping to mitigate supply–demand mismatches while enhancing overall operational flexibility and efficiency. At the same time, SCI promotes the adoption of green processes and energy-saving equipment, improves overall resource utilization, and lays the foundation for sustainable innovation performance (Yi et al., 2025). Recent empirical evidence also supports this view. For example, Tan et al. (2022) found that blockchain-enabled visibility significantly enhances supply chain integration, positively affecting overall supply chain performance, particularly under digital transformation pressures. Patil et al. (2024) further expand on this by showing that organizational readiness for digital twins significantly improves supply chain transparency, which mediates enhancements in sustainable performance among manufacturing firms. Building on these findings, Dubey (2023) emphasizes that effective crisis leadership plays a critical role in strengthening the influence of digital technologies on collaborative practices within emergency supply chains and achieving sustainable performance. His study underscores that leadership commitment is essential to fully realizing the benefits of technology-driven integration.

Second, establishing a unified information platform within supply chain integration enables real-time sharing of critical data—such as orders, inventory levels, and demand forecasts—significantly improving response speed and supporting more informed, data-driven decision-making. Information sharing not only reduces information asymmetry, but also promotes trust and collaborative relationships between upstream and downstream members, which supports the implementation of green strategies and innovative decision-making by enterprises (Fan et al., 2024; Wang et al., 2022). These mechanisms enhance firms' agility and sustainable innovation capabilities in uncertain environments.

Finally, supply chain integration creates an enabling environment for collaborative innovation among multiple organizations. A high level of integration supports technological cooperation and knowledge sharing among firms to promote green product development, new energy technology application, and environmentally friendly process improvement. This type of collaborative innovation not only enhances enterprises' R&D efficiency and market adaptability and forms a green innovation-oriented alliance mechanism, demonstrating green transformation for the whole industry (Sun et al., 2023； Xia et al., 2022).

In summary, supply chain integration effectively supports realizing enterprises' sustainable innovation performance through the three dimensions of resources, information, and collaboration. To this end, this study proposes the following hypotheses:

H3: Supply chain integration has a positive impact on innovation performance. (Mashat et al., 2024)

2.4. The Mediating Role of SCI between DL and SIP

In the context of accelerated digital transformation, Digital Leadership (DL) not only directly promotes the sustainable innovation performance (SIP) of enterprises but also indirectly affects the innovation performance of enterprises through the mediating mechanism of Supply Chain Integration (SCI). An intermediary mechanism that indirectly affects an organization's sustainability.

First, digital leaders lay the foundation for supply chain integration by promoting cross-functional process collaboration and information sharing within the organization through a clear digital strategy, data-driven management mechanisms, and advocacy of an innovation culture (Sagbas et al., 2023). This top-down digital push can enhance the efficiency of collaboration between enterprises, suppliers, and customers, thus strengthening the overall collaborative capability of the supply chain. Yu et al.'s (2019) study shows that DL significantly improves the level of SCI, which, in turn, directly and positively influences an enterprise's Overall Sustainable Supply Chain Performance (OSSCP) and partially mediates between DL and OSSCP.

Second, supply chain integration is an important factor influencing innovation performance. SCI bridges DL and SIP, facilitating firms in green knowledge acquisition and innovation performance. Siagian's (2021) study points out that a high level of SCI enhances a firm's responsiveness to environmental changes and resource allocation efficiency, thereby enhancing organizational innovation responsiveness in uncertain environments. The study by Ashraf (2024) found that DL enhances innovation performance by increasing firms' ability to acquire green knowledge, ultimately leading to improved sustainable firm performance. Similarly, Li, Zhang and Wang (2023) found that SCI acts as a mediating mechanism to effectively connect digital transformation with supply chain resilience, which is an important support for enhancing innovation performance.

In addition, SCI also plays a key mediating role between DL and firms' green innovation. Wang et al.'s (2022) study points out that DL enhances firms' green innovation capability by promoting the realization of SCI, which in turn enhances firms' sustainable competitive advantage. In the cultural and creative industries, DL promotes sustainable innovation in digital content collaboration, cross-platform linkage, and IP operation through the mediating role of SCI. For example, business leaders have improved innovation capabilities and market responsiveness by promoting digital transformation and integrating internal resources and external partners.

Further, research has demonstrated that the path of digital leadership to enhance innovation by improving supply chain integration has been validated across multiple industries (Ning, L., & Yao, D., 2023). In the context of cross-border e-commerce firms, Zhu et al. (2024) found that digital capabilities influence innovation performance primarily through resource integration, highlighting a complete mediation pathway. Together, these findings support the theoretical validity of the logical chain of "digital leadership→ supply chain integration→ innovation performance".

Based on the above analysis, this study proposes the following hypotheses:

H4: Supply chain integration plays a mediating role in the relationship between digital leadership and innovation performance.

2.5. Theoretical Foundation: Resource-Based View and Dynamic Capabilities Theory

This study draws upon the Resource-Based View (RBV) and the Dynamic Capabilities Theory (DCT) to provide a coherent theoretical foundation. RBV posits that firms achieve competitive advantage by effectively deploying valuable, rare, inimitable, and non-substitutable (VRIN) resources (Barney, 1991; Wernerfelt, 1984). In this context, digital leadership (DL) is conceptualized as a strategic intangible resource that empowers the organization with vision, adaptability, and technological foresight. Meanwhile, supply chain integration (SCI) represents a coordination capability that supports efficient resource alignment and cross-functional collaboration.

Complementing RBV, the Dynamic Capabilities Theory emphasizes the firm's ability to integrate, build, and reconfigure internal and external resources in response to dynamic environments (Teece et al., 1997; Teece, 2007). In this study, SCI functions as a dynamic capability enabling the transformation of digital leadership into sustainable innovation outcomes. The mediating role of SCI reflects the mechanism through which strategic leadership is operationalized into concrete performance improvements. Thus, the RBV–DCT lens offers a theoretically grounded explanation for the hypothesized relationships in the proposed model.

3. Research Design and Methodology

3.1. Research Model and Hypotheses

Based on the theoretical framework constructed in the previous chapter, this study proposes a structural model for empirically examining the relationship between Digital Leadership, Supply Chain Integration, and Sustainable Innovation Performance. The conceptual model hypothesizes that digital leadership directly and indirectly affects sustainable innovation performance through the supply chain integration mediating variable.

Digital leadership is believed to enhance synergies between firms and supply chain partners by providing strategic direction, facilitating cross-functional collaboration, and applying digital tools to promote supply chain integration. In turn, good supply chain integration contributes to the firm's sustainable innovation capability regarding information flow efficiency, joint problem-solving capability, and adaptability to environmental changes. Meanwhile, the model also considers the direct path of digital leadership on sustainable innovation performance, reflecting the extensive influence of strategic leadership in driving organizational innovation.

The structural model proposed in this study is shown in Figure 1 and contains the following four research hypotheses:

H1: Digital leadership has a positive impact on sustainable innovation performance.

H2: Digital leadership has a positive impact on supply chain integration.

H3: Supply chain integration has a positive impact on sustainable innovation performance.

H4: Supply chain integration mediates between digital leadership and sustainable innovation performance.

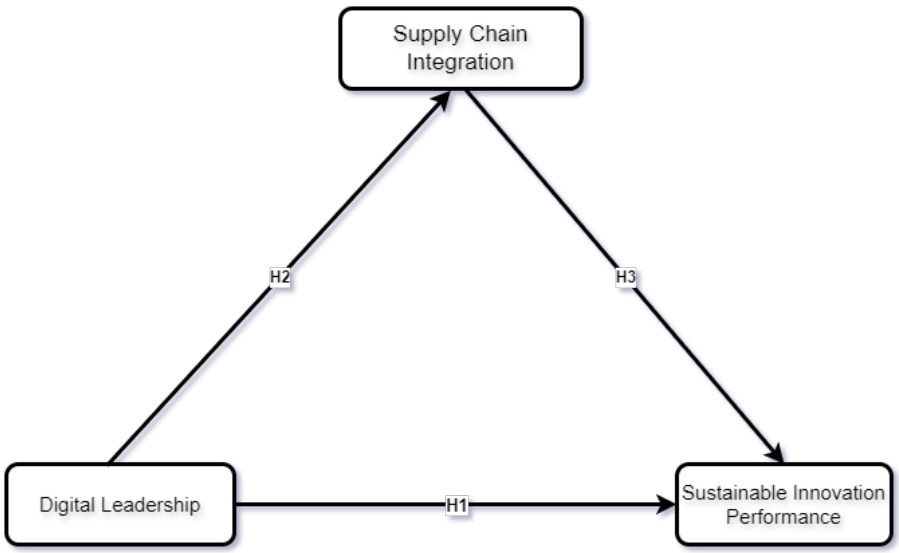

Fig. 1: Conceptual Framework

This study will use the structural equation modeling (SEM) method to test the above hypothesized paths. This method is suitable for dealing with complex causal relationships between multiple latent variables. It allows for the simultaneous assessment of the goodness-of-fit of the measurement and structural models. The following sections describe in detail the design process, data sources, scale construction, and analysis techniques of this study.

3.2. Study Design and Ethical Statement

This study adopts a quantitative research method, aiming to explore the structural relationship between digital leadership, supply chain integration and innovation performance, and takes Enlight media as the research object, and constructs an empirical model applicable to cultural and creative enterprises by using employees and managers from different departments within the enterprise as the data source. The research design adopts structural equation modeling (SEM) for path analysis, emphasizing the causal logic test between variables and constructing measurement tools based on mature scales.

Data was collected through the online platform "Questionnaire Star", and structured questionnaires were used for distribution and collection. A five-point Likert scale (1=" strongly disagree", 5="strongly agree") was used for all questions to measure the subjective perceptions of digital leadership behaviors, supply chain collaboration, and sustainable innovation performance. The questionnaire collection in this study was conducted anonymously. It was not designed to include any information related to personal privacy, such as name, phone number, email address, IP address, or job rank, to ensure that the data collection process fully respected the privacy of the respondents (Hutchinson, D., & Chyung, S. Y., 2023).

In terms of ethics, although the study did not involve any biomedical or special populations or constitute a risky study, the study still followed the basic ethical norms of social science research. An informed statement was set up at the beginning of the questionnaire, clearly informing respondents that participation was entirely voluntary, that the information provided was for academic research only, and that the data analysis did not involve individual identification or adversely affect the business. Given that the data were not private, did not involve sensitive topics, and were anonymized and controlled, the research team did not apply to an ethical review body for approval. Overall, this study followed the principles of "informed consent, data anonymity, and single use" to ensure the study design's ethical rationality and the data's legitimacy.

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While formal IRB approval was not required due to the minimal-risk nature of the study, all participants provided informed consent. The data collection process followed institutional guidelines for anonymous social science survey research. Overall, this study followed the principles of "informed consent, data anonymity, and single use" to ensure the study design's ethical rationality and the data's legitimacy.

3.3. Sampling method and sample characteristics

This study takes Enlight Media as a case study company, and the target respondents include employees and middle and senior managers from various business departments within the company, covering functional units such as content production, platform management, marketing operation, data technology, etc. The company is a typical example in the cultural and creative industry. The company has typical digital transformation characteristics in the cultural and creative industry, providing a good background for studying digital leadership and sustainable innovation performance.

To ensure the sample's representativeness and data quality, a convenience sampling method was used, and the questionnaire star link was placed through the enterprise's internal email system and WeChat workgroups to encourage employees at different functional and management levels to complete the questionnaire.

Sample size estimation followed two criteria:

First, according to the rule of thumb proposed by Black, W., Babin, B.J. (2019), each estimated parameter of a structural equation model needs to be equipped with more than 10 times the observed sample. The model in this study contains about 30 free parameters, and the recommended sample size is not less than 300. The model in this study contains about 30 free parameters. Specifically, the structural equation model includes three core latent variables (DL, SCI, SIP), one mediation path (DL → SCI → SIP), and 19 observed variables, resulting in approximately 30 freely estimated parameters, including factor loadings, regression paths, variances, and covariances. According to Black and Babin (2019), a rule-of-thumb suggests at least 10 observations per parameter, leading to a minimum sample size of 300 to ensure model estimation stability and validity.

Second, to more accurately assess statistical efficacy, this study used G*Power 3.1 for sample size calculation. Setting an effect size of medium ($f^2 = 0.15$), a significance level of $\alpha = 0.05$, a statistical efficacy (Power) of 0.80, and several predictor variables of three (DL, SCI, and IP), the results showed a minimum sample requirement of 77. Considering the model complexity and the high number of covariance paths between the latent variables, the study set the target sample at 300-350 copies to improve the stability and fit of the model estimation (Kang, H. 2021).

After data collection, all data will be analyzed by R, including data preprocessing, reliability and validity tests, latent variable modeling, and path estimation. The analytical method of R is characterized by openness and reproducibility, and has been widely used in social science and management research.

3.4. Measurement tools and variable construction

To ensure the scientific and empirical reliability of the measurement tools, three sets of well-established scales from high-quality academic literature were used in this study to measure Digital Leadership (DL), Supply Chain Integration (SCI), and Sustainable Innovation Performance (SIP),

respectively. All items were rated on a five-point Likert scale (1=" strongly disagree" to 5=" strongly agree") to measure the respondents' subjective perception of the behavior or phenomenon in question.

Digital Leadership (DL) was measured using five question items developed by Zeike et al. (2019), which focus on the ability of top executives to steer their organizations, apply technology strategically, and their propensity for employee empowerment in driving their organization's digital transformation. Typical questions include "Our leaders are open to emerging digital technologies" and "Management actively promotes digital tools in the organization." The scale has been validated in several industries and has good construct validity and cross-situational applicability.

Supply Chain Integration (SCI) uses the three-dimensional integration model scale proposed by Flynn (2010), covering internal, supplier, and customer integration. Considering the characteristics of the cultural and creative industries, this study extracted nine core items from the original scale, including, for example, "Our company has established a unified coordination process between departments," "We share market and customer information frequently with our key partners." "We maintain close communication with downstream channels in content distribution and marketing". This scale is widely used in manufacturing, service, and digital platform research with good breadth.

The Sustainable Innovation Performance (SIP) measure adopts the performance dimensions from the Organizational Innovation Scale proposed by Calik et al., (2016) and Demir et al., (2025), and five questions are selected to measure the firm's performance in terms of new product development, technological application, and market responsiveness. Example questions include "We are better than our peers in introducing new products or services", "We have a higher percentage of new products successfully developed", "We can respond quickly to market changes ", etc.

All original English scale items were first translated into Chinese by two independent bilingual researchers familiar with management and innovation research. A third expert then conducted back-translation into English to verify conceptual equivalence. Discrepancies were discussed and resolved among the three experts.

To ensure cultural appropriateness in the context of the Chinese media industry, three additional domain experts were consulted to review the translated items for clarity and contextual relevance. Based on their feedback, minor revisions were made to improve semantic precision.

Before formal data collection, the final version of the questionnaire was pilot-tested with 10 employees at Enlight Media to assess readability and comprehension. Based on their responses and comments, a few wording adjustments were applied to enhance clarity. This multi-step process ensured both linguistic and cultural validity of the measurement tools..

3.5. Data Collection and Processing Procedures

After completing the questionnaire design, the research team conducted an online survey between March and April 2025 through the "Questionnaire Star" platform. In order to ensure the clarity and applicability of the scale, 10 Enlight media employees were invited to pre-test the questionnaire before its official distribution, and some expressions were slightly adjusted after collecting feedback to ensure accurate language and no ambiguity in understanding. The final questionnaire consisted of three core latent variables (Digital Leadership, Supply Chain Integration, and Sustainable Innovation Performance) totaling 19 items, all rated on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

The questionnaire links were delivered through multiple channels such as internal email systems, workgroups, and project coordinators. Respondents could complete the questionnaire voluntarily, which took about 5 to 7 minutes. To ensure the quality of the data, respondents were explicitly informed in the survey instructions that the study was completely anonymous, that the data obtained would be used for academic purposes only, and that no personally identifiable information would be collected. The research team did not intervene during the entire research process to ensure voluntary participation and data independence.

All data processing and statistical analyses were done using the R language. The main R software packages used in the study included tidyverse (for data cleaning and transformation), lavaan (for structural equation model estimation), psych and semTools (for reliability and validity analyses), ggplot2 (for visualization), and officer and flextable (for generating thesis forms). Before modeling, all continuous variables were tested for normality, and variables used for interaction analysis were centered to control for the risk of multicollinearity.

This study adopts the structural equation modeling (SEM) methodology with the help of the open-source analysis platform in the R language, which not only ensures the high transparency and reproducibility of the modeling process but also meets the high standards of rigor and methodological scientificity of data processing required in current management research.

3.6. Confidence and Validity Test Methods

Before proceeding to the structural model path analysis, this study will first test the reliability and validity of the measurement model through the structural equation modeling (SEM) method. The measurement model will be evaluated based on several metrics, including factor loadings (whether the standardized coefficient is significant and greater than 0.6), Composite Reliability (CR > 0.7), Average Variance Extracted (AVE > 0.5), and Discriminant Validity test (Fornell-Larcker criterion with Heterogeneous Convergence-Homogeneous Consistency Ratio, HTMT < 0.85).

Data processing and model estimation for all latent variables will be done in R, using software packages such as lavaan, semTools, and psych. The empirical analyses of the structural path coefficients and hypothesis testing will be conducted after ensuring that the measurement model has goodness of fit and indicator quality.

4. Data Analysis and Results

4.1. Descriptive Statistics of Respondents' Basic Information

This study, 472 valid questionnaires were collected from Enlight Media, covering employees in various departments such as content production, marketing, technical platform, and administrative support. Table 1 shows the basic demographic characteristics of the respondents.

Table 1. Frequency of General Information

Characteristic		Frequency	Percentages(%)
Gender	Male	213	45.0
	Female	259	55.0
Age	Below 25	118	25.0
	26-35	169	36.0
	36-45	111	24.0
	Over 46	74	16.0
Edu	Below Bachelor	293	62.0
	Over Master	179	38.0
Title	Office Worker	279	59.0
	General Managers	133	28.0
	Senior Managers	60	13.0

Regarding gender distribution, there are 259 female respondents (55.0%) and 213 male respondents (45.0%). In terms of age structure, employees between 26 and 35 years old are the leading group, accounting for 36.0%, followed by those under 25 years old (25.0%) and between 36 and 45 years old (24.0%), and those over 46 years old only account for 16.0%, which indicates that the sample group is mainly young and middle-aged employees.

Regarding education, most respondents have less than a bachelor's degree, accounting for 62.0%, while 179 have a master's degree or above, accounting for 38.0%. This reflects the co-existence of employees with different education levels in the cultural and creative industries.

Regarding job levels, front-line office workers are the main component, accounting for 59.0%; middle-level managers (e.g., department managers) account for 28.0%; and top-level managers account for 13.0%. This grade distribution helps to collect multi-dimensional cognitive data on digital leadership, supply chain integration, and innovation performance from different organizational levels.

The diverse and representative sample provides a solid data foundation for the subsequent structural model fitting and empirical analysis. In order to present the structural distribution of the sample more intuitively, Figure 1 shows the distribution of bar charts for the main demographic characteristics such as gender, age, education, and rank.

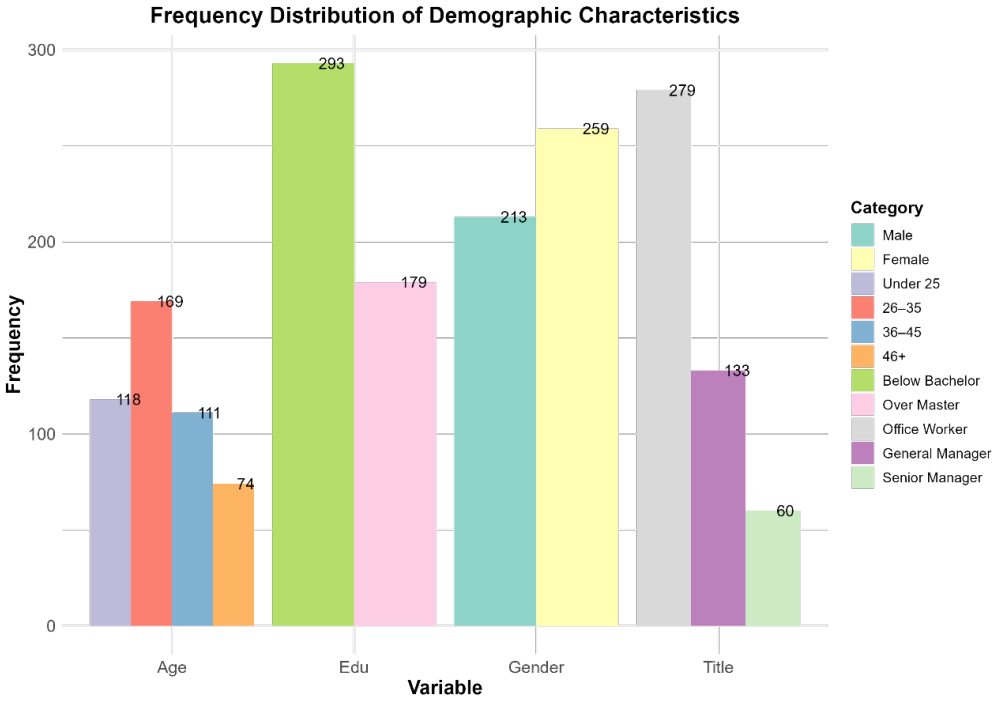

Fig. 2: Frequency of General Information

4.2. Reliability and Validity Assessment of the Measurement Model

Confirmatory factor analysis (CFA) was conducted to evaluate the reliability and validity of the measurement model. Table 2 presents the factor loadings, Cronbach's alpha, and the results of the CFA. Loadings, Cronbach's alpha (CA), composite reliability (CR), and average variance extracted (AVE) for all constructs.

Table 2. Confirmatory Factor Analysis

Observed and Latent Variables	Loading
Digital Leadership (DL) CA=0.953, CR=0.953, AVE=0.802 *Source(s): Based on* Zeike et al. [3]	
DL1. Our leaders are open to new digital technologies.	0.906
DL2. Our top management promotes the use of digital tools.	0.899
DL3. Our leaders encourage employees to develop digital skills.	0.895
DL4. Our leadership provides a clear digital vision for the organization.	0.893
DL5. Our managers actively drive digital change.	0.886
Supply Chain Integration (SCI). CA=0.977, CR=0.977, AVE=0.828 *Source(s):* Flynn [12]	
SCI1. We have standardized processes across departments.	0.919
SCI2. Departments work together to solve problems jointly.	0.900
SCI3. We regularly share important information across departments.	0.916
SCI4. We frequently exchange information with our key suppliers.	0.914
SCI5. We collaborate with suppliers in product development.	0.907
SCI6. We jointly solve problems with our suppliers.	0.902
SCI7. We share demand forecasts with major customers.	0.917
SCI8. We collaborate with customers to improve products/services.	0.912
SCI9. We are involved in planning with customers.	0.903

Observed and Latent Variables	Loading
Sustainable Innovation Performance (IP). CA=0.962, CR=0.962, AVE=0.836	
Sources(s): Calik et al., [1]和 Demir et al., [11]	
SIP1. Our organization has developed new products that reduce environmental impact.	0.896
SIP2. We have implemented innovative processes that enhance energy efficiency and reduce waste.	0.910
SIP3. Our sustainable innovation initiatives have contributed to the company's brand image.	0.924
SIP4. Our company promotes eco-friendly practices in product design and marketing strategies.	0.916
SIP5. Sustainable innovation practices in our organization help maintain long-term competitive edge.	0.924

As shown in Table 2, all factor loadings exceeded the recommended threshold of 0.70, indicating sufficient indicator reliability. Cronbach's alpha and CR values for the three factors are shown in Table 2. Cronbach's alpha and CR values for all constructs ranged from 0.953 to 0.977, far exceeding the 0.70 cutoff, suggesting excellent internal consistency (Black, W., Babin, B.J., 2019). The AVE values for all constructs were above the recommended value of 0.50, demonstrating strong convergent validity (Fornell, C., & Larcker, D. F. 1981). These results confirm that the measurement model has satisfactory reliability and convergent validity.

Table 3. Fornell-Larcker Discriminant Validity Matrix

Construct	DL	SIP	SCI
DL	0.896	0.028	0.614
SIP	0.028	0.914	0.478
SCI	0.614	0.478	0.910

In this study, we tested the discriminant validity of the constructs using the Fornell-Larcker criterion (see Table 3). The values on the diagonal of the matrix are the square root of the AVE of each latent variable (DL = 0.896, SCI = 0.910, SIP = 0.914), and the off-diagonal values are the correlation coefficients between the latent variables (DL-SCI = 0.614, DL-SIP = 0.028, SCI -SIP = 0.478). According to Fornell & Larcker's (Fornell, 1981) criterion, the square root AVE of any latent variable is greater than its correlation coefficient with the other latent variables (e.g., DL: 0.896 > max(0.614, 0.028)), which suggests that there is good discriminant validity among all constructs and that the measurement model can discriminate between different theoretical concepts.

Table 4. HTMT Discriminant Validity Ratios

Construct	DL	SCI	SIP
DL		0.614	0.036
SCI	0.614		0.478
SIP	0.036	0.478	

To further validate the discriminant validity of the latent constructs, this study calculated the Heterotrait-Monotrait (HTMT) ratios between pairs of constructs (see Table 2). The results showed that the HTMT between digital leadership (DL) and supply chain integration (SCI) = 0.614, between DL and sustainable innovation performance (SIP) = 0.036, and between SCI and SIP = 0.478. All ratios were below 0.85 according to the criterion proposed by Henseler et al. (2015), which indicates that the potential constructs are sufficiently differentiated statistically and have good discriminant validity.

4.3. Correlation Coefficient Test

Table 5. Correlation Coefficient

Term	Age	Gender	Edu	Title	SCI	SIP	DL
Age	1.000						
Gender	-0.018	1.000					
Edu	0.020	0.007	1.000				
Title	-0.087	0.079	0.050	1.000			
SCI	-0.120	-0.058	-0.050	0.089	1.000		
SIP	-0.077	-0.050	-0.003	0.077	0.464	1.000	
DL	-0.091	0.012	-0.013	0.114	0.593	0.026	1.000

In order to preliminarily explore the relationship between the demographic variables and the core latent variables, Pearson correlation coefficients were calculated between the variables. As shown in Table 5, most of the demographic variables (age, gender, education, and job title) are associated with three core latent variables- Digital Leadership (DL), Supply Chain Integration (SCI), and Sustainable Innovation Performance (SIP). The correlations with the three core latent variables- Digital Leadership (DL), Supply Chain Integration (SCI), and Sustainable Innovation Performance (SIP)-were weak. For example, job title was weakly positively correlated with digital leadership (r = 0.114), suggesting that employees at higher management levels may have higher perceptions of digital leadership in the organization. In contrast, age was negatively correlated with supply chain integration (r = -0.120), indicating that younger employees have a relatively higher perception of the degree of integration.

Between the three core latent variables, there is a significant positive correlation between digital leadership and supply chain integration (r = 0.593), indicating that organizations with stronger digital leadership also perform better in collaborative supply chain integration; the correlation between supply chain integration and sustainable innovation performance is moderately positive (r = 0.464), while the correlation between digital leadership and sustainable innovation performance is weaker (r = 0.026), suggesting that the path of influence may be indirect. Overall, the correlation coefficients between all variables do not exceed 0.70, indicating no serious multicollinearity problem between the variables.

In order to present the relationship structure between the variables more intuitively, a correlation heatmap (see Figure 2) is drawn in this study, which further demonstrates the correlation strength and direction between the variables through visualization. It provides support for the subsequent structural equation modeling analysis.

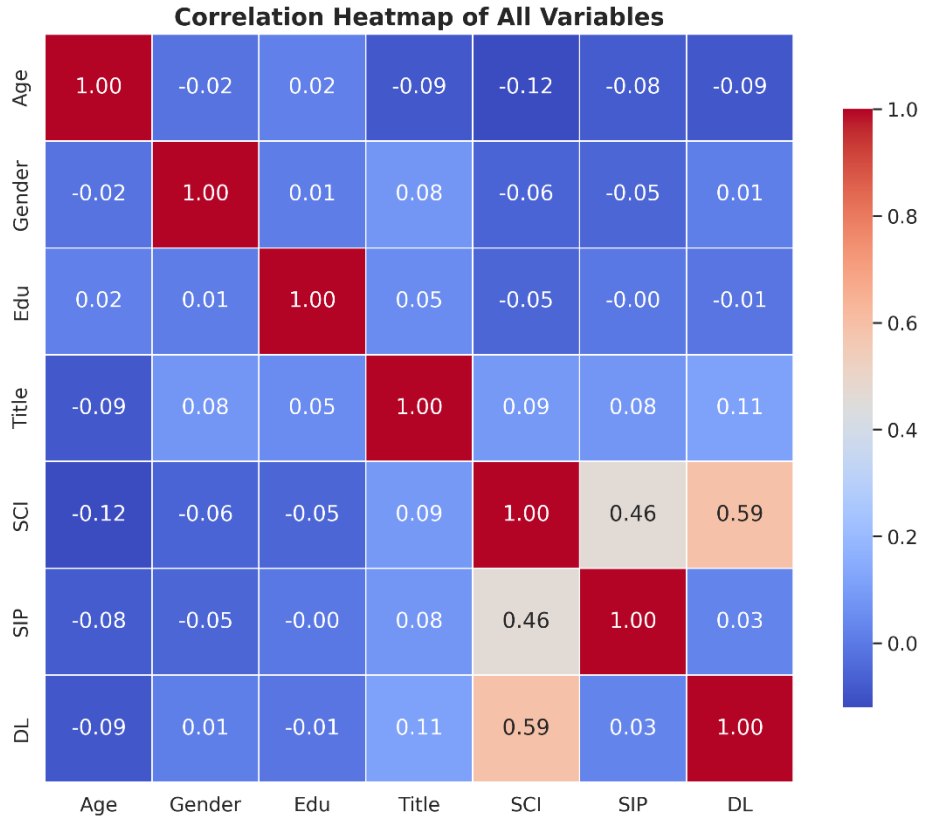

Fig.2: Correlation Heatmap

4.4. Structural Equation Modeling (SEM) and Hypothesis Testing

Table 6. Structural Path Coefficients

EffectType	Path	Std_Beta	CI	P_value	Effect_Size
Direct	DL → SCI	0.614***	[0.588, 0.734]	0.000	Large
Direct	SCI → SIP	0.739***	[0.598, 0.782]	0.000	Large
Direct	DL → SIP	-0.426***	[-0.526, -0.327]	0.000	Medium
Indirect	DL → SCI → SIP	0.454***	[0.381, 0.542]	0.000	Medium
Total	DL (Total Effect on SIP)	0.028	[-0.062, 0.118]	0.532	Negligible

Note： Based on Cohen's (1988) guidelines, path coefficients greater than 0.5 are considered significant, those between 0.3 and 0.5 are medium, and those between 0.1 and 0.3 are small.

In order to test hypotheses H1-H4, this study uses maximum likelihood estimation to conduct path analysis of structural equation modeling (SEM), and the results are shown in Table 6.

As shown in Table 6, digital leadership (DL) exerts a significant and large positive effect on supply chain integration (SCI) ($\beta = 0.614$, $p < 0.001$, 95% CI [0.588, 0.734]), supporting Hypothesis 1. SCI, in turn, demonstrates a substantial positive impact on sustainable innovation performance (SIP) ($\beta = 0.739$, $p < 0.001$, 95% CI [0.598, 0.782]), validating Hypothesis 2. Surprisingly, DL has a significant but moderately negative direct effect on SIP ($\beta = -0.426$, $p < 0.001$, 95% CI [–0.526, –0.327]), which supports Hypothesis 3 and indicates a suppression effect in the presence of SCI. The indirect effect of

DL on SIP via SCI is significant (β = 0.454, p < 0.001, 95% CI [0.381, 0.542]), confirming Hypothesis 4.

However, the total effect of DL on SIP is statistically non-significant (β = 0.028, p = 0.532, 95% CI [–0.062, 0.118]), suggesting that SCI fully mediates the relationship and offsets the adverse direct effect of DL on innovation outcomes.

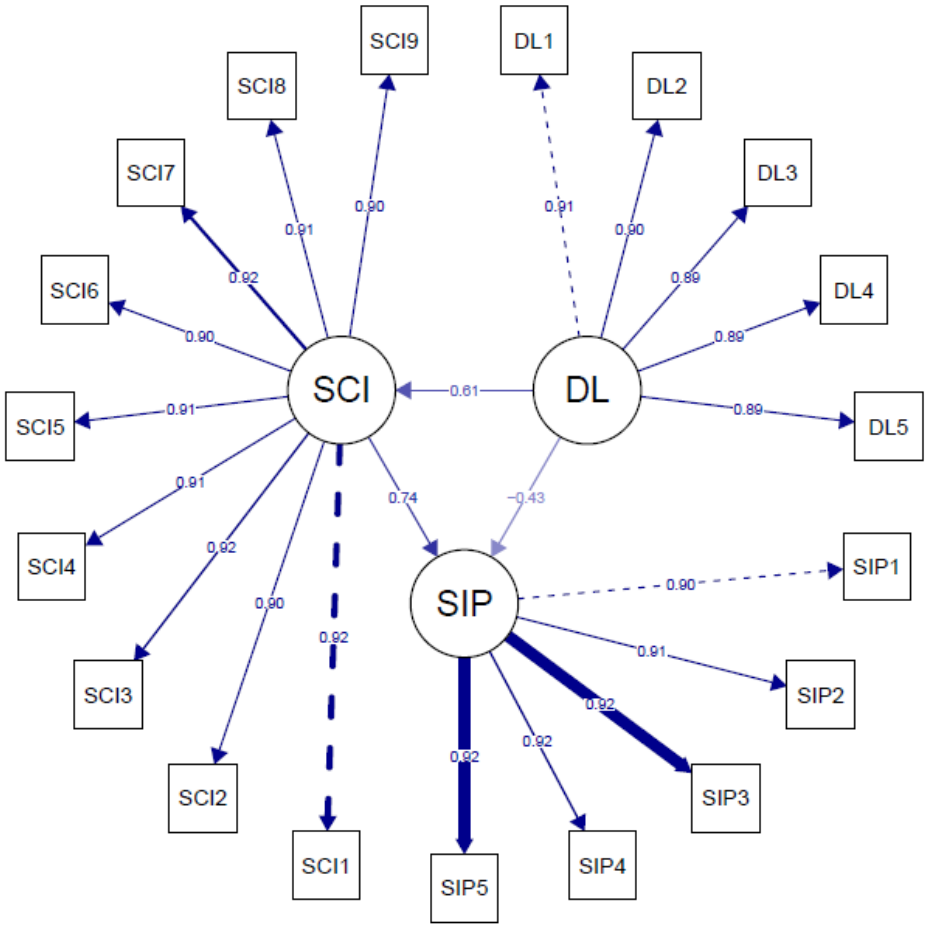

Fig. 3: Model Path

In summary, the findings reveal the key bridging role of supply chain integration between digital leadership and sustainable innovation performance, emphasizing the mediating mechanism of integration capabilities in transforming digital strategies into sustainable innovation outcomes.

Table 7. Model Fit Indices with Recommended Thresholds

Index	Value	Recommended.Threshold
Chi-square	161.702	As low as possible
Degrees of Freedom	149.000	—
p-value	0.225	> 0.05
CFI	0.999	≥ 0.90 (better if ≥ 0.95)
TLI	0.999	≥ 0.90 (better if ≥ 0.95)
RMSEA	0.013	≤ 0.08 (good if ≤ 0.05)
RMSEA 90% CI Lower	0.000	—
RMSEA 90% CI Upper	0.026	—
SRMR	0.017	≤ 0.08

As shown in Table 7, the structural model exhibited an excellent overall fit to the data. The chi-square statistic was non-significant (χ^2 = 161.702, df = 149, p = 0.225), suggesting no substantial discrepancy between the hypothesized and observed covariance structures.

Key incremental fit indices, including the Comparative Fit Index (CFI = 0.999) and Tucker-Lewis Index (TLI = 0.999), greatly exceeded the recommended threshold of 0.90, indicating near-perfect model fit.

The Root Mean Square Error of Approximation (RMSEA) was 0.013, with a 90% confidence interval of [0.000, 0.026], and the Standardized Root Mean Square Residual (SRMR) was 0.017—both well below the recommended maximum of 0.08.

These results confirm that the proposed structural equation model fits the empirical data exceptionally well and strongly supports subsequent hypothesis testing.

5. Discussion

This study explores the structural relationship between digital leadership (DL), supply chain integration (SCI), and sustainable innovation performance (SIP) in Chinese cultural and creative enterprises undergoing digital transformation. It focuses on how SCI mediates the influence of DL on SIP. These results are theoretically valuable for understanding innovation mechanisms under digitalization and provide practical insights for organizational strategy during green transitions.

First, digital leadership significantly positively affects supply chain integration (β = 0.614, p < 0.001). This indicates that managers who demonstrate digital leadership are better positioned to foster information sharing, standardize processes, and facilitate cross-functional collaboration, particularly under the pressure of rapid technological change. This result aligns with previous findings by Zeike (2019) and Yu et al. (2019), who identified a strong association between digital leadership and organizational integration. However, unlike prior studies primarily focused on healthcare or general corporate environments, this research provides empirical evidence from the cultural and creative industry, where cross-platform integration and content supply chain coordination are increasingly central. Therefore, our findings extend the existing literature by validating the transferability of digital leadership's integrative effect in a highly dynamic, creative, and digitally disrupted context.

Second, supply chain integration (SCI) significantly contributes to sustainable innovation performance (β = 0.739, p < 0.001). This indicates that firms can enhance their ability to develop environmentally friendly products, streamline internal workflows, engage external partners, and ultimately build green brand value through integration practices. This result corroborates Flynn et al. (2010), who emphasized the role of internal and external integration capabilities in driving innovation performance. Our findings also expand on this by demonstrating SCI's strategic significance in the green transformation of digital-intensive industries such as media and entertainment. In these sectors, supply chain integration improves operational efficiency. It is a critical mechanism for translating

digital inputs into sustainable outputs, particularly under heightened regulatory and market expectations for sustainability..

Interestingly, and contrary to prior expectations, digital leadership significantly negatively affects sustainable innovation performance ($\beta = -0.426$, $p < 0.001$). This surprising result challenges the mainstream assumption that digital leadership benefits innovation outcomes. One plausible explanation lies in the absence of effective integration mechanisms. Without coordinated internal processes or aligned external partnerships, digital initiatives may induce fragmented efforts, resource misallocation, or strategic inconsistency, ultimately hindering sustainable innovation. This pattern resonates with Zhou, Wang, and Li (2023), who argue that digital transformation, when poorly embedded within the firm's strategic orientation (e.g., cost leadership vs. differentiation), can backfire. It also echoes suppression effects identified in prior SEM literature, where indirect paths may offset or reverse direct influences (MacKinnon, 2012). Therefore, this finding not only underscores the risks of digital idealism but also introduces a rare empirical case where digital leadership's direct influence is negative, highlighting the critical role of integration as an enabler and safeguard.

Mediation analysis further confirms that supply chain integration (SCI) fully mediates the relationship between digital leadership and sustainable innovation performance. While the indirect effect is statistically significant ($\beta = 0.454$, $p < 0.001$), the total effect becomes non-significant ($\beta = 0.028$, $p = 0.532$), highlighting a complete mediation structure. This pattern suggests that digital leadership alone cannot directly foster sustainable innovation unless channeled through integrated supply chain mechanisms. In conceptual terms, SCI functions as a capability conduit, transforming leadership intent into tangible innovation outputs. This finding contributes to the literature by reinforcing the importance of integration as a strategic enabler of innovation. It aligns with growing empirical evidence that the effectiveness of organizational capabilities depends on structural mechanisms (e.g., supply chain and cross-functional integration).

In summary, this study enriches the theoretical connotation of the relationship between digital leadership and sustainable innovation, emphasizes the bridging role of the integration mechanism, and provides a feasible path for the green transformation of the media industry. Especially in the context of data-driven and sustainable transformation, enterprise managers need to be wary of "technological idealism" and pay more attention to mechanism design and resource synergy to realize sustainable innovation in the true sense.

6. Conclusion

In the context of increasing global emphasis on green transformation and digital synergy, this study constructed and tested a structural equation model (SEM) to examine the relationships among Digital Leadership (DL), Supply Chain Integration (SCI), and Sustainable Innovation Performance (SIP), using empirical data from China's media industry. Three key findings emerged:

First, digital leadership strongly and significantly affects supply chain integration ($\beta = 0.614$, $p < 0.001$). This indicates that leaders' digital competence and strategic mindset are instrumental in fostering internal-external resource coordination during digital transformation. This supports the notion that leadership behaviors are a critical upstream capability that enables downstream integration structures.

Second, supply chain integration is positively associated with sustainable innovation performance ($\beta = 0.739$, $p < 0.001$), reinforcing its role as a strategic lever for improving green product development, emission reduction, and innovation agility. This finding extends prior integration theory by positioning SCI as an operational necessity and a core mechanism for sustainable competitiveness in content-intensive industries.

Third, and most intriguingly, the direct effect of digital leadership on innovation performance is significantly adverse ($\beta = -0.426$, $p < 0.001$). In contrast, its indirect effect via SCI is significantly positive ($\beta = 0.454$, $p < 0.001$), producing a fully mediated model. This counterintuitive result

challenges the prevailing assumption that digital leadership inherently enhances innovation. It underscores the importance of structural enablers such as SCI in translating leadership vision into innovation outcomes.

Collectively, these findings enrich the theoretical understanding of how digital capabilities influence innovation through integrative mechanisms and provide actionable insights for media firms seeking to align digital leadership with sustainable transformation.

7. Management Implications and Future Research Directions

7.1. Theoretical Contributions

This study contributes to the theoretical understanding of digital leadership and innovation in several meaningful ways. It challenges the conventional assumption that digital leadership inherently drives positive innovation outcomes. By revealing a statistically significant adverse direct effect of digital leadership on sustainable innovation performance, the study introduces a conditional perspective: digital leadership may be ineffective or counterproductive when not complemented by integrative organizational mechanisms. Another important theoretical advancement lies in the confirmation that supply chain integration fully mediates the relationship between digital leadership and sustainable innovation performance. This finding extends the integration literature by elevating SCI from an operational facilitator to a strategic enabler. It supports the view that integration capability is not merely supportive infrastructure but a core channel through which digital leadership becomes transformative. Moreover, the study enriches structural modeling in digital strategy by adopting a dual-path SEM approach, distinguishing between direct and mediated relationships. This methodological rigor contributes to the broader literature by offering a replicable framework for examining how digital capabilities interact with organizational systems to generate innovation outcomes. Finally, by focusing on a content-driven enterprise within the Chinese media industry, the study provides context-specific insights into an under-explored setting. It adds cultural and institutional nuance to existing theories, paving the way for comparative research across different sectors and regions..

7.2. Practical Implications

The findings of this study offer several actionable insights for managers navigating digital transformation in content-intensive industries. Rather than relying solely on visionary digital leadership, organizations should focus on building structured integration mechanisms across internal functions and external partners. These mechanisms include standardized digital workflows, cross-departmental communication protocols, and resource co-allocation systems that align innovation efforts and operational capacity. Enterprises should treat supply chain integration as a strategic priority, not just a technical coordination function. This includes fostering long-term partnerships with upstream suppliers and downstream distributors, enhancing real-time information sharing, and aligning digital tools with green innovation goals. A high level of integration can significantly enhance responsiveness, creativity, and sustainability, especially in cultural and creative sectors, where content development, IP licensing, and multi-platform distribution are intertwined. Digital transformation initiatives should be sequenced appropriately. Managers are advised to prioritize integration readiness, ensuring internal processes and external relationships can support digital initiatives before launching large-scale technological upgrades. This sequencing mitigates the risk of fragmented strategies and supports more cohesive innovation outcomes. The case of Enlight Media provides a practical example of how digital leadership, when embedded within an integrated supply chain, can lead to scalable innovation performance. The success of “The Descent of Nezha” was due to digital creativity and the firm’s ability to coordinate across planning, production, distribution, and branding functions. This case highlights the importance of

combining leadership vision with operational structure, offering a reference model for other media firms pursuing sustainable innovation.

7.3. Directions for Future Research

While this study provides important theoretical and empirical insights, several limitations offer opportunities for future research.

The first limitation lies in the single-industry, single-firm design, which may restrict the generalizability of the findings. Future studies could conduct comparative cross-industry analyses—for instance, contrasting cultural industries with manufacturing, education, or fintech sectors—to validate whether the DL–SCI–SIP framework holds across heterogeneous environments.

Second, this study adopts a cross-sectional design, which limits the ability to infer causal relationships or capture temporal dynamics. Longitudinal studies using panel data could explore how the effects of digital leadership and integration evolve, particularly in response to changing external conditions or organizational maturity.

Third, as Enlight Media operates under an IP-driven and platform-oriented business model, future research could investigate how digital leadership fosters creative co-production platforms and external innovation ecosystems. Such studies could explore how firms like Enlight transition from episodic innovation to systematic value creation via platform-supply chain integration.

Finally, future research can extend the current model by incorporating moderating and mediating variables, such as organizational learning capability, environmental turbulence, and market orientation. This would enable researchers to test more nuanced mechanisms and better reflect the complexity of digital transformation in dynamic environments.

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