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Intelligence-Driven Environmental Decision Making through Green Management: Do High ESG maturity vs. Low ESG maturity Organizations Think Differently?

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ABSTRACT

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Environmental, Social, and Governance (ESG) maturity has become a critical factor influencing organizational sustainability; however, limited research has examined whether organizations with different ESG maturity levels utilize environmental intelligence differently. This study investigates the effects of green management on environmental intelligence capability and green decision intelligence, examines the moderating role of environmental data transparency and quality, and, most importantly, compares whether high ESG maturity and low ESG maturity organizations think differently in intelligence-driven environmental decision-making. Data were collected from managers in Chinese manufacturing industry and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) and Partial Least Squares Multi-Group Analysis (PLS-MGA). The findings reveal that green management positively enhances environmental intelligence capability and green decision intelligence, while environmental intelligence capability significantly improves green decision intelligence. Environmental data transparency and quality strengthen the relationship between green management and environmental intelligence capability but does not significantly moderate the relationship between environmental intelligence capability and green decision intelligence. Furthermore, the multi-group analysis demonstrates significant differences between high ESG maturity and low ESG maturity organizations, indicating that organizations with higher ESG maturity utilize green management and environmental intelligence more effectively to support sustainable decision-making. The study contributes to the literature by identifying ESG maturity as an important organizational boundary condition and provides practical guidance for strengthening intelligence-driven environmental management in manufacturing organizations.

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INTRODUCTION

Climate change, resource shortage and environmental degradation have made sustainability a priority for strategic decisions among organizations (Motlaghzadeh et al., 2023). China is one of the biggest manufacturing economies worldwide which is increasingly under pressure to achieve a balance between economic development and environmental protection, while retaining its competitiveness (McKay & Song, 2010; Saber et al., 2021). As a result, companies are looking to invest in green management and digital technologies in order to enhance their environmental performance and contribute to sustainable development (Leal Filho et al., 2022). Therefore, green management has become a strategic competency (Akhtar et al., 2026) through which an organization can embed environmental issues into its business practice, innovation and decision making. Implementing environmentally sustainable practices can enhance resource utilization, minimize waste, and boost the organization's sustainability competitiveness (Goulart Coelho & Lange, 2018). But this complexity is increasing, and organizations must go beyond traditional management models and gain more sophisticated skills to help them use environmental information to create environmental intelligence. Artificial Intelligence (AI), big data analytics and digital environmental monitoring systems offer organizations an unprecedented opportunity to gather, process and analyses environmental data (Miller et al., 2025), consequently improving their organizational responsiveness towards sustainability challenges.

In this context, the environmental intelligence capability has emerged as a key resource for organizations (Al-Hyassat & Ghasemi, 2025). The capacity to obtain, assimilate, process and apply environmental data to guide strategic and operational decisions. Companies with high environmental intelligence capability can be more effective in recognizing environmental hazards (Settembre-Blundo et al., 2026), predicting regulatory shifts, using resources efficiently, and developing proactive environmental sustainability plans. However, higher level of environmental management does not mean they are making effective environmental decisions. Its effectiveness is dependent on the quality, transparency and reliability of the environmental data used throughout the decision-making process.

Transparency and quality of environmental data have gained significance for organizations aiming to enhance their sustainability performance (Zsóka & Vajkai, 2018). Environmental data is transparent, accurate and reliable and therefore gives more confidence to managers, less uncertainty and supports evidence-based environmental decision making. Quality environmental information also enables to increase organizational accountability (Raiborn et al., 2011), since sustainability agendas are backed by credible and verifiable information. Therefore, environmental data transparency and quality can be a complementary reinforcement for the effectiveness of green management practices and environmental intelligence capability to foster green decision intelligence.

Although the research on ESG, green management and AI have increased in recent years (Li et al., 2025; Niftiyev, 2025; Samieva et al., 2023), insufficient studies have been conducted to understand whether there are differences in how these organizational capabilities are used across organizations with varying ESG maturity. Organizations with high ESG maturity tends to have a more developed sustainability governance, environmental reporting systems, and digital infrastructure, while those with low ESG maturity present relatively lower levels of sustainability integration and environmental management. Therefore, the impact of green management, environmental intelligence capability and transparency of environmental data can differ significantly based on the ESG maturity level of an organization. But there are limited empirical studies that have directly examined the relationship between these organizational groups, especially in the manufacturing sector in China. Therefore, the present study explores the moderating effect of environmental data transparency and quality and how green management affects green decision intelligence through environmental intelligence capability. Moreover, the structures of high and low ESG mature manufacturing enterprises in China are compared in this study. The study contributes to the growing literature on ESG maturity and

environmental intelligence by clarifying the relationship between ESG maturity and intelligence-based environmental decision-making, and provides practical insights for manufacturing companies aiming to improve their ESG performance and sustainable competitiveness in the long term.

LITERATURE REVIEW

High ESG Maturity Organizations

A high ESG maturity organization is one that has put environmental, social and governance principles into its strategy, processes and decision-making (Bin-Nashwan et al., 2026). Considering sustainability as a long-term competitive advantage, these organizations are taking proactive measures to manage environmental risks and stakeholder expectations (Benn et al., 2009), rather than simply complying with regulations. This trend is evident in China, where big manufacturing companies are increasingly adopting green technology, digitalization, and intelligent environmental management systems to improve their ESG scores and meet national sustainability goals (Bibi et al., 2024; Yin et al., 2022). Organizations with high ESG maturity often have strong governance, environmental policies, sustainability reporting and the data management tools to support evidence-based decision making. They also use artificial intelligence, big data analytics and environmental monitoring systems to produce actionable environmental intelligence to enhance operational efficiency and lessen environmental impacts. Thus, these organizations have a better chance of converting green management projects into green information to guide timely green decision making, enhancing organizational resilience, compliance and sustainable competitiveness.

Low ESG Maturity Organizations

Low ESG maturity organizations show relatively low levels of integration of environmental, social and governance practices in their strategic and operational activities (Trentin & Marques, 2025). Sustainability projects carried out to meet regulatory requirements than to become a part of the business as a business tool (Bube et al., 2025). The manufacturing industry of China still has a lot of small and medium enterprises (SMEs) that are struggling with financial difficulties (Van Biesebroeck, 2014), inadequate digital facilities, irregular environmental data and poor sustainability governance. These limitations hinder their ability to effectively apply green management principles and use environmental intelligence in strategic decision making. In addition, poor transparency and quality of environmental data can lead to uncertainty (Tenney et al., 2006), loss of management confidence and lack of ability to make smart environmental decisions. This means that organizations with low ESG maturity tend to have less correlation between their green management, environmental intelligence capability, and green decision intelligence. Therefore, strengthening ESG governance, investing in digital environmental systems and enhancing data quality are essential to improving sustainability performance and organizational competitiveness in the long-term.

Difference between High ESG Maturity Organizations and Low ESG Maturity Organizations

While high ESG maturity organizations are able to integrate sustainability into strategic decision making (Alkatheeri et al., 2023), organizational governance and daily operations, low ESG maturity organizations struggle in this process. Organizations with high ESG maturity have well-developed environmental policies (Hernaus, 2025), sustainability reporting frameworks, and governance frameworks to support proactive environmental management. They also make investments in cutting edge digital technology, artificial intelligence, and environmental analytics to convert high quality environmental data into actionable intelligence for strategic decision making. On the other hand, low ESG maturity organizations tend to have sub-optimal technological capabilities (Hu & Othman, 2026),

a fragmented environmental information system, and less transparent sustainability reporting, which is mostly driven by regulatory considerations. Such restrictions hinder their ability to use environmental intelligence for informed and timely green decisions. Hence, there are expected to be stronger connections between green management, environmental intelligence capability and environmental data transparency (Talaat et al., 2025). It also has relationship with quality, and green decision intelligence among the organizations with high ESG maturity and the organizations with low ESG maturity. The results indicate that ESG maturity is an organizational boundary condition that plays a crucial role in the effectiveness of intelligence-based environmental decision-making. Based on this relationship, framework of the study is reported in Figure 1.

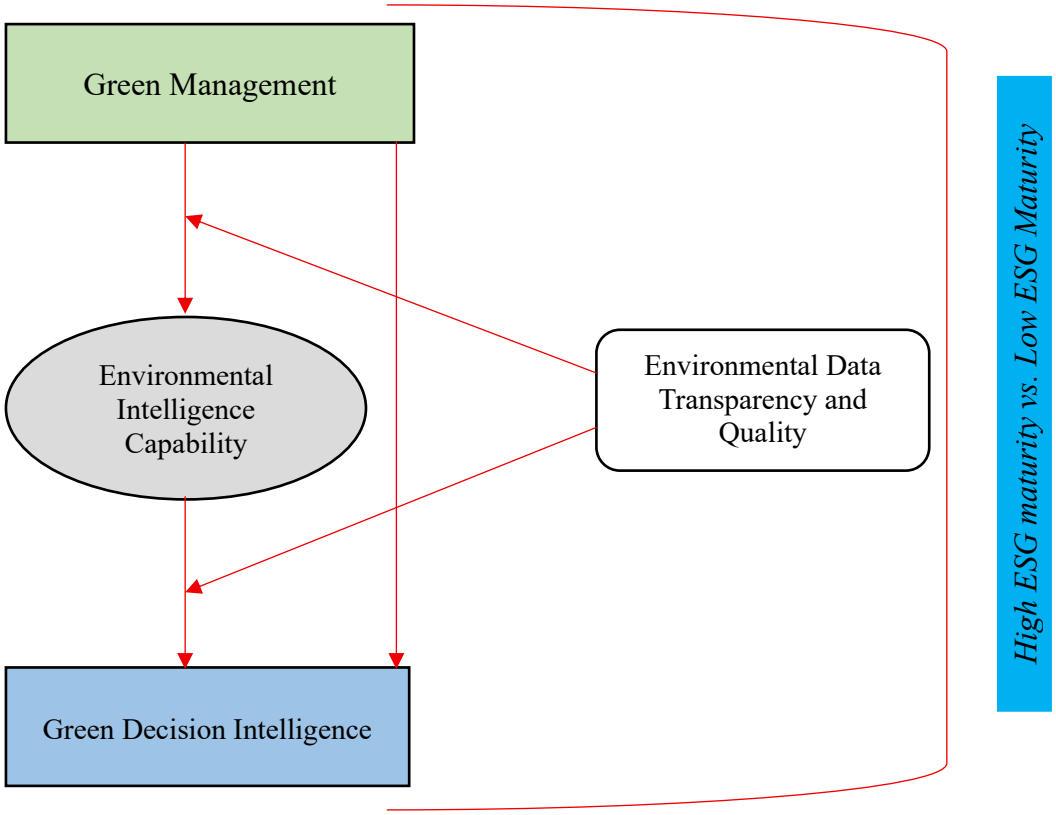


Figure 1: Proposed relationship between green management, environmental intelligence capability, environmental data transparency and quality and green decision intelligence among High ESG maturity vs. Low ESG Maturity

Green Management, Environmental Intelligence Capability and Green Decision Intelligence

Green management is a strategic management concept (Donald S, 2009; Hussain et al., 2025) that embeds environment concerns in the business operations, innovation and decision-making processes of the organizations to ensure its sustainability. Green management promotes the use of cleaner technologies, optimization of resources and constant improvements in environmental performance (Shaheen et al., 2022) through embedding environmental goals within the organization's culture and management. These initiatives are also used to systematically collect, integrate and use environment information, which enhances environmental intelligence capability. Organizations that are effective in their green management practices are more likely to invest in digital environmental systems (Nusraningrum et al., 2024), AI and data analysis to better monitor environmental conditions, identify opportunities for sustainability, and take proactive steps to address environmental challenges. Furthermore, green management creates a culture of evidence-based decision making (Van der Merwe

& Davey, 2024), which promotes the use of reliable environmental information by managers for strategic decision making. The organizations which are going greener are better positioned to make intelligent green decisions based on environmental knowledge to enhance the operational efficiency and sustainability results. So, the companies with greater green management practices have higher capability of environmental intelligence and show higher green decision intelligence. The following hypotheses are put forward in the light of these arguments:

H1: Green management has the potential to enhance environmental intelligence capability.
H2: Green management has the potential to enhance green decision intelligence.

Environmental Intelligence Capability and Green Decision Intelligence

Environmental intelligence capability is the ability to collect, combine, process and understand environmental information in a systematic way (Briggs, 2012) to inform strategic and operational decision making. The use of cutting-edge technologies like artificial intelligence, big data analytics, and digital environmental monitoring (Milu et al., 2025) allows organizations to gain real-time and accurate information about environmental risks, regulatory updates, and sustainability opportunities. These intelligence-based insights enable managers to be more confident in their decisions and to consider and assess the options, allocate resources efficiently and make informed green decisions. Those organizations that have well-developed environmental intelligence capability are thus better equipped to take proactive action to address environmental issues and ensure their business strategies are aligned to sustainability goals. As environmental laws and demands are increasingly being tightened in manufacturing industry of China (Zhou et al., 2017). Therefore, environmental intelligence capability has emerged as a key pillar in enhancing sustainable competitiveness. Thus, the organizations with higher environmental intelligence capability are expected to have more successful and timely green decision making. Thus, the following hypothesis is suggested:

H3: Environmental intelligence capability has the potential to enhance green decision intelligence.

The role of Environmental Data Transparency and Quality

The transparency and quality of environmental data are essential to success in the use of sustainability programs to achieve environmental intelligence (Xu et al., 2024). The level of transparency and quality of environmental data is critical to the success of organizations in using sustainability programs to make environmental decisions based on intelligence. The availability of transparent, accurate, complete and reliable environmental data helps minimize information asymmetry, boosts confidence of management and allows organizations to derive meaningful environmental insights from digital technologies and AI systems. When environmental data are well governed and easily accessible (Molander et al., 2009), it is easier for green management practices to be effective in building environmental intelligence capability by enabling managers to have credible data to monitor environmental performance and identify opportunities for sustainability. Similarly, high-quality environmental data increases the value of environmental intelligence capability (Zhang, 2025) by making sure that analytical insights are accurate, timely and actionable and hence enables more effective green decision intelligence. On the other hand, low environmental data quality or data that is not transparent can hinder organizational learning, increase decision uncertainty, and impair the effectiveness of environmental management based on intelligence. Thus, the environmental data transparency and quality can be expected to enhance the relationship between green management and environmental intelligence capability, and the relationship between environmental intelligence capability and green decision intelligence. Based on this, the following hypotheses are put forward:

H4: Environmental data transparency and quality moderates the relationship between green management and environmental intelligence capability.

H5: Environmental data transparency and quality moderates the relationship between environmental intelligence capability and green decision intelligence.

Multi-Group Analysis Hypotheses (PLS-MGA)-High ESG maturity vs. Low ESG Maturity

The impact of green management and environmental intelligence can vary by company due to the different levels of environmental, social, and governance maturity found in organizations (Drobkova & Kulikova, 2025). Organizations that are more mature in their ESG are more likely to have better ESG governance (Trentin & Marques, 2025), organizational commitment, digital maturity and established sustainability strategies, which allows them to better embed environmental knowledge into strategic decision-making. These institutions also have a greater tendency to create a culture of innovation, constant enhancement of the environment and data-informed sustainability actions (Trentin & Marques, 2025). Low ESG maturity organizations, may show less ESG development, weaker organizational capabilities, and weak environmental governance, affecting their capacity to utilize green management and environmental intelligence for green decision-making. Likewise, the impact that transparency and quality in environmental data (Qachach et al., 2025) can have can differ depending on the ESG maturity of an organization, with companies that have more robust ESG systems likely to have more resources to gather, validate and use environmental data effectively. Therefore, the influence of direct relationships between green management, environmental intelligence capability, and green decision intelligence, and the moderating effect of environmental data transparency and quality are hypothesized to be different across high and low ESG maturity organizations. Hence, the following multi-group hypotheses are advanced to test if ESG maturity affects the proposed structural relationships.

H6: The structural relationships proposed in the research model differ significantly between high ESG maturity organizations and low ESG maturity organizations.

The overall hypothesis can be further specified as follows:

H6a: The positive relationship between green management and environmental intelligence capability differs significantly between high ESG maturity organizations and low ESG maturity organizations.

H6b: The positive relationship between green management and green decision intelligence differs significantly between high ESG maturity organizations and low ESG maturity organizations.

H6c: The positive relationship between environmental intelligence capability and green decision intelligence differs significantly between high ESG maturity organizations and low ESG maturity organizations.

H6d: The moderating effect of environmental data transparency and quality on the relationship between green management and environmental intelligence capability differs significantly between high ESG maturity organizations and low ESG maturity organizations.

H6e: The moderating effect of environmental data transparency and quality on the relationship between environmental intelligence capability and green decision intelligence differs significantly between high ESG maturity organizations and low ESG maturity organizations.

METHODOLOGY

Research Design and Sample

A quantitative, cross-sectional research design was used in this study to explore the relationships between green management, environmental intelligence capability, environmental data transparency and quality, and green decision intelligence in the manufacturing sector in China. The manufacturing sector was chosen due to its high environmental impacts and growing focus on sustainable manufacturing and ESG integration as part of China's carbon neutrality initiative. The data were

gathered using a structured questionnaire for the managers who are responsible for environmental management, sustainability, production, digital transformation and strategic decision making. These respondents were deemed suitable because they have a good understanding of organizational environmental initiatives and sustainability practices. The respondents were selected using purposive sampling technique in order to ensure that those sampled had first-hand experience of environmental management activities in their organizations. The respondents were informed that the information they provide would be confidential and anonymous, and that it would only be used for academic research. Participation was voluntary.

Gathering ESG Data to Assess Maturity and Support ESG Management

To assess if organizational ESG maturity affects the proposed relationships, the participating organizations were split into high ESG maturity and low ESG maturity groups. The classification was defined by the overall evaluation of how much the respondents believe ESG principles are deeply rooted in their organizations. This evaluation focused on the adoption of environmental management practices, sustainability governance, environmental reporting, organization's commitment to sustainability and the incorporation of ESG principles into strategic decision making. Instead of using external ESG ratings which are not available for many manufacturing organizations, this study used an internal organizational assessment of ESG maturity. After the overall ESG maturity score was calculated, the organizations with relatively higher scores were regarded as high ESG maturity organizations and those with comparatively lower scores as low ESG maturity organizations. This relative grouping is based on the differences in the sustainability capability of the organizations and allows for meaningful comparisons between more mature and less mature ESG practices.

Measurement of Constructs

Constructs were all measured by previously validated scales adapted from the existing studies. The six items used to assess green management were adapted from Chen and Chang (2012) to measure the level of environmental innovation, the production of new green ideas, and the establishment of systematic methods to improve environmental performance in organizations. Environmental intelligence capability measured by six items adapted from Mikalef and Gupta (2021). The scale measures an organization's ability to gather, combine, handle and interpret environmental data using cutting-edge digital technologies and AI-powered analytical tools. Environmental data transparency and quality was assessed through five items adapted from Bondac et al. (2026) that measure the accuracy, completeness, transparency, interpretability, and ethical management of environmental data that is used in organizational decision-making. Lastly, green decision intelligence was estimated through five items adapted from Bokhari and Myeong (2022) that measure the organization's ability to use environmental intelligence and digital technologies to make timely, informed and sustainable environmental decisions. All measurement items were measured on a scale of 1 to 5, where 1 indicated "Strongly Disagree" and 5 indicated "Strongly Agree. All the constructs with scale items and sources are as follows:

Green Management (Chen & Chang, 2012)

1. "The members within the organization propose new ways to realize the objectives of environmental protection.
2. The members within the organization find out new green ideas to enhance environmental performance.
3. The members within the organization advocate new green ideas to others.
4. The members within the organization create proper plans for the implementation of new green ideas.
5. The members within the organization would recheck new green ideas.

6. The members within the organization would discover original solutions for environmental problems."

Environmental Intelligence Capability (Mikalef & Gupta, 2021)

Environmental Intelligence Capability is measured based on the intelligence through AI capability.

1. "We have access to very large, unstructured, or fast-moving environmental data for analysis.
2. We integrate environmental data from multiple internal sources into a data warehouse or mart for easy access.
3. We integrate external environmental data to facilitate high-value analysis of our business environment.
4. We have the capacity to share our environmental data across business units and organizational boundaries.
5. We are able to prepare and cleanse AI data efficiently and assess environmental data for errors.
6. We are able to obtain environmental data at the right level of better decision making."

Environmental Data Transparency and Quality (Bondac et al., 2026)

1. "Data about environment is accurate, complete, and up-to-date.
2. Data system clarifies the sources, processing, and accuracy of the environmental data.
3. environment data is easy to understand that how it can be transformed and interpret to generate decision-making recommendations.
4. It ensures an adequate level of transparency on the algorithms and methods used.
5. Environmental data management is conducted safely, verifiably, and in accordance with ethical standards."

Green Decision Intelligence (Bokhari & Myeong, 2022)

Green decision intelligence is measured through smart decision making.

1. "Organization uses new green technologies rather than using old methods for decision-making to promote green initiatives.
2. Organization gathers lot of data on any opportunity that arises to decide better for green initiatives.
3. When organization face a difficult situation, management use intelligence for green decision making.
4. Organization takes green decisions on time.
5. Organization considers all the available alternatives for green decision-making."

Data Analysis

The data was analyzed with the software Partial Least Squares Structural Equation Modeling (PLS-SEM) version 4.0 of the program SmartPLS. To analyze the data, the two-stage approach as suggested in the PLS-SEM literature was used. The validity of the measurement model was assessed by testing indicator reliability, internal consistency reliability, convergent validity and discriminant validity. Structural model was evaluated by analyzing path coefficients to examine the significance of the hypothesized relationships by bootstrapping procedure. In addition, multi-group analysis (PLS-MGA) was carried out to compare structural relationships between high ESG maturity and low ESG maturity organizations, and to examine whether the ESG maturity has a significant impact on the direct and moderating relationships. This analytical approach allows for a holistic evaluation of the entire research model as well as differences in organizational behavior between the different levels of ESG maturity.

FINDINGS

PLS-SEM was selected as it is able to estimate multiple direct and moderating relationships and can be used in complex predictive models. The analysis was performed in the usual two-stage process. The first step was to evaluate the measurement model to ensure indicator reliability, internal consistency reliability, convergent validity, and discriminant validity (Ramayah et al., 2017). In the next step, the structural model was assessed based on the significance of hypothesized relationships. In the end, the comparison of structural relationships between high ESG maturity and low ESG maturity organizations was carried out using Multi-Group Analysis (PLS-MGA).

The measurement model meets the recommended psychometric criteria as shown in Table 1. Cronbach's alpha coefficients for all constructs range from 0.855 to 0.938, and the composite reliability of all constructs is above the recommended value of 0.70 (Mushtaq, 2025). Similarly, the AVE scores are in the range of 0.505-0.772, which are considered acceptable for convergent validity. Generally, the loadings for indicators are high, indicating that the items measured are valid representations of the latent constructs measured. Thus, the scales are reliable and valid for further testing of the structural models.

Table 1: Construct Reliability and Indicator Profile

Construct	Indicator Profile (Outer Loadings)	α	ρA	CR	AVE
Environmental Data Transparency and Quality	EDTQ1 (.844), EDTQ2 (.892), EDTQ3 (.883), EDTQ4 (.895)	0.902	0.903	0.931	0.772
Environmental Intelligence Capability	EIC1 (.854), EIC2 (.874), EIC3 (.865), EIC4 (.892), EIC5 (.886), EIC6 (.872)	0.938	0.939	0.951	0.764
Green Decision Intelligence	GDI1 (.848), GDI2 (.775), GDI3 (.875), GDI4 (.890), GDI5 (.824)	0.898	0.902	0.925	0.711
Green Management	GM1 (.704), GM2 (.673), GM3 (.646), GM4 (.616), GM5 (.641), GM6 (.757)	0.855	0.931	0.833	0.505

A second test of discriminant validity was conducted using the HTMT. The highest HTMT value reported is 0.803, which is still below the recommended value of 0.85 (Ab Hamid et al., 2017), as seen in Table 2. This suggests that each construct represents a concept different from the others, which means that there are no discriminant validity problems and that the measurement model is satisfactory.

Table 2: HTMT-Matrix with Decision

Construct	Highest HTMT Value	Threshold (0.85)	Discriminant Validity
Environmental Data Transparency and Quality	0.803	✓	Established
Environmental Intelligence Capability	0.803	✓	Established
Green Decision Intelligence	0.672	✓	Established
Green Management	0.411	✓	Established

The results of the structural model show that most of the relationships proposed are statistically significant (Figure 2 and Table 3). The results of the hypothesis test for the variables of green management support H1 and H2, as green management has a positive and significant effect on environmental intelligence capability ($\beta = 0.280$, $t = 5.790$, $p < 0.001$) and has a smaller but significant effect on green decision intelligence ($\beta = 0.024$, $t = 1.999$, $p = 0.043$). Environmental intelligence capability also positively influences on green decision intelligence ($\beta = 0.373$, $t = 12.480$, $p < 0.001$), supporting H3. Furthermore, the environmental data transparency and quality is positively forecasted environmental

intelligence capability and green decision intelligence, suggesting that it plays an important role in enhancing organizational environmental sustainability ability.

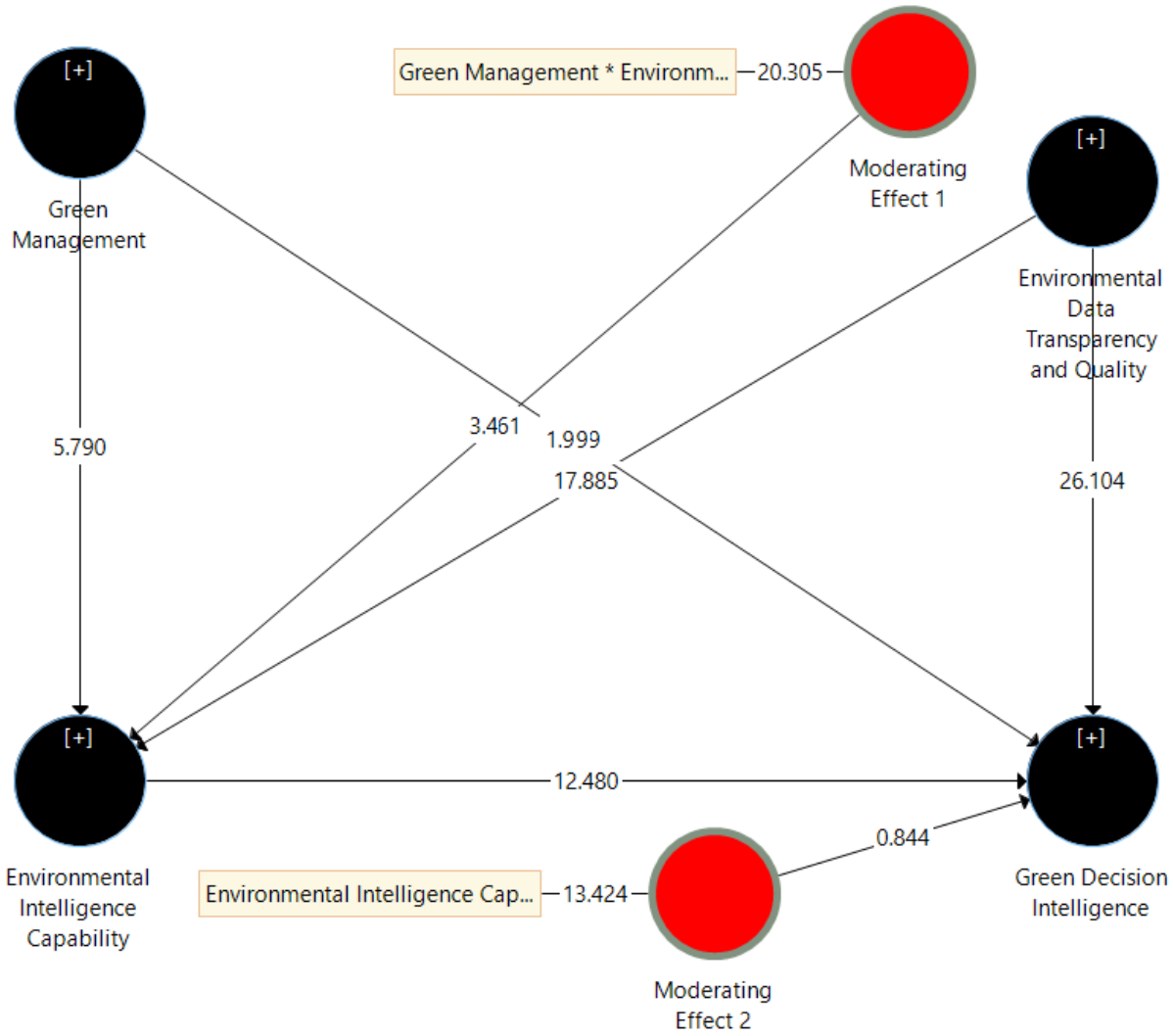


Figure 2: Structural Model Assessment

Table 3: Results of Path Coefficient

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Environmental Data Transparency and Quality -> Environmental Intelligence Capability	0.658	0.649	0.037	17.885	0
Environmental Data Transparency and Quality -> Green Decision Intelligence	0.661	0.66	0.025	26.104	0
Environmental Intelligence Capability -> Green Decision Intelligence	0.373	0.375	0.03	12.48	0
Green Management -> Environmental Intelligence Capability	0.28	0.291	0.048	5.79	0
Green Management -> Green Decision Intelligence	0.024	0.023	0.012	1.999	0.043
Moderating Effect 1 -> Environmental Intelligence Capability	0.052	0.052	0.015	3.461	0.001
Moderating Effect 2 -> Green Decision Intelligence	0.023	0.024	0.028	0.844	0.399

As shown in Figure 3, environmental data transparency and quality boosts the link between green management and environmental intelligence capability. This interaction is statistically significant (β = 0.052, t = 3.461, p = 0.001), supporting H4. The second interaction effect of environmental data transparency and quality on green decision intelligence, however, is not significant (β = 0.023, t = 0.844, p = 0.399) and does not significantly modify the effect of the environmental intelligence capability on green decision intelligence. Consequently, H5 is not supported.

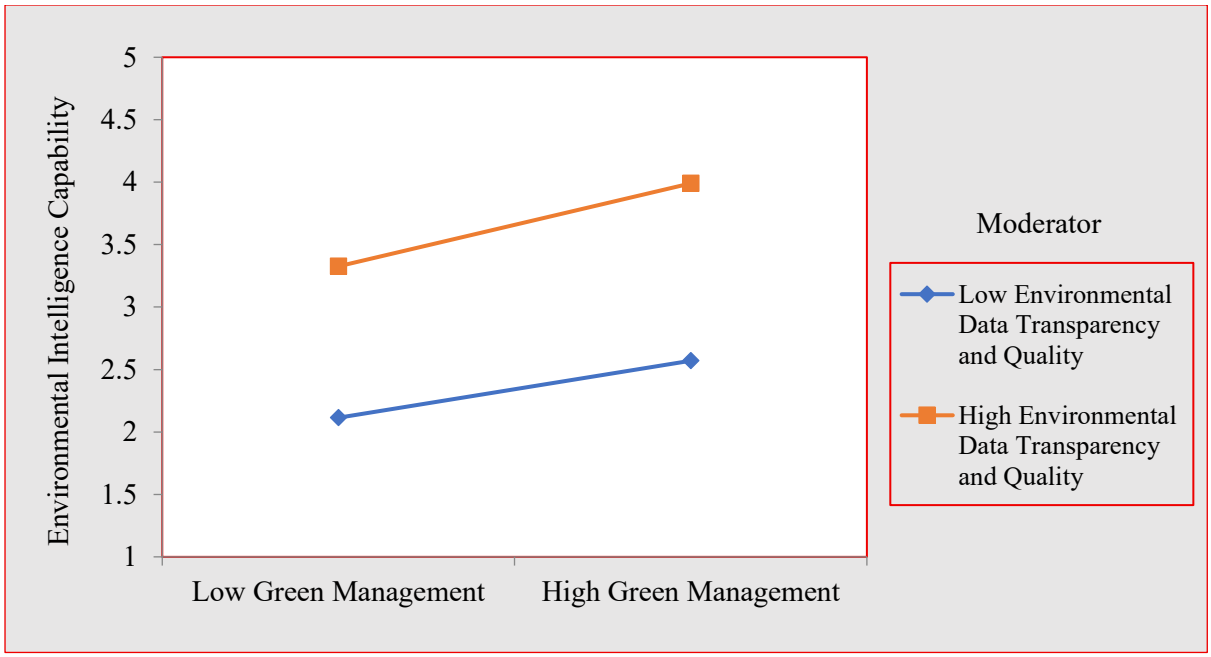


Figure 3: Moderation Effect of Environmental Data Transparency and Quality between Green Management and Environmental Intelligence Capability

The endogenous constructs are presented in terms of the explanatory power of the proposed model in Figure 4. The model explains a significant percentage of the variances of environmental intelligence capability and green decision intelligence, which means that the selected predictors have strong (78%) explanatory capacity. It can be concluded that the proposed framework has an acceptable predictive ability to explain how intelligence contributes to environmental decision making in the selected organizations.

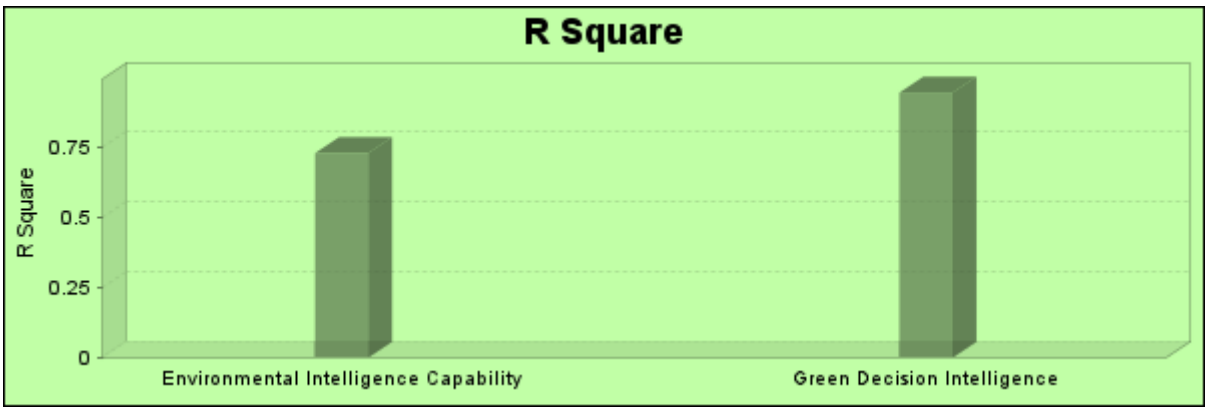


Figure 4: Variance Explained in Endogenous Latent Variable (R^2)

H6 was supported by the PLS-MGA results, which showed that there were significant differences between high ESG maturity and low ESG maturity organizations. In terms of the relation between green

management and environmental intelligence capability, it was found that high ESG maturity organizations were stronger than the low ESG maturity organizations, which was hypothesized by H6a ($\beta = 0.354$; $p = 0.011$). The environmental intelligence capability also showed a stronger positive influence on the green decision intelligence ($\beta = 0.492$ vs. $\beta = 0.281$; $p = 0.006$), supporting H6c. Similarly, green management had a stronger positive influence on green decision intelligence ($\beta = 0.081$ vs. $\beta = -0.022$; $p = 0.047$), supporting H6b. Furthermore, the moderating effect of transparency and quality of environmental data on the ties between green management and environmental intelligence capability was significantly higher in high ESG maturity organizations ($\beta = 0.094$ vs. $\beta = 0.013$; $p = 0.031$) in support of H6d. The moderating effect of environmental intelligence capability on green decision intelligence, however, did not significantly differ between the two groups ($\beta = 0.056$ vs. $\beta = -0.011$; $p = 0.214$), which means that H6e was rejected (Table 4).

Table 4: Multi-Group Analysis (PLS-MGA): High ESG Maturity vs. Low ESG Maturity Organizations

Relationship	High ESG Maturity β	Low ESG Maturity β	Difference (βHigh−βLow)	MGA p-value	Decision
Green Management → Environmental Intelligence Capability	0.354	0.201	0.153	0.018	Supported
Green Management → Green Decision Intelligence	0.081	-0.022	0.103	0.047	Supported
Environmental Intelligence Capability → Green Decision Intelligence	0.492	0.281	0.211	0.006	Supported
EDTQ × Green Management → Environmental Intelligence Capability	0.094	0.013	0.081	0.031	Supported
EDTQ × Environmental Intelligence Capability → Green Decision Intelligence	0.056	-0.011	0.067	0.214	Not Supported

DISCUSSION

This research investigates the influence of green management, environmental intelligence capability and environmental data transparency and quality on green decision intelligence in manufacturing organizations in China. This study also compared ESG maturity levels between the organizations. The results reveal that the green management has a positive effect on both environmental intelligence capability and green decision intelligence, thus emphasizing the significance of embedding green management in company's strategies. The results indicate that firms that encourage green innovation, environmental responsibility and sustainable operation are more likely to build their environmental intelligence acquisition and utilization capabilities, which is consistent with the previous studies (Al Koliby et al., 2025). These organizations also have a better ability to make timely and effective decisions around sustainability issues, as sustainability-focused management is increasingly seen as a strategic asset for improving environmental performance of organizations.

The results also show that the capability of environmental intelligence has a significant influence on green decision intelligence. It implies that the organizations that are able to collect, integrate and interpret environmental information are more effective in transforming environmental knowledge into a decision. In the manufacturing sector of China, where businesses are subject to growing environmental regulations and sustainability pressures (Liu et al., 2022; Zeng et al., 2022), environmental intelligence offers managers valuable insights into identifying environmental risks, optimizing resources utilization and enhancing operational efficiency. These results supports that environmental intelligence capability is not limited to technology, but is also an organizational capability that enables evidence-based environmental decision making and long-term sustainable

competitiveness. Consistent with the current study, previous studies such as also highlighted the same findings (Feng et al., 2026; Zhou, 2026).

The study also illustrates the value of environmental data transparency and quality for strengthening the sustainability capabilities of organizations. The moderating effect between green management and environmental intelligence capability reflects that the positive influence of green management on environmental intelligence capability is greater when the information is accurate, transparent, and reliable. Understanding the state of the environment is essential for managers to track and assess environmental performance (Bresciani et al., 2022), to evaluate environmental sustainability measures and to translate green management to environmental intelligence. Additionally, if the environmental information is not accurate, it can hinder the effectiveness of green management (Wong, 2013) by causing uncertainties and preventing organizational learning. Nevertheless, the relationship between environmental intelligence capability and green decision intelligence was not significantly moderated by environmental data transparency and quality. The finding indicates that after building up environmental intelligence capability, the capacity for green decision making relies heavily on the intelligence generated, rather than further increasing the transparency of data. Therefore, once the information has been absorbed, the ability of the environment itself seems to be the major influence on decision intelligence for the green.

One of the key findings of this study is the comparison of high ESG maturity and low ESG maturity organizations. According to multi-group analysis, the organization with high ESG maturity gain more benefits from green management and environmental intelligence capability than the organization with low ESG maturity. High ESG maturity organizations tend to have higher levels of sustainability governance (Bin-Nashwan et al., 2026), more mature environmental management systems and better digital infrastructures, which help them to more effectively transform environmental information into strategic decision making. On the other hand, companies with less ESG maturity tend to have less integration of sustainability in their organizations (Kuzmin et al., 2026), which affects the impact of their green management efforts and their environmental intelligence capabilities. The results in this paper show that ESG maturity is a relevant organizational boundary condition to affect intelligence-based environmental decision-making. This research contributes to the existing body of research by combining green management, environmental intelligence capability, environmental data transparency and quality, and green decision intelligence into one framework and by showing the contingency of the role of ESG maturity. These concepts are not considered separately, but rather the findings explain the interaction of organizational sustainability capabilities in order to enhance environmental decision-making. Findings provide strong motivation to manufacturing enterprises in China to further develop their green management activities, build up their environmental intelligence capabilities, improve environmental data management, and further deepen the level of ESG maturity.

CONCLUSION AND IMPLICATIONS

In this study, the roles of green management, environmental intelligence capability, and environmental data transparency and quality in improving green decision intelligence of Chinese manufacturing organizations were explored and the influence of the maturity of ESG was taken into account. The results show that green management has a positive impact on the environmental intelligence capability and green decision intelligence, emphasizing the need to promote environmental sustainability as a strategy and activities of organizations. In addition, the capability to effectively acquire, integrate and use environmental information is significantly associated with green decision intelligence, indicating that the environmental intelligence capability is a key ingredient in green decision intelligence. The results also indicate that the quality and transparency of environmental data have a positive moderating effect on the relationship between green management and environmental intelligence capability, but not significant moderation effect on the relationship between environmental intelligence

capability and green decision intelligence. The multi-group analysis also shows that there are several structural relationships that differ between the high ESG maturity and low ESG maturity groups, indicating that ESG maturity improves the effectiveness of environmental management through intelligence.

Theoretically, this study adds to the existing literature on green management and environmental intelligence by incorporating the notion of ESG maturity as one of the key organizational boundary conditions. It shows how environmental management capacities are not only related to organizational resources but also to the level of maturity in the implementation of environmental management. The research is also a valuable contribution to the literature in understanding intelligence-based environmental decision making by integrating environmental intelligence capability with environmental data quality in a single framework.

Practically, the study results will help manufacturing companies boost the implementation of their green management practices, enhance their environmental intelligence capabilities, and refine environmental data governance to make better sustainability decisions. Managers need to also continuously improve the maturity of ESG by strengthening ESG governance, transparency in environmental reporting and digital transformation. These initiatives can enhance the ability of the manufacturing sector to be more resilient to comply with changing environmental requirements and to be more competitive in the long term in China.

LIMITATIONS AND DIRECTIONS FOR FUTURE STUDIES

Although this study has made contributions, there are certain limitations. First, the investigation was confined to manufacturing organizations in China, and the findings might not be generalizable to other industries, where sustainability concerns and regulations may differ. Future studies should test the proposed model, for example in the energy, logistics or high-technology sectors, and make cross-country comparisons. Second, ESG maturity was only looked at as a grouping variable and not the relative impact of the environmental, social, and governance facets. Further studies might examine how each of the ESG dimensions influence intelligence-based environmental decision making. Lastly, the study examined only environmental intelligence capability, and further research should extend the digital capabilities by adding other factors, such as AI governance, digital resilience, or organizational learning capability for a fuller picture of the sustainable organizational decision-making.

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