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Identifying sustainability readiness for Industry 5.0: a cultural perspective from developing country

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The shift from Industry 4.0 toward the human-oriented and sustainability-driven Industry 5.0 marks a significant transformation in industrial priorities. This research explores how Malaysian organizations, particularly in the manufacturing and logistics sectors, are preparing for sustainable development within this new industrial context. Emphasizing the impact of cultural attributes on organizational readiness, a quantitative survey was conducted involving 150 participants from company in Malaysia. The results demonstrate that culturally embedded factors such as leadership styles, workforce mindset, and openness to technological advancement strongly influence the adoption of sustainable approaches. Among these, leadership engagement and people-centered innovation are identified as crucial enablers. The study provides a localized understanding of how sustainability initiatives can be more effectively aligned with Industry 5.0 objectives when cultural dynamics are taken into account. These insights are valuable for both policymakers and practitioners seeking to foster sustainable transformation within culturally diverse industrial settings.

KEYWORDS

Industry 5.0, environmental sustainability, cultural influences, technological adoption, structural equation modeling

1 Introduction

In recent years, the evolution from Industry 4.0 to Industry 5.0 has marked a significant shift in how industries approach technological integration, emphasizing not only automation but also human-centric and sustainable development. Industry 5.0 promotes a balance between technological progress and environmental, social, and cultural considerations (Alessandri et al., 2024). This paradigm shift reflects the growing awareness of sustainability as an integral element in industrial strategies, particularly in developing nations where economic growth often challenges environmental stewardship. Developing countries encounter unique obstacles in preparing for Industry 5.0, including limited infrastructure, skill gaps, and deeply rooted cultural norms influencing organizational behavior (Abdollah et al., 2016; Hiswara et al., 2023). Culture plays a pivotal role in determining how industries embrace technological changes and sustainability efforts. Thus, understanding cultural influences is

essential for formulating effective guidelines that facilitate the adoption of sustainable practices aligned with Industry 5.0 principles.

Previous studies have primarily focused on technological readiness and economic factors, leaving a research gap concerning the cultural dimensions of sustainability readiness (Aprilisa, 2020). This study seeks to address that gap by examining the relationship between cultural factors and sustainability readiness in the context of Industry 5.0 within developing nations (Caingcoy, 2023). The research aims to contribute to both theoretical and practical knowledge by offering insights that support policymakers and industry stakeholders in creating culturally responsive strategies for sustainable industrial transformation. The sequence for Cultural Perspectives of Developing Countries can be seen in the Figure 1.

As depicted in Figure 1, current research primarily focuses on the technological aspects of Industry 5.0 readiness, often overlooking the critical connection to sustainability concerns (Naudé et al., 2019). The implementation and adoption of Industry 5.0 systems show considerable variation across different sectors, influenced by factors such as technological readiness, workforce capabilities, financial capacity, and cultural differences (Li, 2023). These variations determine how well industries are prepared to embrace advanced

technologies while upholding sustainable practices. Although many studies have focused on the technical and economic aspects of Industry 5.0 readiness, there remains a significant gap in understanding the influence of cultural diversity, especially in relation to sustainability (Ghobakhloo et al., 2024). The role of cultural values and practices is often overlooked, even though they play a crucial part in shaping the success and effectiveness of Industry 5.0 initiatives. Recognizing this gap, this study aims to explore how cultural variations affect industry readiness for adopting Industry 5.0 technologies, with a particular focus on their impact on sustainability (Nunes et al., 2022). By examining these cultural factors, the study seeks to provide a more comprehensive perspective on the challenges and opportunities involved in adopting Industry 5.0 in a way that supports sustainable development.

2 Cultural perspective

Culture holds a crucial influence on how societies approach sustainability and adopt emerging technologies, particularly in developing nations preparing for Industry 5.0 (Casciani et al., 2022).

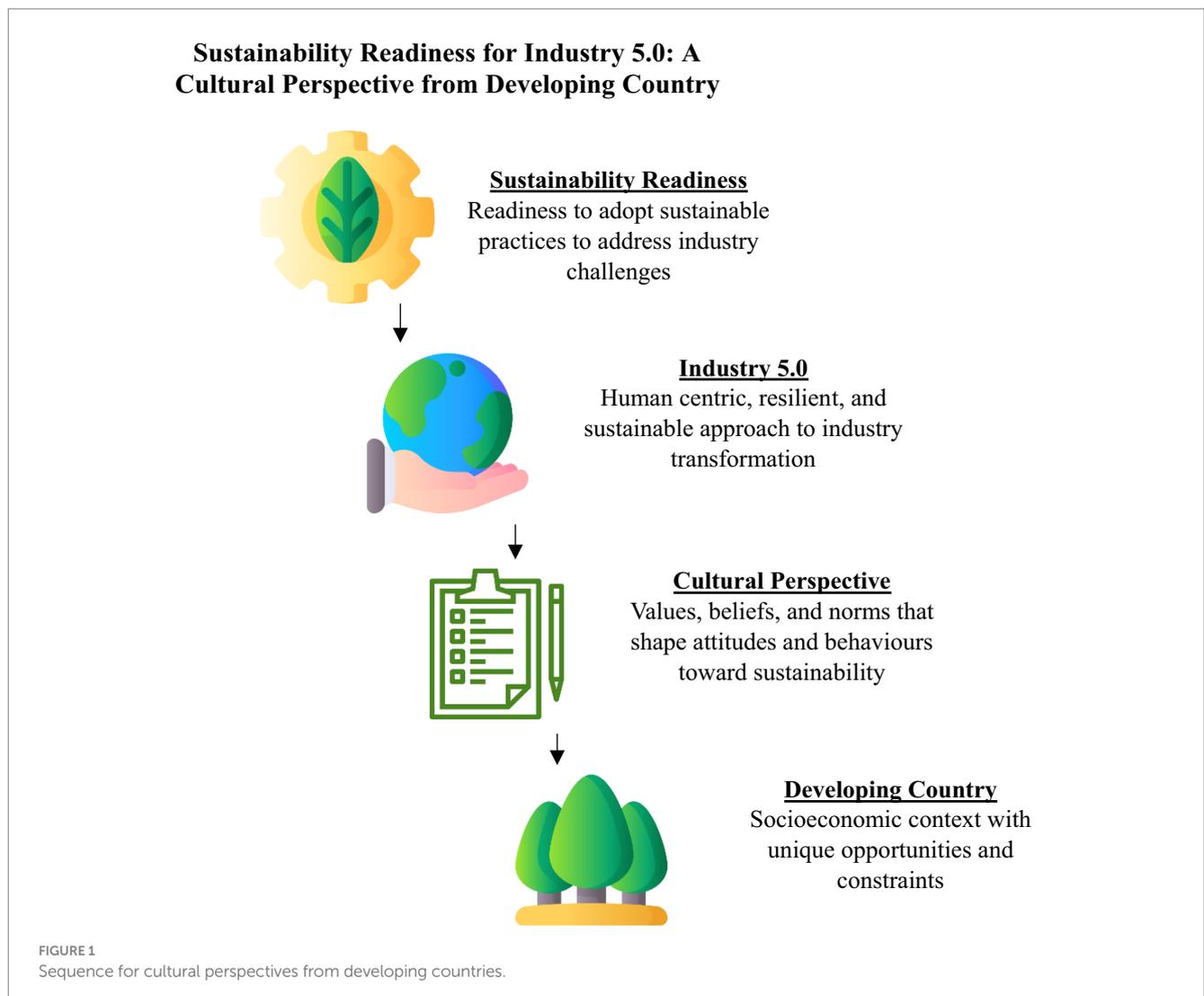


TABLE 1 Research trend by title and abstract based on Scopus database.

Item	Number of articles
Industry	55
Technology	35
Perspective	20
Sustainability	53
Culture value	20
Sustainable development	21
SDGs	25
Readiness factor	13
Culture	50
Industry 5.0	25

identified 55 articles focusing on industry, highlighting strong academic interest in industrial transformation. Technology appeared in 35 articles, underscoring its critical role in advancing Industry 5.0. The perspective theme was covered in 20 articles, showing the need for multidisciplinary approaches. Sustainability was discussed in 53 articles, confirming its central role in industrial strategies. Culture value was explored in 20 articles, emphasizing the influence of cultural norms on sustainability practices. Meanwhile, sustainable development and SDGs appeared in 21 and 25 articles, reflecting alignment with global sustainability goals. There were 13 articles on readiness factors, offering insights into key enablers for Industry 5.0. Culture in a broader sense was featured in 50 articles, underlining its relevance across contexts. Finally, 25 articles directly addressed Industry 5.0, indicating growing scholarly attention on this emerging concept.

4 Research framework

Global attention is increasingly directed toward merging sustainability with technological progress, especially as nations move toward Industry 5.0. This industrial shift emphasizes not only automation but also human-centered, sustainable, and intelligent systems (Nallusamy et al., 2015). For developing nations, the capacity to adopt Industry 5.0 technologies for environmental sustainability is influenced not only by financial strength or technical resources but also by cultural factors rooted in societal and organizational norms. Cultural values shape how individuals perceive, decide, and act, affecting the acceptance, implementation, and use of new technologies aimed at sustainability (Wang and Doudna, 2023). One key cultural aspect is the balance between collectivism and individualism, which determines whether people prioritize group interests or personal goals. In collectivist societies, caring for the environment is often seen as a collective responsibility, fostering greater support for technologies that promote sustainability. In such environments, strategies and policies are likely to align with communal principles, encouraging innovations that benefit the broader community. In contrast, individualistic cultures may adopt sustainable technologies more selectively or slowly, as decisions are typically guided by individual or organizational benefit rather than collective welfare. Another cultural dimension that shapes readiness is masculinity versus femininity. Masculine cultures, marked by competition, assertiveness, and a focus

on achievement, may pursue sustainability only when it offers clear economic or productivity gains. In these settings, Industry 5.0 technologies are often implemented to improve efficiency and business performance (Salam et al., 2022). On the other hand, feminine cultures, which prioritize cooperation, well-being, and care, are more likely to adopt technologies that enhance environmental quality and public health, even if immediate financial returns are not evident.

Power distance, which reflects the acceptance of unequal power distribution, also plays a significant role. In high power distance societies, decisions about technological adoption and sustainability are generally made by top leaders. If those in leadership positions value environmental sustainability, the adoption of Industry 5.0 technologies can proceed quickly and with little opposition (Cope et al., 2022). Conversely, in cultures with low power distance where participation in decision-making is common, readiness may depend on collective agreement and broader involvement. While this inclusive process may encourage innovative, locally tailored solutions, it can also delay implementation if consensus is difficult to achieve.

Tolerance for uncertainty further influences how sustainable technologies are adopted. Cultures that avoid uncertainty tend to prefer structured systems, clear guidelines, and predictable outcomes (Gopalkrishnan, 2019). In such contexts, the adoption of new technologies may be more cautious, requiring thorough evaluation, regulation, and risk management. Meanwhile, cultures comfortable with uncertainty are more willing to experiment and try new approaches, allowing for faster adoption of Industry 5.0 solutions even when information is incomplete. This flexibility can enhance responsiveness to environmental challenges by encouraging early integration of sustainable technologies. In a detailed explanation of the cultural dimensions and Industrial Revolution 5.0 on Readiness Sustainability Practices will be described in Tables 2, 3 and then these hypotheses are illustrated in Figure 3, which outlines the conceptual framework guiding this research.

H1: Collectivism has a notable impact on sustainability readiness for Industry 5.0 in various countries.

H2: Masculinity significantly influences sustainability readiness for Industry 5.0 in various countries.

H3: Power distance has a significant effect on sustainability readiness for Industry 5.0 in various countries.

H4: Uncertainty avoidance plays a significant role in shaping sustainability readiness for Industry 5.0 in various countries.

H5: Long-term orientation strongly influences sustainability readiness for Industry 5.0 in various countries.

H6: Indulgence has a meaningful influence on sustainability readiness for Industry 5.0 in various countries.

5 Methodology

A total of 150 survey responses were collected, with equal representation from participant at Malaysia, that participant is workers from company. A self-administered questionnaire was used,

TABLE 2 Detailed explanation of the cultural dimensions.

Cultural dimensions	Definition
Collectivism	Prioritizing group goals over individual interests.
Masculinity	Emphasizing achievement, assertiveness, and success.
Uncertainty avoidance	Preference for certainty, rules, and structured situations.
Power distance	Acceptance of unequal distribution of power.
Long term oriented	Focus on future planning, perseverance, and adaptation.
Indulgence	Allowing enjoyment and gratification of basic human desires.

TABLE 3 Detailed explanation of industrial Revolution 5.0 on readiness sustainability practices.

Construct	Definition
Energy management	Efficient control and conservation of energy use.
Waste reduction strategies	Minimizing waste through reuse, recycling, or optimization.
Environmental assessment	Evaluating potential environmental impacts.
Sustainable design	Creating products with environmental and social awareness.
Training and development	Enhancing employee skills for sustainability and Industry 5.0.
Tech integration	Applying advanced technologies for sustainable outcomes.
Human-centric innovation	Innovation that prioritizes human well-being.
Leadership and vision	Guiding sustainability goals through strategic leadership.
Workforce competence	Employee readiness to support sustainable practices.

allowing respondents to complete the survey at their convenience. The manufacturing and logistics sectors were chosen because they represent the core of industrial transformation toward Industry 5.0, where human-centric innovation and sustainability integration are most critical. Malaysia was selected as the case study due to its developing-economy status, active participation in Industry 4.0 initiatives, and ongoing transition toward sustainable industrial practices. These revisions strengthen the methodological rationale and contextual relevance of the research. To ensure data quality, an initial screening removed incomplete or inconsistent responses, resulting in 128 valid responses for analysis. The minimum sample size was calculated based on the number of arrows pointing to a latent variable in the structural model, using an 80% statistical power. With 11 arrows and an expected R^2 of 0.5, the recommended sample size was 59. The final sample size exceeded this requirement, ensuring sufficient data for structural equation modeling.

The questionnaire consisted of three sections with 54 items. The first section gathered demographic data, including gender, age, marital status, and job position. The second assessed cultural values using a modified CVSCALE framework for the industrial and sustainability context. The third section focused on sustainability readiness for Industry 5.0, with five measurement items per construct. A 0 to 10 Likert scale was used, where 0 indicated “strongly disagree” or “strongly unimportant,” and 10 indicated “strongly agree” or “strongly important.” The questionnaire was pre-tested with industry professionals and academic reviewers to ensure clarity and relevance. The demographic profile of the respondents is presented in Table 4 and then summary of result survey method presented in Table 5, and the methodology flow is visualized in Figure 4.

6 Goodness of measurement

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed on the survey data to assess its reliability and sample adequacy. The results met the necessary criteria for both analyses. The Cronbach’s alpha coefficient was 0.931, surpassing the minimum threshold of 0.7, confirming the reliability of the data for further analysis. Both EFA and CFA supported the validity of the measurement model, confirming that the constructs used in the study were accurately represented in the data. These analyses validate that the survey instruments were both reliable and suitable for examining sustainability readiness for Industry 5.0 in developing countries, then sample adequacy and reliability test in Table 6.

The research on Sustainability Readiness for Industry 5.0: A Cultural Perspective from Developing Countries employed a hierarchical component model (HCM) for analysis using partial least squares–structural equation modeling (PLS-SEM). This model incorporated both second-order and higher-order constructs, simplifying the complexity of relationships within the structural model and providing a clearer analytical framework. The higher-order component (HOC) encapsulated the overall concept of sustainability readiness, while the lower-order components (LOC) detailed the sub-dimensions contributing to Industry 5.0 readiness (Zreik, 2023). The detail of calculation Low-order components are served in Supplementary Figure S1. Given that Industry 5.0 readiness is a multi-faceted concept, the HOC integrated key factors such as environmental sustainability, leadership, innovation, technology adoption, and workforce development. These factors together outlined the crucial elements needed for achieving sustainability readiness in developing countries. Principal component analysis showed that each indicator exceeded the 0.5 loading threshold, with communalities above 0.3, confirming the reliability of the measurement model. Both formative and reflective indicators were considered in the confirmatory factor analysis (CFA).

The six cultural value dimensions were treated as reflective constructs, with checks for convergent and discriminant validity. Convergent validity was confirmed through factor loadings, composite reliability (CR), and average variance extracted (AVE), ensuring the values met the recommended criteria. Discriminant validity was confirmed using the heterotrait monotrait ratio (HTMT), with all values below the 0.85 threshold. An item was removed due to low loading, ensuring the measurement model’s consistency. This robust

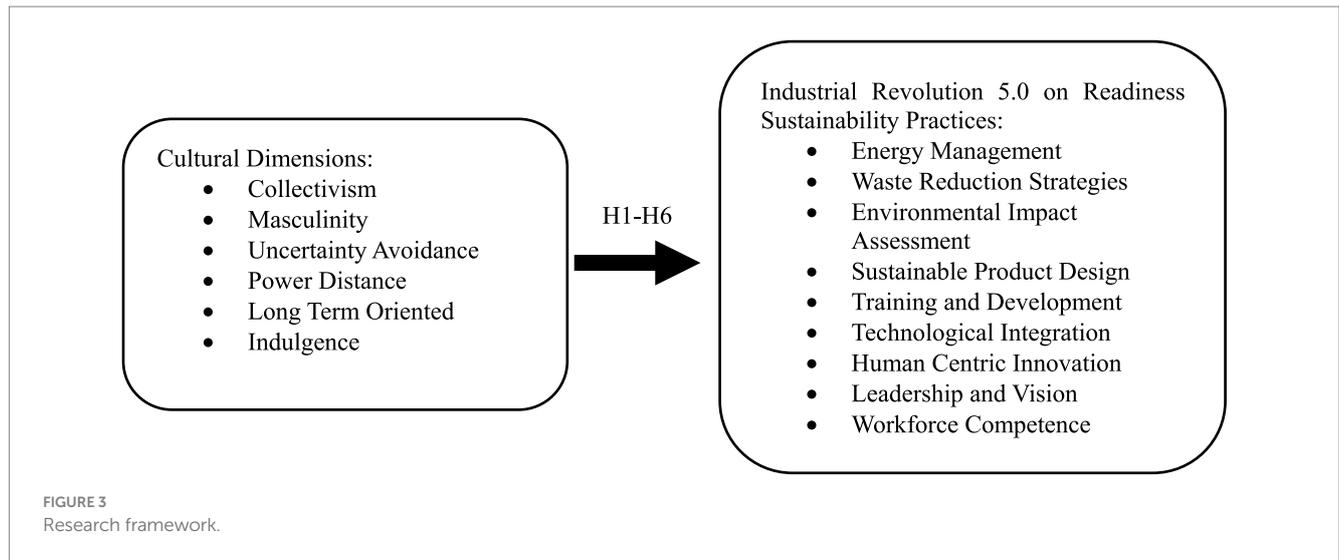


FIGURE 3 Research framework.

TABLE 4 Demographic characteristics of the respondents.

Demographic variables	Category	Frequency (n)
Gender	Male	85
	Female	65
Age group	18–25	50
	26–35	55
	36–45	30
	46+	15
Marital status	Single	80
	Married	70
Position	Managerial	40
	Technical/Operational	90
	Other	20

validation process confirmed that the model accurately captured cultural factors impacting sustainability readiness for Industry 5.0 in developing countries, offering valuable insights for policy and industrial practices, then measurement model of the cultural value constructs in Table 7.

Given that the values are less than 0.85, Table 8 demonstrate that the HTMTs (Heterotrait–Monotrait Ratios) for each of the six cultural value dimensions meet the criteria for discriminant validity. This computation aimed to establish the foundation of statistical discriminant validity. It was discovered that the HTMT inference interval confidence value is less than the crucial 0.9 threshold. This demonstrates that the six cultural value dimensions namely, Collectivism, Masculinity, Uncertainty Avoidance, Power Distance, Long-term Orientation and Indulgence have established discriminant validity. Furthermore, a collinearity assessment was conducted for the formative measurement model in order to ascertain the variance inflated factor (VIF). The VIF is less than 5, suggesting that collinearity is not an issue and the dimensions are sufficiently distinct from each other.

Based on Table 9, masculinity (t -value = 2.456, $p < 0.05$) and collectivism (t -value = 2.382, $p < 0.05$) significantly influence

TABLE 5 Summary of result survey method.

Category	Result
Total responses	150 collected, 128 valid after screening.
Respondents	Employees from Malaysian manufacturing and logistics companies.
Method	Self-administered questionnaire.
Focus	Core sectors of Industry 5.0 emphasizing human-centric sustainability.
Context	Malaysia as a developing economy transitioning toward sustainable industry.
Sample size	Required 59; achieved 128, ensuring adequacy for PLS-SEM.
Questionnaire	54 items: demographics, cultural values (CVSCALE), and sustainability readiness.
Scale	0–10 Likert scale (strongly disagree–strongly agree).
Validation	Pre-tested with experts; incomplete data removed.

sustainability readiness for Industry 5.0 among respondents from developing countries. In contrast, power distance, uncertainty avoidance, long-term orientation, and indulgence have no significant influence.

7 Discussion

This research aimed to assess sustainability Readiness for Industry 5.0, considering cultural influences from developing nations. The findings provide valuable insights into how cultural factors impact sustainability readiness for Industry 5.0 (Caingcoy, 2023). Specifically, the study reveals that while dimensions such as long-term orientation, uncertainty avoidance, power distance, and indulgence have minimal

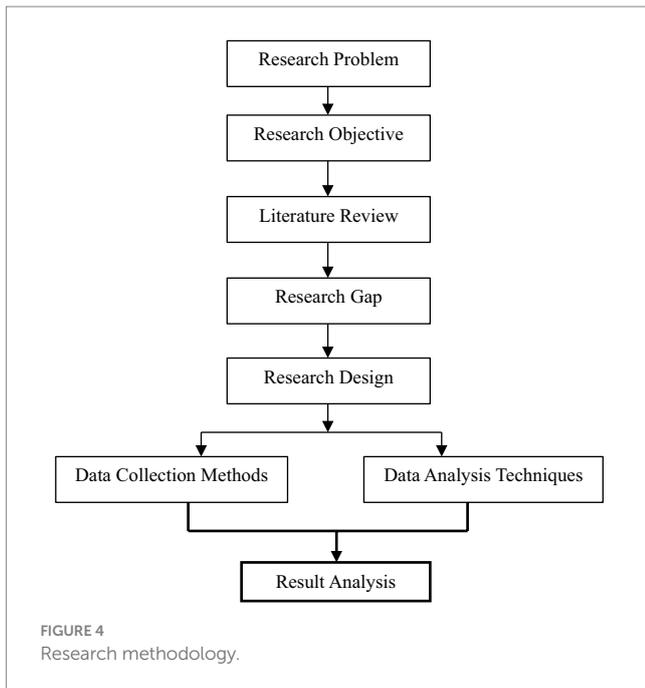


FIGURE 4 Research methodology.

TABLE 6 Sample adequacy and reliability test.

Measurement	Malaysia
Keiser–Meyer–Olkin (KMO) of sampling adequacy	0.912
Bartlett’s test of sphericity	Approx. Chi square
Df	1,225
Sig	0.000
Cronbach’s alpha	0.927

KMO should be >0.5; Bartlett’s should be significant, $p < 0.001$, Cronbach’s alpha > 0.7.

impact, masculinity and collectivism play key roles (Ghazali et al., 2017). Additionally, analyzing the path coefficients offers a deeper understanding of the importance of these cultural factors in shaping sustainability readiness for Industry 5.0. This discussion explores these dimensions and their implications, providing possible explanations for the observed patterns.

First, the significant effect of masculinity on sustainability readiness for Industry 5.0 indicates that the characteristics associated with this cultural dimension are crucial in shaping attitudes and behaviors (Hazrat, 2023). Masculinity is linked to traits such as ambition, assertiveness, competitiveness, and achievement. In developing countries, a moderate level of masculinity may encourage organizations and individuals to prioritize success and performance, leading them to adopt advanced technologies and sustainable practices to gain a competitive edge (Mazhandu et al., 2022). This is especially relevant in the context of Industry 5.0, where sustainability and technological innovation provide platforms to demonstrate leadership and expertise. Organizations and individuals influenced by these values may view the integration of sustainable practices not only as a compliance requirement but also as an opportunity to showcase innovation and strengthen their market position.

Furthermore, collectivism also demonstrates a significant positive impact on sustainability readiness within the Industry 5.0 context. In

TABLE 7 Measurement model of the cultural value constructs.

Cultural dimensions	Items	Loading	AVE	CR	Cronbach alpha
Collectivism	COL1	0.554	0.583	0.843	0.842
	COL2	0.914			
	COL3	0.880			
	COL4	0.725			
Masculinity	MAS1	0.834	0.596	0.853	0.770
	MAS2	0.809			
	MAS3	0.828			
	MAS4	0.587			
Uncertainty Avoidance	UAI1	0.752	0.623	0.892	0.854
	UAI2	0.802			
	UAI3	0.806			
	UAI4	0.856			
	UAI5	0.720			
Power Distance	PDI1	0.435	0.581	0.710	0.406
	PDI2	0.981			
Long-term Orientation	LTO1	0.876	0.842	0.955	0.940
	LTO2	0.930			
	LTO3	0.933			
	LTO4	0.933			
Indulgence	IND1	0.764	0.689	0.900	0.873
	IND2	0.821			
	IND3	0.872			
	IND4	0.694			

AVE represents the extracted average variance. AVE ought to be greater than 0.5. Composite reliability is denoted by CR. A CR of 0.60 to 0.70 is appropriate for exploratory research.

collectivist societies, there is a strong emphasis on community, family, and group harmony (Reiber-Kuijpers et al., 2021). This cultural background fosters a sense of shared responsibility and collaboration toward common goals, including sustainability. In such cultures, the welfare of the group takes precedence over individual success, leading individuals to adopt environmentally friendly behaviors that benefit the wider community. Organizations driven by this collective mindset may be motivated to implement Industry 5.0 technologies like collaborative robotics, human-centric innovations, and eco-friendly production processes. These initiatives not only improve environmental outcomes but also strengthen social cohesion as individuals and organizations work together toward common goals (Hassan, 2024).

As described in Table 10, the outer weight data analysis provides a clearer understanding of the key factors that drive sustainability readiness for Industry 5.0. The highest outer weight (0.482) of Human-Centric Innovation (SR3) indicates that placing people at the center of innovation is crucial for advancing Industry 5.0 initiatives and sustainable practices (Kull et al., 2014). By focusing on human needs, values, and creativity, organizations are better positioned to integrate technology in ways that enhance both productivity and sustainability. Empowering individuals and creating solutions that prioritize well-being can drive meaningful progress toward sustainability goals (Cope et al., 2022).

TABLE 8 Heterotrait–Monotrait ratio (HTMT) for discriminant validity.

	Power distance	Collectivism	Masculinity	Long-term orientation	Uncertainty avoidance	Indulgence
Power distance	–					
Collectivism	0.146	–				
Masculinity	0.291	0.291	–			
Long-term orientation	0.780	0.045	0.299	–		
Uncertainty Avoidance	0.306	0.089	0.331	0.487	–	
Indulgence	0.233	0.145	0.215	0.098	0.246	–

HTMT value should be <0.85 to establish discriminant validity.

TABLE 9 Result of structural model.

Hyp.	Description	Path coefficient	Std. dev	t-value	Result
H1	Power distance → Sustainability Readiness for Industry 5.0	0.095	0.073	1.301	Not supported
H2	Collectivism → Sustainability Readiness for Industry 5.0	0.162	0.068	2.382**	Supported
H3	Masculinity → Sustainability Readiness for Industry 5.0	–0.145	0.059	2.456**	Supported
H4	Uncertainty avoidance → Sustainability Readiness for Industry 5.0	–0.067	0.061	1.098	Not supported
H5	Long-term orientation → Sustainability Readiness for Industry 5.0	0.048	0.065	0.738	Not supported
H6	Indulgence → Sustainability Readiness for Industry 5.0	0.120	0.070	1.714	Not supported

* $p < 0.01$, ** $p < 0.05$, *** $p < 0.1$.

TABLE 10 The outer weight results.

Indicator	Sustainability readiness for Industry 5.0	Outer weight
SR3	Human-centric innovation	0.482
SR2	Technological integration	0.401
SR4	Leadership and vision	0.356
SR1	Sustainable product design	0.294
SR5	Workforce competence	0.218
SR6	Energy management	–0.172

Following with an outer weight of 0.401, Technological Integration (SR2) highlights the importance of seamlessly adopting and embedding advanced technologies to support sustainability readiness (Brozzi et al., 2018). The effective integration of emerging technologies such as artificial intelligence, collaborative robotics, and smart systems enables organizations to optimize processes, reduce waste, and enhance sustainability outcomes. However, technology alone is not sufficient; its integration must align with human-centered values and organizational strategies (Alcaraz, 2023). Leadership and Vision (SR4), with an outer weight of 0.356, reinforces the critical role of visionary leadership in steering sustainability readiness for Industry 5.0 (Casciani et al., 2022). Leaders who articulate a clear vision and inspire collective action can align organizational objectives with sustainability principles, mobilize resources, and foster innovation. Leadership that prioritizes sustainability encourages continuous improvement and creates a culture where sustainability becomes embedded in every level of the organization.

Sustainable Product Design (SR1), with an outer weight of 0.294, also plays a significant role by emphasizing the need to develop

products that minimize environmental impact throughout their lifecycle. Sustainable design practices not only contribute to reducing waste and pollution but also support long-term environmental goals and market competitiveness (Ghobakhloo, 2024). Organizations that prioritize eco-friendly design are better prepared to meet regulatory standards and consumer demands for sustainability (Allen et al., 2016).

With an outer weight of 0.218, Workforce Competence (SR5) reflects the importance of having skilled and knowledgeable employees capable of supporting Industry 5.0 initiatives. The success of sustainability efforts depends on the ability of the workforce to implement new technologies, adopt sustainable practices, and innovate solutions (Saheal and Mohammad, 2025). Continuous learning and upskilling are therefore essential to enhance workforce readiness for sustainability in the Industry 5.0 era. Interestingly, Energy Management (SR6) has a negative outer weight (–0.172), suggesting a more complex relationship or potential challenges in this area. This may indicate that efforts to improve energy management face barriers such as technological constraints, high

implementation costs, or competing priorities within organizations. It could also reflect a tendency to prioritize other sustainability measures over energy management or a lag in adopting energy-efficient technologies (Fraga-Lamas, 2022). Overall, this analysis provides valuable insights into the complex interplay of cultural factors and key elements influencing sustainability readiness for Industry 5.0 in developing countries. While power distance, uncertainty avoidance, long-term orientation, and indulgence show limited influence, masculinity and collectivism emerge as significant drivers, highlighting the importance of competitive ambition and collective responsibility. The outer weight findings further emphasize the central roles of human-centric innovation, technological integration, leadership, and workforce competence in achieving sustainability goals. These insights offer important implications for leaders, policymakers, and organizations seeking to promote sustainability readiness through the adoption of Industry 5.0 technologies in culturally diverse settings (Troisi, 2023).

8 Conclusion

This research explored the key factors influencing sustainability readiness for Industry 5.0, with a focus on cultural influences. The results suggest that while long-term orientation, uncertainty avoidance, power distance, and indulgence do not have a significant effect on the adoption of sustainable practices within the Industry 5.0 framework, masculinity and collectivism are crucial factors. Specifically, masculinity drives a focus on success and competition, encouraging organizations to embrace innovative technologies and sustainable practices to gain a competitive edge. On the other hand, collectivism promotes collaboration and shared responsibility, fostering collective efforts toward sustainability.

The analysis of outer weights highlights the essential roles of human-centric innovation and technological integration in shaping sustainability readiness for Industry 5.0. Human-centric innovation shows the highest outer weight, underscoring the importance of focusing on people when aligning technological developments with sustainability and well-being. Technological integration is closely behind, emphasizing the need for smooth adoption of advanced technologies to optimize processes and achieve sustainable outcomes. Leadership and vision are also crucial elements, as strong leadership is necessary for guiding organizations toward sustainability objectives. Furthermore, sustainable product design and workforce competence play important roles in readiness by promoting eco-friendly product development and preparing the workforce for sustainable practice implementation.

The insights from this study aim to provide decision-makers and organizational leaders with a more focused understanding of the key areas to prioritize when advancing sustainability readiness for Industry 5.0. By investing in human-centered innovation, enhancing technological integration, fostering effective leadership, and addressing critical sustainability factors, organizations can better manage the transition to Industry 5.0. The practical implications emphasize the need for culturally aware, strategic approaches to ensure that technological advancements are effectively integrated and used to achieve sustainable long-term outcomes. These efforts will support developing countries in moving toward a sustainable and technologically advanced future that aligns with global sustainability targets.

Data availability statement

The datasets presented in this article are not readily available because the dataset is restricted to research purposes only and cannot be shared publicly due to confidentiality agreements with participating organizations. Access to the dataset may be provided upon reasonable request, subject to approval and compliance with ethical guidelines. Requests to access the datasets should be directed to ihwan@utem.edu.my.

Ethics statement

The studies involving humans were approved by Ihwan Ghazali and Universiti Teknikal Malaysia Melaka. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because written informed consent was waived because the study did not involve direct participation of human subjects, patient data, or any personally identifiable information. The research relied solely on secondary data and aggregated responses, ensuring anonymity and compliance with ethical standards.

Author contributions

TT: Data curation, Writing – original draft. IG: Writing – original draft, Supervision, Validation, Visualization. AM: Writing – review & editing, Funding acquisition, Resources. WW: Investigation, Software, Writing – original draft, Writing – review & editing. SH: Investigation, Writing – review & editing, Visualization.

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The authors affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frsus.2025.1698178/full#supplementary-material>

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