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Structural Equations of the Organizational Innovation Model with the Role of Intellectual Capital in Organizations

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Abstract

Undoubtedly, human capital constitutes the core pillar of every organization. On the other hand, innovation is indispensable for the survival of organizations. The present study analyzed the structural equations of the organizational innovation model, emphasizing the role of intellectual capital within organizations. Methodologically, the study employed a quantitative-descriptive approach based on structural equation modeling. Furthermore, the study is applied in nature. The statistical population comprised experts, managers, supervisors, and board members of the Ur Company in Iraq, totaling 195 individuals. Accordingly, the sample size was determined as 130 based on Cochran's formula. A researcher-made questionnaire was used as the data collection instrument. To evaluate the reliability of the instrument, Cronbach's alpha method was applied, yielding an overall reliability coefficient of 0.93. For data analysis, structural equation modeling was conducted using Amos version 24. Based on the research findings, causal conditions had a significant effect on the core phenomenon. The standardized path coefficient (β) was 0.66. The standardized path coefficient for intervening factors on strategies was 0.26, indicating a positive and moderate relationship between contextual factors and strategies. The standardized path coefficient (β) for strategies was 0.32, reflecting a moderately positive relationship between strategies and outcomes. Ultimately, all model fit indices, including RMSEA and CFI, demonstrated acceptable results, indicating a good fit of the proposed model with the data. It can be concluded that innovation based on an intellectual capital approach—especially in large companies such as Ur Company in Iraq—can, through the utilization of appropriate organizational infrastructures, innovative strategies, and knowledge management, lead to enhanced performance and organizational credibility.

Keywords: Structural Equations, Ur Company, Iraq, Intellectual Capital, Organizational Innovation

1. Introduction

In today's dynamic and knowledge-driven economies, organizations are increasingly reliant on intangible resources to sustain competitive advantage, adapt to change, and innovate continuously. Among these intangible assets, intellectual capital has gained strategic prominence for its role in creating value, enabling innovation, and improving organizational performance. Intellectual capital, encompassing human, structural, and relational capital, serves as the foundational infrastructure upon which knowledge-based capabilities are built and deployed. As organizations face rapid technological shifts and global competition,

the capacity to leverage intellectual capital has become essential for innovation-led growth and long-term sustainability (Ali et al., 2022; Xu et al., 2023).

The rise of intellectual capital as a central concept in strategic management has been accompanied by empirical efforts to assess its impact across a variety of sectors. Several studies have established its role in enhancing financial performance and facilitating resource optimization. For instance, a comparative study by (Barak & Sharma, 2024) shows that intellectual capital significantly contributes to financial efficiency in Indian public sector banks. Similarly, (Beigi Siassal et al., 2024) emphasize how intellectual capital influences financial flexibility, particularly when moderated by variables such as tax avoidance and leverage. These findings underscore the financial dimension of intellectual capital while pointing toward the need for comprehensive models that incorporate innovation, strategy, and environmental conditions. This study seeks to address this need by analyzing organizational innovation through a structural model that integrates intellectual capital as a core driver.

The role of intellectual capital in fostering innovation has been widely explored, particularly in relation to absorptive capacity, technological advancement, and digital transformation. According to (Truong & Nguyen, 2024), intellectual capital enhances firm performance through its influence on innovation and environmental compliance. Likewise, (Niwash et al., 2022) demonstrate that the quality and speed of innovation mediate the relationship between intellectual capital and competitive advantage. As digital technologies increasingly permeate all sectors, the strategic deployment of intellectual capital is vital for achieving alignment with innovation imperatives. In this context, (Yilmaz & Tuzlukaya, 2024) conduct a bibliometric analysis confirming the interdependence between intellectual capital and digital transformation, emphasizing the importance of aligning knowledge assets with technological capabilities.

Within transitional and post-conflict economies such as Iraq, the need for intellectual capital is particularly acute. In these contexts, rebuilding institutional frameworks and improving organizational resilience demand innovative strategies anchored in knowledge-based assets. However, empirical research in this setting remains limited. Studies conducted in neighboring countries provide useful models. For instance, (Zareian Moradabadi et al., 2022) proposed an evaluation model for intellectual capital in Iranian state banks, offering a context-sensitive approach that informs this research. In the industrial sector, (Kafili et al., 2022) confirmed the positive relationship between intellectual capital and financial outcomes in pharmaceutical firms, suggesting cross-sector applicability of intellectual capital models. These findings provide theoretical justification for exploring the structural relationships between intellectual capital, innovation strategies, and outcomes in large Iraqi companies.

Intellectual capital also plays a crucial mediating role in linking internal capabilities with strategic decision-making and innovation management. For example, (Samimi et al., 2021) explore its impact on defense knowledge-based organizations, finding that intellectual capital enhances performance via organizational innovation. A similar pattern is observed in the study by (Taheri Hoshi & Aroni Tabatabaei, 2024), which integrates organizational intelligence and innovation as key mediators in achieving business intelligence in the insurance sector. These models reflect the value of intellectual capital not only as a direct contributor to performance but also as a strategic enabler of innovation processes. The present study adopts this conceptualization by positioning innovation as a core phenomenon influenced by multiple organizational conditions, including intellectual capital.

The relationship between intellectual capital and sustainability has also received increasing attention in recent scholarship. In the oil and gas sector, (Nazir et al., 2024) explore how intellectual capital supports sustainable performance and disaster preparedness, highlighting its critical role in high-risk environments. In tourism and urban development, (Seifollahi, 2024) demonstrates that green intellectual capital significantly mediates the relationship between marketing mix variables and green brand attitudes. These studies suggest that intellectual capital has far-reaching effects beyond financial metrics, extending to ecological resilience and social responsibility. Such multidimensional contributions reinforce the need for integrative models that account for intellectual capital's diverse roles in organizational innovation.

Green and sustainable dimensions of intellectual capital are increasingly relevant as organizations face global environmental pressures. In this context, (Hu & Tresirichod, 2024) emphasize the mediating effect of green supply chain management and green intellectual capital on sustainable performance. Likewise, (Pazaki, 2024) developed a paradigmatic model for sustainable

rural entrepreneurship, showing how strategic orientation and green intellectual capital drive local economic development. These findings are particularly important for emerging economies that must balance economic growth with environmental stewardship, and they provide additional rationale for incorporating sustainability indicators into innovation models rooted in intellectual capital.

In developing countries, intellectual capital also interacts with social capital and organizational innovation to shape long-term performance. (Shahriari & Shahrabi Farahani, 2021) highlight the interplay between innovation and social capital, asserting that cohesive organizational relationships enhance knowledge flow and innovative thinking. Similarly, (Mohammadi Yazdi et al., 2024) investigate human resource development in Iran's e-commerce sector, revealing how competency-based frameworks contribute to innovation via knowledge management. The present study acknowledges these dynamics by including organizational culture, leadership style, and participatory management as key contextual factors in the model. These elements are essential for nurturing a knowledge-rich environment conducive to innovation.

Startups and small enterprises also benefit significantly from intellectual capital, particularly in relation to competitive positioning and value creation. (Shafaat Takoldan et al., 2024) examine intellectual capital's impact on competitive advantage in startups, finding that knowledge-based differentiation strategies enhance market performance. Similarly, (Jayabalan et al., 2024) argue that intellectual capital is instrumental in fostering frugal innovation in resource-constrained environments. These insights demonstrate that intellectual capital is scalable across organizational types, reinforcing the universality of its relevance in innovation modeling.

Corporate responsibility and knowledge disclosure are also influenced by intellectual capital. (Tetteh et al., 2024) present evidence from Ghana that firms with stronger intellectual capital tend to engage more in corporate social responsibility reporting, which in turn affects their financial performance. In line with this, (alkhatib & Valeri, 2024) propose a moderated mediation model showing how service innovation and big data analytics interact with intellectual capital to enhance competitive advantage. These studies underscore the strategic role of intellectual capital in fostering transparency, innovation, and accountability, themes that are particularly relevant in the organizational context of Iraq's evolving corporate sector.

The present research is further grounded in the process-oriented frameworks proposed by (Rahimi et al., 2022), who conceptualize organizational innovation as a process of transitioning toward optimal conditions for enhancing effectiveness. Their model aligns with the broader theoretical assumption that innovation is both a process and an outcome of intellectual and social inputs. Similarly, (Taheri Hosseini & Aruni Tabatabai, 2023) validate a multi-component structural model linking organizational intelligence, innovation, and intellectual capital to business intelligence, suggesting the suitability of structural equation modeling (SEM) for capturing these complex relationships. The methodological choice of SEM in this study is thus informed by both theoretical coherence and empirical precedent.

To address these research gaps and contextual needs, the present study proposes and validates a structural model that explains how intellectual capital influences organizational innovation in a large Iraqi industrial organization.

2. Methods and Materials

This study adopted a quantitative-descriptive methodological approach utilizing structural equation modeling (SEM). The research is applied in nature. The statistical population included experts, managers, supervisors, and board members of the Ur Holding Company in Iraq, totaling 195 individuals. Accordingly, the sample size was determined to be 130 based on Cochran's formula. The data collection instrument was a researcher-constructed questionnaire. The initial questionnaire was designed based on the conceptual model derived from a preceding qualitative study and was submitted to experts for review. Based on expert feedback, the sub-criteria of the questionnaire were screened, and the final version of the questionnaire was developed and validated by subject matter specialists. To assess reliability, Cronbach's alpha method was used, yielding an overall reliability coefficient of 0.93. For data analysis, structural equation modeling was conducted using Amos version 24.

3. Findings and Results

In the study sample, the number of female participants was 10, representing 7.69% of the total sample, while males constituted 120 participants, accounting for 92.31% of the respondents. In terms of age distribution, the highest frequency was observed in the 30–40-year range, encompassing 95 individuals, which corresponds to 73.08% of the total population. Among the 130 respondents, the highest frequency was associated with individuals holding a bachelor's degree, totaling 50 individuals (38.46%). This was followed by participants with a master's degree, numbering 45 (34.61%), and finally, participants with a doctoral degree, who numbered 28 (21.54%), representing a significant portion of the sample.

To validate the proposed research model, structural equation modeling was employed. Initially, the normality of data distribution was examined, and the results are presented in Table 1.

Table 1. Skewness-Kurtosis Test

Variable	Skewness	Kurtosis
Causal Conditions	-0.68	0.51
Core Phenomenon	-0.66	-0.025
Contextual Factors	-0.266	0.099
Intervening Factors	0.31	-0.18
Strategies	-0.35	-0.71
Outcomes	0.054	0.37

The results in Table 1 indicate that all skewness and kurtosis values fall within the acceptable range of -2.5 to +2.5, confirming that the data are normally distributed. After verifying and confirming the measurement models, structural equation modeling was utilized in the second stage to test the study hypotheses.

Table 2. Structural Model Fit Indices for the Overall Research Model

Fit Index	CMIN/DF	PNFI	CFI	RMSEA
Structural Model	3.34	0.51	0.91	0.09
Acceptable Threshold	<5	>0.50	>0.90	<0.10

Based on the results presented in Table 2, several key indicators were assessed to evaluate the fit of the structural model. The RMSEA value was 0.09, which is close to the threshold value of 0.08 and indicates a relatively good model fit. The CFI value was 0.91, exceeding the acceptable minimum of 0.90, suggesting a satisfactory level of model fit. The PNFI value was 0.51, slightly above the acceptable threshold of 0.50, indicating the model's parsimony. Additionally, the CMIN/DF value was 3.34, which falls below the commonly accepted maximum of 5, further supporting the adequacy of the model fit. Overall, the results suggest that the structural model exhibits an acceptable fit and can adequately explain the observed data.

Table 3. Hypotheses Testing Results

Hypothesis Statement	β	C.R.	P	Result
Causal conditions affect the core phenomenon.	0.66	4.21	0.000	Significant
Contextual factors affect strategies.	0.36	5.44	0.000	Significant
Intervening factors affect strategies.	0.26	3.55	0.000	Significant
The core phenomenon affects strategies.	0.37	2.82	0.005	Significant
Strategies affect outcomes.	0.32	3.27	0.001	Significant

In summary, the structural equation modeling results confirmed the significance of all hypothesized relationships within the model. Specifically, causal conditions had a strong and significant effect on the core phenomenon ($\beta = 0.66$, C.R. = 4.21, $p < 0.001$). Contextual factors showed a moderate, significant impact on strategies ($\beta = 0.36$, C.R. = 5.44, $p < 0.001$), while intervening factors also contributed significantly to strategy formation ($\beta = 0.26$, C.R. = 3.55, $p < 0.001$). The core phenomenon exerted a significant influence on strategies ($\beta = 0.37$, C.R. = 2.82, $p = 0.005$), and strategies, in turn, significantly predicted organizational outcomes ($\beta = 0.32$, C.R. = 3.27, $p = 0.001$). These findings collectively support the validity of the proposed innovation model grounded in the role of intellectual capital.

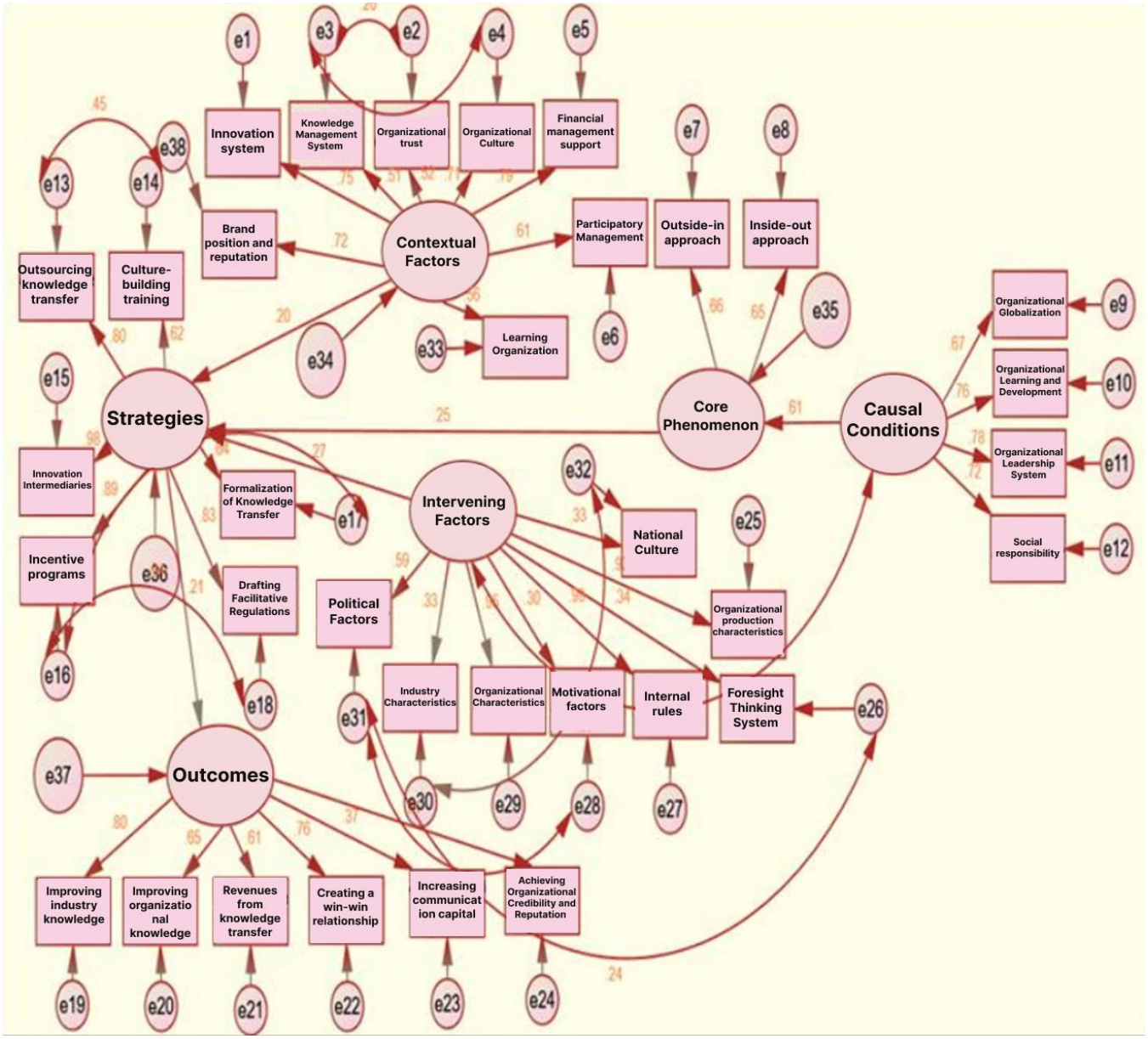

Figure 1. Final Model of Organizational Innovation with the Role of Intellectual Capital in Organizations

4. Discussion and Conclusion

The findings of this study, derived through structural equation modeling, confirmed the central hypothesis that intellectual capital plays a significant role in shaping organizational innovation. Each hypothesized relationship within the proposed structural model was found to be statistically significant, indicating strong interconnections between causal conditions, contextual and intervening factors, strategic decisions, and innovation outcomes. Specifically, the results revealed that causal conditions had a robust direct effect on the core phenomenon of organizational innovation ($\beta = 0.66$), underscoring the foundational role of elements such as globalization, leadership systems, and organizational commitment. This finding aligns with the assertion that macro-organizational drivers—like strategic vision, leadership orientation, and commitment to learning—are prerequisites for fostering innovation in knowledge-intensive environments (Rahimi et al., 2022; Shahriari & Shahrabi Farahani, 2021).

Moreover, contextual factors including organizational culture, meritocracy systems, and knowledge management frameworks showed a statistically significant and positive influence on the formulation of strategies ($\beta = 0.36$). This relationship confirms that innovation is not an isolated outcome but rather an emergent process rooted in the broader organizational

ecosystem. These results are in line with the model developed by (Zareian Moradabadi et al., 2022), which emphasized the importance of structural and cultural readiness in enhancing intellectual capital utilization in Iranian state banks. The findings also echo the perspective of (Kafili et al., 2022), who demonstrated that organizational context significantly influences how intellectual capital translates into financial and strategic outcomes in the pharmaceutical sector.

The influence of intervening factors such as national culture, government policy, and industry-specific characteristics on strategy development (β = 0.26) was also found to be meaningful. This suggests that innovation strategies are not only internally driven but also shaped by exogenous variables such as regulatory environments and industry norms. This result aligns with the framework proposed by (Beigi Siassal et al., 2024), where tax regulations and leverage moderated the impact of intellectual capital on organizational flexibility. Moreover, (Truong & Nguyen, 2024) and (Tetteh et al., 2024) have argued that contextual mediators—such as compliance requirements and corporate social responsibility—significantly affect how intellectual assets are deployed in strategic innovation processes. The moderate yet significant effect of intervening factors validates the need to consider broader institutional and socio-economic dynamics when designing innovation strategies in industrial environments.

The relationship between the core phenomenon of organizational innovation and strategy formulation (β = 0.37) further reinforced the view that innovation serves as a mediating structure between resources and outcomes. This finding complements the empirical work of (Samimi et al., 2021), who demonstrated that innovation operates as a functional bridge between intellectual capital and organizational performance in defense-oriented knowledge-based organizations. Similarly, (Taheri Hoshi & Aroni Tabatabaei, 2024) revealed that innovation enables the transformation of internal knowledge into actionable insights that support business intelligence systems. These results collectively underscore that innovation is not only a product of intellectual capital but also a key mechanism through which it exerts its effects on performance and adaptation.

Finally, strategies formulated through this intellectual and contextual process had a moderate yet significant effect on outcomes (β = 0.32), such as enhanced reputation, increased credibility, and the ability to build university–industry linkages. This is consistent with the findings of (Ali et al., 2022), who argued that intellectual capital-driven strategies positively influence organizational reputation and stakeholder trust. Moreover, (Jayabalan et al., 2024) highlighted how such strategies enable frugal innovation and long-term resilience, particularly in resource-scarce environments. These final pathways affirm the theoretical model proposed in this study, which places intellectual capital at the center of a systemic framework involving strategy, context, and outcomes.

The model's overall fit indicators (CMIN/DF = 3.34, CFI = 0.91, RMSEA = 0.09, PNFI = 0.51) fall within acceptable thresholds, further validating the model's structural robustness. The reasonably high CFI and PNFI scores indicate that the model accounts for parsimony and model fit, supporting the multidimensional approach that incorporates causal, contextual, and mediating variables. These indicators are similar to those reported in previous works, such as (Taheri Hosseini & Aruni Tabatabai, 2023), who used SEM to validate a multicomponent model linking organizational intelligence, innovation, and business intelligence.

A notable contribution of this study lies in its application to a large Iraqi holding company, filling a gap in Middle Eastern organizational research, where empirical data on intellectual capital and innovation are relatively sparse. While studies in neighboring countries have laid a foundation for understanding intellectual capital dynamics (Mohammadi Yazdi et al., 2024; Pazaki, 2024), the contextual specificity of this model—built on actual organizational data from Iraq—provides a grounded and applicable framework for organizations operating in similarly transitional economies. The importance of context in shaping both intellectual capital deployment and innovation strategy is evident across the structural paths validated in this model.

This study also contributes to the growing body of literature emphasizing the greening of intellectual capital. Although the current model does not isolate green intellectual capital as a discrete construct, the emphasis on learning organizations, participatory management, and sustainable knowledge transfer reflects similar values. As suggested by (Hu & Tresirichod, 2024) and (Seifollahi, 2024), the integration of ecological and social dimensions into intellectual capital strategies enhances long-term sustainability and broadens the value horizon of innovation systems. Future models could benefit from incorporating explicit environmental indicators to reflect the increasingly critical role of sustainability in organizational innovation.

Moreover, the interaction between intellectual capital and technology was implicit in several constructs—such as knowledge systems, technological foresight, and innovation intermediaries—present in the final model. These components align with the findings of (Yilmaz & Tuzlukaya, 2024), who emphasized the interplay between intellectual capital and digital transformation in driving organizational change. The inclusion of such elements reflects the adaptive orientation of the organization under study and supports the argument that digital integration is a critical enabler of intellectual capital utilization in modern industrial ecosystems.

In summation, the validated model supports a multi-layered conceptualization of organizational innovation that includes foundational conditions, intervening variables, and strategic levers. The significance of each path confirms that innovation is not an isolated phenomenon but a composite process shaped by intellectual capital, contextual dynamics, and strategic intent. These findings contribute to both theory and practice by offering a model that is empirically validated, contextually grounded, and analytically robust.

Despite its contributions, this study has several limitations that should be acknowledged. First, the data were collected from a single large industrial company in Iraq, which may limit the generalizability of the findings to other sectors or countries. Second, the reliance on self-reported data through questionnaires introduces the possibility of response bias and social desirability effects. Third, while the structural model incorporated a wide range of variables, it did not include time-based or longitudinal data, which are essential for understanding how the impact of intellectual capital evolves over time. Finally, some emerging dimensions such as digital readiness and environmental sustainability were not fully isolated as constructs, though they were implicitly present in the conceptual framework.

Future research could enhance the current model by incorporating longitudinal data to track changes in innovation performance and intellectual capital over time. Cross-sectoral comparative studies could also provide deeper insights into how the dynamics of intellectual capital differ across industries such as healthcare, education, or technology. Moreover, future models could explicitly include green intellectual capital and digital innovation variables as distinct constructs to capture the evolving priorities of sustainable and tech-enabled development. Mixed-method approaches, combining structural modeling with qualitative interviews, could also enrich the analysis and provide more nuanced interpretations of organizational processes.

Managers and policymakers should recognize the central role of intellectual capital in enabling innovation strategies and driving performance. Organizations should invest in systems that support participatory management, institutional learning, and knowledge transfer, as these are crucial for fostering an innovation-friendly environment. Furthermore, attention must be paid to contextual and regulatory factors that may enhance or hinder innovation pathways. Finally, developing a culture of continuous learning, ethical leadership, and strategic foresight will allow organizations to leverage their intellectual assets more effectively in pursuit of long-term sustainability and competitive advantage.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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