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Digital Accountability Management Paradox Resolving Controls with AI Blockchain Assurance for Sustainability Performance

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ABSTRACT

Purpose—This study analyzes how digital capabilities, governance, and accounting translate into sustainability-oriented outcomes via an integrated performance measurement system.

Design/methodology/approach—This model was tested using a unique design to provide a quantitative explanation in terms of structural equation modelling (SEM) of direct effects, mediating effects, moderating effects, and resilience measures.

Findings—The findings show that digital governance does not automatically result in high performance. The same is true of agile principles and controls. The same is true of modern accounting assurance. And the same is true of sustainability control systems. Instead, these outcomes are largely realized through performance measurement capabilities that resolve the paradox of balancing efficiency/accountability and sustainability agendas. This ability is believed to be crucial in turning digital resources and management into a lasting competitive edge and organizational strength. Regulatory and environmental pressures show a marginal level of influence in context, suggesting that a robust internal measurement architecture remains stable across contexts.

Originality/value—This study introduces performance measurement capabilities that resolve the paradox as a unique organizational capability, expanding existing knowledge about digital transformation and sustainability accounting beyond static views of control systems. This paper expands capability-based theories of digital accountability and sustainability performance by synthesizing digital leadership, AI-blockchain assurance, agile governance, and sustainability controls within an integrated explanatory framework.

Implications—Integrating digital and sustainability initiatives into learning-based performance measurement systems is strategically vital. They suggest ways in which digital accountability mechanisms can be used in institutional environments that are under pressure to transform into long-term sustainable value generators.

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1. Introduction

In the past decade, digital transformation has disrupted how organizations generate value, govern operations, and maintain competitive advantage. Technological improvements in artificial intelligence (AI), blockchain, and data-led systems of management not only impact operational activities but also strategically and accountably the bases upon which modern firms are built (Vial, 2019; Teece, 2018). Simultaneously, companies are coming under growing pressure to reconcile economic goal attainment with social and environmental responsibilities, which has led to the emergence of so-called sustainability-oriented management and accounting practices that go beyond classical financial measurements (Hahn et al., 2020). These trends raise digital capabilities from a peripheral tactical tool into core strategic resources that are entrenched in organizational governance and control structure. More recent literature emphasizes the importance of digital leadership and agile governance when orchestrating digital resources to fit with corporate goals. Finally, digital leadership capacity supports senior management

in developing a meaningful digital vision, marshaling resources, and creating an organizational readiness for ongoing technological changes (Cortellazzo et al., 2019; Warner and Wäger, 2019). Concurrently, the agile governance of organizations also improves companies' ability to reconfigure organizational forms, means of decision-making, and control systems in order to react to changes in their environments (Teece, 2007). This latter view, based on resources and dynamic capabilities, highlights the importance of these capabilities in converting digital investments into sustainable competitive advantages, as opposed to short-term performance increases. AI and blockchain technologies in the accounting area are transforming the assurance, transparency, and trust toward organizational reporting and control systems. AI-blockchain accounting assurance potential. AI-blockchain-enabled accounting assurance assists the performance of routine attestation tasks and increases the efficiency and effectiveness of verifying data precision and real-time verification (Moll and Yigitbasioglu, 2019; Dai and Vasarhelyi, 2017). At the same time, sustainability management control systems are developing to embed environmental and social goals

within formal planning, measurement, and incentive processes (Malmi and Brown, 2020; Hahn et al., 2020). In any case, empirical evidence indicates that the mere embrace of state-of-the-art digital or sustainability tools does not necessarily lead to better organizational results in turbulent and heavily regulated situations.

Emerging literature highlights that organizations and their leaders are increasingly confronted by a performance paradox—managing the polarity between short-term financial efficiency and long-term sustainability and resilience (Smith and Lewis, 2011; Van der Byl and Slawinski, 2015). The potential of digital technologies is efficiency and accuracy, but the demands for sustainability lie with flexibility, inclusion, and long-term thinking. However, extant research tends to focus on digital transformation, sustainability management, or accounting control as a distinct concept and does not advance the understanding of how these competing logics are combined in practice within organizations. Invisibility of performance measurement competences to paradoxical demands in management accounting research. The role of performance measurement capabilities that reconcile paradoxical demands is under-examined, particularly questioning.

In addition, organizational results in the form of sustainable competitive advantages and resiliences are more influenced by external contextual influences. Regulatory pressure exacerbates the expectations for institutions to be transparent, compliant, and responsible in their conduct, particularly those that experience environmental and financial scrutiny (DiMaggio and Powell, 1983; Zhou et al., 2022). Simultaneously, the environmental dynamism represented by fast technological innovation and market uncertainty determines how digital and governance competencies perform (Dess and Beard, 1984; Hitt et al., 2021). However, these contextual moderators are seldom integrated systematically into comprehensive digital sustainability models.

Emerging research suggests that businesses are confronted with a "performance paradox" (Smith and Lewis, 2011; Van der Byl and Slawinski, 2015) where the pursuit of short-term financial efficiency competes with long-term sustainability and resilience. Whereas digital technologies advocate efficiency and precision, sustainability requirements call for flexibility, inclusivity, and focus on the long term. This is because, although current research tends to address digital transformation and sustainability management and accounting controls in isolation from each other, little focus has been placed on how organizations negotiate these competing logics in practice. For example, the specific contribution of capabilities in measuring performance to reconcile paradoxical demands has not been well developed in the streams of management and accounting research.

Furthermore, organizational results, including sustainable competitive advantage and resilience, are increasingly driven by external contextual forces. Pressure from regulations increases requirements for transparency, compliance, and responsible behavior, particularly in industries under environmental and financial scrutiny (DiMaggio and Powell, 1983; Zhou et al., 2022). Simultaneously, fast technological change and market uncertainty in the environment shape how effective digital and governance capabilities are (Dess and Beard, 1984; Hitt et al., 2021). However, those contextual moderators are rarely considered in an integrated manner in digital sustainability models.

The remainder of this paper is structured as follows. Section 2 presents the theoretical foundation and hypothesis development. Section 3 outlines the research methodology and data analysis procedures. Section 4 reports the empirical results, followed by Section 5, which discusses theoretical and practical implications. Section 6 concludes the study by highlighting limitations and directions for future research.

2. Literature Review

2.1 Theoretical background

This research is theoretically based upon the amalgamation of RBV, Dynamic Capabilities Theory, and Institutional Theory to understand the transformation path of digital and governance capabilities into sustainable organizational performance. RBV claims that firms gain SCA if they have valuable, rare, inimitable, and non-substitutable (VRIN) resources such as digitally embodied managerial and accounting skills (Barney, 1991). By extending some of the central elements of RBV, Dynamic Capabilities Theory highlights that it is firms' ability to sense, size, and reconfigure resources in relation to environmental change that takes center stage in digitally turbulent environments (Teece, 2007). Institutional Theory further elaborates on how regulative pressures and normative expectations influence the organizational architectures and control systems, as in sustainability and reporting practices (DiMaggio and Powell, 1983). Taken in sum, these theories support the above studies of digital leadership, agile governance, and advanced accounting controls as strategic capabilities that are dependent on institutional and environmental conditions.

2.2 Digital and governance capabilities in shaping organizational outcomes

In sum, digital leadership capacity allows top management to coordinate digital activities with strategic goals, encourage innovation, and integrate sustainability into long-term value generation. Existing research has demonstrated that digital-savvy leaders enhance the capacity of organizations to use technology for competitive advantage and resilience by driving strategic renewal and organizational learning (Warner and Wäger, 2019; Vial, 2019). Empirical evidence also reveals that digital leadership exerts a significant positive impact on sustainability performance, due to the integration of environmental and social concerns in strategic decision-making (Cortellazzo et al., 2019; El Sawy et al., 2020). Hence, these capabilities would potentially enhance sustainable competitive advantage as well as organizational resilience in turbulent environments.

Organizational agile governance supports leadership in the facilitation of flexible decision-making, coordination across functions, and quick reaction to environmental volatility. Researchers argue that firms use agile governance to enable a firm's adaptive capacity and resilience (El Sawy et al., 2020), and also to realise sustainable value creation by continuously reconfiguring their processes and controls (Teece, 2007; Hitt et al., 2021). At the same time, AI blockchain accounting assurance ability enhances transparency and trust real-time verification among others, associated with improved corporate resilience and performance (Dai and Vasarhelyi, 2017; Moll and Yigit-basioglu, 2019). SC-control strength strengthens these effects, as it structures financial and non-financial performance with a view to balancing efficiency, accountability, and long-term sustainability (Malmi and Brown, 2020; Hahn et al., 2020).

2.3 Digital capabilities and performance measurement architecture

Performance measurement capacity that resolves paradoxes (PR-PMC): PR-PMC has to do with an organization's ability to "develop and use performance measurement systems which succeed in the same time accommodating competing logics of performance, such as efficiency versus sustainability, or short-term results versus long-term resilience." However, the architecture of this kind of analytics is also highly dependent on digital leadership capability that can be instrumental to strategically aligning a firm's digital initiatives and performance measurement systems. Digital business-savvy leaders facilitate the inclusion of real-time data, analytics, and non-financial-based indicators in organization dashboards to aid the organization in watching and balancing paradoxical demands on performance (Vial, 2019; El Sawy et al., 2020). Previous research explains that leadership-led digital transformation drives more agile and long-term-oriented performance measurement systems because of practicing organizational learning and strategic renewal (Warner and Wäger, 2019).

Agile governance at the organization level, in turn, enhances PR-P.M.C. by nurturing flexible decision rights, quick feedback loops, and cross-functional coordination within performance review. Agile governance mechanisms allow firms to regularly reprogram measurement systems in order to adjust for a changing environment and reduce rigidity and control overload (Teece et al., 1997). Simultaneously, AI-blockchain accounting assurance directly contributes to increasing the precision, transparency, and appropriateness of the performance data required for resolving the performance paradoxes in complex organizational form (Dai and Vasarhelyi, 2017; Moll and Yigitbasioglu, 2019). Sustainability management control strength reinforces these digital capabilities by incorporating environmental and social metrics into formal control systems, thereby creating synergy between strategic sustainability aspirations and operative performance measurement (Malmi and Brown, 2020; Hahn et al., 2020).

2.4 Performance measurement capability and organizational outcomes

Paradox-resolving performance measurement capability PR-PMC helps companies to both monitor and act on competing goals, e.g., financial efficiency versus sustainability vs long-term adaptability. PR-PMC combines financial and non-financial metrics to assist strategic decision-making by linking operational interventions with triple-bottom-line goals. Previous studies suggest that sophisticated performance measurement systems contribute to SCA by making strategic alignment, transparency, and resource allocation more effective (Kaplan and Norton, 1996; Hahn et al., 2020). When firms develop reconciliation capabilities that fit paradoxical performance requirements into adaptive measurement architectures, they are more capable of translating strategic intent into ongoing value creation, especially in complex and changing conditions.

Other than competitive advantage, PR-PMC is also important in enhancing a firm's capacity for resilience. Resilience entails anticipating disruptions, absorbing the shocks, and regaining equilibrium in a manner that sustains core functions and strategic direction. There is also evidence that performance evaluation systems with future-oriented indicators and real-time information feedback contribute to organizational learning and adaptation and ultimately help in maintaining the

systems' resilience (Lengnick-Hall et al., 2011; Duchek, 2020). It contributes towards organisational resilience and flexibility in uncertain environments by facilitating constant performance monitoring and fast managerial reaction (PR-PMC). Hence, it is assumed that organizations' paradox resolution measurement capability will lead to more sustainable competitive advantage and organizational resilience.

2.5 Performance measurement as an integrative mechanism

The paradox-resolving performance measurement capability (PR-PMC) acts as a sense-making mechanism for the transformation of digital and governance capabilities into actual organizational outputs. Although digital leadership, agile governance, and sophisticated accounting technologies promise to be strategic assets, their actual effects on performance are contingent on the extent to which they are institutionalized in organizational measurement and control systems. Previous research suggests that performance measurement systems are an important mediator in the sense that they align strategic intent with operational execution, a process which enables organizations to turn capabilities into long-term competitive advantage (Kaplan and Norton, 1996; Malmi and Brown, 2020). The digital leaders and agile governance improve the creation and utilization of adaptive measurement systems, enabling organizations to balance conflicting performance demands aimed at coordinating cross-functional decision-making (Teece et al., 1997; Teece, 2018; Warner and Wäger, 2019).

Furthermore, AI-blockchain accounting assurance capability and sustainability management control power affect organizational performance mainly through their inclusion in performance measurement systems. Newer, more advanced data assurance tools enhance the reliability and transparency of information, but their strategic utility only fully emerges when there exist measurement systems that allow for timely interpretation and managerial action (Dai and Vasarhelyi, 2017; Moll and Yigitbasioglu, 2019). Control systems for sustainability foster the reflection and operationalization of environmental and social targets in performance measurement to consider both short-run efficiency and long-term endurance (Hahn et al., 2020). As a result, PR-PMC plays the mediating role in the relationship between digitization capability and control efficiency capability with sustainable competitive advantage and organizational resilience, and it is a core machine to help firms solve performance paradoxes under a complex business environment.

2.6 Regulatory and environmental contingencies

Regulatory pressure is an important institutional contingency that conditions the effectiveness of digital and sustainability-related capabilities. Institutional theory Institutions exert an influence on how organizations use accounting assurance technologies and management control systems in relation to the attainment of legitimacy and competitive advantage (DiMaggio and Powell, 1983). Previous research suggests that in the context of stringent regulation, advanced accounting assurance systems, such as AI blockchain-enabled information systems, are likely to add value for improving transparency, compliance, and stakeholder trust through strengthening sustainable competitive advantage and organization resilience (Dai and Vasarhelyi, 2017; Zhou et al., 2022). Furthermore, management control systems of sustainability are also more likely to lead to higher performance when regulatory systems support environmental

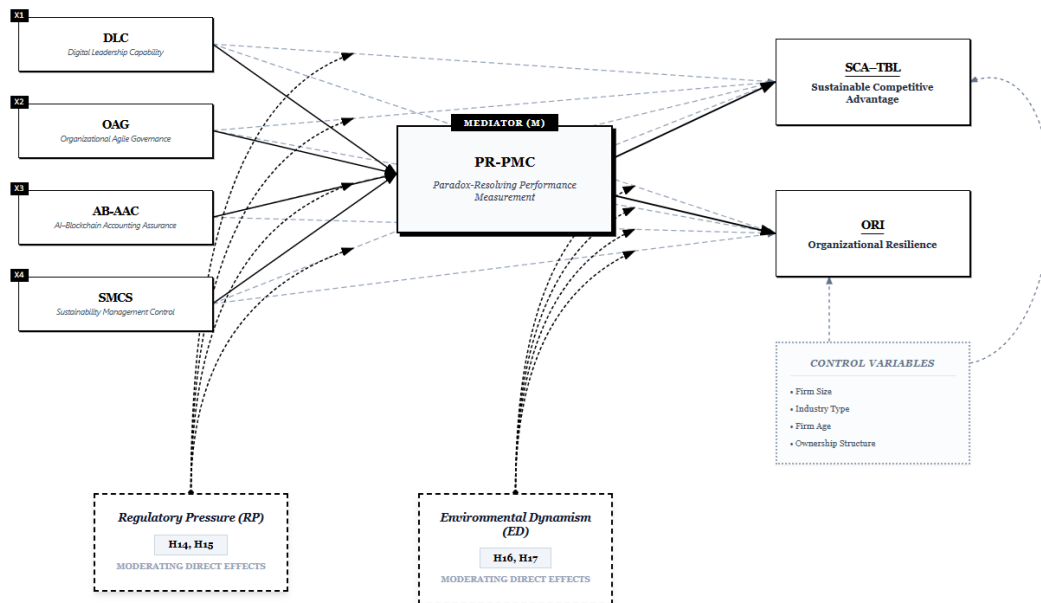


Fig. 1. Conceptual research framework of digital leadership, agile governance, AI-blockchain accounting assurance, sustainability management control strength, paradox-resolving performance measurement capability, and organizational outcomes.

and social responsibility, thus underpinning the strategic relevance of sustainability-related controls (Hahn et al., 2020; Dumay et al., 2022).

Environmental dynamism is a market-based contingency that moderates the relationship between leadership and governance capabilities and HCOs’ effectiveness. In volatile environments subject to rapid technological changes and market uncertainty, flexible governance and digital leadership are increasingly important for time-critical decisions and adaptive reactions (Dess and Beard, 1984; Teece, 2007). There is empirical evidence that an enhancement in environmental dynamism increases the importance of adequate flexible governance structures, and digitally enabled leadership, since it escalates the need for swift sensing, coordination, and reconfiguration of organizational resources (Warner and Wäger, 2019; Duchek, 2020). It is therefore anticipated that the positive impact of organizational agile governance and digital leadership on sustainable competitive advantage and organizational resilience is enhanced by high levels of environmental dynamism.

2.7 Conceptual research framework

This study develops an integrated conceptual framework that explains how digital, governance, and accounting-related capabilities jointly influence sustainability-oriented organizational outcomes under varying institutional and environmental conditions. In the proposed model, Digital Leadership Capability (DLC), Organizational Agile Governance (OAG), AI-Blockchain Accounting Assurance Capability (AB-AAC), and Sustainability Management Control Strength (SMCS) are conceptualized as core strategic capabilities that shape Sustainable Competitive Advantage (SCA-TBL) and Organizational Resilience (ORI).

At the center of the framework is Paradox-Resolving Performance Measurement Capability (PR-PMC), which functions as an integrative mediating mechanism translating strategic digital and governance capabilities into organizational-level

performance outcomes. This capability enables organizations to reconcile competing demands such as efficiency, accountability, sustainability, and adaptability by aligning strategic intent with operational performance measurement.

Furthermore, the framework incorporates Regulatory Pressure (RP) and Environmental Dynamism (ED) as contextual contingencies that moderate selected relationships, reflecting the influence of institutional constraints and environmental uncertainty. Firm-level control variables are included to isolate the explanatory power of the proposed capability relationships.

3. Methods Innovation

3.1 Research design

We employ a quantitative explanatory research design to investigate the associations between digital, governance, and accounting capabilities and their effects on firm outcomes. A cross-sectional survey with a time-lagged design is used to minimize common method bias by measuring the independent variables, mediating mechanisms, and dependent outcomes over time. The response reliability is highly improved, and single-informant bias can be minimized by using more than one organizational role as a data source. The model incorporates both direct, mediating, and moderating effects, characterizing a configuration-based and process-oriented model. Due to its complexity and predictive approach, Second, the Partial Least Squares Structural Equation Modeling (smart.PLS-SEM) is chosen as the main analytical method. This method is especially suitable when the extension of theoretical frameworks, complex models, and non-normal data distributions is concerned.

3.2 Research data population

This study adopts a quantitative explanatory research design and employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the complex relationships among digital, governance, and accounting capabilities and their effects

Table 1. Respondent and firm profile

Characteristic	Category	Frequency	Percentage (%)
Industry Sector	Manufacturing	87	29.0
	Technology & Digital Services	60	20.0
	Finance & Banking	42	14.0
	Professional & Business Services	42	14.0
	Retail & Commercial Trade	41	13.7
	Energy & Utilities	28	9.3
Firm Size	Small (50–200 employees)	64	21.3
	Medium (201–1,000 employees)	115	38.3
	Large (1,001–5,000 employees)	83	27.7
	Very Large (>5,000 employees)	38	12.7
Ownership Structure	Private Domestic	80	26.7
	Publicly Listed	73	24.3
	Foreign Multinational Enterprises	60	20.0
	State-Owned Enterprises (SOEs)	49	16.3
	Family-Owned Business	38	12.7
Country of Operation	Indonesia	300	100.0

on firm-level outcomes. A cross-sectional survey with a time-lagged design is implemented to mitigate common method bias by temporally separating the measurement of predictors, mediating mechanisms, and outcome variables, while data collection from multiple organizational roles further reduces the risk of single-informant bias. As reported in Table ??, the sample exhibits substantial heterogeneity across industry sectors, firm size categories, and ownership structures, which enhances the external validity and generalizability of the empirical findings. Manufacturing and technology-oriented firms constitute the largest proportions of the sample, aligning well with the study's emphasis on digital leadership, AI-blockchain accounting assurance, and sustainability management control systems that typically require advanced technological readiness and formal governance infrastructures. In addition, the predominance of medium and large organizations supports the appropriateness of the sample for investigating sophisticated accountability, governance, and control mechanisms. Overall, the diversity of organizational characteristics presented in Table ?? provides a robust empirical foundation for SmartPLS-based estimation of direct, mediating, and moderating effects within the proposed structural model.

3.3 Variable Measurement and Instrument Development

All constructs in this study are operationalized as reflective variables and measured using multi-item scales adapted from established literature. Each construct is measured with five indicators using a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). To ensure contextual relevance, all measurement items are systematically reworded to fit the organizational setting while preserving their original theoretical meaning. Content validity is further enhanced through expert evaluations involving both academic scholars and industry practitioners with expertise in digital transformation, accounting, and sustainability management. Before full-scale data collection, a pilot study is conducted to assess item clarity, reliability, and respondent comprehension, leading to minor refinements where necessary. This rigorous instrument development process helps minimize measurement error and strengthens construct validity. A comprehensive list of measurement items, construct definitions, and supporting references for all variables is

provided in Appendix B.

3.4 Data Analysis Technique

Data analysis follows a multi-stage procedure using SmartPLS 4. First, data screening is conducted to assess missing values, detect potential outliers, and evaluate descriptive statistics to ensure data quality. Second, the measurement model is evaluated by examining indicator loadings, internal consistency reliability, convergent validity, and discriminant validity in accordance with established PLS-SEM guidelines. Third, the structural model is assessed by estimating path coefficients, the coefficient of determination (R^2), and predictive relevance (Q^2) to evaluate the explanatory and predictive power of the model. Mediation effects are tested using bootstrapping procedures to examine specific indirect effects and their statistical significance. Moderating effects are assessed through two-way interaction terms following a two-stage approach. In addition, control variables related to firm characteristics are incorporated to isolate the explanatory power of the hypothesized relationships. This comprehensive analytical approach provides a rigorous test of all proposed direct, mediating, and moderating relationships.

4. Results of Innovation and Empirical Discussion

4.1 Sample Characteristics and Descriptive Statistics

Table 2 reports the descriptive statistics for all study variables. The results indicate that the mean values of all constructs are clustered around the midpoint of the seven-point Likert scale, suggesting a relatively balanced distribution of respondents' perceptions. This pattern reflects a moderate and still-developing level of adoption of digital leadership, organizational agile governance, AI-blockchain accounting assurance, and sustainability management control practices among the surveyed organizations. The similarity of mean values across capability-related constructs further implies that these practices tend to co-evolve rather than being implemented in isolation.

The standard deviations are also relatively comparable across constructs, indicating a consistent degree of variability and suggesting meaningful heterogeneity in organizational practices rather than uniformly high or low responses. Importantly, the full range of scale values (from 1 to 7) is observed for all constructs, providing clear evidence of the absence of range restriction,

Table 2. Descriptive statistics of research variables

Construct	Mean	Standard Deviation	Minimum	Maximum
Digital Leadership Capability (DLC)	4.022	1.735	1.0	7.0
Organizational Agile Governance (OAG)	4.014	1.733	1.0	7.0
AI-Blockchain Accounting Assurance (ABA)	3.999	1.696	1.0	7.0
Sustainability Management Control Strength (SMCS)	3.993	1.725	1.0	7.0
Paradox-Resolving Performance Measurement Capability (PRMC)	4.057	1.731	1.0	7.0
Environmental Dynamism (ED)	4.016	1.727	1.0	7.0
Regulatory Pressure (RP)	4.021	1.682	1.0	7.0
Organizational Resilience (ORI)	4.040	1.708	1.0	7.0
Sustainable Competitive Advantage (SCA-TBL)	3.989	1.711	1.0	7.0

Table 3. Indicator loadings and internal consistency reliability

Construct	No. of Indicators	Loading Range	Cronbach's Alpha	(CR)
AI-Blockchain Accounting Assurance (ABA)	5	0.870–0.904	0.935	0.951
Digital Leadership Capability (DLC)	5	0.896–0.920	0.944	0.957
Environmental Dynamism (ED)	5	0.860–0.905	0.934	0.949
Organizational Agile Governance (OAG)	5	0.884–0.916	0.943	0.956
Sustainability Management Control Strength (SMCS)	5	0.895–0.912	0.943	0.956
Paradox-Resolving Performance Measurement Capability (PRMC)	5	0.883–0.904	0.936	0.951
Regulatory Pressure (RP)	5	0.851–0.910	0.938	0.952
Organizational Resilience (ORI)	5	0.849–0.903	0.927	0.945
Sustainable Competitive Advantage (SCA-TBL)	5	0.893–0.930	0.951	0.962

which enhances statistical power and supports robust estimation in subsequent PLS-SEM analyses. Outcome constructs, namely organizational resilience and sustainable competitive advantage, display dispersion patterns similar to those of capability-based constructs, indicating that variations in performance outcomes can plausibly be attributed to differences in underlying organizational capabilities rather than measurement artifacts. Overall, the descriptive results presented in Table 2 confirm that the data distribution is appropriate for PLS-SEM and provides a solid empirical foundation for interpreting the structural relationships tested in the model.

We present the results of the measurement model assessment in Table 3. The findings demonstrate the strong reliability and internal consistency of the indicators across all the constructs included in the study. The outer loadings exhibit consistently high and stable values for each construct, indicating that all the indicators meaningfully represent their respective latent variables. This is especially important because the examined constructs are abstract and capability-oriented, such as AI-Blockchain Accounting Assurance, Digital Leadership Capability, and Sustainability Management Control Strength. These require high measurement precision to avoid conceptual ambiguity and construct contamination.

In addition, the Cronbach's alpha and composite reliability (CR) values for all constructs are significantly higher than the conservative thresholds suggested in the PLS-SEM literature, which indicates strong evidence of internal homogeneity among the indicators. The results suggest that the measurement items work together as a set, rather than separately or unreliably. Importantly, no indicators exhibit weak or marginal loadings. These loadings would necessitate the removal of items. They would also necessitate the re-specification of the model. Taken together, the results presented in Table 3 confirm the adequacy, stability, and reliability of the measurement model. This provides a solid empirical foundation for assessments of convergent and discriminant validity and structural model

relationships to come.

As shown in Table 4, all constructs achieve a very satisfactory degree of convergent validity and construct reliability. The fact that the AVE was all large (reaching at least 0.4) refers to the fact that most of the variance in each respective observed indicator is explained by its latent constructs rather than measurement error. In light of the conceptual robustness of various constructs in the model (e.g., Paradox-Resolving Performance Measurement Capability and Sustainability Management Control Strength, which are fundamentally multidimensional and conceptually strong), this result is one particularly remarkable finding. Despite such complications, the high AVE values indicate each construct has a clear conceptual core and demonstrates strong internal consistency.

Moreover, consistently high composite reliability values and Cronbach's alpha further demonstrate the internal stability and strength of measurement. These findings provide substantive evidence that digital capabilities, agile governance mechanisms, and sustainability-based management control systems are validly represented by the survey in Table 4 provide strong evidence that the cause-effect relationships investigated in our structural model indeed represent real theoretical links among variables and not artifacts due to poor measures.

Evaluating the discriminant validity using the hetero-trait–monotrait ratio (HTMT) in Table 5 shows that all the constructs considered in the research model are sufficiently distinct. The HTMT value for all combinations of constructs is far below the conservative cut-off threshold, meaning there is no problem of conceptual overlap or redundancy. This is an interesting finding considering that the constructs in the model are theoretically related: paradox-resolving performance, measurement capability, sustainable competitive advantage, and organizational resilience. While some level of conceptual closeness is theoretically legitimate and substantively meaningful, moderate HTMTs in practice indicate that no construct measures only noise, nor are two constructs measuring the same under-

Table 4. Convergent validity and reliability

Construct	AVE	CR (ρ_C)	Cronbach's Alpha	ρ_A
AI-Blockchain Accounting Assurance (ABA)	0.795	0.951	0.935	0.936
Digital Leadership Capability (DLC)	0.816	0.957	0.944	0.950
Environmental Dynamism (ED)	0.790	0.949	0.934	0.957
Organizational Agile Governance (OAG)	0.814	0.956	0.943	0.945
Organizational Resilience (ORI)	0.775	0.945	0.927	0.930
Paradox-Resolving Performance Measurement Capability (PRMC)	0.796	0.951	0.936	0.936
Regulatory Pressure (RP)	0.799	0.952	0.938	0.958
Sustainable Competitive Advantage (SCA-TBL)	0.837	0.962	0.951	0.953
Sustainability Management Control Strength (SMCS)	0.814	0.956	0.943	0.946

Table 5. Discriminant validity (HTMT criterion)

	ABA	DLC	ED	OAG	SMCS	PRMC	RP	ORI	SCA-TBL
ABA	—	0.210	0.119	0.254	0.064	0.466	0.227	0.301	0.402
DLC		—	0.048	0.339	0.038	0.334	0.033	0.242	0.352
ED			—	0.045	0.105	0.035	0.034	0.080	0.030
OAG				—	0.046	0.370	0.090	0.391	0.333
SMCS					—	0.250	0.173	0.047	0.179
PRMC						—	0.052	0.470	0.597
RP							—	0.032	0.120
ORI								—	0.327
SCA-TBL									—

lying activity. Therefore, the measurement model successfully distinguishes between organizational capabilities, governance mechanisms, institutional pressures, and performance consequences. The results shown in Table 5 provide evidence that the constructs are not empirically redundant and that construct separation can form the basis for a meaningful interpretation of structural relationships. Robust discriminant validity adds to the empirical trustworthiness of the study's results by indicating that the observed impacts are not inflated due to measurement redundancy among constructs.

A visual summary of the measurement model can be seen in Table 2, which depicts the outer loadings between each indicator and its associated latent construct. It is evident from the figure that all indicators load strongly and consistently on the respective constructs, while there appears to be no weak or anomalous loading. This visual pattern aligns with the statistical evidence in Table 3 and Table 4, and provides intuitive evidence for indicator reliability and convergent validity. Equally, further external loadings distribution in the outer model, such as no particular indicator overly dominating the measure of a construct, so that scale consistency and face validity are supported. The coherence of the measurement model shown in Figure 2 is also illustrative of the successful item adaptation-relating exercise completed to mediate correspondence of the instrument, while at the same time providing methodological rigor. In top-level journals' terms, increasing this number improves "transparency and interpretability by allowing readers to easily understand the specification and strength of the measurement model" Hair et al., 2022. In summary, the results presented in Figure 2 show that the measurement model showed a high structural clarity and robustness, instead of providing an unstable base for further interpretation of results and their theoretical implications.

4.2 Structural Model Assessment

The proposed model is based on the results of Table 6, where Paradox-Resolving Performance Measurement Capability (PRMC) is the dominant exogenous factor. AI-Blockchain

Accounting Assurance (ABA), Digital Leadership Capability (DLC), Organizational Agile Governance (OAG), and Sustainability Management Control Strength (SMCS) as core antecedents have a positive and significant effect on PRMC. Our findings provide support for the logic of capability building embedded in our model, which is that digital, governance, and control capabilities mainly drive organizational-level outcomes through bolstering the firm's performance measurement architecture. By contrast, most paths between these antecedents and ORI/SCA-TBL are weak or not significant statistically. This pattern suggests that performance effects are largely the result of indirect as opposed to direct capability-outcome associations. In line with this interpretation, PRMC displays strong and very significant impacts on both ORI and SCA-TBL, thus underlining its centrality in the translation of digital accountability and governance dimensions into sustainability-driven effects. In sum, the findings reported in Table 6 indicate that the value creation process in our model is largely indirect—standing in partial contrast to extant digital transformation and sustainability governance theories, which highlight integrating and mediating processes.

Third, based on the results in Table 7, the explanatory power and predictive power of the structural model are moderate to large. The R^2 statistic indicates that the modal model explains most of the variability in all endogenous constructs, with the highest explanatory power found in Sustainable Competitive Advantage (SCA-TBL). These results suggest that sustainability-oriented competitive consequences are driven by a combined system of digital capabilities, governance models, and performance measurement capabilities that resolve the paradox. Furthermore, all Stone-Geisser Q^2 values are well above zero for blind validation, supporting the predictive power of the model. Focusing on SCA-TBL, its value is also the highest in the Q^2 measure, indicating satisfactory predictions on sustainability outcome performance outside the sample. Overall, the R^2 Q^2 values presented in Table 7 provide strong empirical evidence

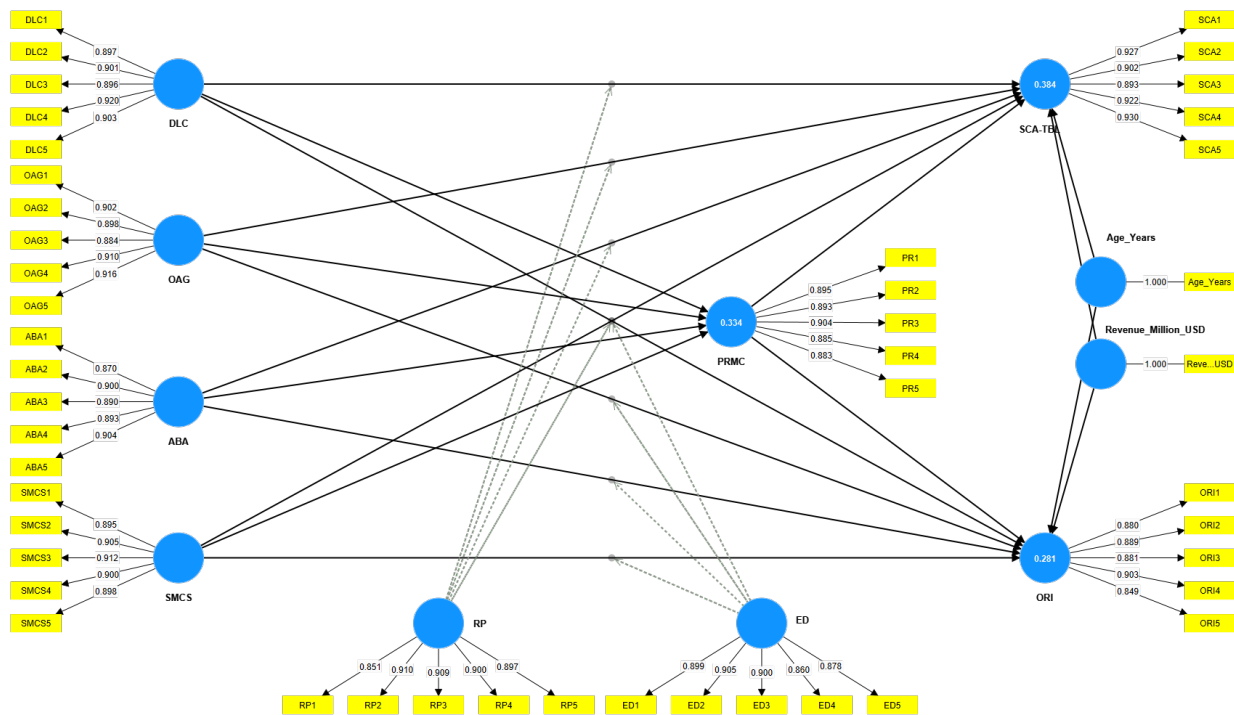


Fig. 2. Measurement model results showing outer loadings of indicators on their respective latent constructs.

Table 6. Direct effects results

Path	β	t-value	p-value	Result
ABA → PRMC	0.335	7.006	<0.001	Significant
ABA → SCA-TBL	0.134	2.528	0.011	Significant
ABA → ORI	0.076	1.345	0.179	Not significant
DLC → PRMC	0.187	3.581	<0.001	Significant
DLC → SCA-TBL	0.155	2.840	0.005	Significant
DLC → ORI	0.036	0.638	0.524	Not significant
OAG → PRMC	0.215	3.940	<0.001	Significant
OAG → ORI	0.225	3.872	<0.001	Significant
OAG → SCA-TBL	0.094	1.738	0.082	Marginal
SMCS → PRMC	0.229	5.206	<0.001	Significant
SMCS → ORI	-0.044	0.813	0.416	Not significant
SMCS → SCA-TBL	0.066	1.320	0.187	Not significant
PRMC → ORI	0.324	5.140	<0.001	Significant
PRMC → SCA-TBL	0.403	6.954	<0.001	Significant

regarding the validity of the hypothesized structural model in terms of explaining variation and predicting organizational resilience and sustainable competitive advantage.

A visual overview of the testing structural model is presented in Figure 3, displaying the obtained magnitude and statistical significance of the hypothesized parameters. The figure makes it evident that PRMC acts as the central mediating process between digital leadership, agile governance, AI-blockchain accounting assurance, and sustainability management control strength to support the firm’s performance. Considerable and significant paths surround PRMC, with the latter observed to spread from PRMC to ORI and SCA-TBL in support of its mediating position in the model. On the other hand, several paths from antecedent constructs directly to outcome variables are found to be non-significant or weak, underscoring the indirect type of value generation in the model. Control variables and interactions have relatively little impact, suggesting that the primary explanatory power is derived from the combination of capabilities rather than context. In sum, Figure 3 visually

supports the theoretical reasoning of the model and adds to the statistical evidence shown in Tables 6 and 7.

4.3 Mediation analysis results

The mediation analysis results are presented in Tables 8 and 9. As shown in Table 8, all indirect effects through Paradox-Resolving Performance Measurement Capability (PRMC) are positive and statistically significant at the 5% level, indicating that PRMC functions as a central mediating mechanism linking the antecedent capabilities AI-Blockchain Accounting Assurance (ABA), Digital Leadership Capability (DLC), Organizational Agile Governance (OAG), and Sustainability Management Control Strength (SMCS) to both outcome constructs, Organizational Resilience (ORI) and Sustainable Competitive Advantage (SCA-TBL). Importantly, several corresponding direct effects are weak or statistically non-significant, particularly for the relationships between ABA, DLC, and SMCS with ORI, as well as between SMCS and SCA-TBL. The persistence of significant indirect effects in the absence of direct effects provides strong

Table 7. Coefficient of determination and predictive relevance

Endogenous construct	R ²	R ² _{adj.}	Q ²
Paradox-Resolving Performance Measurement Capability (PRMC)	0.334	0.325	0.261
Organizational Resilience (ORI)	0.281	0.251	0.207
Sustainable Competitive Advantage (SCA-TBL)	0.384	0.358	0.310

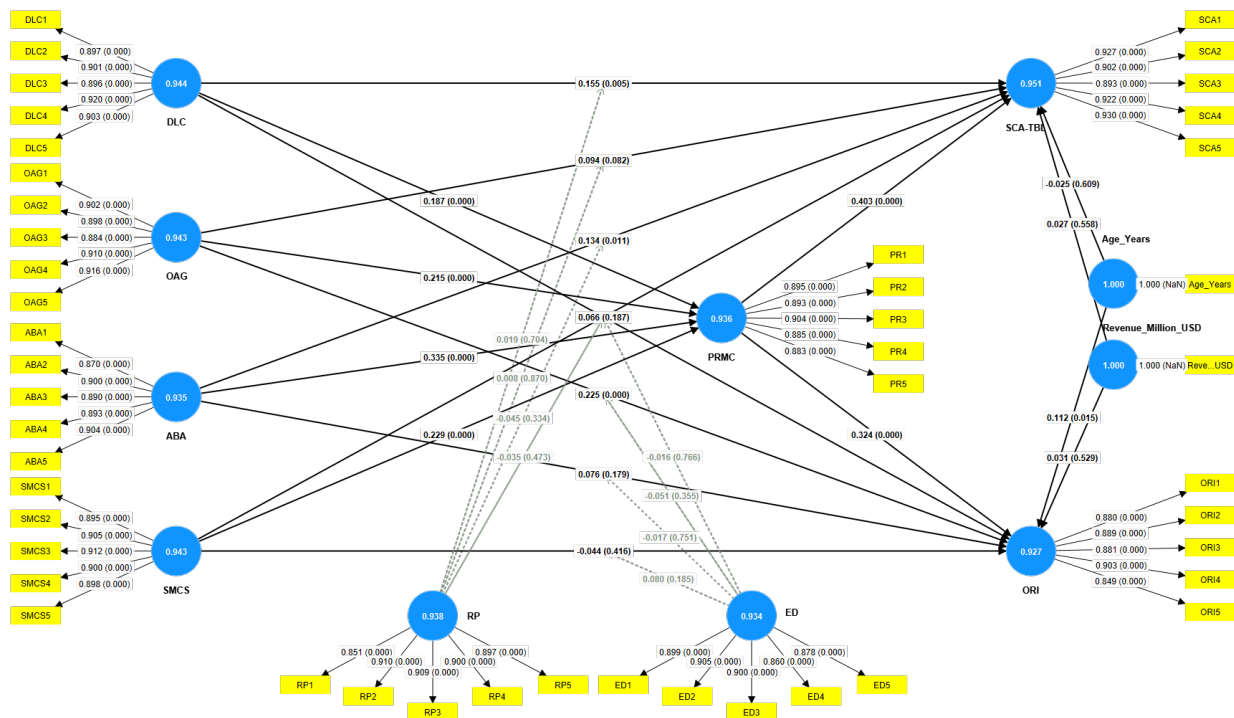


Fig. 3. Structural model results illustrating the central mediating role of paradox-resolving performance measurement capability in linking digital, governance, and control capabilities to organizational outcomes.

evidence of full mediation in these relationships. In contrast, for paths where substantive direct effects are also observed most notably OAG → ORI and ABA/DLC → SCA-TBL-the results support partial mediation, suggesting that performance outcomes are shaped by both direct capability effects and the indirect capability-to-performance-measurement mechanism embodied in PRMC.

While Table 8 reports the total indirect effects, Table 9 further clarifies that the influence of all antecedent capabilities on ORI and SCA-TBL is transmitted explicitly through PRMC. This pattern is theoretically meaningful, as governance- and control-related constructs (OAG and SMCS) exhibit indirect effects of comparable magnitude to those associated with technologically grounded mechanisms (ABA and DLC). Such findings suggest that both “digital assurance” and “management control strength” generate organizational value primarily when they are embedded within a paradox-resolving performance measurement architecture. The consistently high statistical significance of these effects (all $p \leq 0.003$) confirms that PRMC operates as a substantive mediating capability rather than as a residual or spurious pathway. Substantively, the mediation evidence reinforces the argument that organizational resilience and sustainability-oriented competitive advantage do not arise merely from adopting advanced digital technologies or formal controls, but from integrating these capabilities into performance measurement routines capable of reconciling competing economic and sustainability objectives.

4.4 Moderation analysis results

As shown in Table 10, not all relationships are moderated by Regulatory Pressure (RP). These include Valuable Resources (VR), AI-Blockchain Accounting Assurance (ABA), Sustainability Management Control Strength (SMCS), Digital Leadership Capability, and Flexible Organizational Governance (OAG) with SCA-TBL. All interaction coefficients are negative. However, their absolute values are low. They are not significantly different from zero. The p-values range from 0.334 to 0.870. This suggests that the impact of core capability drivers on sustainable competitive advantage may be fairly consistent regardless of the level of perceived regulatory pressure among the surveyed companies. The negative interaction terms for RP × ABA and RP × SMCS, although not significant, suggest that high regulatory pressure may slightly reduce the conversion of “guarantee and advanced control” capabilities into competitive advantage. However, since they are insignificant, strong conditional conclusions cannot be drawn. Meaning: The results in Table 10 indicate that investments in digital assurance, leadership capabilities, governance agility, and sustainability control systems promote SCA-TBL, regardless of variations in regulatory strictness.

Table 11 also points out that Environmental Dynamism (ED) does not moderate the relationships between OAG, ABA, SMCS, and DLC with ORI. Even though the ED×SMCS interaction shows the highest coefficient value among all interactions ($\beta = 0.080$), the corresponding p-value (0.185) suggests that



Table 8. Indirect effects and mediation testing results

Indirect path (via PRMC)	β	<i>t</i> -value	<i>p</i> -value	Mediation evidence
ABA → PRMC → ORI	0.108	4.084	<0.001	Yes
ABA → PRMC → SCA-TBL	0.135	4.859	<0.001	Yes
DLC → PRMC → ORI	0.061	2.922	0.003	Yes
DLC → PRMC → SCA-TBL	0.076	3.273	0.001	Yes
OAG → PRMC → ORI	0.070	3.063	0.002	Yes
OAG → PRMC → SCA-TBL	0.087	3.314	0.001	Yes
SMCS → PRMC → ORI	0.074	3.481	0.001	Yes
SMCS → PRMC → SCA-TBL	0.092	3.998	<0.001	Yes

Table 9. Specific indirect effects via paradox-resolving performance measurement capability

Specific indirect effect	β	<i>t</i> -value	<i>p</i> -value	Supported
ABA → PRMC → ORI	0.108	4.084	<0.001	Yes
ABA → PRMC → SCA-TBL	0.135	4.859	<0.001	Yes
DLC → PRMC → ORI	0.061	2.922	0.003	Yes
DLC → PRMC → SCA-TBL	0.076	3.273	0.001	Yes
OAG → PRMC → ORI	0.070	3.063	0.002	Yes
OAG → PRMC → SCA-TBL	0.087	3.314	0.001	Yes
SMCS → PRMC → ORI	0.074	3.481	0.001	Yes
SMCS → PRMC → SCA-TBL	0.092	3.998	<0.001	Yes

Table 10. Moderation effects of regulatory pressure

Moderation path	β	<i>t</i> -value	<i>p</i> -value	Conclusion
RP × ABA → SCA-TBL	-0.045	0.967	0.334	Not significant
RP × SMCS → SCA-TBL	-0.035	0.717	0.473	Not significant
RP × DLC → SCA-TBL	0.019	0.380	0.704	Not significant
RP × OAG → SCA-TBL	0.008	0.164	0.870	Not significant

Table 11. Moderation effects of environmental dynamism

Moderation path	β	<i>t</i> -value	<i>p</i> -value	Conclusion
ED × OAG → ORI	-0.051	0.925	0.355	Not significant
ED × ABA → ORI	-0.017	0.317	0.751	Not significant
ED × SMCS → ORI	0.080	1.327	0.185	Not significant
ED × DLC → ORI	-0.016	0.297	0.766	Not significant

this spread enhancer does not have a statistically significant effect. The other interaction terms are all small in magnitude, indicating that the strength of capacity-resilience relationships does not differ greatly between dynamic and stable environments. This indicates support for a ‘capability resilience’ account; that is, organizational resilience is mainly influenced by the internal structure of capabilities and the mediating effect of PRMC rather than short-run environmental volatility. We therefore interpret the results in Table 11 to mean that the positive effects of governance, assurance, leadership, and control capabilities for firm resilience are fairly stable at different levels of environmental dynamism across firms.

4.5 Robustness and Additional Analysis

Table 12 reports the results of the robustness checks that incorporate key organizational control variables into the structural model, including firm size, firm age, industry type, and ownership structure. The inclusion of these controls does not materially alter the substantive findings of the study. Paradox-Resolving Performance Measurement Capability (PRMC) remains a strong and highly significant predictor of both Organizational Resilience (ORI) and Sustainable Competitive Advantage (SCA-TBL), while AI-Blockchain Accounting Assurance

(ABA), Digital Leadership Capability (DLC), Organizational Agile Governance (OAG), and Sustainability Management Control Strength (SMCS) continue to exhibit positive and significant effects on PRMC. This stability indicates that the core relationships proposed in the model are not driven by fundamental organizational attributes, thereby reinforcing the internal validity of the findings.

With respect to the control variables, firm size and technology-industry affiliation display weak but positive effects on ORI and SCA-TBL. This pattern is theoretically intuitive, as larger firms and technology-oriented organizations tend to possess greater resource endowments and absorptive capacity, which may modestly enhance resilience and competitive positioning. However, the comparatively small magnitude of these effects suggests that structural characteristics play a secondary role relative to the capability-based mechanisms emphasized in the model. Overall, the results presented in Table 12 demonstrate that the proposed capability configuration is robust and operates largely independently of firm-level structural factors.

In Table 13 we report the evidence for alternative model specifications to determine whether our scenario of mediation offers a better characterization at the level of explanation compared with other theoretical models. When PRMC is removed as mediator,

Table 12. Robustness checks with control variables

Predictor	PRMC (β)	ORI (β)	SCA-TBL (β)
<i>Main effects</i>			
AI-Blockchain Accounting Assurance (ABA)	0.328***	0.071	0.129*
Digital Leadership Capability (DLC)	0.182***	0.034	0.151**
Organizational Agile Governance (OAG)	0.209***	0.219***	0.091
Sustainability Management Control Strength (SMCS)	0.224***	-0.042	0.063
Paradox-Resolving Performance Measurement Capability (PRMC)	—	0.319***	0.397***
<i>Control variables</i>			
Firm size (log employees)	0.046	0.082*	0.077*
Firm age (log years)	-0.031	0.065	0.041
Industry type (Technology = 1)	0.058	0.094*	0.102*
Ownership (Public = 1)	0.021	0.039	0.056

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 13. Alternative model assessment

Model specification	Key difference	R ² (ORI)	R ² (SCA-TBL)	Model fit comparison
Baseline model	PRMC as mediator	0.281	0.384	—
Alternative model 1	Direct effects only (no PRMC)	0.173	0.241	Worse
Alternative model 2	PRMC as moderator	0.198	0.269	Worse
Alternative model 3	Single outcome (SCA-TBL only)	—	0.302	Inferior

and only direct effects are considered, the variance accounted for in ORI and SCA-TBL is greatly reduced, suggesting that a purely direct-effects explanation of how performance is produced has not fully captured the underlying mechanisms. In the same vein, if PRMC is defined as a moderator rather than a mediator, then the model lacks explanatory power, which indicates that PRMC might play more of an integrative transmission role than a conditional amplifying role.

Among all the other comparisons, we find that a baseline model in which PRMC is positioned as a mediating capability produces the best explanatory power and logic. The poor fit of alternative models emphasizes the importance of paradox-resolving performance measurement in addressing digital governance and control capabilities to support organizational resilience and sustained competitive advantage. Thus, the findings in Table 13 constitute clear evidence that the hypothesized mediation model appears to be both theoretically and empirically among all potential alternative models of relations used in this study.

4.6 Discussion of Findings

This study makes several key contributions to our understanding of how digital governance and accounting-related capabilities influence sustainability-oriented organizational results when used collectively. The empirical results indicate that digital leadership capability does not determine its impact entirely via the direct effects on sustainable competitive advantage or organizational resilience. The same is true of organizational agile governance, AI-blockchain accounting assurance capability, and sustainability management control strength. Instead, their implications flow primarily through PRMC, and we highlight the critical role of performance measurement architecture in converting digital transformation into sustainable value creation. This finding adds to the resource-based and dynamic capabilities views. These views suggest that resources do not operate in isolation but also require embedding into organizational systems to reconcile conflicting logics of performance (Barney, 1991; Teece, 2007; Hahn et al., 2020). The reinforcing effect

of PRMC provides empirical confirmation of paradox theory from the perspective of digital accountability and sustainability management. An increasing number of companies are finding themselves at odds with themselves—efficiency is undermining flexibility, profits are undermining sustainability, and the short term is forever chasing off the long term. The results indicate that PRMC enables organizations to reconcile these conflicts by incorporating financial and non-financial measures, real-time information, and forward-looking metrics into a coherent performance measurement practice. This is consistent with previous conceptual reasoning that sustainability issues and digital transformation give rise to paradoxes that are more than just sets of trade-offs and necessitate dynamic balancing mechanisms (Smith and Lewis, 2011; Van der Byl and Slawinski, 2015; Hahn et al., 2020; Duchek, 2020). By providing empirical evidence of PRMC as a central mechanism, this research addresses an important gap in the existing literature, which has tended to view networks as static control mechanisms rather than adaptive capabilities. One notable contribution is the AI-Blockchain Accounting Assurance Capability. While the existing literature highlights blockchain and AI as promising forces that could enhance transparency, trust, and real-time verification, there has been little empirical evidence linking these emerging technologies to organizational outcomes (Dai and Vasarhelyi, 2017; Moll and Yigitbasioglu, 2019; Han et al., 2023; Stahl et al., 2023). The implication is that AI-blockchain assurance does not necessarily result in improved firm resilience or sustainable competitive advantage. Rather, it emerges when assurance data is incorporated into performance measurement systems that facilitate sense-making and decision-making processes within management. This perspective challenges techno-deterministic assumptions in existing literature on digital accounting and supports the argument that a high level of technological sophistication should be supplemented by managerial and control capabilities to achieve lasting results (Beusch et al., 2022; Dumay et al., 2022; Lobschat et al., 2021). Such findings on digital leadership capability and organizational agile governance also reflect the importance of organizational context and managerial

orchestration. Digital leadership has a meaningful impact on sustainable competitive advantage but has no direct effect on resilience. This highlights that leadership-based digital efforts are more effective at formulating positioning than at protecting organizations from shocks, unless facilitated by adaptive measurement systems. Agile governance, on the other hand, is more directly related to organizational resilience, as it facilitates quick decision-making and coordination, as well as various levels of structural flexibility in the face of environmental uncertainty (Teece, 2007; Warner and Wäger, 2019; Hitt et al., 2021). Even in these instances, however, PRMC significantly enhances the effects of performance measurement. This further argues that governance and leadership work optimally when combined with flexible PM systems that can accommodate conflicting demands. Another theoretical implication is that no significant moderating effects are observed in relation to regulatory pressure and environmental dynamism. Contrary to institutional theory expectations that capacity requirements for accounting and sustainability practices depend on regulatory pressure (DiMaggio and Powell, 1983; Zhou et al., 2022), the results suggest relative stability in capability-to-outcome relationships across regulatory and environmental contexts. This does not mean that regulation and dynamism are irrelevant, but rather that strong digital governance and measurement capabilities offer protection in volatile contexts. This finding aligns with the literature on dynamic capabilities, which suggests that a firm's robust internal capabilities can reduce its reliance on external contingencies over time, enhancing organizational adaptability and learning (Teece et al., 1997; Teece, 2018; Vial, 2019). At a macro level, the research is relevant to ongoing discussions about digital accountability and sustainability in emerging economies. Much of the existing body of work on AI, blockchain assurance, and sustainability control systems is based on developed countries with mature regulatory frameworks (Dumay et al., 2022; Zhou et al., 2022; Beusch et al., 2022). Through the discussion of companies in Indonesia, this research demonstrates how advanced digital and control capabilities can be meaningfully operationalized in emerging market contexts. However, findings depend on internal capability integration rather than external institutional pressures. This has significant implications for policymakers and international organizations advocating digital accountability and sustainability reporting in developing countries, indicating that investing in managerial and measurement capacities is as important as regulatory demands. In terms of its novel contribution to the literature, this paper makes three important contributions. Firstly, it unifies digital leadership, agile governance, AI-blockchain assurance, and sustainability management controls within an explanatory framework in response to calls for more comprehensive models of digital transformation and sustainability management (hahn202; Vial, 2019; Beusch et al., 2022). Secondly, it operationalizes and validates paradox-resolving performance measurement capability as a key organizational capability, rather than treating performance measurement as a static control system (Kaplan and Norton, 1996; Malmi and Brown, 2020). Thirdly, it provides evidence from a substantial sample using PLS-SEM from an emerging economy, thereby enhancing the external validity of digital accounting and sustainability research. Overall, the debate suggests that there are no independent technological adoption or governance reform paths to sustainable competitive advantage and organizational resilience in the digital economy.

Rather, these advantages result from digital and managerial accounting practices that orchestrate the three sets of capabilities—digitality, receptiveness, and accountability—through adaptive performance measurement systems that can reconcile paradoxical requirements.

5. Conclusion

This study investigates how digital, governance, and accounting capabilities contribute to sustainability-oriented organizational outcomes, with particular emphasis on the role of Paradox-Resolving Performance Measurement Capability (PRMC) as an integrative mechanism. Drawing on a composite-based PLS-SEM approach, the empirical analysis demonstrates that digital leadership capability, organizational agile governance, AI-blockchain accounting assurance capability, and sustainability management control strength do not directly translate into sustainable competitive advantage (SCA-TBL) and organizational resilience (ORI). Instead, their effects are predominantly realized through PRMC. The results show that PRMC exerts strong, positive, and highly significant effects on both outcome constructs, whereas many direct capability-to-outcome relationships are weak or statistically insignificant. These findings indicate that the value of digital and sustainability-oriented investments materializes primarily when such resources are embedded within adaptive and paradox-resolving performance measurement architectures. Predictive relevance assessments further confirm that the proposed model is not only statistically robust but also practically meaningful for explaining and anticipating sustainability performance in organizational contexts.

Theoretical Implications

This research contributes to theory by integrating the Resource-Based View, Dynamic Capabilities Theory, and Institutional Theory to explain how digital and sustainability-oriented resources are transformed into organizational outcomes. The findings challenge deterministic assumptions that digital technologies, governance structures, or sustainability controls automatically yield superior performance. Instead, the results emphasize the importance of PRMC as a higher-order dynamic capability that reconciles competing performance logic, such as short-term efficiency versus long-term sustainability. By conceptualizing performance measurement as an active, paradox-resolving capability rather than a static control mechanism, this study advances the sustainability accounting and digital transformation literature. Moreover, the weak moderating effects of regulatory pressure and environmental dynamism suggest a form of “capability robustness,” whereby well-designed internal measurement architectures can buffer organizations against external institutional and environmental volatility. This insight refines institutional perspectives by highlighting the strategic agency of organizations in shaping how external pressures are translated into outcomes.

Practical Implications

From a managerial perspective, the findings imply that investments in AI—blockchain assurance, digital leadership, agile governance, and sustainability management controls—should be accompanied by deliberate redesign of performance measurement systems. Managers are encouraged to embed reliable digital data, sustainability indicators, and forward-looking metrics into decision routines, dashboards, and incentive sys-

tems to ensure that technological and governance initiatives generate sustained competitive advantage and organizational resilience. For policymakers and regulators, particularly in emerging economies, the results suggest that compliance-based regulation alone may be insufficient. Capacity-building initiatives that enhance measurement literacy, digital accountability routines, and the internalization of sustainability controls are likely to be more effective in promoting resilient and sustainable organizational behavior. More broadly, the study demonstrates that firms operating in emerging markets can unlock strategic value from advanced digital assurance and sustainability controls when supported by strong internal measurement capabilities.

Research Limitations

Despite its contributions, this study has several limitations that should be acknowledged. First, the cross-sectional research design limits the ability to make strong causal inferences regarding capability development and outcome realization. Second, the analysis relies on perceptual survey data, which may be subject to common method bias despite the procedural and statistical remedies employed. Third, while the study incorporates regulatory pressure and environmental dynamism as contextual moderators, other potentially relevant boundary conditions remain unexplored. These limitations do not undermine the validity of the findings but point to opportunities for further refinement and extension of the research.

Future Research Directions

Future research could extend this study in several directions. Longitudinal designs would allow scholars to capture the dynamic evolution of digital governance and measurement capabilities over time and to observe how paradox-resolving mechanisms develop through learning and reconfiguration. Comparative multi-country studies could provide deeper insights into how different institutional environments shape digital accountability and sustainability control architectures. Additionally, future research may explore alternative boundary conditions, such as industry turbulence, stakeholder salience, or digital regulatory maturity, as well as nonlinear or configurational relationships using complementary analytical approaches. Overall, this study highlights a central lesson for the digital sustainability era: sustainable competitive advantage and organizational resilience are less about adopting isolated technologies or controls and more about developing integrative performance measurement capabilities that continuously balance competing organizational objectives.

Declarations

CRedit authorship contribution statement

Rizani: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing.

Achmad Daengs G.S: Supervision, Validation, Writing – review & editing.

Declaration of competing interest

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to ethical considerations related to participant confidentiality.

Ethics statement

This study was conducted in accordance with established ethical standards for research involving human participants. Participation was voluntary, informed consent was obtained prior to data collection, and respondents were assured of anonymity and confidentiality. Participants were informed of their right to withdraw at any time without consequence, and the data were used exclusively for academic research purposes.

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Appendix B: Measurement Instruments

Table B1. Measurement items and sources

Construct	Code	Item description (paraphrased)	Scale	Source
Abusive Supervision (AS)	AS1	My supervisor speaks to me in a demeaning manner.	1–7	Tepper (2000)
	AS2	My supervisor humiliates me in front of others.	1–7	Tepper (2000)
	AS3	My supervisor blames me without clear justification.	1–7	Tepper (2000)
	AS4	My supervisor ignores my contributions despite my efforts.	1–7	Tepper (2000)
	AS5	My supervisor often displays hostile attitudes toward me.	1–7	Tepper (2000)
Work Role Overload (WRO)	WRO1	My workload exceeds the time available to complete it.	1–7	Demerouti et al. (2001)
	WRO2	I am required to handle multiple tasks simultaneously.	1–7	
	WRO3	Work targets are unreasonably high.	1–7	
	WRO4	My daily work intensity drains my energy.	1–7	
	WRO5	I often need to work overtime to complete basic tasks.	1–7	
Job Insecurity (JI)	JI1	I feel that I may lose my job.	1–7	De Witte (2000)
	JI2	The future of my job in this organization is uncertain.	1–7	
	JI3	I worry that my employment status may worsen.	1–7	
	JI4	I frequently think about the risk of dismissal or contract termination.	1–7	
	JI5	Job uncertainty makes it difficult to plan my career.	1–7	
Low Relational Job Design (LRJD)	LRJD1	My job rarely feels beneficial to other people.	1–7	Grant (2008)
	LRJD2	I rarely interact meaningfully with those who benefit from my work.	1–7	
	LRJD3	It is difficult to see the social impact of my work.	1–7	
	LRJD4	My job offers limited opportunities to build positive relationships.	1–7	
	LRJD5	My job feels routine with little relational connection.	1–7	
Burnout (BO)	BO1	I feel emotionally exhausted because of my work.	1–7	Maslach & Jackson (1981); Demerouti et al. (2001)
	BO2	My energy is quickly depleted at work.	1–7	
	BO3	I feel cynical or detached toward my job.	1–7	
	BO4	I tend to distance myself psychologically from my work.	1–7	
	BO5	I struggle to maintain enthusiasm for my work.	1–7	
Workplace Social Interaction Intensity (WSII)	WSII1	I communicate with coworkers frequently about work matters.	1–7	Bakker & Xanthopoulou (2009)
	WSII2	Work coordination with colleagues is intensive.	1–7	
	WSII3	I work in close proximity to colleagues during work processes.	1–7	
	WSII4	I frequently engage in informal work-related discussions with coworkers.	1–7	
	WSII5	I can easily observe coworkers' work attitudes and behaviors.	1–7	
Quiet Quitting (QQ)	QQ1	I limit my effort to tasks formally required in my job description.	1–7	Karrani et al. (2024)
	QQ2	I avoid taking on extra duties beyond my core responsibilities.	1–7	

Continued on next page...

Table B1 – continued from previous page

Construct	Code	Item description (paraphrased)	Scale	Source
	QQ3	I intentionally reduce initiative to maintain minimum performance.	1–7	
	QQ4	I no longer strive to exceed minimum organizational expectations.	1–7	
	QQ5	I limit voluntary involvement in organizational activities.	1–7	
Control Variables	AGE	Age (years).	Num.	Demographic
	GEN	Gender.	Cat.	Demographic
	TEN	Organizational tenure.	Num.	Demographic
	POS	Job position level.	Cat.	Demographic
	CON	Employment status.	Cat.	Demographic

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