

The Interplay of Ambidextrous Intellectual Capital and Ambidexterity: Achieving Sustainable Performance in Technological Turbulent Environments

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Abstract

Purpose- This research will seek to examine the effects of intellectual capital (including human, structural, and relational capital) and sustainable firm performance. It also examines how the ambidextrous organization mediates this relationship as well as the moderating effects of technological turbulence in this relationship.

Design/Methodology- The research design was a cross-sectional quantitative research. The information was gathered through structured survey to managers and employees in manufacturing industries. Partial least squares structural equation modeling (PLS-SEM) was used to test the hypotheses proposed.

Findings- The results verify the fact that the three aspects of intellectual capital positively affect the sustainable performance. The organization is able to balance between exploration and exploitation (ambidexterity), which is where this relationship is completely mediated. Also, technological turbulence enhances the calibrating impact of the ambidextrous organization on sustainable performance.

Practical Implications - To succeed in the turbulent markets, the practitioners need to invest strategically in the development of all aspects of intellectual capital. Moreover, designing an organizational culture that is both innovation-oriented and productive would be a key to transforming intellectual resources into actual and long-term results.

Managerial implications - The managers are encouraged to incorporate the intellectual capital measures in their performance management systems and strategic planning. Leadership should be the frontier of ambidextrous practices, which allocate resources towards exploration innovation and operational efficiency to ensure that they get maximum value out of their human, structural and relational capital.

Originality/value - This paper presents a new integrative model whereby the ambidextrous organization is placed as a point of convergence between intellectual capital and

sustainable performance. It is the only source that does not view technological turbulence as a preventive factor, but as a situational enhancer of the returns of ambidextrous capabilities.

Keywords – Ambidextrous Intellectual Capital, Ambidextrous Organization, Sustainable Performance, Technological Turbulence, PLS-SEM.

Introduction

With the dynamic modern business climate, organizations are becoming more and more challenged in regard to sustaining competitiveness and survival amidst fast changing technology. Having human, relational and structural elements, Ambidextrous Intellectual Capital (AIC) is crucial in facilitating firms to balance exploration and exploitation processes that lead to innovation and flexibility (Huma et al., 2024). Technological Turbulence (TT) is also becoming an important aspect in determining the effective use of intellectual resources by firms as markets increasingly become dynamic (Puspita et al., 2024). It is important to develop an Ambidextrous Organization (AO) that would help in converting knowledge capabilities into strategic products that would improve Sustainable Firm Performance (SFP). Such performance is indicated by major performance indicators like innovation, productivity and export growth (Sarmad et al., 2024). Nonetheless, with increased concern on ambidexterity and intellectual capital, very few studies examine the interaction between AIC and AO as well as technological turbulence to deliver sustainable performance, especially in the small and medium enterprises (SMEs) in the emerging economies such as Pakistan (Zhang & Suntrayuth, 2024).

IC has components and sub-dimensions, which include, structural / process, human, and relational / social capital of organizations. The three sub-parts of IC are eventually value-creating to an organization (Asiaei, O'Connor, et al., 2023). Other scholars like (Dahiyat et al., 2023; Fait et al., 2023) have even stated that scholars and policy advisers have ignored IC as a component or a type of knowledge capital. Some authors have asserted that there is no awareness of IC yet the prospects of any individual company and the nation can be altered with IC (Mahmood et al., 2021; Shahbaz et al., 2021). Enhancement of IC can open the path to the achievement of sustainable competitive advantages. The ability of an organization to be fit between exploration and exploitation, known as ambidexterity, should be considered in the frames of raising questions related to the nature of IC and the objective that the latter can accomplish (Shehzad et al., 2023). According to Elmakkawy et al. (2025) ambidexterity is an origin of sustainable competitive advantages (SCA) and organizational performance (OP). Such definition presupposes that a company needs IC as it leads to its AO.

The areas and gaps in research that are appropriate are identified after a detailed literature review study are identified. An organization with multi-domain and multi-level exhibits ambidexterity structures, has been brought out as under-investigated. The context of SMEs in the manufacturing industry is a good study field (Suleiman, 2023). When combining literature and theory in evidently the following chapter, complete understanding of the construct of AIC is not developed. There are theoretical gaps on how complex organizational structures can be manifested ambidexterity. Micro-processes underlying are fairly poorly understood (Hayaeian & Hesarzadeh, 2024). Although the advantages of AIC to an organization have been proved, realistic processes and there is a deficiency of

managerial practices that can facilitate this success. The majority of the empirical research has been carried out at the organizational/structural level, and much fewer studies have considered the elaborate administrative function and the social situation that it is executed in (Odhano et al., 2025). Numerous studies suggest to explore intellectual capital shaping technological turbulence; however, with firm adaptability to achieve sustainable performance (Cosa et al., 2024).

This study contributes to the theoretical knowledge by incorporating the scattered aspects of intellectual capital (human, relational and structural) into the notion of AIC. It offers a broad model that elaborates on how AIC is a dynamic capability that can make firms engage in simultaneous exploration and exploitation activities therefore create ambidexterity at individual, group, and organizational levels. Second, the research has an empirical contribution in the sense that it investigates the mediating force of AO that helps in the translation of AIC to SFP. It also takes technological turbulence as a mediating variable and provides knowledge on the effectiveness of environmental forces in either reinforced or undermined the AIC-performance relationship. Third, this study broadens the contextual frontiers of the ambidexterity research by concentrating on the SMEs in Pakistan where there is minimal empirical evidence available.

Literature Review

Resource-Based View (RBV)

Resource-Based View (RBV) theory focuses on the fact that sustainable competitive advantage of a firm is derived because of valuable, rare, inimitable, and non-substitutable resources (Chen et al., 2024). In these regards, the notion of Ambidextrous Intellectual Capital (AIC) consisting of human and relational dimensions and structural dimension can be considered a strategic resource that allows companies to create a balance between exploration and exploitation processes (Robb et al., 2025). The AO leverages such intellectual capabilities to effectively be adaptable and be innovative in the face of Technological Turbulence (TT). Using such dynamic and knowledge based resources, firms improve their adaptability, potential to innovate and to run their operations more efficiently and eventually increase their Sustainable Firm Performance (SFP) (Kianto et al., 2017). Therefore, RBV supports the role of ambidextrous capabilities and intellectual capital as the sources of sustainable survival of organizations.

Ambidextrous Intellectual Capital (AIC): Ambidextrous Human Capital, Ambidextrous Relational Capital and Ambidextrous Structural Capital

AIC is the ability of the organization to be balanced and combine exploitative and explorative utilization of knowledge resources to attain sustainable competitive advantage (Mahmood et al., 2021). It integrates three major dimensions namely; Ambidextrous Human Capital, Ambidextrous Relational Capital and Ambidextrous Structural Capital. AHC puts more emphasis on the capacity of the employees to utilize the acquired knowledge in acquisition of new skills (Asiaei, O'Connor, et al., 2023). ARC is concerned with the management of stable and innovative external relationship whereas ambidextrous structural capital is concerned with the support of flexibility and productivity of the organizational systems (Khalequzzaman et al., 2025). These elements help the firms to fit in dynamic environments, be innovative, and improve overall performance. AIC is essential to strategic regeneration and continuity in the knowledge-based and technologically tumultuous markets (Shehzad et al., 2023).

Ambidextrous Organization (AO)

AO is the capability of a firm to engage in exploration and exploitation at the same time so as to succeed and become flexible in the long-term horizons (Moreno-Luzon et al., 2024). Exploration is concerned with innovation, experimentation, and exploration of new opportunities whereas exploitation is concerned with refining on the processes of existing processes, enhancing efficiency, and utilizing existing competencies (AlSaied & Alkhoraif, 2024). The ability to strike a balance between these two capabilities enables organizations to be flexible and competitive in the changing environments (Hassan et al., 2023). Organizations that are ambidextrous incorporate learning, knowledge transfer and structural flexibility as a way of handling competing demands efficiently. Such a two-pronged strategy helps companies to adapt to technology, become more innovative, and perform better on a long-term basis (Sarmad et al., 2024).

Technological Turbulence (TT)

Technological turbulence can be defined as the speed and uncertainty of technological changes with regard to the operations, products, and markets of an organization (Hossain et al., 2025). It is an indication of the speed of the introduction, development, or obsolescence of new technologies, providing opportunities to companies and posing a challenge to them. Organizations based in such environments should be able to constantly adapt, innovate, and refresh their knowledge and skills to stay abreast with the competition (He & Wu, 2024). Technological turbulence is more high-tech thus requires more flexibility, dynamic capabilities and learning orientation to deal with uncertainty (Puspita et al., 2024).

Sustainable Firm Performance (SFP)

Sustainable Firm Performance (SFP) is defined as the capacity of the organization to attain long-term success by balancing between the economic, environmental, and social goals. It extends to long-term financial benefits such as responsible use of resources, environmental conservation, and social welfare (I. Khan et al., 2023). Companies that have a good sustainable performance incorporate sustainability concepts in their strategy, operations, and decision-making processes to generate long-term value to the stakeholders (Al Hawaj & Buallay, 2022). SFP is the ability of a company to be competitive and reduce the negative environmental and social impacts. It focuses on unceasing innovation, ethical undertakings, and stakeholder participation to guarantee the stability and development within changing markets (Dinu, 2025).

Hypothesis Development**Ambidextrous Intellectual Capital and Ambidextrous Organization**

Ambidextrous Intellectual Capital (AIC) offers a basic platform on which an Ambidextrous Organization (AO) can be built, one that is able to strike a balance between the activities of exploration and exploitation (Lopez-Zapata & Ramírez-Gómez, 2023). Having high levels of AIC by the firms in terms of the human, relational and structural capital allows the firm to have the flexibility and knowledge capable of supporting two strategic orientations (Taha et al., 2024). In addition, AIC also provides the employees and the systems, the capacity to be innovative and streamline the current operations. Moreover, excellent intellectual resources help the organization to respond to dynamic market needs by changing its structure, culture, and processes (Shahbaz et al., 2021). Moreover, in case AIC is properly applied, it promotes collaboration, learning, and agility, which deem the

core of the ambidextrous functioning. Hence, organizations that possess a lot of ambidextrous intellectual capital will tend to grow to the level of ambidexterity (Mubarik et al., 2022).

H1: AIC has a significant impact on AO

Ambidextrous Intellectual Capital and Technological Turbulence

The concept of Ambidextrous Intellectual Capital (AIC) helps companies to fully control and react to Technological Turbulence (TT) by means of combining knowledge exploration and exploitation (Asiaei, O'Connor, et al., 2023). Strong AIC firms that include ambidextrous human, relational and structural capital are in a better position to respond to the dynamic technological changes and uncertainties. In addition, these companies also have the innovation and learning capacity to incorporate innovation and technology (Begum et al., 2023). Besides, AIC improves the capacity of a firm in sensing, absorbing and implementing the new technologies to remain competitive. Moreover, intellectual tools that are ambidextrous will facilitate the aspect of flexibility and strategic renewal and hence the organization will be able to use technological disruptions as a growth and sustainability opportunity (Asiaei, Bontis, et al., 2023).

H2: AIC has a significant impact on TT

Ambidextrous Intellectual Capital and Sustainable Firm Performance

Ambidextrous Intellectual Capital (AIC) is crucial in the improvement of Sustainable Firm Performance (SFP) since it allows firms to trade-off innovation and efficiency (Mahmood et al., 2021). The companies with good AIC that include human, relation, and structure capital will be able to exploit the knowledge they have as they pursue new opportunities of sustainable development (Zahid et al., 2024). In addition, AIC promotes creativity, learning and flexibility, which will lead to environmentally and socially responsible practices. Moreover, ambidextrous knowledge resource integration promotes continuous improvement, operational excellence, and sustainability facilitated by innovation (Shehzad et al., 2023). Moreover, companies that have ambidextrous intellectual capacities will be in a good position to make strategic objectives aligned with the long term environmental and economic objectives (Begum et al., 2023).

H3: AIC has a significant impact on SFP

Ambidextrous Organization and Sustainable Firm Performance

Ambidextrous Organization (AO) allows firms to attain sustainable performance of the firms (SFP) through proper balancing of exploration and exploitation activities. With this two-fold ability, organizations are able to innovate and streamline operations they have in order to ensure long term competitiveness (Asiaei, O'Connor, et al., 2023). In addition, AO promotes flexibility and adaptability, which enable the firms to react effectively to changes in the environment and the market (Sarmad et al., 2024). Moreover, ambidextrous organizations promote lifetime learning, innovation, and optimization of resources, which all are critical toward sustainability. In addition, companies that are ambidextrous are better placed to achieve economic, social and environmental goals at the same time (Hwang et al., 2023). As a result of balancing short-term productivity with long-term innovation,

H4: AO has a significant impact on SFP

Technological Turbulence and Sustainable Firm Performance

Technological turbulence plays a major role in determining the way companies deal with innovation, flexibility, and sustainability (Hossain et al., 2025). When operating in fast paced and volatile technological settings, those companies which are responsive to the

emerging technology are able to improve efficiency, product quality and come up with novel solutions that reinforce their competitive edge (He & Wu, 2024). This flexibility enables the sustainability of the practices through resource optimization, environmentally friendly production, and constant enhancement. On the other hand, companies that fail to adapt to changes in technology might record poor performance and low sustainability performances (Santa et al., 2022). Thus, the organizations, which plan their resources, as well as capabilities to handle the turbulence in technology, have higher chances of attaining better sustainability results. Therefore, the hypotheses is:

H5: TT has a significant impact on SFP

Ambidextrous Organization mediates the relationship between Ambidextrous Intellectual Capital and Sustainable Firm Performance

The linkage between the AIC and the SFP is achieved through AO as a crucial channel. Companies with high AIC that include human, structural, and relational capital are able to create ambidextrous structures that are effective and balanced in regard to exploration and exploitation (Khalequzzaman et al., 2025). In addition, these organizations also apply their knowledge resources in innovating and still ensure operational efficiency. Moreover, AO helps firms transform intellectual capabilities into action plans which make firms more adaptive and sustainable (Hayaeian & Hesarzadeh, 2024). Moreover, ambidextrous strategy enables the firms to act proactively to the changes in the environment and the market so that the firms are maintained in a constant state of renewal and competitive advantage (Shehzad et al., 2023). Therefore, in a case where AIC enables the emergence of ambidextrous organizational capabilities, it enhances sustainable performance outcomes.

H6: AO mediates the relationship between AIC and SFP

Technological Turbulence mediates the relationship between Ambidextrous Intellectual Capital and Sustainable Firm Performance

TT is an important mediator between the AIC and the SFP. Companies that have high AIC levels in terms of human, structural, and relational levels can negotiate and utilize technological changes more effectively (Aboalhool et al., 2024). In addition, these companies use their ambidexterity in the knowledge in determining new technology and adjusting strategies. Besides this, technological turbulence fosters innovation whereby firms take advantage of their intellectual resources in order to achieve sustainable results (Hossain et al., 2025). Moreover, AIC improves the sustainability and competitiveness of a company by intensifying the route to become more responsive to technological changes (Puspita et al., 2024).

H7: TT mediates the relationship between AIC and SFP

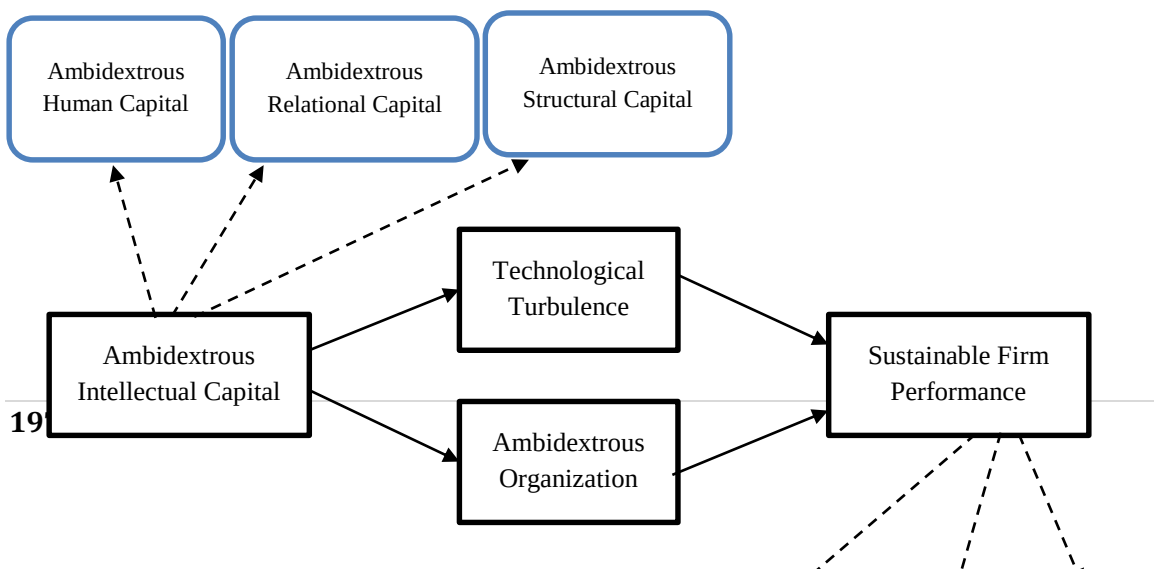


Figure 1: Conceptual Framework**Methodology****Measuring instrument**

In this research, the primary method of data collection will be used in this study, where questionnaires will be used as the main tool of data collection. Likert scale (5 points scale) was developed in this study. The scales will be on a 1 (Strongly Agree) to 5 (Strongly Disagree) scale.

Table 1 Instrument

S.no	Variables	Items	Sources
1	Ambidextrous Organization	6	(As'ad et al., 2024)
2	Technological Turbulence	4	(Shehzad et al., 2023)
3	Sustainable Firm Performance	5	Schöggl et al. (2024)
4	Ambidextrous Intellectual Capital	13	(Hayaeian & Hesarzadeh, 2024)

Sample and Data Collection

The table 2 shows the demographic profile of the respondents. The sample is also well balanced with a percentage of 53 and 47, respectively, implying that the ratio is balanced. In terms of employment, 23 percent are CEOs, 25 percent are senior managers, 20 percent are middle managers and 32 percent are the operational staff which is a diverse organizational structure. The majority of the respondents are employees of the companies that have less than 50 people (42%), then 37% of the respondents are employees of the medium companies. Regarding the work experience, 46 percent have 1015 years, 38 percent have 510 years, and 16 percent have more than 20 years of experience.

Table 2: Respondents' profile

	Frequency	Percentage
Gender		
Male	106	53%
Female	94	47%
Work position		
CEO	46	23%
Senior manager	50	25%

Middle manager	40	20%
Operational staff	64	32%
Company size		
<50	84	42%
50-250	74	37%
>250	42	21%
Work experience		
5-10 years	76	38%
10-15 years	92	46%
>20years	32	16%

PLS-SEM Analysis

PLS-SEM is the method of assessment of complex cause-and-effect relationships between latent constructs that is used in this study as the sophisticated method of multivariate analysis. It is especially applicable in the context of exploratory research and prediction-based research studies with minimal sample sizes. Hair et al. (2019) outlined that the non-normal data type and the presence of multiple mediators or hierarchic elements in the model are the main advantages that distinguish PLS-SEM as the best approach to analyze the offered conceptual framework and confirm the hypothesis of the relationships in the given study (S. Khan et al., 2023).

Results and Analysis

Confirmatory Factor Analysis (CFA)

In this study, to assess internal consistency and convergent validity of measurement model, factor loading, Cronbach's alpha, composite reliability (CR) and average variance extracted (AVE) measures were used; the results of this are reported in the table. The table shows that the constructs are all highly reliable. All the constructs have higher values than the accepted level of Cronbach's alpha and composite reliability ($CR > 0.7$), which validates that there is internal consistency among the items that measure each latent variable (Hair et al., 2017). Moreover, all the AVE values are above 0.5, which means that the constructs would explain an adequate level of variance in their corresponding indicators and would form convergent validity. Namely, the factor loadings of the items of AO are significantly large, with factor loading of 0.67 and above, and AO3 (0.894) is an especially good indicator. Likewise, TT has good measuring items, which are loaded with more than 0.77. These results prove the constructs to be strong, reliable and valid to analyze the proposed structural relationships within the model.

Table 3 Confirmatory Factor Analysis

Construct Name	Items	Loading	Cronbach's alpha	CR	AVE
Ambidextrous Intellectual Capital	AIC1	0.746	0.887	0.891	0.549
	AIC2	0.732			
	AIC3	0.666			
	AIC4	0.642			

	AIC5	0.557			
	AIC6	0.637			
	AIC7	0.602			
	AIC8	0.525			
	AIC9	0.731			
	AIC1	0.678			
	AIC11	0.746			
	AIC12	0.732			
	AIC13	0.754			
Ambidextrous Organization	AO1	0.792	0.834	0.912	0.662
	AO2	0.876			
	AO3	0.894			
	AO4	0.875			
	AO5	0.791			
	AO6	0.678			
Sustainable Firm Performance	SFP1	0.685	0.819	0.826	0.581
	SFP2	0.732			
	SFP3	0.823			
	SFP4	0.805			
	SFP5	0.759			
Technological Turbulence	TT1	0.814	0.841	0.843	0.678
	TT2	0.880			
	TT3	0.825			
	TT4	0.770			

Discriminant Validity

Heterotrait-monotrait ratio (HTMT)

The HTMT table 4 shows the result of the HTMT, which is applied to evaluate the discriminant validity. The results are acceptable because all HTMT values are significantly less than the conservative value of 0.90, which proves that the constructs in the measurement model are not similar to each other (Cheung et al., 2024). Based on the HTMT values, there are significant correlations between the constructs. There is an intermediate correlation between the AIC and the SFP (0.536) indicating that the AIC is significantly related to the performance results. In the same way, TT has an average correlation with SFP (0.509) and AIC (0.451), which implies that market dynamics and its external factors are mutually related with the internal performance of the organization and its eventual success. Moreover, the least strong in the model is the one between the AO and SFP (0.138). This low correlation is already an indication that the AO construct, as measured, can be, perhaps, left directly, linearly related to the performance, and this point is an indication that its impact might be mediated by other variables in the structural model. These lessons highlight the multi-facetedness of the intersection of AIC and organizational structures in dynamic settings in order to affect performance.

Table 4 Heterotrait-monotrait ratios (HTMT)

Constructs	AIC	AO	SFP	TT
Ambidextrous Intellectual Capital				
Ambidextrous Organization	0.347			
Sustainable Firm Performance	0.536	0.438		
Technological Turbulence	0.451	0.380	0.509	

Fornell and Larcker Criterion

The results of Fornell and Larcker Criterion which measures the discriminant validity is given in Table 5. The findings affirm that all the square roots of all the Average Variance Extracted (AVE), which are marked on the diagonal, are above the other inter-construct correlations. This confirms that each construct has a greater variance with its own indicators as compared to other constructs hence confirming their discriminant validity (Fornell & Larcker, 1981). The outcome of the criterion indicates high distinctiveness of the constructs. TT (0.823) and AO (0.814) show the largest square roots of AVE, which marks their great differences in measurements. There are also some interesting correlations in the findings; e.g., TT demonstrates a medium correlation with SFP (0.415), which indicates that the dynamics in the external market are linked to the results of performance. However, the low correlation of the variables between the AO and SFP (0.118) suggests that there is a clear distinction between the organizational structure and the ultimate performance outcome, which supports the idea of complex and mediated relationships in structural model.

Table 5 Fornell and Larcker Criterion

Constructs	AIC	AO	SFP	TT
Ambidextrous Intellectual Capital	0.670			
Ambidextrous Organization	0.302	0.814		
Sustainable Firm Performance	0.336	0.118	0.762	
Technological Turbulence	0.387	0.278	0.415	0.823

Cross-loading for Correlation

The cross-loadings examination of the table affirms the discriminant validity of the measurement model because all items show greater loadings on their constructs than any other construct, with the discriminations being much larger than the required threshold of 0.01 (Ramezani & Mostafavi, 2025). This presents the fact that the items are different and they accurately measurably quantify their intended latent variables. The table shows meaningful relationships and strong items contributions. Some items, like AO3 (0.894) and AO4 (0.875), indicate very good loadings on the item AO, and this implies that they are of the greatest significance in the measurement of this construct. In the same way TT2 (0.880) and SFP3 (0.823) have a significant impact on TT and SFP respectively. In addition, there are also notable cross-loadings that are items AIC9 and AIC10 on SFP (0.797 and 0.765) which indicate that the facets of the AIC are especially strongly interconnected with the final performance outcome. All in all, these results confirm the reliability of the model and indicate that the organizational strategies that are centered on high-loading items on the case of the AO and AIC are essential in overcoming the TT and attaining sustainable performance.

Table 6 Cross loadings

Items	AIC	AO	SFP	TT
AIC1	0.746	0.223	0.536	0.218
AIC2	0.732	0.200	0.545	0.187
AIC3	0.666	0.266	0.503	0.269
AIC4	0.642	0.220	0.512	0.292
AIC5	0.557	0.351	0.383	0.326
AIC6	0.637	0.207	0.506	0.242
AIC7	0.602	0.197	0.481	0.325
AIC8	0.525	0.228	0.433	0.355
AIC9	0.731	0.101	0.797	0.277
AIC10	0.678	0.083	0.765	0.226
AIC11	0.746	0.223	0.536	0.218
AIC12	0.732	0.200	0.545	0.187
AIC13	0.749	0.238	0.461	0.275
AO1	0.460	0.706	0.085	0.489
AO2	0.405	0.702	0.187	0.367
AO3	0.316	0.894	0.164	0.201
AO4	0.263	0.875	0.071	0.180
AO5	0.207	0.791	0.076	0.217
AO6	0.138	0.678	0.020	0.440
SFP1	0.541	0.128	0.685	0.414
SFP2	0.548	0.031	0.732	0.342
SFP3	0.656	0.107	0.823	0.338
SFP4	0.729	0.097	0.805	0.297
SFP5	0.677	0.085	0.759	0.216
TT1	0.304	0.223	0.318	0.814
TT2	0.356	0.226	0.352	0.880
TT3	0.320	0.234	0.332	0.825
TT4	0.293	0.231	0.362	0.770

Note: All self-loadings are significant (bold).

Common Bias Method

Table 7 evaluates the possibility of the common method bias based on the Variance Inflation Factor (VIF). The overall VIF values of all items depict low to moderate levels of multicollinearity and all the results are well lower than the conservative measure of 3.3, implying that common method bias is not of much concern in the data. The range of values is 1.397 (AIC1) to 2.570 (TT2) which is a moderate high. TT with item TT2 and TT3 having VIFs of 2.570 and 2.022, respectively and AO with item AO4 and AO3 with VIFs of 2.268 and 2.081, respectively have higher but still acceptable levels of internal correlation of indicators. In general, these results indicate that multicollinearity does not have a negative impact on the measurement model, which proves the reliability and validity of the constructs to be used further in the analysis of the structural model.

Table 7 Common Bias Variance

Items	VIF
AIC1	1.397
AIC2	1.549
AIC3	1.659
AIC4	1.511
AIC5	1.535
AIC6	1.760
AIC7	1.644
AIC8	1.411
AIC9	1.868
AIC10	1.697
AIC11	1.397
AIC12	1.651
AIC13	1.521
AO1	1.892
AO2	1.753
AO3	2.081
AO4	2.268
AO5	1.746
AO6	1.501
SFP1	1.443
SFP2	1.558
SFP3	1.959
SFP4	1.814
SFP5	1.589
TT1	1.929
TT2	2.570
TT3	2.022
TT4	1.543

Predictability of the model

The structural model has a high predictive force, as shown by the value of R-squared (R^2) and adjusted R-squared in Table 8. The model has a high level of explanatory power of the dependent variable, SFP such that the R^2 is 0.731 with an adjusted R^2 of 0.727. This implies that the antecedent constructs in the model are very effective predictors of the outcomes of the organization, given that the model has explained nearly 73.1 percent of the variance in SFP. The model further indicates the mediation mode TT has a significant explanatory power ($R^2 = 0.501$, Adjusted $R^2 = 0.458$), which implies that approximately 50.1% of its variance is explained. However, the construct of AO has a lower value of R^2 of 0.091, which implies that the model can only capture 9.1 in other words the other vital external variables not considered in this analysis. These results suggest that the model is especially

effective in forecasting end performance and that the strategies designed to manipulate the major mediators are the elements that can and should be used to cause sustainable performance.

Table 8 Predictivity of the Model

Constructs	R-square	R-square adjusted
Ambidextrous Organization	0.091	0.086
Sustainable Firm Performance	0.731	0.727
Technological Turbulence	0.501	0.458

Hypothesis Results

According to the findings in Table 9, all those seven hypotheses are statistically significant which allows detecting a full complex of the relationships that drive SFP. The strongest result is the great and considerable direct impact of AIC on SFP (H3). The strongest in the model is the relationship with a beta value of 0.834 and p-value of 0.000 indicating that the intellectual capital of an organization is the strongest direct impact on the outcome of its performance. The other various important direct effects are also confirmed by the analysis. AIC has a positive impact on the AO (H1, $\beta = 0.302$) and TT (H2, $\beta = 0.387$), which proves its background contribution to the development of organizational abilities and views on the outer environment. In addition, both mediators have a considerable, yet relatively lesser, direct effect on performance according to H4 (AO $\rightarrow$ SFP, $\beta = 0.172$) and H5 (TT $\rightarrow$ SFP, $\beta = 0.140$ as well). Importantly, the model finds important mediation pathways. Both the AIC $\rightarrow$ AO $\rightarrow$ SFP (H6) and AIC $\rightarrow$ TT $\rightarrow$ SFP (H7) paths are supported with a p-value of 0.002 and 0.019 respectively. This proves that, the presence of the AIC does not only serve the purpose of improving the performance of firms directly but also indirectly through the development of adaptive organizational structures and the way technological changes in the market are handled. However, the results emphasize the fact that the achievement of SFP is best associated with a multi-dimensional approach. The main focus of the organizations should be to develop their AIC because this is the very core of the company which not only directly enhances the performance but also provides the ability to effectively respond to the external environment both organizationally and strategically.

Table 9 Hypothesis testing

	Hypothesis Regression Path	Standard deviation (STDEV)	Beta values	T statistics (O/STDEV)	P values	Results
H1	Ambidextrous Intellectual Capital $\rightarrow$ Ambidextrous Organization	0.074	0.302	4.076	0.000	Supported
H2	Ambidextrous Intellectual Capital $\rightarrow$ Technological Turbulence	0.082	0.387	4.722	0.000	Supported

H3	Ambidextrous Intellectual Capital -> Sustainable Firm Performance	0.022	0.834	3.711	0.000	Supported
H4	Ambidextrous Organization -> Sustainable Firm Performance	0.042	0.172	4.070	0.000	Supported
H5	Technological Turbulence -> Sustainable Firm Performance	0.045	0.140	3.113	0.002	Supported
H6	Ambidextrous Intellectual Capital -> Ambidextrous Organization -> Sustainable Firm Performance	0.017	0.052	3.111	0.002	Supported
H7	Ambidextrous Intellectual Capital -> Technological Turbulence -> Sustainable Firm Performance	0.023	0.054	2.350	0.019	Supported

Discussion and Hypotheses Validation

Hypothesis 1: Ambidextrous Intellectual Capital and Ambidextrous Organization

As speculated, it is hypothesized that AIC has a positive relationship with the evolution of an AO. These findings in the current research indicate a good support to this correlation, the effect size being $\beta = 0.302$. The observation is consistent with the theoretical basis that organizational capabilities are anchored on knowledge-based resources. According to (Lopez-Zapata & Ramírez-Gómez, 2023), AIC architectures that are tailored solely in promoting both exploratory and exploitative learning are essential in realizing organizational ambidexterity. In the same way, Asiaei, O'Connor, et al. (2023) established that the elements of the IC in a firm can directly facilitate the maintenance of both innovation and efficiency at the same time, thus establishing the nature of ambidexterity of the organization.

Hypothesis 2: Ambidextrous Intellectual Capital and Technological Turbulence

It is stated that the AIC has a positive impact on the perception and handling of TT by a firm. This suggestion is proven in the analysis, as the effect of $\beta = 0.387$ is significant. This implies that companies with high AIC are in a better position to feel and discern technological changes in their surroundings. It agrees with the dynamic capabilities perspective, as put up by (Shehzad et al., 2023) which suggests that the capacity of a firm to evolve easily in a fast changing technological environment can be founded on the knowledge and learning process within the firm. Moreover, He and Wu (2024) proved that particular structures of IC have a direct positive impact on the ability of a firm to act and react under changing market conditions.

Hypothesis 3: Ambidextrous Intellectual Capital and Sustainable Firm performance

It assumes that there is a positive and direct effect of the AIC on the SFP. This research shows that there is a strong and significant relationship with a substantial effect size of $\beta = 0.834$ and thus this is the strongest direct path in the model. This observation greatly lends credence to the resource-based perspective of the firm that considers that special, valuable, and inimitable resources, including specialized AIC, are the main sources of competitive advantage and high performance (Taha et al., 2024). A large body of research and a meta-analysis study by Zahid et al. (2024) has repeatedly established a strong positive relationship between intellectual capital and several performance measures in an organization, which highlights its underlying importance in an economic context.

Hypothesis 4: Ambidextrous Organization and Sustainable Firm Performance

According to it, an AO has a positive impact on SFP. The outcomes confirm this hypothesis, which means that the effect of $\beta = 0.172$ is significant. It proves that the organizational capacity to balance between the exploration of the new opportunities and the exploitation of the existing competencies is one of the main determinants of the long-term success. The masterpiece of Martínez-Falcó et al. (2024) offers sufficient evidence that the ability to successfully cope with disruptive change and sustain performance over time is higher in AO. Equally, in a detailed meta-analysis, Mankgele (2023) discovered an overall positive and significant performance impact of organizational ambidexterity in the various settings and methods of measurement.

Hypothesis 5: Technological Turbulence and Sustainable Firm Performance

It indicates that TT positively affects SFP and the findings affirm large effect of $\beta = 0.140$. This means that a TT environment, instead of being a menace only, can become a trigger in performance once carefully taken care of. This is in line with the concept of environmental jolts that create strategic renewal and innovation as mentioned by Hossain et al. (2025). This is also supported by research by Aboalhool et al. (2024) who found that TT could moderate positively the relationship between the learning orientation of a firm and its performance to transform the uncertainty in the market to an advantage of the firm.

Hypothesis 6: Ambidextrous Organization mediates Ambidextrous Intellectual Capital and Sustainable Firm Performance

According to it, the connection between AIC and SFP is mediated by AO. This mediation is supported by the important indirect effect of $\beta = 0.052$, which demonstrates an important mechanism in the context of which AIC is converted into firm performance. This chain of action proves that the knowledge resources should be properly structured and operationalized to produce the outcomes. This observation is supported by other works like that of Asiaei, O'Connor, et al. (2023) who discovered that AIC promotes performance based on dynamic capabilities, which comprise ambidextrous processes of resource reconfiguring to suit the emerging market needs.

Hypothesis 7: Technological Turbulence mediates Ambidextrous Intellectual Capital and Sustainable Firm Performance

It is proposed that TT positively moderates the relationship between AIC and SFP. This hypothesis is confirmed by the significant indirect effect of $\beta = 0.054$, which reveals that there is a second crucial pathway. It implies that AIC contributes to the improvement of the performance insofar as it allows the firm to respond and anticipate the changes in the technological environment in a proactive manner, and, as such, neutralizes threats and leverages new opportunities. This substantiates the efforts of Shehzad et al. (2023) who

believe that dynamic capabilities (based on knowledge) enable the firms to reap benefits of environmental turbulence; in other words, volatility becomes a source of value creation rather than a risk.

Practical Implications

This study highlights the fact that the most important driver of SFP is the development of the AIC. The managers need to focus on learning and the innovative powers of the workforce. Such investment has a direct effect on increasing the results and at the same time creates an AO that is able to balance efficiency and innovation. Moreover, companies must leverage this AIC as a way of trying to preempt TT, and reframe it as a strategic benefit. It is a two-fold approach that determines success: creating a learning, light-on-its-feet organization that can take advantage of market shifts to grow, long-term, sustainably.

Managerial Implications

The managerial implication of the research is the essential role of the strategic investment and development of the AIC. Hiring, developing, and retaining talent, that is capable of guiding innovation as well as efficiency, is a priority to the leaders. It is this human capital that forms the basis to develop an agile, AO as well as taking a proactive step in utilizing TT as a strategic weapon. To realize sustainable performance, managers would want to develop organizational structures and cultures that would allow this AIC thrive so that the firm is able to at any given time utilize the existing capabilities and pursue future opportunity in an ever-changing market.

Conclusion

The study clearly shows that the foundation of the SFP is the AIC that is the strong direct driver as well as a key facilitator of the important mediators. The tested model confirms that knowledge resources of a firm stimulate the rise of an AO and increase the possibility of the firm to gain out of TT. The pronounced mediation paths include that the performance is maximized where the AIC is directed to the development of the agile structures and proactive environmental strategies. Finally, long-term sustainability requires initial investment in human and intellectual resources that will create resilience and strategic flexibility within the organization.

Limitations and Future Research Direction

The limitations of this study are the cross-sectional character of the data used in the study, which does not allow forming definitive conclusions regarding causality, as well as the narrow scope of the research to one geographic or industrial setting that may limit the scope of generalization. The low value of explanatory power (R^2) of AO indicates that other important influencing factors were not reflected in the model. Longitudinal designs should be used in future studies in order to follow how these relationships can change over time. The missing antecedents of ambidexterity should also be identified and incorporated in the investigations and further mediation of other factors, including the dynamic capabilities, should be explored to form a more elaborate theoretical framework.

References

- Aboalhool, T., Alzubi, A., & Iyiola, K. (2024). Humane entrepreneurship in the circular economy: The role of green market orientation and green technology turbulence for sustainable corporate performance. *Sustainability*, 16(6), 2517.
- Al Hawaj, A. Y., & Buallay, A. M. (2022). A worldwide sectorial analysis of sustainability reporting and its impact on firm performance. *Journal of Sustainable Finance & Investment*, 12(1), 62-86.
- AlSaied, M. K., & Alkhoraif, A. A. (2024). The role of organizational learning and innovative organizational culture for ambidextrous innovation. *The Learning Organization*, 31(2), 205-226.
- As'ad, A., Brasit, N., Muis, M., & Umar, F. (2024). Unveiling the antecedents of sustainable performance: Insights from hospitality industry managers. *Problems and Perspectives in Management*, 22(4), 299.
- Asiaei, K., Bontis, N., Askari, M. R., Yaghoubi, M., & Barani, O. (2023). Knowledge assets, innovation ambidexterity and firm performance in knowledge-intensive companies. *Journal of knowledge management*, 27(8), 2136-2161.
- Asiaei, K., O'Connor, N. G., Barani, O., & Joshi, M. (2023). Green intellectual capital and ambidextrous green innovation: The impact on environmental performance. *Business Strategy and the Environment*, 32(1), 369-386.
- Begum, S., Ashfaq, M., Asiaei, K., & Shahzad, K. (2023). Green intellectual capital and green business strategy: the role of green absorptive capacity. *Business Strategy and the Environment*, 32(7), 4907-4923.
- Chen, Y.-A., Guo, S.-L., & Huang, K.-F. (2024). Antecedents of internationalization of Taiwanese SMEs: a resource-based view. *International Journal of Emerging Markets*, 19(11), 3581-3600.
- Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2024). Reporting reliability, convergent and discriminant validity with structural equation modeling: A review and best-practice recommendations. *Asia pacific journal of management*, 41(2), 745-783.
- Cosa, M., Pedro, E., & Urban, B. (2024). How to assess the intellectual capital of firms in uncertain times: a systematic literature review and a proposed model for practical adoption. *Journal of Intellectual Capital*, 25(7), 1-22.
- Dahiyat, S. E., Khasawneh, S. M., Bontis, N., & Al-Dahiyat, M. (2023). Intellectual capital stocks and flows: Examining the mediating roles of social capital and knowledge transfer. *VINE Journal of Information and Knowledge Management Systems*, 53(1), 11-42.
- Dinu, E. (2025). Bridging intellectual capital management, technological orientation, innovativeness and innovative performance in KIBS: a new perspective. *Journal of Intellectual Capital*, 26(2), 526-561.
- Elmakkawy, M. H., Hassan, H., & Magdy, A. (2025). Does green intellectual capital matter for green ambidexterity? Insights from the hotel industry. *Tourism and Hospitality Research*, 14673584251361233.
- Fait, M., Cillo, V., Papa, A., Meissner, D., & Scorrano, P. (2023). The roots of “volunteer” employees’ engagement: The silent role of intellectual capital in knowledge-sharing intentions. *Journal of Intellectual Capital*, 24(2), 399-429.

- Fornell, C., & Larcker, D. F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. In: Sage Publications Sage CA: Los Angeles, CA.
- Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial Management & Data Systems*, 117(3), 442-458.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review*, 31(1), 2-24.
- Hassan, S., Raza, S., Malik, M. F., Ishaque, A., & Fiza, M. (2023). Connecting the dots: a serial mediation of intellectual capital and organizational ambidexterity between high-performance work system and innovation performance. *Journal of Intellectual Capital*, 24(6), 1578-1603.
- Hayaeian, S., & Hesarzadeh, R. (2024). Knowledge management strategies, intellectual capital, and ambidextrous innovation capability in SMEs: Are they relevant? *Journal of the Knowledge Economy*, 15(2), 6832-6859.
- He, X., & Wu, X. (2024). Social networks and ambidextrous innovation in SMEs: the mediating role of dynamic capabilities and the moderating role of technological turbulence. *Technology Analysis & Strategic Management*, 36(10), 2662-2675.
- Hossain, M. I., Ong, T. S., Jamadar, Y., Teh, B. H., & Islam, A. (2025). Nexus among green entrepreneurship orientation, green ambidexterity innovation, green technological turbulence and green performance: moderated-mediation evidence from Malaysian manufacturing SMEs. *European Journal of Innovation Management*, 28(7), 2761-2783.
- Huma, S., Muslim, S., & Ahmed, W. (2024). Understanding the role of organizational intellectual capital on developing absorptive capacity to strategize innovation ambidexterity. *Review of International Business and Strategy*, 34(3), 433-453.
- Hwang, B.-N., Lai, Y.-P., & Wang, C. (2023). Open innovation and organizational ambidexterity. *European journal of innovation management*, 26(3), 862-884.
- Khalequzzaman, M., Wang, S., Zhang, N., & Wang, L. (2025). Integrating HR, intellectual capital, ambidextrous innovation, and environmental regulation for sustainable success in Bangladesh's manufacturing industry. *Systems*, 13(2), 99.
- Khan, I., Jia, M., Lei, X., Niu, R., Khan, J., & Tong, Z. (2023). Corporate social responsibility and firm performance. *Total Quality Management & Business Excellence*, 34(5-6), 672-691.
- Khan, S., Rashid, A., Rasheed, R., & Amirah, N. A. (2023). Designing a knowledge-based system (KBS) to study consumer purchase intention: the impact of digital influencers in Pakistan. *Kybernetes*, 52(5), 1720-1744.
- Kianto, A., Sáenz, J., & Aramburu, N. (2017). Knowledge-based human resource management practices, intellectual capital and innovation. *Journal of Business Research*, 81, 11-20.
- Lopez-Zapata, E., & Ramírez-Gómez, A. D. J. (2023). Intellectual capital, organizational culture and ambidexterity in Colombian firms. *Journal of Intellectual Capital*, 24(2), 375-398.
- Mahmood, T., Mubarik, M. S., Islam, T., & Naghavi, N. (2021). Ambidextrous intellectual capital (AIC): a measuring framework. In *The dynamics of intellectual capital in current era* (pp. 1-30). Springer.

- Mankgele, K. P. (2023). The effect of organizational ambidexterity on the sustainable performance of SMEs in the Limpopo province of South Africa. *International Journal of Research in Business & Social Science*, 12(2).
- Martínez-Falcó, J., Marco-Lajara, B., Zaragoza-Sáez, P., & Sánchez-García, E. (2024). The effect of organizational ambidexterity on sustainable performance: A structural equation analysis applied to the Spanish wine industry. *Agribusiness*, 40(4), 773-803.
- Moreno-Luzon, M., Gil-Marques, M., Lloria, M. B., & Salas-Vallina, A. (2024). Quality-oriented human resource practices (QHRP), ambidextrous culture and organizational ambidexterity: a study of green agro-food companies. *European Journal of Management and Business Economics*, 33(3), 253-271.
- Mubarik, M. S., Bontis, N., Mubarik, M., & Mahmood, T. (2022). Intellectual capital and supply chain resilience. *Journal of Intellectual Capital*, 23(3), 713-738.
- Odhan, Q. A., Mahmood, T., Naqvi, S. R., & Ahmed, M. (2025). From Knowledge to Growth: How Intellectual Capital Drives Technological Innovation and Firm Performance in Pakistan's Manufacturing Sector. *Annual Methodological Archive Research Review*, 3(6), 147-162.
- Puspita, M., Yuniarsih, T., Ahman, E., & Muhidin, S. A. (2024). The Influence of Environmental Turbulence and Organizational Culture on Financial Performance Through Human Capital Strategies in Educational Technology Start-Ups in Indonesia. *Atestasi: Jurnal Ilmiah Akuntansi*, 7(2), 1148-1163.
- Ramezani, S. G., & Mostafavi, Z. S. (2025). Developing and validating a comprehensive scale for accreditation standards and quality assurance in e-learning institutions. *Education and Information Technologies*, 1-49.
- Robb, C. C., Brownell, K. M., Brännback, M., & Rumi, S. (2025). Applying resource-based theory to social value creation: A conceptual model of contributive advantage. *Journal of Small Business Management*, 63(1), 147-169.
- Santa, R., Ferrer, M., Tegethoff, T., & Scavarda, A. (2022). An investigation of the impact of human capital and supply chain competitive drivers on firm performance in a developing country. *PloS one*, 17(12), e0274592.
- Sarmad, G. S., Naseem, A., Shahzad, A., & Ullah, M. (2024). Do Quality Management Practices, Organizational Ambidexterity, and Green Innovation Influence Sustainable Performance? A Structural Equation Modeling approach. *Sage Open*, 14(4), 21582440241302310.
- Schöggl, J. P., Stumpf, L., & Baumgartner, R. J. (2024). The role of interorganizational collaboration and digital technologies in the implementation of circular economy practices—Empirical evidence from manufacturing firms. *Business Strategy and the Environment*, 33(3), 2225-2249.
- Shahbaz, M., Mubarik, M. S., & Mahmood, T. (2021). *The dynamics of intellectual capital in current era*. Springer.
- Shehzad, M. U., Zhang, J., Dost, M., Ahmad, M. S., & Alam, S. (2023). Linking green intellectual capital, ambidextrous green innovation and firms green performance: evidence from Pakistani manufacturing firms. *Journal of Intellectual Capital*, 24(4), 974-1001.
- Suleiman, S. (2023). Factors influencing decision-making in ambidextrous SMEs/Author Sandra Suleiman.

- Taha, N., Siam, W., Alshurafat, H., & Al Shbail, M. O. (2024). Does organizational ambidexterity mediate the relationship between intellectual capital and financial performance. *Journal of Intellectual Capital*, 25(4), 711-743.
- Zahid, Z., Zhang, J., Shahzad, M. A., Junaid, M., & Shrivastava, A. (2024). Green Synergy: Interplay of corporate social responsibility, green intellectual capital, and green ambidextrous innovation for sustainable performance in the industry 4.0 era. *PloS one*, 19(8), e0306349.
- Zhang, S., & Suntrayuth, S. (2024). The synergy of ambidextrous leadership, agility, and entrepreneurial orientation to achieve sustainable AI product innovation. *Sustainability*, 16(10), 4248.