Exploring the Link between Intellectual Capital and Firm Financial Performance through Mediation of Innovation Speed

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Abstract

This study aimed to examine the association between intellectual capital and the financial performance of firms, taking innovation speed into account as a mediating factor. Our study paradigm is built upon the innovation literature and the IC viewpoint. Utilizing structural equation modeling, we examine data gathered from the top 10 information technology companies operating in Pakistan, with 320 employees serving as the sample size for the model's testing. The findings indicate a significant association between the elements of intellectual capital, i.e., human and structural capital, and the speed of innovation. This relationship, in turn, improves the financial performance of a company. The speed of innovation serves as a crucial mediator, magnifying the influence of human and structural capital on financial performance. Among the limited number of research papers exploring the potential mediating influence of innovation speed on the association between intellectual capital and firm performance, this study significantly contributes to the existing body of knowledge in human resource management concerning innovation and intellectual capital. Moreover, it offers practical comprehensions for managers on harmonizing their practices and strategies to cultivate intellectual capital while simultaneously striving towards the Firm's financial performance objectives and fostering innovation.

1 Introduction

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Researchers and practitioners worldwide have been paying close attention to intellectual capital (IC) as knowledge-based economies grow at an accelerated rate. It is thought to be more significant than conventional tangible resources and is considered a crucial component of a company's success (Wang et al., 2016b; Zakery & Saremi, 2021). Leading businesses are aware of the value of IC. They have started to implement intellectual capital initiatives and have invested a significant amount of money in creating, upkeep, and protecting IC, emphasizing the human resource viewpoint. However, the literature's link between IC and organization performance is less evident. According to particular academics, IC and its constituent parts directly impact a firm's performance, particularly its financial performance (Sardo & Serrasqueiroro, 2017; Xu, & Liu, 2020). However, some academics are skeptical of this immediate impact, claiming that because environmental changes might be unforeseen and disruptive, simply owning IC may not ensure optimal performance. Instead, through specific intermediate outcomes, IC may indirectly impact performance (Ferreira, & Coelho, 2020; Tseng et al, 2013).

The fact that previous research has operationalized the concept of IC differently could be one reason for the discrepancy. While some research (Bontis, 2001) defines a single construct of IC, others (Wang et al., 2016b) find multiple sub-constructs or aspects of the notion. Examples of these include human capital and structural capital. Moreover, several studies assume that different IC components affect company performance similarly (Ahmed et al., 2020; Asiaei & Jusohoh, 2015). On the other hand, various IC elements might have differential effects on the success of an organization (Wang et al., 2016b). It is usually acknowledged that organizational competitive advantage is based on IC (De Castro et al., 2010). Probing the precise impacts of IC components on performance of firm is significant. Moreover, current research has introduced several mediators between IC components and firm performance. For example, Hsu and Sabherwal (2011) demonstrate how knowledge enhancement, knowledge utilization, and dynamic capability influence the correlation between IC and a company's financial performance (Ali et al., 2021).

Previous research has revealed a strong correlation between IC and its constituent parts and innovation and a substantial relationship with firm performance (Han & Li, 2015; Xu, & Li, 2022). Furthermore, a multitude of research investigations have demonstrated that innovation will result in enhanced firm performance (Wang et al., 2016a). It follows that innovation may be a significant additional component mediating the impacts of IC on business success. Innovation refers to implementing or developing anything novel in goods, services, workflows, or managerial techniques to obtain a competitive edge. According to earlier research, organizations' strategic decisions, behavioral traits, and technological adoption influence innovation, which is a knowledge-driven outcome (Shahzad et al., 2020; Vaccaro et al., 2010). One of the most critical aspects of innovation in complicated and quickly evolving corporate contexts is speed, which has been directly linked to firm performance (Wang & Wang, 2012). According to Tseng and Wu (2007), a company's ability to innovate rapidly and efficiently increases the likelihood of satisfying market demands and achieving its objectives (Khalatur et al., 2022).

Conversely, Kessler and Chakrabartiti (1996) argue that elements related to innovation, such as staff-related factors, project support, structure-related factors, and partnerships, play a vital role in increasing a company's speed of innovation. The literature on intellectual capital (IC) and innovation suggests that innovation speed may mediate the link between IC and firm performance (Wang et al., 2021). However, the mechanisms underlying these impacts have received negligible attention. To address this research gap, scholars initially construct a theoretical framework elucidating how innovation speed mediates IC and firm performance.

The researchers use survey data from Pakistan's top ten IT firms—whose domains range from domestic to international, international to multinational, and multinational to domestic to test the hypotheses empirically. Pakistan is a prime example, having embraced digital transformation with great success. Pakistan's information technology industry is rapidly growing, making up about 1%

of the nation's GDP, which is projected to two-fold over the next three to four years. The Ministry of Information Technology and Telecommunication estimates that in 2021, Pakistan's IT exports cost $1.70 billion (Gul et al., 2021). The nation is now ranked fourth globally for freelancing, with more than 2000 information technology companies. We have investigated and compiled an extensive list of Pakistan's leading IT companies.

The list does not show competition since each IT company is improving Pakistan's digital environment with state-of-the-art technology, innovation, and solution development. Systems Limited, NETSOL Technologies, United Sol, Arpatech, TRG Pakistan, 10Pearls, Ovex Technologies, Cubix, Venture Dive, and Folio3 are Pakistan's top ten IT companies (United Sol, 2021). With their cutting-edge goods and services, these IT companies serve vital roles and contribute to Pakistan's thriving economy. However, as Pakistan becomes more accessible to the outside world, global industry titans will compete fiercely with Pakistani IT companies. They must efficiently use their IC to innovate swiftly and effectively to thrive in a cutthroat environment. Thus, the information technology sector in Pakistan provides an ideal environment for examining the connections between IC, innovation speed, and firm performance.

This research article offers several significant contributions. Firstly, it investigates how two essential components of IC, i.e., human and structural capital, affect innovation speed, enhancing a firm's performance. The research analysis uncovers the underlying mechanisms that link IC components to firm performance, revealing that different IC components exert distinct influences on firm performance. Additionally, this study provides valuable insights for managers on aligning their human resource management practices and strategies to nurture intellectual capital (IC) while pursuing performance objectives and fostering innovation. Secondly, regarding the mediating role of innovation speed, research findings suggest that it mediates the effects of the two intellectual capital components on financial performance. These insights into innovation speed contribute to the growing body of human resource management literature investigating the association between IC and firm performance.

2 Literature Review

2.1 IC, Innovation Speed, and Firm Financial Performance

Resource-based theory states that businesses can use IC as a strategic asset to improve performance and obtain a competitive edge (Marr et al., 2003; Nayak et al., 2023). Intangible intellectual capital is a concept that lacks a standard definition despite its growing significance in businesses that rely heavily on technological innovation and information (Canibano et al., 2000; Yüksel et al., 2022; Zambon, 2004). However, according to the Swedish company Skandia's first Annual Intellectual Capital Report (Edvinsson, 1999), the accounting literature frequently defines intellectual capital (IC) as possessing knowledge, organizational technology, applied experience, customer relationships, and professional skills.

These traits are then divided into three intellectual capital categories: relational human capital. Human capital (HC) and internal structural capital is the degree of competence (Beltramino et al., 2020; Vergauwen et al., 2007), the education and abilities of employees, and their efficacy and efficiency in raising the company's productivity. According to Guthrie and Petty (2000), internally developed IC is known as structural capital that captures the value of the company's procedures and regulations, the atmosphere in which employees work, and the innovations generated by the R&D departments of the companies. Brand names, patents, and strategies are examples of goods that are part of internal structural capital. Lastly, interactions with other parties, such as suppliers and customers, are captured by relational capital (Bontis, 2001; Onofrei et al., 2020). Traditional accounting revelations do not adequately address the increasing reliance on IC and its components (Bozzolan et al., 2003). According to Zambon (2004), every event that could impact a firm's performance in the future or its current financial situation should be included in yearly accounts.

Although IC may meet this requirement, disclosure of IC is hampered by other recognition requirements.

Generally speaking, the present research points to a favorable link between ICs and corporate performance; however, the exact details may vary. Mavridis (2004), for example, found that the most successful Japanese banks were the best at using their human capital; the effectiveness of using their physical assets was not as important (Zhang et al., 2021). However, Bontis et al. (2000) found a positive link between structural capital (SC) and the financial success of Malaysian businesses, highlighting that investments in structural capital and human capital indirectly affect a company's financial performance.

According to a German study by Bollen et al. (2005), all intellectual capital (IC) components exhibit an indirect relationship with performance. Similarly, findings from a study conducted by Cohen and Kaimenakis (2007) on small European businesses suggest that while "functional" IC is positively correlated with sales per staff, "hard" IC is significantly associated with profitability (Kim et al., 2020). However, no correlation between "soft" IC and performance has been observed. Cohen and Kaimenakis (2007) acknowledge the possibility of a lag period between IC investment and performance improvements, which may be beyond their control. This study aims to address such time-lag challenges. According to Phusavat et al. (2011), IC significantly and favorably contributes to profitability, revenue growth, and staff productivity compared to firm performance in the Thai manufacturing industry (Vetchagool, 2023). Nimtrakoon (2015) found that the ASEAN countries produced consistent results (Smriti & Das, 2018). Most research has verified that IC has a beneficial impact on business performance. Although this theory has been extensively tested in wealthy nations, new research has concentrated on the function of IC in emerging nations.

Furthermore, earlier research showed that specific IC components may impact company performance. However, in the Serbian information and communication technology (ICT) sector, Dženopoljac et al. (2016) discovered no connection between IC and financial success (Xu & Li, 2022). For instance, Tarighi et al. (2022) examine the relationship between social capital, intellectual capital, and firm performance.

Globalization, intense market competition, and technological development have made innovation and distinctiveness essential for any business. In order to maintain a competitive edge and succeed in the market, companies must simultaneously seize new chances and create new goods and services. Putting fresh ideas into practice that provide value is what innovation means.

This broad-spectrum definition covers a variety of innovative activities, including new process technology implementations, management techniques, and product development. In order to improve overall profitability and competitiveness, new goods and processes must be adopted following client demands and specifications. The Oslo Guide (2005) has devoted a significant amount of space to the definitions of innovation and its various forms. Four different categories of innovation are included in these definitions. They are organizational, marketing, process, and product innovation. Further, Oslo Guide (2005), offers two types of product innovations: introducing new goods and services to the market and significantly enhancing the usability or functionality of already-existing products and services. Process innovation encompasses significant modifications to apparatus, software, and procedures. Process innovation can be demonstrated via a novel kind of production technique. Marketing innovations can help a business grow by opening up new markets, locating its product novelly, responding to client wants more successfully, or increasing sales.

Marketing innovations include innovative methods of financing venture capital and sales strategies. According to Antonioli et al. (2004), organizational innovation uses a novel organizational strategy in a company's external relations, workplace structure, or commercial

practices. In commercial practices, organizational innovations refer to implementing novel techniques for arranging work routines and procedures (Kalkan et al., 2014). IC significantly and favorably impacts innovation and performance within a firm. (Truong et al., 2024).

Based on the description mentioned above, the following hypothesis can be stated as

H1: Intellectual capital significantly influences the firm financial performance.

H2: Innovation Speed serves as the mediator between ICs and the Firm's financial performance
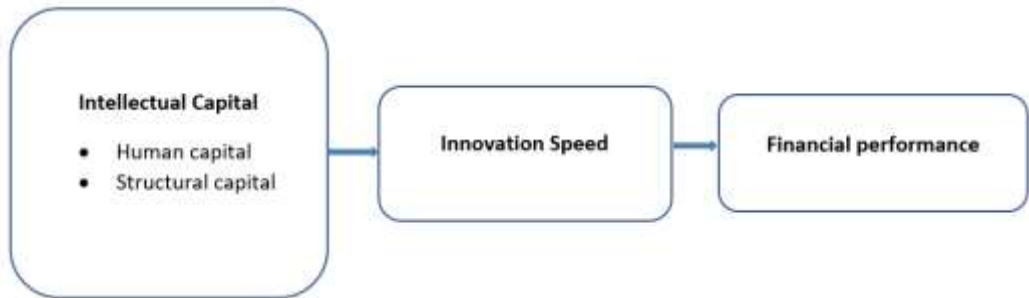

Figure 1: Conceptual Framework

3 Methodology

By surveying the top ten information technology firms in Pakistan, which have locations across the country's metropolitan cities of Lahore, Karachi, Islamabad, Multan, and Rawalpindi, we tested the study model empirically. For this study, the context of the information technology companies had been chosen for several reasons. First, information technology companies have a high-value addition and are knowledge-intensive. Thus, they need structural and human capital to find a competitive advantage in the market. Second, IT companies need to constantly develop quickly while improving the quality of their work due to the volatile surroundings and short product life cycles they face.

Third, this sector operates in an exceedingly dynamic and unpredictable environment due to Pakistan's significant economic upheaval over the previous few decades. They must fully utilize their IC to develop swiftly and efficiently to survive. In conclusion, Pakistani IT companies offer an appropriate framework for researching the mediating function of innovation speed. Researchers used a convenient sampling technique to survey IT companies in Pakistan.

Because the top management of the chosen organizations may be the best sources of knowledge, we specifically used a critical informant method when gathering data from those firms. We found the possible responders using several methods, including contact details from IT companies' websites and introductions from acquaintances. We contacted one of the senior managers, general managers, or CEOs of each organization, inviting them via phone or email to participate in our research. Following their consent, we sent our questionnaire via email to 400 participants. Out of the 380 returning surveys, 360 were filled out completely.

3.1 Measurement

A seven-point Likert-type scale, one denoting complete disagreement, and seven denoting complete agreement, was used to rate each survey item. The human capital measurement scale is based on work by Youndt et al. (2004) and Bontis (1998). The structural capital measuring scale was developed using the items suggested by Wu et al. (2008) and Bontis (1998). Metrics measuring innovation speed were adapted from Wang and Wang (2012). The Firm's financial performance

was measured using the following scale: Wang et al. (2016a), Wang et al. (2016b).

4 Data Analysis

PLS-SEM, a 2nd generation multivariate data analysis technique, was used in this investigation (Ringle et al., 2015). It is a powerful prediction technique that functions well with intricate structural models. It assesses accuracy and can be used for single- and multi-item scales, especially when dealing with significant sample sizes. It is appropriate for both reflective and formative models, following Sarstedt et al. (2021). Every variable in this investigation was reflective. The measurement model was used to evaluate the variables' validity and reliability, and the structural model was used to evaluate the path coefficient and significance. In the current study, intellectual capital was a second-order concept. A repeated indicator strategy was employed to examine the reflective-reflective model. The repeated indicators technique applies the indicators of the 1st-order constructs to the 2nd-order construct.

The outer loading was computed to assess the reliability of the indicators. The findings showed that the external loading score, which varied from 0.642 to 0.877, was significantly higher than 0.60. Cronbach's alpha was used to assess internal consistency, and the findings varied between 0.833 and 0.922, above the suggested range of 0.70. These findings show that internal consistency has been established. Additionally, the composite reliability coefficient—which needed to be greater than 0.70—was used to compute the internal consistency reliability. The obtained results, which ranged from 0.878 to 0.934, further supported the study's constructs' internal consistency. Table 1 shows the findings.

Table 1: Reflective Model Assessment

| 1st-Order variable	2nd-Order Construct	Items	Loading	α	CR	AVE
Financial Performance		FP1	0.769	0.874	0.905	0.613
		FP5	0.791			
		FP4	0.800			
		FP3	0.815			
		FP2	0.777			
Human Capital		HC7	0.785	0.887	0.912	0.600
		HC6	0.820			
		HC5	0.782			
		HC4	0.812			
		HC3	0.823			
		HC2	0.642			
		HC1	0.741			
Innovation Speed		IS5	0.739	0.833	0.878	0.589
		IS4	0.761			
		IS3	0.766			
		IS2	0.756			
		IS1	0.815			
Structural Capital		SC5	0.828	0.886	0.917	0.688
		SC4	0.767			
		SC3	0.855			
		SC2	0.877			
		SC1	0.816			
	Intellectual Capital			0.922	0.934	0.541
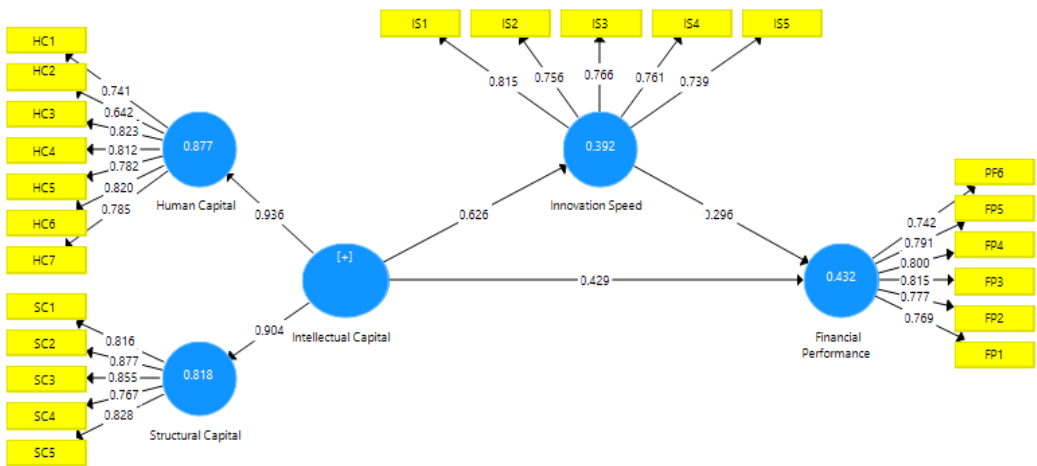
Figure 2: Measurement Model

The AVE criterian (Fornell and Larcker, 1981) was employed to check convergent validity. The AVE and outer loading scores of each constucts were used to compute the convergent validity or the association between one construct and other variables and measurements of the same construct. Further, Sarstedt et al. (2021), the score must be higher than 0.50. The data shows convergent validity, which indicates that all AVE scores were more significant than the cutoff. Construct validity, which indicates that every construct be distinctive from other variables under research, was also assessed (Bagozzi et al., 1991). The heterotrait-monotrait (HTMT) ratio (Henseler et al., 2015), cross-loadings, and the Fornell-Larcker test (Fornell and Larcker, 1981) are often used to assess construct validity.

Table 2: Fornell-Larcker test

	1	**2**	**3**
Financial Performance	0.783		
Innovation Speed	0.566	0.768	
Intellectual Capital	0.615	0.626	0.735

Haider et al. (2018) state that when the HTMT value falls below one, this study's variables may vary. However, 0.85 has also been proposed as a more cautious threshold value (Henseler et al., 2015). The findings indicate that Table 3 displayed discriminant validity.

Table 3: HTMT Criterian

	1	**2**	**3**
Financial Performance			
Innovation Speed	0.612		
Intellectual Capital	0.681	0.669	

Another way to evaluate discriminant validity is to compare the loading of the items with their cross-loading (Götz et al., 2009). Table 4 illustrates that in this study, item loading outweighed cross-loading. The findings suggest that, as a result, discriminant validity was established.

Table 4: Cross-loading

	1	**2**	**3**	**4**
FP1	**0.769**	0.503	0.490	0.493
FP2	**0.777**	0.439	0.390	0.387

FP3	**0.815**	0.470	0.489	0.468
FP4	**0.800**	0.403	0.439	0.426
FP5	**0.791**	0.454	0.454	0.412
HC1	0.508	**0.741**	0.457	0.537
HC2_	0.379	**0.642**	0.252	0.404
HC3	0.546	**0.823**	0.540	0.606
HC4	0.395	**0.812**	0.427	0.549
HC5	0.375	**0.782**	0.442	0.516
HC6	0.452	**0.820**	0.522	0.596
HC7	0.449	**0.785**	0.363	0.544
IS1	0.590	0.571	**0.815**	0.584
IS2	0.317	0.344	**0.756**	0.405
IS3	0.501	0.477	**0.766**	0.497
IS4	0.343	0.313	**0.761**	0.372
IS5	0.288	0.341	**0.739**	0.327
SC1	0.454	0.578	0.492	**0.816**
SC2	0.512	0.641	0.551	**0.877**
SC3	0.488	0.571	0.474	**0.855**
SC4	0.397	0.506	0.400	**0.767**
SC5	0.452	0.587	0.542	**0.828**

Bootstrapping was employed to assess the effectiveness of the structural model. An estimate from a structural model was initially used to gauge the collinearity concern. According to Sarstedt et al. (2021), collinearity is a higher relationship between variables, and the variance inflation factor (VIF) was the main criterion used to evaluate collinearity. It is possible to elude collinearity if the VIF is smaller than 5. The study's result, which ranged from 1.00 to 1.646, indicated that the sample lacked collinearity.

A significant relationship is shown by a t-value of more than 1.96 ($p<0.05$), and the path coefficients between the constructs were then calculated using the algorithm. Their significance was then evaluated using the standard error of the bootstrap approach. To determine the degree of variation expressed by the exogenous components, the coefficient of determination (R^2) was later computed; values of 0.25 (weak), 0.50 (moderate), and 0.75 (strong) denote significant variation (Sarstedt et al., 2021). Table 5 shows that all antecedents produced an average variation in innovative speed and firm performance.

Table 5: Evaluation of Structural Model

	R^2	t	P	Evaluation
Financial Performance	0.429	11.109	0.000	Moderate
Innovation Speed	0.391	9.405	0.000	Moderate

Mediation evaluation was conducted using the criteria proposed by Hair et al. (2016). The analysis found that innovation speed is a complementary factor mediating the relationship between intellectual capital and firm performance. According to the results, the innovation speed could act as a mediator for the recommended path.
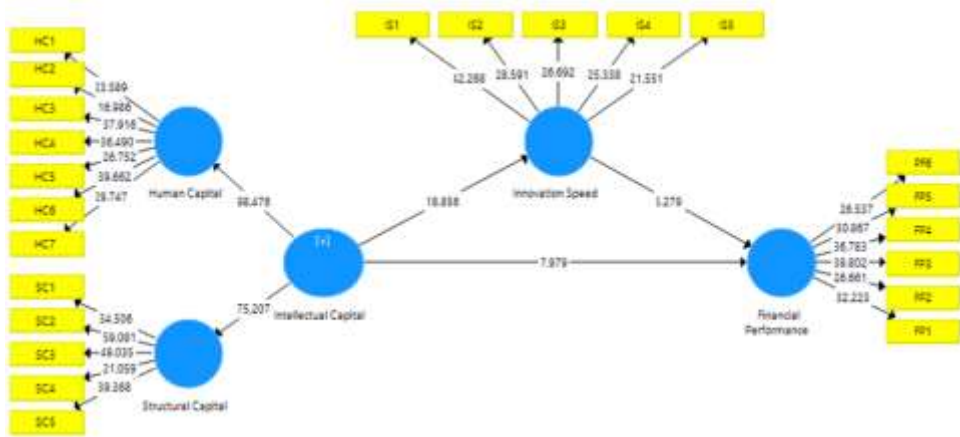
Figure 3: Structural Model

Table 6: Hypothesis Testing

Linkages	β	S. error	t	p	Evaluation	Confidence Interval	
						2.50%	97.50%
Innovation Speed -> Financial Performance	0.296	0.056	5.279	0.000	Supported	0.191	0.398
Intellectual Capital -> Financial Performance	0.615	0.034	17.912	0.000	Supported	0.551	0.688
Intellectual Capital -> Innovation Speed	0.626	0.033	18.856	0.000	Supported	0.561	0.684
Intellectual Capital -> Innovation Speed -> Financial Performance	0.186	0.034	5.418	0.000	Supported	0.120	0.252

H1 is supported by Table 6, which shows that intellectual capital significantly impacts financial performance (β = 0.615, P = 0.000). Moreover, the direct relationship (β = 0.626, P = 0.000) between intellectual capital and innovation speed supports H2. Additionally, there is a direct correlation (β = 0.296, P = 0.000) between firm performance and innovation speed. Furthermore, innovation speeds (β=0.186, P=0.000) mediate the association between firm performance and intellectual capital, further confirming hypothesis H2.

5 Conclusion

This research delves into the intricate relationship between intellectual capital (IC), innovation speed, and firm financial performance. We propose a conceptual framework where innovation speed mediates between the key IC components and financial outcomes. The empirical analysis confirms this hypothesis, demonstrating a positive influence of these IC components on innovation speed, which ultimately translates to enhanced financial performance.

These findings challenge the notion that only specific IC components contribute to firm success (Ling, 2011). Our research aligns with prior studies suggesting the collective impact of IC components (Wang et al., 2014; Yang & Lin, 2009). However, we extend the discussion by revealing the "how": innovation speed emerges as the crucial mechanism through which IC fosters

financial performance.

Furthermore, our study sheds light on the nuanced influence of IC on a firm's financial health. The two IC components exert direct and indirect effects (through innovation speed) on financial performance. This highlights the importance of considering the mediating role of innovation speed when examining the IC-performance relationship (Wang et al., 2021).This research contributes significantly to various knowledge domains. First, it enhances our understanding of how IC components influence firm performance by illuminating the mediating role of innovation speed. Second, it provides valuable insights into human resource management (HRM) practices. By identifying the IC components most relevant for specific performance goals, HRM can tailor strategies to bolster those components.

Third, our findings support the existence of other potential mediators in the IC-performance relationship (Hsu & Wang, 2012). While innovation speed proves to be a significant mediator, our research paves the way for further exploration of other mediating factors. This expanded perspective offers a more nuanced understanding of the complex relationship between IC and financial performance.

Finally, this study emphasizes the critical role of innovation speed within organizational innovation. It demonstrates that innovation speed thrives on the foundation provided by various IC components, challenging the single-construct view of innovation in some previous studies (Musteen & Ahsan, 2013). By highlighting the positive correlation between IC components and innovation speed, our research offers fresh insights into the organizational processes that fuel innovation. Businesses can leverage these findings to develop comprehensive HR systems that enhance innovation, bolster IC, and ultimately drive overall firm performance.

6 Practical implications

Our findings have two significant implications for practitioners. Firstly, managers must constantly work to maintain and grow their IC since both components are linked to financial performance. They can do this by investing in employee training and development, personnel recruitment and selection, procedure design and optimization, and other activities related to human resources management (Sparrow & Otaye-Ebede, 2014). Managers must be aware that the overall effects of different IC components on company performance vary. In light of the performance objectives that their company strategies emphasize, companies should, therefore, allocate more resources to specific components. These ramifications are particularly significant for human resources management in information technology firms. It is possible that their workers already have specific knowledge, expertise, and competence in the areas of their work. In this instance, increasing human capital may not be the main priority. An increased focus should be on tactics and procedures like performance reviews, managing relationships, and HR planning meant to fortify structural capital. Second, to fully realize the enormous potential of intellectual capital, managers need to understand the importance of innovation speed. In particular, businesses should do more than gather, develop, and preserve their intellectual capital. Instead, companies should build plans into their entire IC strategy to increase invention speed. The potential of innovation capital (IC) to boost company performance will be severely curtailed if innovation speed is overlooked and falls behind competitors. To increase the speed of innovation, managers can take steps to address several essential concerns (Wei et al., 2011). Verhezen et al. (2022) are of the view that intellectual capital improves the firm performance.

Significantly, these initiatives necessitate cooperation from several organizational areas. According to Camelo-Ordaz et al. (2011), employee affective commitment and information sharing are two ways HRM practices foster innovation. Wei et al. (2011) further proved that an organizational-wide developmental culture combined with strategic HRM can improve product innovation. In order to achieve the intended company performance, managers from various

departments, including Human resource management and R&D, should collaborate to guarantee that a thorough strategy on IC and innovation speed is appropriately designed, consciously balanced, and executed synergistically.

7 Limitations and Future Implications

Certain constraints govern our work, but these also offer possible avenues for further investigation. Initially, a cross-sectional design was utilized to examine the fundamental process behind IC's impact on the Firm's financial performance. Nevertheless, causation between constructs cannot be revealed by cross-sectional design. In order to determine more precise causal links and investigate any potential time lag effects of intellectual capital formation, future studies may carry out longitudinal investigations. Secondly, the study was carried out within the framework of IT companies in Pakistan.

Compared to other industries, the correlations between IC, innovation speed, and firm performance may be higher in the IT sector because these sectors are typically knowledge-intensive and innovation-oriented. It is advised that to verify the accuracy of our research findings, data from other businesses be gathered in subsequent studies. Third, by concentrating on financial performance, this study explores the underlying process relating to intellectual capital. Managers assess such constructs' scale elements arbitrarily. More objective measurements of firm performance might be required for future research.

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