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Structural Equation Modeling of the Relationships Between Intellectual Capital, Psychological Capital, and Human Resource Productivity

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A B S T R A C T

Objective: The purpose of this study was to investigate the interrelationships among intellectual capital, psychological capital, and human resource productivity in the banking sector.

Methods and Materials: The research employed a cross-sectional survey design using structural equation modeling (SEM). The statistical population consisted of managers of Parsian Bank branches in Tehran, from which 287 individuals were selected through simple random sampling. Data were collected using three instruments: Bontis's Intellectual Capital Questionnaire, Luthans's Psychological Capital Questionnaire, and a researcher-developed Human Resource Productivity Questionnaire. Reliability was confirmed with Cronbach's alpha coefficients above acceptable thresholds, and validity was verified by expert review. Data analysis was performed using SPSS and LISREL, with model fit assessed through indices such as RMSEA, GFI, and AGFI.

Findings: The results revealed that intellectual capital significantly and positively influenced human resource productivity. Among its components, human capital exerted the strongest effect (path coefficient = 0.37), followed by structural capital (0.29) and relational capital (0.23). In addition, psychological capital had a positive and significant impact on human resource productivity, with a standardized coefficient of 0.32. All path coefficients were statistically significant (t-values > 1.96), confirming the robustness of the relationships. Goodness-of-fit indices indicated that the proposed structural model adequately fit the data, with RMSEA = 0.077, GFI = 0.90, and AGFI = 0.89.

Conclusion: The study underscores the dual importance of intellectual capital and psychological capital as complementary intangible resources that jointly enhance human resource productivity. By investing in knowledge-based assets and fostering positive psychological states among employees, organizations—particularly in knowledge-intensive industries like banking—can achieve sustainable improvements in productivity and competitiveness.

Keywords: *Intellectual Capital, Psychological Capital, Human Resource Productivity, Structural Equation Modeling, Organizational Performance*

1 Introduction

In the contemporary knowledge-driven economy, human resources are widely recognized as the most crucial drivers of organizational competitiveness and long-term success. The ongoing shift from traditional resource-based views of organizations toward knowledge-based paradigms highlights the centrality of intangible resources, particularly intellectual capital and psychological capital, in achieving sustained productivity and performance (Kengatharan, 2019). This transformation has altered how organizations view value creation, placing greater emphasis on innovation, adaptability, and resilience in the face of global uncertainty (Cosa et al., 2024). Accordingly, the study of the interplay between intellectual capital, psychological capital, and human resource productivity has become increasingly relevant for both academics and practitioners, especially in banking and service-oriented industries where human resources are fundamental assets.

Intellectual capital (IC) refers to the intangible knowledge-based resources that drive organizational innovation and competitive advantage. It generally encompasses three components: human capital, structural capital, and relational (or customer) capital (Pigola et al., 2022). Human capital represents employees' knowledge, skills, and competencies, which act as the foundation for value creation. Structural capital captures organizational systems, processes, and intellectual property that support knowledge sharing and efficiency. Relational capital involves networks, customer relationships, and external partnerships, which are essential for business continuity and reputation (Ognjanović et al., 2022).

The significance of IC has been repeatedly confirmed in empirical research. For example, IC has been shown to significantly enhance firm performance by strengthening innovation capacity and organizational adaptability (Anam, 2024). Similarly, studies demonstrate that IC is critical for improving employee performance and engagement, particularly under conditions of environmental uncertainty (Faridi et al., 2022). These findings suggest that intellectual capital, beyond its intangible nature, is a measurable and actionable resource that can be strategically developed to boost organizational outcomes.

Recent meta-analyses have reinforced these conclusions, showing that all three dimensions of IC contribute positively to performance across industries (Pigola et al., 2022). Moreover, systematic reviews highlight the need for organizations to adopt integrated models of IC assessment to ensure resilience in uncertain times (Cosa et al., 2024). These insights provide a theoretical basis for examining the role of IC in enhancing human resource productivity within dynamic and competitive contexts such as the financial sector.

While intellectual capital focuses on organizational and collective resources, psychological capital (PsyCap) emphasizes the positive psychological states of individuals. Defined by hope, efficacy, resilience, and optimism, PsyCap represents a higher-order construct of personal resources that significantly influences employee attitudes and performance (Vilariño del Castillo, 2022). Unlike traditional forms of capital, PsyCap can be developed with relatively low investment, making it an attractive resource for organizations seeking sustainable performance improvements (Hu et al., 2023).

Research consistently shows that PsyCap enhances innovative behavior (Mutonyi, 2021), fosters job satisfaction (Alshebami, 2021), and improves task performance (Al Kahtani & Sulphey, 2022). Moreover, PsyCap mediates the relationship between organizational support and job performance, suggesting that it plays a crucial role in translating supportive environments into tangible productivity gains (Hu et al., 2023). A systematic review of PsyCap research further emphasizes its antecedents, moderators, and mediators, underscoring its integrative role in workplace well-being and performance (Vilariño del Castillo, 2022).

Importantly, PsyCap has been shown to interact with other forms of capital such as social and intellectual capital. For example, self-esteem, an important psychological resource, has been found to mediate the relationship between PsyCap, academic engagement, and performance (Almurumudhe et al., 2024). These findings reveal the synergistic nature of PsyCap, which not only strengthens individual performance but also amplifies the value of organizational resources like IC.

The integration of intellectual and psychological capital offers a comprehensive framework for understanding human resource productivity. While IC provides the knowledge, skills, and structural enablers for productivity, PsyCap energizes individuals with the motivation, resilience, and optimism to apply these resources effectively (Trivedi & Srivastava, 2024). In practice, organizations that simultaneously invest in IC-enhancing HR practices and in the development of PsyCap are more likely to foster innovation and adaptability (Trivedi & Srivastava, 2024). This is particularly vital in sectors like banking, where

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knowledge intensity, service quality, and employee resilience are critical success factors.

Studies in diverse contexts affirm the interdependent roles of IC and PsyCap. For instance, research in healthcare demonstrates that both IC and PsyCap jointly enhance job performance by promoting employee engagement and organizational identification (Hu et al., 2023). In community health centers, IC and supportive work environments foster human resource engagement, which in turn drives performance (Faridi et al., 2022). Likewise, in higher education, PsyCap has been linked to innovative behavior, while IC provides the structural foundation for knowledge creation (Mutonyi, 2021). These cross-sectoral findings highlight the need to examine the integrated effects of IC and PsyCap on human resource productivity.

Human resource productivity (HRP) is increasingly viewed as a strategic driver of sustainable competitive advantage (Husain et al., 2025). Beyond traditional measures of efficiency, HRP reflects the ability of employees to contribute meaningfully to organizational goals through effective utilization of both tangible and intangible resources. HRP is not only a function of individual capabilities but also depends on the organization's capacity to harness IC and foster PsyCap (Emami et al., 2024).

Earlier work emphasized the role of leadership in shaping productive workplaces (Frank et al., 1997), while contemporary approaches stress flexible working arrangements, employee well-being, and capital development as enablers of productivity (Emami et al., 2024). In banking, HRP is particularly critical due to the sector's reliance on knowledge-intensive services and customer relationships. Effective human resource practices that build IC and PsyCap have been shown to directly impact organizational innovativeness and efficiency (Chantabutr & Wanarat, 2024).

Furthermore, intellectual capital is often recognized as a primary determinant of firm productivity, particularly when combined with supportive cultural and HR practices (Asutay & Ubaidillah, 2023). For example, in Islamic banking, IC performance has been found to strongly influence financial outcomes, reinforcing the idea that knowledge-based resources are integral to productivity and competitiveness (Asutay & Ubaidillah, 2023). This connection is echoed in the broader literature, where IC-driven innovation is regarded as a cornerstone of modern performance strategies (Trivedi & Srivastava, 2024).

The notion of the "war for talent" emphasizes the strategic importance of human resources in achieving sustainable success (Hatum, 2010). Modern organizations must not only attract and retain talented employees but also provide environments where IC and PsyCap can flourish. Strategic HR practices that enhance employee engagement, knowledge sharing, and well-being are essential to this endeavor (Al Kahtani & Sulphey, 2022). At the same time, productivity improvements are increasingly tied to leadership approaches that support employee development and capitalize on intangible assets (Husain et al., 2025).

The broader theoretical frameworks also suggest that knowledge management mediates the relationship between IC-enhancing practices and innovation (Trivedi & Srivastava, 2024). This positions IC not merely as a static resource but as a dynamic process of leveraging knowledge through supportive practices and cultures. By aligning talent management strategies with the development of IC and PsyCap, organizations can create self-reinforcing systems that continually enhance HR productivity (Chantabutr & Wanarat, 2024).

Despite extensive evidence on the independent effects of IC and PsyCap, limited research has systematically examined their joint impact on HR productivity, particularly within the banking sector. Much of the existing literature has focused on specific industries such as healthcare (Hu et al., 2023), higher education (Mutonyi, 2021), or community health services (Faridi et al., 2022), leaving a gap in understanding how these constructs interact in financial institutions. Furthermore, while meta-analyses provide broad evidence of IC's positive impact (Pigola et al., 2022), they often overlook the psychological dimensions that drive the effective utilization of IC resources.

Given the knowledge-intensive and customer-oriented nature of banking, examining the synergy between IC and PsyCap offers valuable insights for improving HR productivity. This research therefore aims to evaluate the relationships between intellectual capital, psychological capital, and human resource productivity using structural equation modeling, focusing on managers in the banking sector.

2 Methods and Materials

This research is a cross-sectional survey based on method of data collection. The statistical population of this study consists all managers of parsian bank in Tehran, Iran. Statistical population in this study is approximately equal to 382 managers based on Cochran formula and the selected sample size has been considered to be equal to 287

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individuals. These individuals will be selected based on simple random sampling. The method used in this research to gather information is use of questionnaires. Three questionnaires were used to evaluate the relation between variables and test the hypotheses of this research. The first one is bontis intellectual capital questionnaire which has been presented in 2007.

The constituent elements of each of these components (human capital, structural capital and communicational capital) were introduced and measured. Collection of these elements has taken place based on Roos and Roos (1997), Bontis (1998), Mayo (2001) and Scandia intellectual capital reports.

In a more analytical way, human capital component encompasses four elements: the element of capabilities and skills which matches education level of employees and their skills and work experience, the element of sincerity and commitment which goes back to the extent to which employees consider their goals and wishes in harmony with the organization's goals, the element of satisfaction which describes the employee satisfaction with the current reward system as well as organizational climate and Finally, the element of values and culture which shows employee attitudes toward work tasks and coworkers.

The structural capital component encompasses three elements: the element of knowledge management which is in line with the level of knowledge in the organization, quality of information systems and degree of knowledge coding, the element of organizational cultural which describes the organization's core values and in particular is the degree to which an organization allows employees to participate in decision making, the level of support shown to employees and organizational structure, and finally, the element of efficiency which is related to efficiency and trading time which occur in the organization and whether it can be improved.

The third component of intellectual capital, communicational capital, consists of two elements: the element of customer fit which shows a degree to which customers facilitate the path for organization to achieve success and the element of customer satisfaction and market-orientation. The last element shows the level of customer satisfaction with organization's services and pricing policies as well as their cooperation with the staff. It addition, it indicates the level to which the organization is trying to keep its customers satisfied.

The second questionnaire is Luthans psychological capital questionnaire in 2007 which consists of 24 questions and each subset consists of 6 items and subject responses to each item with Likert scale (strongly disagree to strongly agree). And the third questionnaire is a researcher made questionnaire about the productivity of human resources with 7 variables (Include: ability, perception, organizational support, motivation, feedback, credit and compatibility) and 26 items which will measure the productivity of human resources in sample organizations.

Questionnaires of intellectual capital and psychological capital were standard so there are no need to evaluate reliability and validity for them. But the validity of third questionnaire was approved by experts and Cronbach's alpha coefficient was used to confirm its reliability (0.796). Also, structural equation model and SPSS and LISREL were used to analyze the data.

3 Findings and Results

The adequacy of samples was tested in order to confirm whether collection of research data is appropriate for factor analysis or not. Kaiser-Meyer-Olkin (KMO) index or Bartlett's test was used for this matter. KMO index should be above 0.6 or Bartlett's test should be significant to confirm the adequacy of samples. Results of KMO-Bartlett test are shown in Table 1. KMO index shows the adequacy of samples and confidence level of zero for Bartlett's test also shows the suitability of cited factor model.

Table 1

Results of KMO-Bartlett test

Index	Value
Kaiser-Meyer-Olkin (KMO) index	0.823
Chi-square statistic	3456.34
Degrees of freedom	286
The significance level	0.005

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Before estimating the final model, it should be approved that the proposed model has been estimated properly. For this purpose, LISREL provides indexes called goodness of fit indexes which have been evaluated in this section.

In structural equation model, level of compliance of research data and conceptual model of the researches will be evaluated on one hand to find out whether there is a good fitness or not and significancy of this adjusted model will be tested on the other hand. The appropriate indicators of model include X2/df, GFI (Goodness of Fit Index) and AGFI (adjusted goodness of fit index). In this way that has good fitness level which has X^2/df smaller than 3 and GFI and AGFI close to one.

Based on the output of LISREL software, RMSEA index is equal to 0.077 and it can be said based on what was said that the model has a good fit. Other indicators of goodness of fit have been shown in Table 2. Given the fact that goodness of fit model indexes of the model show a good fit for model, it can be concluded that a good model has been estimated. Thus, the coefficients of research variables can be evaluated.

Table 2

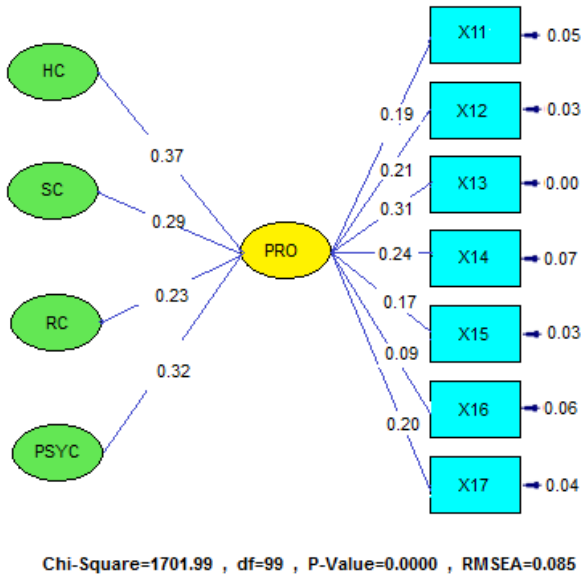
Model Fit Evaluation

Index	Abbreviation	Value
Comparative fit index	CFI	0.88
Increasing fit index	IFI	0.94
Goodness of fit index	GFI	0.90
Adjusted goodness of fit index	AGFI	0.89
Bentler Bonnet index or softened fitness	NFI	0.95

In addition, by defining the final parameters of each factor the relation between variables is estimated using LISREL software:

Figure 1

Model with Beta Values



X11: Ability, X12: Perception, X13: Organizational Support, X14: Motivation, X15: Feedback, X16: Credit, X17: compatibility, PRO: Productivity of Human Resources, PSYC: psychological capital, HC: human capital, SC: structural capital and RC: relational capital.

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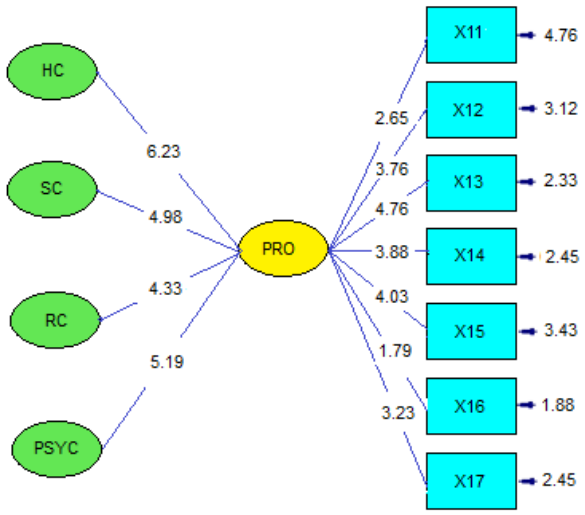
Productivity of organizational resources is affected by human capital with the ration of 0.37 and is affected by structural capital with the ration of 0.29. Also, the correlation coefficient of communication relations is 0.23. In other words, the greatest effect among intellectual capital components is related to human capital.

Also, the psychological capital has an acceptable effect on organizational resources with correlation coefficient of 0.32

The interpretation of the relation between the study variables as above is subject to the significancy of variables and model of research. Significancy of model was approved in the previous section by indicators of goodness of fit. The significancy of relation between variables will be evaluated in this section. For this purpose, T test is done to evaluate the relation between variables in the model:

Figure 2

Model with T-Values



Based on the above figure, given that all t values are more than 1.96, the relationship between all two variables at the confidence level of 95% is confirmed.

4 Discussion and Conclusion

The present study examined the relationships between intellectual capital, psychological capital, and human resource productivity among bank managers using structural equation modeling. The findings revealed that all three components of intellectual capital—human, structural, and relational capital—exert significant positive effects on human resource productivity, with human capital emerging as the strongest predictor. Additionally, psychological capital demonstrated a robust and positive influence on productivity, underscoring the dual importance of intellectual and psychological resources in enhancing organizational outcomes. Together, these results confirm the value of integrating knowledge-based and psychological perspectives to understand and improve employee productivity in knowledge-intensive sectors such as banking.

The results highlighted that human capital, encompassing employees' knowledge, skills, and competencies, had the most substantial positive effect on human resource productivity. This finding aligns with earlier scholarship that views human capital as the foundation of intellectual capital and the primary driver of organizational success (Kengatharan, 2019). Employees' intellectual abilities not only create direct value but also serve as catalysts for innovation and adaptability, which are essential in competitive service industries. The observed positive effect of structural capital—organizational processes, systems, and knowledge repositories—on productivity resonates with research showing that effective organizational infrastructure enables knowledge sharing and operational efficiency (Cosa et al., 2024; Pigola et al., 2022). Similarly, the positive role of relational capital is consistent with studies highlighting the importance of customer relationships and external

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networks in sustaining productivity and performance (Faridi et al., 2022; Ognjanović et al., 2022).

Meta-analytical findings reinforce this perspective by demonstrating that all three components of IC significantly enhance organizational performance, particularly in environments where knowledge and innovation are critical (Pigola et al., 2022). In uncertain contexts, robust frameworks for assessing IC—such as the Integrated Intellectual Capital Measurement model—are vital for organizations to systematically develop and deploy their intangible resources (Cosa et al., 2024). The evidence from this study thus supports the argument that IC is not only an intangible concept but also a strategic resource with measurable and actionable outcomes for productivity.

In addition to IC, psychological capital (PsyCap) emerged as a significant predictor of human resource productivity, confirming the growing recognition of psychological resources in organizational research. PsyCap, defined by hope, efficacy, resilience, and optimism, provides employees with the psychological strength to face challenges and maintain motivation (Vilariño del Castillo, 2022). This study's finding that PsyCap positively impacts productivity corroborates previous research across diverse contexts. For example, PsyCap has been shown to foster innovative behavior (Mutonyi, 2021), enhance job satisfaction (Alshebami, 2021), and directly improve task performance (Al Kahtani & Sulphey, 2022). Moreover, PsyCap mediates the effects of organizational support on job performance, emphasizing its role as a conduit through which external support translates into individual and organizational outcomes (Hu et al., 2023).

The significance of PsyCap is particularly pronounced in dynamic and high-pressure environments such as banking. The positive psychological states associated with PsyCap help employees cope with uncertainty, maintain performance under stress, and remain committed to organizational goals. These results also align with systematic reviews that highlight PsyCap as an integrative construct influencing both attitudinal and behavioral outcomes at work (Vilariño del Castillo, 2022). By confirming the contribution of PsyCap to productivity, the present study extends this literature to the banking sector, where psychological resilience and optimism are critical for sustaining employee effectiveness and service quality.

Perhaps the most significant implication of the study is the synergistic effect of intellectual and psychological capital on human resource productivity. Intellectual capital provides the knowledge base, skills, and organizational structures necessary for effective performance, while psychological capital energizes employees with the motivation, confidence, and resilience to leverage these resources (Trivedi & Srivastava, 2024). The integration of IC and PsyCap thus represents a holistic framework for understanding productivity, where tangible knowledge resources and intangible psychological strengths interact to create sustainable performance outcomes.

Empirical studies in related contexts support this integrative perspective. For instance, in healthcare settings, both IC and PsyCap have been shown to jointly enhance job performance by promoting employee engagement and organizational identification (Hu et al., 2023). In higher education, PsyCap fosters innovative behavior, while IC provides the structural foundation for knowledge creation and dissemination (Mutonyi, 2021). Similarly, in community health centers, IC combined with supportive work environments fosters employee engagement and drives organizational performance (Faridi et al., 2022). These findings converge with the results of the present study, confirming that organizations must simultaneously develop intellectual and psychological resources to maximize productivity.

The positive associations found in this study reaffirm the strategic importance of human resource productivity as a foundation for competitive advantage. Productivity in this context extends beyond efficiency to encompass employees' ability to contribute innovatively and meaningfully to organizational objectives (Husain et al., 2025). Leadership and organizational culture play central roles in shaping this productivity. Earlier work emphasized leadership's role in fostering effective work environments (Frank et al., 1997), while more recent studies stress flexible working arrangements and well-being as enablers of higher productivity (Emami et al., 2024). The results of this study demonstrate that IC and PsyCap development strategies are crucial mechanisms through which such productivity can be realized.

In banking specifically, knowledge intensity and customer orientation make HR productivity a decisive factor for competitiveness. Research on Thai banks, for example, demonstrates that human capital and employee performance directly drive sustainable competitive advantage through improvements in work processes and productivity (Chantabutr & Wanarat, 2024). Likewise, studies in Islamic banking confirm that IC strongly influences financial performance, illustrating that productivity is closely linked to the strategic management of intangible resources (Asutay

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& Ubaidillah, 2023). These findings echo the results of the present study, which underscores that the interplay of IC and PsyCap is indispensable for enhancing productivity in the financial sector.

The results also resonate with broader discussions on talent management and knowledge-based practices. The "war for talent" emphasizes the importance of identifying, attracting, and retaining skilled employees to achieve long-term success (Hatum, 2010). However, talent alone is insufficient unless organizations provide environments that cultivate IC and PsyCap. Strategic HR practices that enhance employee engagement, support knowledge sharing, and nurture positive psychological states are essential in this regard (Al Kahtani & Sulphey, 2022).

Knowledge management processes further mediate the relationship between IC-enhancing practices and innovation, highlighting the dynamic nature of IC as a resource (Trivedi & Srivastava, 2024). In this sense, IC is not simply a static repository of knowledge but a set of practices and systems that enable employees to continuously create, apply, and refine knowledge. When combined with PsyCap, these practices foster a culture of innovation, resilience, and adaptability, all of which are vital for sustaining productivity in the face of change and uncertainty.

Theoretically, this study contributes to the literature by integrating intellectual and psychological capital into a single model of human resource productivity. Previous research often examined these constructs separately, with IC studies focusing on organizational knowledge resources (Cosa et al., 2024; Pigola et al., 2022) and PsyCap studies emphasizing individual psychological states (Hu et al., 2023; Vilariño del Castillo, 2022). By demonstrating their complementary effects, this research advances a more holistic understanding of the intangible factors that drive productivity.

Practically, the findings underscore the importance for managers and policymakers of investing in both IC and PsyCap. Human capital development through training, talent management, and knowledge sharing must be complemented by initiatives that build employees' resilience, optimism, and confidence. Such integrated strategies not only enhance productivity but also create organizational cultures that support long-term innovation and competitiveness.

Although the study provides valuable insights, several limitations must be acknowledged. First, the research is limited to managers of bank branches in Tehran, which may constrain the generalizability of findings to other sectors or cultural contexts. Second, the use of self-reported questionnaires introduces the possibility of response bias, as participants may have provided socially desirable answers. Third, the cross-sectional design of the study precludes definitive conclusions about causality between intellectual capital, psychological capital, and productivity. Finally, while structural equation modeling provides robust analytical insights, the complexity of human resource dynamics suggests that additional qualitative approaches could yield deeper understanding of the underlying mechanisms.

Future research could expand the scope of this study in several directions. Comparative studies across different industries—such as healthcare, education, and technology—would help clarify whether the observed relationships hold consistently or vary by sectoral context. Longitudinal research designs would also be valuable to establish causal relationships and capture the dynamic evolution of IC, PsyCap, and productivity over time. Additionally, future studies could incorporate moderating and mediating variables such as leadership styles, organizational culture, or digital transformation to enrich the explanatory power of the models. Finally, mixed-method approaches that combine quantitative modeling with qualitative interviews or case studies could provide a more nuanced understanding of how IC and PsyCap interact to influence productivity.

From a practical standpoint, managers should design integrated strategies that simultaneously enhance intellectual and psychological capital. Investment in training programs, knowledge management systems, and structural improvements should be accompanied by interventions that develop resilience, optimism, and self-efficacy among employees. Leaders should foster inclusive and supportive organizational cultures that enable both knowledge sharing and psychological growth. Banking institutions in particular should recognize that customer trust and service quality are closely linked to employees' intellectual competence and psychological well-being. By prioritizing these intangible resources, organizations can strengthen their competitive positions and ensure long-term productivity gains.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

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In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

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