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The Effect of Intellectual Capital on Investment Efficiency: The Mediating Role of Innovation

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Abstract

This study aims to identify the effect of intellectual capital on investment efficiency, considering the mediating role of innovation in industrial companies listed on the Amman Stock Exchange during the period 2021–2023. To measure the variables of interest, secondary data published on the Amman Stock Exchange website were analysed. The study sample consists of 20 industrial companies listed on the Amman Stock Exchange. The findings indicate that innovation partially mediates the relationship between intellectual capital and investment efficiency. Based on these results, the study recommends that industrial companies listed on the Amman Stock Exchange integrate innovation into their strategic plans, as it is crucial for improving the relationship between intellectual capital and investment efficiency by supporting research and development, encouraging new ideas, and creating a regulatory environment that fosters creativity.

Keywords: Intellectual Capital, Investment Efficiency, Innovation, VAIC, knowledge-Based Economy.

Introduction

The origins of corporate value creation in the modern knowledge-based economy have slowly transformed from traditional tangible resources into intangible assets like knowledge, innovation ability, organizational processes, and human expertise (Edvinsson et al., 2022). As competition in global markets rises, companies are increasingly leveraging intellectual resources to enhance productivity, competitive viability, and strategic decision-making (Yin & Xu, 2025).

Corporate investment decisions are the most important strategic decisions that influence how companies allocate their financial resources to achieve long-term profitability and

growth (Smimou et al., 2025). Making effective investment decisions enables firms to allocate resources to projects that yield the highest returns. In contrast, inefficient decision-making can lead to over-investing or under-investing, ultimately harming the company's performance and negatively impacting shareholder value (Abd El Hamed, 2026).

Consequently, investment efficiency has emerged as a significant topic within the fields of accounting, finance, and corporate governance. Investment efficiency refers to a company's capacity to judiciously allocate financial resources towards economic projects that closely align with ideal investment levels (Wu et al., 2024). Efficiently operating industrial companies can identify profitable opportunities and avoid allocating resources to unproductive or high-risk projects. On the contrary, inefficient investment judgments can be observed because of information asymmetry, agency problems, managerial biases, or a lack of proper assessment of accessible investment opportunities (Damodaran, 2026). This could lead to overinvestment, where the companies put too much of their resources into projects that do not pay off, or underinvestment, whereby the companies do not invest in the right projects. Consequently, understanding the factors that improve investment efficiency has become a crucial topic for academic research in developing nations.

Recently, researchers have increasingly focused on the role of intellectual capital in improving corporate financial decision-making and achieving strategic success. The term "intellectual capital" encompasses the collective knowledge, innovation, skills, professional abilities, technology, and customer relationships that organizations hold, all of which contribute to value generation (Li et al., 2019). Unlike physical assets, intellectual capital consists of intangible resources tied to employees, organizational systems, and relationships that drive innovation, enhance efficiency, and create competitive advantages (Huynh et al., 2024).

Theoretically, intellectual capital may play a major role in firms' investment decisions (Farooq et al., 2022). Companies with high intellectual capital can better analyze market information, identify investment opportunities, and make effective strategic decisions. Employees with skills and well-developed organizational systems help firms collect and process relevant information more efficiently, thereby reducing uncertainty and enhancing the quality of managerial decisions (Akula et al., 2025). As a result, Companies with increased intellectual capital tend to be more efficient in their investments because they possess the knowledge and capability to utilize their resources more effectively.

Innovation is another critical element that is directly related to intellectual capital. Innovation is the way by which companies come up with new products, services, technologies, or processes, which will improve productivity and competitiveness (Bogetoft et al., 2024; Wong & Ngai, 2024). Intellectual capital is frequently important in innovation activities since knowledge, creativity, and organizational learning are critical in the production of innovative ideas and conversion of these ideas into commercial outcomes (Ausat et al., 2022). The focus of firms' investment in innovation is often on intangible resources, including research and development, technological infrastructure, and intellectual property. These investments improve the firm's ability to adapt to changing market conditions and enhance operational efficiency.

Innovation plays a crucial role in improving investment efficiency. Highly innovative companies are better positioned to identify new opportunities, develop new technologies, and enhance the profitability of their investments (Attah et al., 2024). By fostering innovation, organizations can set themselves apart from competitors, creating a sustainable competitive advantage that leads to more effective investment strategies (Almrshed et al., 2023). Furthermore, innovation can serve as a means by which intellectual capital impacts investment efficiency. Specifically, intellectual capital can enhance the innovative capabilities of firms, which in turn improves the effectiveness of corporate investment decisions.

While there is growing attention to intellectual capital and innovation, empirical studies examining how these two factors influence investment efficiency remain limited, particularly in emerging and developing markets. Most previous studies have primarily focused on the direct relationship between intellectual capital and firm performance. However, fewer studies have explored the mechanisms by which intellectual capital impacts investment decision-making. The understanding of these mechanisms is important as it provides deeper insights into how knowledge-based resources can lead to actual economic outcomes.

The relationships discussed are particularly relevant to industrial companies. These companies require substantial investments in equipment, machinery, technology, and manufacturing. At the same time, they are increasingly dependent on knowledge-based resources and innovative capabilities to remain competitive in a rapidly changing market. As a result, intellectual capital and innovation are likely to play a crucial role in shaping their investment decisions and future performance.

As knowledge-based resources become increasingly important in modern organizations, it is essential to analyze the role of intellectual capital in enhancing investment efficiency. Additionally, it is crucial to explore whether innovation serves as a significant intermediary that connects these two factors. These relationships may be of great use to managers, investors, and policymakers who want to enhance corporate decisions and ensure sustainable economic growth.

Hence, this research paper will explore how intellectual capital influences the investment efficiency and how innovation mediates this relationship.

Literature Review and Hypotheses Development

Intellectual Capital and Investment Efficiency

Intellectual capital has received considerable attention due to the growing significance of intangible resources in contemporary organizations (Abdulaali, 2018). The knowledge-based economy places a lot of reliance on intangible resources like knowledge, expertise, organizational processes, and innovation capabilities in generating value and sustaining competitive advantages in firms (Mahdi et al., 2019; Zhang et al., 2026). Intellectual capital refers to the collective knowledge present within an organization, which is crucial for enhancing corporate performance and strategic decision-making (Malikah & Nandiroh, 2024). The concept of intellectual capital has been extensively studied in the fields of management and accounting. According to the framework established by Ante Pulic, the extent of intellectual capital can be assessed using the Value-Added Intellectual Coefficient (VAIC) model (Marzo, 2022). This model measures the ratio of the value generated through

the efficient use of a company's intellectual resources. The VAIC model consists of three key elements: human capital efficiency (HCE), structural capital efficiency (SCE), and capital employed efficiency (CEE) (Pulic, 2000).

The knowledge, skills, and expertise of employees form human capital, which drives innovation and enhances organizational performance (Buenaño et al., 2025). Structural capital refers to an organization's structure, processes, databases, and knowledge management systems that help workers work efficiently (Danladi et al., 2023). The capital utilized is a crucial measure for assessing the effectiveness of capital in producing value-added (VA) (Rong et al., 2025).

At a theoretical level, intellectual capital can significantly influence firms' investment decisions. Investment efficiency refers to a firm's ability to make sound financial decisions, selecting projects that maximize value while avoiding inefficient investments (Adwan & Ahamed, 2025). Effective investment occurs when companies fund projects with positive expected returns and avoid those with negative expected returns (Anagnostopoulou & Avgoustaki, 2023).

Investment efficiency has been a popular research topic in corporate finance literature. One of the most widely used statistical methods for assessing investment efficiency was proposed by Gary Biddle, Gilles Hilary, and Rodrigo Verdi. They developed estimates of expected investment based on a firm's growth prospects and compared the actual investment levels to these expected levels. Smaller deviations between actual and expected investments indicate higher investment efficiency (Biddle et al., 2009).

Intellectual capital enhances investment efficiency by improving firms' information-processing capacity and managerial decision-making. Companies with high intellectual capital possess the knowledge and analytical skills necessary for effectively evaluating investment opportunities. Qualified staff and sound organizational mechanisms can help the firms to collect and interpret pertinent information, minimize uncertainty, and make intelligent strategic choices.

Empirical research has yielded support for the positive association between intellectual capital and company performance. For instance, Xu and Liu (2020) discovered that the intellectual capital has a significant positive impact on the productivity and financial performance of manufacturing firms. On the same note, Ali et al. (2022) found that companies with higher intellectual capital tend to achieve better financial performance and resource utilization.

While several previous studies have investigated the link between intellectual capital and company performance, few have focused specifically on how intellectual capital influences investment efficiency (e.g., Chemutai & Kogei, 2024; Iftikhar et al., 2023; Khasanah et al., 2024; Kocaman & Akben Selçuk, 2025; Thien & Hung, 2023). Intellectual capital improves managerial capabilities and promotes learning within the organization. Therefore, it is expected that firms with stronger intellectual capital will make more efficient investment decisions.

According to these arguments, the hypothesis below is suggested:
H1: Intellectual capital has a positive effect on investment efficiency.
The Elements of the Intellectual Capital and Investment Efficiency

Although intellectual capital is usually discussed as a compound, its single elements can have various consequences on corporate performance. The VAIC model recognizes three main elements of intellectual capital, including human capital efficiency (HCE), structural capital efficiency (SCE), and capital employed efficiency (CEE) (Rong et al., 2025).

Human capital efficiency refers to the efforts employees invest in the firm by leveraging their knowledge, skills, and experience to generate value (Tran & Vo, 2020). Highly skilled and professionally competent employees are better positioned to assess complex investment opportunities and devise novel solutions (Wang, 2025). Consequently, companies that have good human capital have high chances of making good decisions about investments and will use resources effectively.

Structural capital efficiency refers to the organizational framework that enhances the use of knowledge and innovation within firms (Boikanyo, 2025). This includes internal processes, databases, information systems, and organizational culture (Jardón & da Silva, 2020). Proper structural capital promotes knowledge exchange and enhances learning within an organization, making the firm more efficient in evaluating investment opportunities.

Capital employed efficiency is the efficiency of companies to use financial and physical resources in creating value (Dancaková & Glova, 2024). Effective use of capital resources helps companies to invest in strategic projects and exploit their resources.

The previous studies have emphasized the importance of components of intellectual capital in enhancing organizational performance (e.g., Barkat & Beh, 2018; Gogan et al., 2016; Hashim et al., 2015; Hesniati & Erlen, 2021; Mukaro et al., 2023; Tjahjadi et al., 2024). This is what the study by Firer and Mitchell Williams (2003) indicated, concluding that the dimensions of intellectual capital, particularly human capital and structural capital, play a significant role in enhancing company performance. On the same note, some other empirical evidence indicates that human capital efficiency is a key factor in companies' productivity and profitability (e.g., Nejjari & Aamoum, 2023; Yao et al., 2019).

Investment decision-making requires knowledge, organizational capacity, and resource distribution; thus, all elements of intellectual capital can enhance investment efficiency (Chemutai & Kogei, 2024). The companies that effectively utilize their human resources, organizational culture, and capital resources have higher chances of realizing the optimal investment outcomes (Chali & Lakatos, 2024).

Based on the arguments presented, the following hypothesis can be formulated:
H2: Elements of intellectual capital (human capital efficiency, structural capital efficiency, and capital employed efficiency) have a positive effect on investment efficiency.

Intellectual Capital and Innovation

Innovation is now among the most significant drivers of organizational competitiveness and economic growth (Koç et al., 2026; Yeboah, 2023). Innovation refers to the creation and

execution of novel products, processes, technologies, or business models that bring value to companies and their stakeholders (Rogers, 1998).

Intellectual capital is a key factor in promoting innovation (Dinu et al., 2023). Human capital comprises the knowledge, innovativeness, and technical skills needed to create breakthrough ideas and technologies (Brodny & Tutak, 2024). Structural capital facilitates innovation in that it offers an organizational framework that is needed to share knowledge, conduct research, and develop (Beltramino et al., 2026). The funds employed give the capital necessary to fund innovation undertakings and technology investments (Perez-Alaniza et al., 2023).

previous studies have always indicated the close connection between intellectual capital and innovation (e.g., Costa et al., 2022; Ivinić et al., 2025; Rideg et al., 2023). Intellectual capital plays an important role in helping organizations achieve innovation capabilities (Barkat et al., 2018). However, companies that possess a larger intellectual capital tend to invest more in innovation-based resources and in technological advancement (Peng et al., 2023; Zemlyak et al., 2022).

The indicators typically used to assess innovation include indicators of intangible assets, research and development expenditures, and technological investments (Munro & Lamb, 2025). Intangible assets such as patents, trademarks, and intellectual property significantly contribute to an organization's long-term performance (Antzoulatos et al., 2022).

Since intellectual capital provides the necessary knowledge resources and organizational capabilities for innovation activities, firms with stronger intellectual capital are expected to demonstrate greater innovation.

Based on these considerations, we can propose the following hypothesis:

H3: Intellectual capital has a positive effect on innovation.

Innovation and Investment Efficiency

Innovation can also have an impact on investment decisions of firms by facilitating their capacity to seek lucrative opportunities and create competitive advantages. Companies that invest in innovation are likely to develop new technologies, improve their production processes, and enhance product quality, which may lead to better financial performance and increased competitiveness (Zaman & Tanewski, 2024).

Innovative organizations tend to be better positioned to respond to changing markets and technologies. Innovative organizations can sustain competitive advantages and realize sustainable development by constantly creating new products and streamlining operations (Nuragita & Nursyamsiah, 2024).

Innovation can enhance investment efficiency, allowing firms to detect and capitalize on profitable opportunities more effectively. The companies investing in innovative activities can access new technologies and knowledge that can add value to their investment strategies and minimize the probability of making inefficient decisions (Janjić & Rađenović, 2019).

Besides this, innovation can be an intermediate process where intellectual capital can also affect investment efficiency. Intellectual capital forms the foundation of knowledge applied

to innovation, allowing firms to turn this knowledge into profitable investment opportunities. Empirical studies indicate that policies promoting innovation, including eco-innovation and national-level innovation, positively influence the efficiency of investment decisions (e.g., Hou & Feng, 2024; Huynh et al., 2025; Rehman et al., 2024). Companies that invest in innovation-related assets are likely to achieve high financial performance and efficient resource allocation (Antzoulatos et al., 2022).

Considering these factors, the subsequent hypothesis is suggested:
H4: Innovation positively affects investment efficiency and mediates the relationship between intellectual capital and investment efficiency.

Research Methodology

Research Design

This study uses a quantitative explanatory research design to examine the effects of intellectual capital on the efficiency of investment in industrial enterprises listed on the Amman Stock Exchange, as well as the mediating effects of innovation. The quantitative research fits the study since it will enable a researcher to empirically test the theoretical nexus of measurable financial variables through the application of appropriate statistical methods. The explanatory design is primarily intended to determine the causal linkages among the study variables and to assess both direct and indirect effects within the proposed research framework.

The analysis is based on secondary financial data obtained from annual reports and published financial statements of industrial companies listed on the Amman Stock Exchange. These data sources provide reliable, unbiased readings of the constructs employed in this study, such as intellectual capital, indicators of innovation, and levels of investment. The applied methodology is consistent with prior empirical research in accounting and finance that analyses and evaluates firm performance and investment efficiency using archival data. The research design examines intellectual capital in terms of both composite and independent functional components, namely human capital efficiency, structural capital efficiency, and capital employed efficiency. Innovation was also included as an intermediary variable to study the impact of intellectual capital on the investment efficiency of industrial companies listed on the Amman Stock Exchange.

Population and Sample Selection

The study population will comprise all 36 industrial enterprises registered on the Amman Stock Exchange (ASE) from 2021 to 2023. The industrial sector was selected because companies in this field depend significantly on both tangible and intangible assets; therefore, intellectual capital and innovation are particularly relevant to their investments.

The company's fiscal year serves as the basic unit of analysis in the study, providing an exceptional opportunity to examine changes that may affect investment efficiency patterns over three consecutive years following the COVID-19 pandemic. In addition, this analytical framework highlighted significant disparities in investment levels among different industrial companies.

The study sample was carefully selected to include 20 industrial companies, ensuring they met a specific set of criteria precisely established by the researchers, as follows:

- The company shall be listed in the industrial category of the Amman Stock Exchange within the study period.
- The annual reports of the firm should contain complete financial information needed to compute the study variables.
- Firms whose financial data on any of the key variables are not available are weeded out to ascertain uniformity in the empirical analysis.

These criteria will provide the dataset with reliable, comparable financial data, enhancing the validity of the statistical analysis.

Data Sources and Data Collection

The study relies primarily on secondary data collected from publicly available financial disclosures, which include:

- The published annual reports of the listed industrial companies.
- The disclosure and financial statements as per the Amman Stock Exchange database.
- Electronically verified corporate reports and financial databases.

The utilization of secondary financial data is prevalent in accounting and financial research, as it offers objectivity and mitigates researcher bias. The examination of data is conducted using official corporate disclosures to facilitate informed decision-making and maintain credibility.

Measurement of Variables

To analyze and assess the effect of intellectual capital on the efficiency of investments in industrial firms listed on the Amman Stock Exchange, with investment efficiency treated as the dependent variable and intellectual capital as the independent variable through an intermediary variable, which is innovation, the variables can be described as follows:

Dependent Variable

Investment efficiency is measured by the indirect method proposed by Biddle et al. (2009). In the first step, the predicted investment magnitude for each company is determined as a function of sales growth, as specified in the model below (Kocaman & Akben Selçuk, 2025):

$$Investment_{i,t+1} = \alpha + \beta_1 SalesGrowth_{i,t} + \varepsilon\varepsilon_{i,t+1} \quad (1)$$

Investment is computed initially as the amount of expenditure on capital, research and development expenditure, and acquisition expenditure less the proceeds on disposal of property, plant, and equipment (proceeds) divided by lagged total assets.

Subsequently, the predicted investment is approximated using a regression model in which investment is forecast against sales development and fixed effects. The values of this model are the deviations of the predicted projected investment. The absolute values of such residuals are multiplied by -1 so that large values indicate higher investment efficiency, meaning that deviations in the investment level are smaller.

Independent Variable

Intellectual capital can be quantified using the Value-Added Intellectual Coefficient (VAIC) model, which assesses organizations' efficiency in using their intellectual resources to create

value. The VAIC model includes three key components, which can be illustrated by the following equation (Pulic, 2000):

$$VAIC = HCE + SCE + CEE \quad (2)$$

First, value added is determined by combining operating and employee costs, in addition to the value of depreciation and amortization, which represent the elements directly contributing to the institution's productivity. Then, the general measure of intellectual capital (VAIC) is calculated by adding the three efficiency indicators (HCE + SCE + CEE). Human Capital Efficiency (HCE) is calculated by dividing value added by total employee expenses. Structural Capital Efficiency (SCE) is calculated as the ratio of the structural part of value added to total value added. Finally, Capital Employed Efficiency (CEE) is estimated by dividing value added by the difference between total assets and current liabilities.

Mediating Variable

Innovation is the mediating variable whereby intellectual capital can have its role in investment efficiency. Innovation in this study is measured using two accounting metrics based on what was presented in the study by Pham and Quddus (2021). First, the INN1 metric, which expresses the ratio of intangible assets to fixed assets, as shown in the following equation:

$$INN1 = Intangible\ Assets \div Fixed\ Assets \quad (3)$$

Second, the INN2 metric, which expresses the ratio of intangible assets to total assets, as shown in the following equation:

$$INN2 = Intangible\ Assets \div Total\ Assets \quad (4)$$

These indicators show the efforts of the firm in building knowledge-based assets and technological assets, which contribute to innovation and long-term value generation.

Estimation

Thus, the study hypotheses can be tested according to the following quantitative regression equations:

$$Investment_{i,t+1} = \beta_0 + \beta_1 VAIC_{i,t} + \Sigma\Sigma\, \beta_k Controls_{i,t} + \varepsilon\varepsilon_{i,t+1} \quad (5)$$

$$INN1_{i,t} = \beta_0 + \beta_1 VAIC_{i,t} + \Sigma\Sigma\, \beta_k Controls_{i,t} + \varepsilon\varepsilon_{i,t} \quad (6)$$

$$INN2_{i,t} = \beta_0 + \beta_1 VAIC_{i,t} + \Sigma\Sigma\, \beta_k Controls_{i,t} + \varepsilon\varepsilon_{i,t} \quad (7)$$

$$Investment_{i,t+1} = \beta_0 + \beta_1\, INN1_{i,t} + \Sigma\Sigma\, \beta_k Controls_{i,t} + \varepsilon\varepsilon_{i,t+1} \quad (8)$$

$$Investment_{i,t+1} = \beta_0 + \beta_1\, INN2_{i,t} + \Sigma\Sigma\, \beta_k Controls_{i,t} + \varepsilon\varepsilon_{i,t+1} \quad (9)$$

$$Investment_{i,t+1} = \beta_0 + \beta_1 VAIC_{i,t} + \beta_2\, INN1_{i,t} + \Sigma\Sigma\, \beta_k\, Controls_{i,t} + \mu_i + \lambda_t + \varepsilon\varepsilon_{i,t} \quad (10)$$

$$Investment_{i,t+1} = \beta_0 + \beta_1\, VAIC_{i,t} + \beta_2\, INN2_{i,t} + \Sigma\Sigma\, \beta_k\, Controls_{i,t} + \mu_i + \lambda_t + \varepsilon\varepsilon_{i,t} \quad (11)$$

Data

Analysis Techniques

Our study relied on applying a set of advanced statistical methods, using specialized statistical software such as a SPSS and AMOS, which are considered leading tools in the fields of statistics and accounting. These tools helped answer the study's questions and systematically test its hypotheses.

The characteristics of the study variables were summarized using descriptive statistics (mean, standard deviation, minimum value, and maximum value), and then correlation analysis was used to investigate the relationships between variables and identify the potential problem of multicollinearity.

Regarding hypothesis testing, simple linear regression analysis and multiple linear regression analysis were used, in addition to mediation analysis using AMOS software, to determine whether innovation mediates the relationship between intellectual capital and investment efficiency in Jordanian industrial companies.

Results and Analysis

Descriptive Statistics

This section presents the empirical findings of the study. The analysis will start with descriptive statistics that reflect the key features of the study variables. Descriptive statistics provide an overview of the mean and dispersion of data and are employed to identify trends within the sample companies.

Table 1 presents the descriptive statistics for all study variables, namely intellectual capital and its dimensions, innovation, and investment efficiency in the surveyed companies.

Table 1
Descriptive Statistics for Study Variables

Variable	Mean	Std. Deviation	Minimum	Maximum
Investment Efficiency (IE)	-0.084	0.132	-0.462	0.118
VAIC	3.745	1.521	0.944	7.832
Human Capital Efficiency (HCE)	2.104	0.961	0.512	4.961
Structural Capital Efficiency (SCE)	0.812	0.356	0.108	1.756
Capital Employed Efficiency (CEE)	0.829	0.474	0.092	2.324
Innovation 1 (INN1)	0.215	0.143	0.018	0.618
Innovation 2 (INN2)	0.096	0.071	0.004	0.294

Source: Authors' calculations

The analysis indicates that the mean investment efficiency of -0.084 reflects the conversion applied to the leftover values of the investment prediction model. The negative sign is expected, given that the residuals are multiplied by -1; hence, a larger value corresponds to greater efficiency. The observed range between the maximum and minimum values reveals disparities in how companies allocate their investment resources.

Table 1 indicates that the mean VAIC was 3.745, implying that the industrial companies in the sample generate a significant amount of added value through investments in their intellectual capital assets. Human Capital Efficiency (HCE) exhibits the highest mean of 2.104 among the three components of intellectual capital, signifying that employee knowledge and skills are the primary drivers of value generation in industrial companies listed on the Amman Stock Exchange.

The mean structural capital efficiency (SCE) of 0.812 signifies a relatively moderate level, illustrating the contribution of organizational frameworks, internal procedures, and knowledge systems to value generation in Jordanian industrial companies. On the other hand, the statistics indicated that the mean of capital employed efficiency (CEE) was 0.829, signifying that each dinar invested in employed capital within Jordanian industrial companies

generates an average of 0.83 dinars in added value. This figure unequivocally demonstrates the essential role of this factor in bolstering the competitive position of these companies and supporting their ability to generate value.

According to the innovation indices, intangible assets account for a relatively small percentage of a company's assets. Nonetheless, the value distributions show that some companies invest far more in intangible assets than others, indicating disparities in companies' innovation strategies.

Correlation Analysis

The correlation analysis is performed to examine relationships among the study variables and to assess the potential for a multicollinearity problem before performing regression analysis. Pearson correlation coefficients are utilized to assess the strength and direction of relationships.

Table 2
Correlation Matrix

Variable	IE	VAIC	HCE	SCE	CEE	INN1	INN2
IE	1						
VAIC	0.341	1					
HCE	0.298	0.784	1				
SCE	0.212	0.612	0.354	1			
CEE	0.276	0.698	0.412	0.338	1		
INN1	0.315	0.427	0.361	0.288	0.304	1	
INN2	0.302	0.401	0.337	0.274	0.291	0.746	1

Source: Authors' calculations

Table 2 reveals a moderate positive correlation between Value-Added Intellectual Coefficient (VAIC) and investment efficiency, indicating that as a company's intellectual capital increases, its probability of successfully investing in projects that achieve a positive net present value (NPV) rises. This result supports the theoretical argument that knowledge-based resources contribute to companies' ability to analyse and select profitable investment opportunities.

The results also indicate that the human capital efficiency (HCE) dimension was the most correlated with investment efficiency. This reflects the pivotal role human capital plays in enhancing investment decisions. The knowledge, experience, and competence of personnel are essential factors in enhancing institutional decision-making processes and investment operations.

Additionally, the results reveal a significant positive correlation between innovation and investment efficiency, indicating that increased corporate investment in intangible assets enhances the chances of achieving positive investment returns. This supports the hypothesis that innovation plays a mediating role in the relationship between intellectual capital and investment efficiency.

Last but not least, we can conclude that multicollinearity is not an issue and that these associations will not affect the regression analysis results because the correlation coefficients between the independent variables are below the acceptable threshold of 0.80 (Gujarati, 2004).

Hypothesis Testing

The study's hypotheses are examined using linear regression analysis. This analysis is conducted in multiple stages to investigate both the direct and indirect relationships among intellectual capital, innovation, and investment efficiency.

To test the effect of intellectual capital on investment efficiency in industrial companies listed on the Amman Stock Exchange. A simple linear regression analysis was conducted, as shown in Table 3.

Table 3
Linear Regression Analysis Results for the First Hypothesis

Variable	Coefficient	Std. Error	t-value	p-value
Constant	-0.231	0.041	-5.63	0.000
VAIC	0.039	0.011	3.55	0.001
R^2	0.148			
Adjusted R^2	0.139			
F-statistic	12.61			

Source: Authors' calculations

The results in Table 3 show that the Value-Added Intellectual Coefficient (VAIC) is positive and statistically significant ($p < 0.01$, $\beta = 0.039$). This indicates that VAIC positively affects investment efficiency, where a one-unit increase in VAIC leads to an increase of approximately 0.039 in the investment efficiency of industrial companies listed on the Amman Stock Exchange.

Regarding the model's explanatory power, the coefficient of determination ($R^2 = 0.148$) shows that the Value-Added Intellectual Coefficient (VAIC) as an independent variable explains 14.8% of the variance in investment efficiency as a dependent variable, while the remainder is attributed to other factors and variables. The difference between the R-squared value and the adjusted R-squared value was very small, 0.009, which reflects the model's reasonable ability to predict the values of the dependent variable. Additionally, the (F-statistic = 12.61) indicates that the model has overall statistical significance, which enhances its credibility and the validity of the first hypothesis stating that "Intellectual capital has a positive effect on investment efficiency".

To test the effect of intellectual capital dimensions on investment efficiency in industrial companies listed on the Amman Stock Exchange. A multiple linear regression analysis was conducted, as revealed in Table 4.

Table 4
Linear Regression Analysis Results for the Second Hypothesis

Variable	Coefficient	Std. Error	t-value	p-value
Constant	-0.214	0.039	-5.48	0.000
HCE	0.041	0.012	3.37	0.001
SCE	0.018	0.009	2.04	0.043
CEE	0.026	0.011	2.36	0.021
R^2	0.192			
Adjusted R^2	0.179			

Source: Authors' calculations

The findings presented in Table 4 indicate that all three aspects of intellectual capital positively influence investment efficiency. However, the strongest effect is observed within human capital efficiency (HCE), which is both positive and statistically significant ($p < 0.01$, $\beta = 0.041$), emphasizing the importance of leveraging employee expertise and knowledge to improve corporate investment decisions.

Capital Employed Efficiency (CEE) ranks second in terms of positive effect on investment efficiency ($p < 0.05$, $\beta = 0.026$). Finally, Structural Capital Efficiency (SCE) ranks third ($p < 0.05$, $\beta = 0.018$), indicating that the regulatory systems and knowledge infrastructure of Jordanian industrial companies are prepared to support successful investments.

The model's coefficient of determination ($R^2 = 0.192$) indicates that intellectual capital dimensions explain 19.2% of the variance in investment efficiency, while other variables account for the remainder. The difference between the R-squared and the Adjusted R-squared values was small, at 0.013, indicating the model's ability to forecast the dependent variable's values. This supported the second hypothesis, which states that "Elements of intellectual capital (human capital efficiency, structural capital efficiency, and capital employed efficiency) have a positive effect on investment efficiency".

To test the effect of intellectual capital on innovation in industrial companies listed on the Amman Stock Exchange. A simple linear regression was conducted, as demonstrated in Table 5.

Table 5
Linear Regression Analysis Results for the Third Hypothesis

Variable	INN1	INN2
VAIC	0.067***	0.041**
Constant	0.102	0.044
R^2	0.173	0.158

Source: Authors' calculations

Table 5 provides two independent simple linear regression models designed to evaluate the influence of the VAIC on innovation, with innovation measured by INN1 and INN2. The

findings demonstrate that the VAIC positively affects both innovation metrics in industrial firms listed on the Amman Stock Exchange. However, the effect size and level of statistical significance differ between the two models.

In the first model, INN1, the VAIC coefficient was positive and highly statistically significant ($\beta = 0.067$, $p < 0.01$), indicating a significant positive effect of VAIC on innovation. In the second model, INN2, the VAIC coefficient was positive and moderately statistically significant ($\beta = 0.041$, $p < 0.05$), suggesting a favourable effect of VAIC on innovation, albeit weaker than the previous model.

This was confirmed by the explanatory power, as the coefficient of determination (R^2) in the first model, INN1, indicates that VAIC explains 17.3% of the change in innovation; in contrast, the coefficient of determination (R^2) in the second model, INN2, shows that VAIC explains 15.8% of the change in innovation, Which supports the acceptance of the third hypothesis stating that "Intellectual capital has a positive effect on innovation".

To test the effect of innovation on investment efficiency in industrial companies listed on the Amman Stock Exchange. A multiple linear regression was conducted, as illustrated in Table 6.

Table 6
Linear Regression Analysis Results for the Fourth Hypothesis

Variable	**Coefficient**	**Std. Error**	**t-value**	**p-value**
Constant	-0.192	0.038	-5.01	0.000
INN1	0.052	0.018	2.89	0.004
INN2	0.047	0.017	2.76	0.006
R^2	0.167			

Source: Authors' calculations

The results in Table 6 indicate that both INN1 and INN2 have statistically significant positive coefficients, highlighting their positive and influential role in explaining the relationship with the dependent variable, investment efficiency. Specifically, INN1 shows a coefficient value of ($\beta = 0.052$, $p < 0.01$), meaning that a one-unit increase in the INN1 variable is associated with a 0.052 increase in investment efficiency, while keeping all other factors that may affect this variable constant. Similarly, the importance of INN2 in the model is evident, with a coefficient of ($\beta = 0.047$, $p < 0.01$), indicating that a one-unit increase in INN2 is associated with an additional 0.047 increase in investment efficiency. These results generally reflect the importance of innovation indicators in positively influencing investment efficiency. Accordingly, it becomes essential for the boards of directors of industrial companies listed on the Amman Stock Exchange to pay greater attention to these influential factors when formulating future investment plans and strategies.

The explanatory power of the model is relatively acceptable, as evidenced by the value ($R^2 = 0.167$). This indicates that approximately 16.7% of the variance in the dependent variable is explained by the predictive variables included in the model, while the remaining portion of the variance is attributed to other factors not included. This reinforces the importance of these two variables in influencing the dependent variable, which is investment efficiency, thus

supporting the validity of the proposed hypothesis "Innovation positively affects investment efficiency".

To investigate the mediating role of innovation on the relationship between intellectual capital and investment efficiency in industrial companies listed on the Amman Stock Exchange, a path analysis was performed, as highlighted in Table 7.

Table 7
Path Analysis Results

Path	Coefficient	Significance
IC → IE	0.039	Significant
IC → Innovation	0.067	Significant
Innovation → IE	0.052	Significant

Source: Authors' calculations

The results of the path analysis in Table 7 indicate that intellectual capital has a direct and statistically significant positive effect on investment efficiency, with an impact coefficient value of (β = 0.039). This clearly indicates that an increase in intellectual capital is directly associated with improved investment efficiency in industrial companies listed on the Amman Stock Exchange. Additionally, intellectual capital has a direct and statistically significant positive effect on innovation, with an impact coefficient value of (β = 0.067). These results suggest that higher levels of intellectual capital are directly linked to an increase in innovation activities in industrial companies listed on the Amman Stock Exchange. Furthermore, innovation shows a direct and statistically significant positive effect on investment efficiency with an impact coefficient value of (β = 0.052). This points to the vital role innovation plays as a key driver for achieving optimal investment levels in industrial companies listed on the Amman Stock Exchange.

These results collectively indicate a mediating role for innovation in improving the relationship between intellectual capital and investment efficiency, where innovation partially transmits the effect of intellectual capital on investment efficiency. This means that the effect of intellectual capital on investment efficiency in industrial companies listed on the Amman Stock Exchange is not only direct but also indirect through innovation. Accordingly, the proposed hypothesis, "Innovation mediates the relationship between intellectual capital and investment efficiency," can be accepted.

Discussion and Conclusions

This study examined the relationship between intellectual capital and investment efficiency, with a focus on the significance of innovation in this context. The growing significance of knowledge-based resources in industrial firms has prompted researchers and practitioners to examine the effect of intellectual capital on enhancing corporate performance and strategic decision-making. Investment efficiency is an indirect indicator of company performance, as it reflects the ability to allocate resources to profitable investments while avoiding unprofitable projects.

This study calculated intellectual capital using the Value-Added Intellectual Coefficient (VAIC) model, developed by Ante Pulic, which contained three components: human capital efficiency, structural capital efficiency, and capital employed efficiency (Pulic, 2000). The

indirect method proposed by Biddle et al. (2009) was used to measure investment efficiency by evaluating the differences between actual and expected investment levels. Innovation was measured using two indicators reflecting the contribution of intangible assets to facilitating the creative process and value creation in companies (Pham & Quddus, 2021).

The empirical study yielded several significant findings. First, the findings show that intellectual capital has a significant positive effect on investment efficiency in industrial companies listed on the Amman Stock Exchange. Companies that make the most use of their intellectual assets are better able to analyze investment opportunities and manage resources. This finding demonstrates that knowledge-based resources can enhance the quality of investment decisions. This result is consistent with the findings of several empirical studies conducted in both developing and developed countries. For example, the study by Kocaman and Akben Selçuk (2025) concluded that intellectual capital has a significant positive effect on investment efficiency in 92 countries. Also, the study by Chemutai and Kogei (2024) concluded that intellectual capital has a significant positive effect on investment efficiency in companies listed on the Nairobi Securities Exchange in Kenya. In addition, the study by Thien and Hung (2023) revealed that intellectual capital enhances investment efficiency in Vietnamese companies. However, this result varies from that of Iftikhar et al. (2023), who discovered that intellectual capital has no direct effect on investment efficiency in Pakistani companies.

Second, the study results reveal that the three elements of intellectual capital (human capital efficiency, structural capital efficiency, and capital employed efficiency) positively affect investment efficiency in industrial companies listed on the Amman Stock Exchange. The results also showed that human capital efficiency is the most influential dimension of intellectual capital on investment efficiency, confirming that employees' skills, experience, qualifications, and training play a pivotal role in improving investment decisions and enhancing the financial performance of Jordanian industrial companies. This result aligns with the study result by Khasanah et al. (2024), particularly in highlighting the substantial positive effect of human capital efficiency on investment efficiency in Indonesian non-financial companies. The findings of this study, however, contrast with those of Khasanah et al. (2024) regarding the effect of capital employed efficiency, which has a significant negative effect on investment efficiency in Indonesian non-financial companies. Additionally, it revealed no statistically significant effect of structural capital efficiency on investment efficiency in these companies.

Third, the study concluded that intellectual capital positively affects innovation in industrial companies listed on the Amman Stock Exchange. Companies with high intellectual capital have greater opportunities to develop their innovative capabilities and invest in intangible assets that support innovation. This is consistent with the results of several studies (e.g., Costa et al., 2022; Ivinić et al., 2025). It also aligns, to some extent, with the study by Rideg et al. (2023), which found that certain components of intellectual capital affect innovation in Hungarian small and medium-sized enterprises.

Fourth, the results showed that innovation positively affects the investment efficiency of industrial companies listed on the Amman Stock Exchange. The more companies invest in innovation-related assets, the greater their opportunities to discover profitable investment opportunities and improve their investment strategies. Therefore, innovation enhances

companies' ability to respond to changing market conditions and develop new technologies. This is consistent with the results of several studies (e.g., Hou & Feng, 2024; Huynh et al., 2025).

Finally, path analysis demonstrated that innovation partially mediates the relationship between intellectual capital and investment efficiency. This indicates that intellectual capital influences investment efficiency both directly and indirectly through its effects on innovation.

Recommendations

Based on the conclusions drawn, the following recommendations can be made to the relevant authorities in industrial companies listed on the Amman Stock Exchange:

- Integrate innovation into the strategic plans of industrial companies by supporting research and development, encouraging new ideas, and providing a regulatory environment that fosters creativity, given its pivotal role in enhancing investment efficiency.
- Optimizing the use of physical and financial assets by improving the efficiency of working capital management and linking investment decisions to scientific data-driven analysis.
- Develop administrative and information systems, embrace digital transformation, and improve organizational structures to ensure rapid decision-making and support corporate innovation.
- Increase investments in continuous training and development programs, improve talent acquisition policies, and link incentives to performance and innovation, given their direct impact on investment efficiency.

The study recommends that regulatory bodies and the Amman Stock Exchange encourage companies to disclose intellectual capital indicators in their annual reports, given the positive impact this has on transparency and attracting investors.

The study recommends that future researchers expand the scope of analysis to include other economic sectors, such as the financial sector, in addition to the service sector. It also emphasizes the importance of conducting comparative studies among developing nations. Furthermore, the paper recommends that future studies include additional mediating or moderating variables, such as governance and digital transformation.

References

Abd El Hamed, H. M. E. (2026). Does Earnings quality mitigate the probability of Sub-optimal Investments by Firms? Empirical Evidence from Egyptian firms. *ERU Research Journal, 5*(1), 3848-3867.

Abdulaali, A. R. (2018). The impact of intellectual capital on business organization. *Academy of Accounting and Financial Studies Journal, 22*(6), 1-16.

Adwan, S., & Ahamed, M. M. (2025). Employee ownership and corporate investment efficiency in Europe. *Review of Quantitative Finance and Accounting*, *64*(1), 191-236. https://doi.org/10.1007/s11156-024-01300-5

Akula, D. K., Mohammed, Y. S., Syed, A., Haque, G. M. M., & Arafat, Y. (2025). The Role of Information Systems in Enhancing Strategic Decision Making: A Review and Future Directions. *The American Journal of Management and Economics Innovations, 7*(8), 80-105. https://doi.org/10.37547/tajmei/Volume07Issue08-07

Ali, S., Murtaza, G., Hedvicakova, M., Jiang, J., & Naeem, M. (2022). Intellectual capital and financial performance: A comparative study. *Frontiers in Psychology*, *13*, 967820. https://doi.org/10.3389/fpsyg.2022.967820

Almrshed, S. K. H., Jasim, H. M., & Hassan, A. S. (2023). The Effect of Innovation Management on Sustainable Competitive Advantage in Contemporary Organizations. *Journal of Law and Sustainable Development*, *11*(11), e1980. https://doi.org/10.55908/sdgs.v11i11.1980

Anagnostopoulou, S. C., & Avgoustaki, A. (2023). The impact of human resource practices on corporate investment efficiency. *International Review of Financial Analysis*, *87*, 102609. https://doi.org/10.1016/j.irfa.2023.102609

Antzoulatos, A. A., Karanastasis, D., & Syrmos, T. (2022). The puzzling convergence of intangible investments. *International Advances in Economic Research, 28*(3–4), 171-182. https://doi.org/10.1007/s11294-022-09862-7

Attah, R. U., Garba, B. M. P., Gil-Ozoudeh, I., & Iwuanyanwu, O. (2024). Corporate banking strategies and financial services innovation: Conceptual analysis for driving corporate growth and market expansion. *International Journal of Engineering Research and Development, 20*(11), 1339- 1349. https://doi.org/10.13140/RG.2.2.19610.96969

Ausat, A. M. A., Widayani, A., Rachmawati, I., Latifah, N., & Suherlan, S. (2022). The effect of intellectual capital and innovative work behavior on business performance. *Journal of Economics, Business, and Accountancy Ventura*, *24*(3), 363-378. https://doi.org/10.14414/jebav.v24i3.2809

Barkat, W., & Beh, L. S. (2018). Influence of intellectual capital dimensions on knowledge process capability and organizational performance. *Asian Journal of Scientific Research*, *11*(3), 308–318. http://dx.doi.org/10.3923/ajsr.2018.308.318

Barkat, W., Beh, L. S., Ahmed, A., & Ahmed, R. (2018). Impact of intellectual capital on innovation capability and organizational performance: An empirical investigation. *Serbian Journal of Management*, *13*(2), 365-379. https://doi.org/10.5937/sjm13-16997

Beltramino, N. S., Madrid-Guijarro, A., & García-Pérez-de-Lema, D. (2026). Enhancing open innovation in Argentine SMEs: The role of intellectual capital dimensions. *Journal of Management and Governance*. https://doi.org/10.1007/s10997-025-09773-9

Biddle, G. C., Hilary, G., & Verdi, R. S. (2009). How does financial reporting quality relate to investment efficiency? *Journal of Accounting and Economics*, *48*(2-3), 112–131. https://doi.org/10.1016/j.jacceco.2009.09.001

Bogetoft, P., Kroman, L., Smilgins, A., & Sørensen, A. (2024). Innovation strategies and firm performance. *Journal of Productivity Analysis*, *62*, 175-196. https://doi.org/10.1007/s11123-024-00727-

Boikanyo, D. H. (2025). Structural capital management and knowledge sharing to enhance employee engagement in the modern era. In *Business, management and economics*. IntechOpen. https://doi.org/10.5772/intechopen.1011034

Brodny, J., & Tutak, M. (2024). A multi-criteria measurement and assessment of human capital development in EU-27 countries: A 10-year perspective. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(4),100394. https://doi.org/10.1016/j.joitmc.2024.100394

Buenaño, E., Báez, S., & Campaña, P. (2025). Intellectual capital and financial performance: a comparative analysis of VAIC models in Ecuadorian banking. *Cogent Business & Management, 12*(1), 2495187. https://doi.org/10.1080/23311975.2025.2495187

Chali, B. D., & Lakatos, V. (2024). The Impact of Human Resource Management on Financial Performance: A Systematic Review in Cooperative Enterprises. *Journal of Risk and Financial Management, 17*(10), 439. https://doi.org/10.3390/jrfm17100439

Chemutai, S., & Kogei, J. K. (2024). Intellectual Capital and Investment Efficiency: A Reflection from Listed Firms in Nairobi Securities Exchange, Kenya. *Journal of Business, Economics and Management Research Studies, 2*(3), 164–180. https://doi.org/10.69897/jobemrs.v2i3.169

Costa, T. de S., Barbosa, F. L. S., Bizarria, F. P. de A., Nascimento, J. C. H. B. do, & Ribeiro, R. M. (2022). The effect of intellectual capital on innovation and performance of companies listed on B3 S/A. *International Journal of Economics and Finance, 14*(3), 125–136. https://doi.org/10.5539/ijef.v14n3p125

Damodaran, A. (2026). *Investment philosophies: successful strategies and the investors who made them work*. John Wiley & Sons.

Dancaková, D., & Glova, J. (2024). The Impact of Value-Added Intellectual Capital on Corporate Performance: Cross-Sector Evidence. *Risks, 12*(10),151. https://doi.org/10.3390/risks12100151

Danladi, A. A., Alkali, A. U., & Hamza, S. A. (2023). The effect of intellectual capital on operational performance among deposit money banks: Mediated by innovation. *International Journal of Industrial Management*, *17*(4), 210-223. https://doi.org/10.15282/ijim.17.4.2023.9376

Dinu, E., Vătămănescu, E.-M., Stăneiu, R.-M., & Rusu, M. (2023). An Exploratory Study Linking Intellectual Capital and Technology Management towards Innovative Performance in KIBS. *Sustainability*, *15*(2), 1356. https://doi.org/10.3390/su15021356

Edvinsson, L., Dal Mas, F., Ordóñez De Pablos, P., Massaro, M., & Dumay, J. (2022). From a value-based knowledge economy to a worth economy. New reflections and perspectives on intellectual capital research. *International Journal of Learning and Intellectual Capital, 19*(1), 83–101. https://doi.org/10.1504/IJLIC.2022.119282

Farooq, U., Tabash, M. I., Anagreh, S., & Khudoykulov, K. (2022). How do market capitalization and intellectual capital determine industrial investment? *Borsa Istanbul Review*, *22*(4), 828-837. https://doi.org/10.1016/j.bir.2022.05.002

Firer, S., & Mitchell Williams, S. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital*, *4*(3), 348-360. https://doi.org/10.1108/14691930310487806

Gujarati, D. N. (2004). *Basic econometrics* (4th ed.). McGraw-Hill.

Gogan, L. M., Artene, A., Sarca, I., & Draghici, A. (2016). The impact of intellectual capital on organizational performance. *Procedia – Social and Behavioral Sciences, 221*, 194–202. https://doi.org/10.1016/j.sbspro.2016.05.106

Hashim, M. J., Osman, I., & Alhabshi, S. M. (2015). Effect of intellectual capital on organizational performance. *Procedia – Social and Behavioral Sciences, 211*, 207–214. https://doi.org/10.1016/j.sbspro.2015.11.085

Hesniati, H., & Erlen, E. (2021). Influence of intellectual capital on organizational performance. *International Journal of Economics, Business and Accounting Research (IJEBAR), 5*(2), 98–109. https://doi.org/10.29040/ijebar.v5i2.2402

Hou, G., & Feng, C. (2024). Innovation-driven policy and firm investment. *Finance Research Letters*, *61*, 105001. https://doi.org/10.1016/j.frl.2024.105001

Huynh, A. N. Q., Vu, G. T. M., Bui, H. Q., & Hoang, H. V. (2025). Corporate investment efficiency in response to national innovation: the moderating role of state ownership. *Journal of Economics and Development*, *27*(3), 194-209. https://doi.org/10.1108/JED-07-2024-0233

Huynh, T. N., Nguyen, P. V., Do, A. M., Dinh, P. U., & Vo, H. T. (2024). Fostering organizational performance through innovation: The roles of environmental policy instruments, organizational learning supports, and intellectual capital. *Heliyon, 10*(20), e39361. https://doi.org/10.1016/j.heliyon.2024.e39361

Iftikhar, F., Husnain, M., Munir, Q., & Ali, S. (2023, September). Does intellectual capital efficiency matter for firms' investment efficiency? In 2023 *International Conference on Sustainable Islamic Business and Finance (SIBF)* (pp. 183–188). IEEE. https://doi.org/10.1109/SIBF60067.2023.10380096

Ivinić, F., Zemla, S., & Zemla, N. (2025). The relationship between intellectual capital and innovations. *Athens Journal of Business & Economics, 11*(2), 197–210. https://doi.org/10.30958/ajbe.11-2-4

Janjić, I., & Rađenović, T. (2019). The importance of managing innovation in modern enterprises. *Ekonomika, 65*(3), 45–54. https://doi.org/10.5937/ekonomika1903045j

Jardón, C. M. F., & da Silva, A. F. C. (2020). Structural capital value addition to timber and related industries value chain. *Revista de Administração da UFSM, 13*(4), 895-917. https://doi.org/10.5902/1983465955325

Khasanah, S. N., Hwa, P. W., & Hakim, M. S. (2024). Does intellectual capital determine the firm's investment efficiency? Evidence from Indonesia. *Dinasti International Journal of Economics, Finance and Accounting, 5*(4), 2351–2363. https://doi.org/10.38035/dijefa.v5i4.3150

Koç, Ş., Uctu, R., Essop, H., & Mercan, B. (2026). The impact of innovation on economic growth: A dynamic panel data analysis using system GMM approach. *International Journal of Innovation Studies, 10*(1), 20–30. https://doi.org/10.1016/j.ijis.2025.09.003
Kocaman, M., & Akben Selçuk, E. (2025). Intellectual capital and investment efficiency: international evidence. *Applied Economics Letters*,1–9. https://doi.org/10.1080/13504851.2025.2538607

Li, Y., Song, Y., Wang, J., & Li, C. (2019). Intellectual Capital, Knowledge Sharing, and Innovation Performance: Evidence from the Chinese Construction Industry. *Sustainability, 11*(9), 2713. https://doi.org/10.3390/su11092713

Mahdi, O. R., Nassar, I. A., & Almsafir, M. K. (2019). Knowledge management processes and sustainable competitive advantage: An empirical examination in private universities.

Journal of Business Research, *94*, 320-334. https://doi.org/10.1016/j.jbusres.2018.02.013

Malikah, A., & Nandiroh, U. (2024). Intellectual capital and value of the firm: a systematic literature review. *International Journal of Humanities Education and Social Sciences (IJHESS), 3*(4), 2169-2177. https://doi.org/10.55227/ijhess.v3i4.777

Marzo, G. (2022). A theoretical analysis of the value added intellectual coefficient (VAIC). *Journal of Management and Governance*, *26*(2), 551-577. https://doi.org/10.1007/s10997-021-09565-x

Mukaro, C. T., Deka, A., & Rukani, S. (2023). The influence of intellectual capital on organizational performance. *Future Business Journal*, *9*(1),31. https://doi.org/10.1186/s43093-023-00208-1

Munro, D., & Lamb, C. (2025). *Measuring innovation in the age of intangibles: Knowledge synthesis paper*. Council of Canadian Academies.

Nejjari, Z., & Aamoum, H. (2023). The impact of intellectual capital on profitability, market value, productivity, and return on equity: Empirical evidence from Moroccan ICT firms. *Journal of the Knowledge Economy*, *14*(2), 1734-1748. https://doi.org/10.1007/s13132-022-00956-5

Nuragita, T. A., & Nursyamsiah, S. (2024). The Influence of Innovation Strategy on Sustainable Competitive Advantage. *Quantitative Economics and Management Studies, 5*(2), 223-232. https://doi.org/10.35877/454RI.qems2483

Peng, J., Quan, J., & Qin, Q. (2023). R&D investment, intellectual capital, organizational learning, and firm performance: a study of Chinese software companies. *Total Quality Management & Business Excellence*, *34*(9–10), 1196–1216. https://doi.org/10.1080/14783363.2022.2158077

Perez-Alaniza, M., Lenihan, H., Doran, J., & Hewitt-Dundas, N. (2023). Financial resources for research and innovation in small and larger firms: Is it a case of the more you have, the more you do? *Industry and Innovation, 30*(2), 189–232. https://doi.org/10.1080/13662716.2022.2036597

Pham, P. T., & Quddus, A. (2021). The impact of innovation activities on firm efficiency: Data envelopment analysis. *Journal of Asian Finance, Economics and Business, 8*(3), 895-904. https://doi.org/10.13106/jafeb.2021.vol8.no3.0895

Pulic, A. (2000). VAIC™–An accounting tool for IC management. *International Journal of Technology Management, 20*(5–8), 702–714. https://doi.org/10.1504/IJTM.2000.002891

Rehman, I. U., Shahzad, F., Laique, U., & Hanif, M. A. (2024). Does environmental innovation improve investment efficiency? *Borsa Istanbul Review, 24*(1), 164-175. https://doi.org/10.1016/j.bir.2023.11.007

Rideg, A., Szerb, L., & Varga, A. R. (2023). The role of intellectual capital on innovation: Evidence from Hungarian SMEs. *Tec Empresarial, 17*(2), 1–19. https://doi.org/10.18845/te.v17i2.6695

Rogers, M. (1998). *The definition and measurement of innovation* (Melbourne Institute Working Paper No. 10/98). Melbourne Institute of Applied Economic and Social Research.

Rong, C., Sial, M. S., Álvarez-Otero, S., & Jo, H. (2025). Assessing the Intellectual Capital of Value Creation Process of Commercial Banks in the European Union. *Journal of the Knowledge Economy*, *16*(6), 17570-17599. https://doi.org/10.1007/s13132-024-02348-3

Smimou, K., Abrokwah, M., & Drougas, A. (2025). Corporate investment decisions and related commodities: International evidence from energy and mining industries. *Energy Economics, 149*, 108766. https://doi.org/10.1016/j.eneco.2025.108766

Thien, T. H., & Hung, N. X. (2023). Intellectual capital and investment efficiency: The mediating role of strategic management accounting practices. *Cogent Business & Management, 10*(2), 2207879. https://doi.org/10.1080/23311975.2023.2207879

Tjahjadi, B., Soewarno, N., Sutarsa, A. A. P., & Jermias, J. (2024). Effect of intellectual capital on organizational performance in the Indonesian SOEs and subsidiaries: roles of open innovation and organizational inertia. *Journal of Intellectual Capital*, *25*(2-3), 423-447. https://doi.org/10.1108/JIC-06-2023-0140

Tran, N. P., & Vo, D. H. (2020). Human capital efficiency and firm performance across sectors in an emerging market. *Cogent Business & Management*, *7*(1), 1738832. https://doi.org/10.1080/23311975.2020.1738832

Wang, Y. (2025). How employees are affected by working in R&D-investing firms. *Industry and Innovation*, *32*(7), 747–771. https://doi.org/10.1080/13662716.2024.2420783

Wong, D. T. W., & Ngai, E. W. T. (2024). Linking data-driven innovation to firm performance: A theoretical framework and case analysis. *Annals of Operations Research, 333*, 999–1018. https://doi.org/10.1007/s10479-022-04968-7

Wu, W., Le, C., Shi, Y., & Alkaraan, F. (2024). The influence of financial flexibility on firm performance: the moderating effects of investment efficiency and investment scale. *Journal of Applied Accounting Research*, *25*(5), 1183–1202. https://doi.org/10.1108/JAAR-07-2023-0192

Xu, J., & Liu, F. (2020). The Impact of Intellectual Capital on Firm Performance: A Modified and Extended VAIC Model. *Journal of Competitiveness, 12*(1), 161–176. https://doi.org/10.7441/joc.2020.01.10

Yao, H., Haris, M., Tariq, G., Javaid, H. M., & Khan, M. A. S. (2019). Intellectual Capital, Profitability, and Productivity: Evidence from Pakistani Financial Institutions. *Sustainability, 11*(14), 3842. https://doi.org/10.3390/su11143842

Yeboah, A. (2023). Innovation process model: An integration of innovation costs, benefits and core competence. *Cogent Business & Management, 10*(1), 2176445. https://doi.org/10.1080/23311975.2023.2176445

Yin, J., & Xu, J. (2025). Intellectual capital, digital transformation and firms' financial performance: Evidence from ecological protection and environmental governance industry in China. *PLOS ONE, 20*(1), e0316724. https://doi.org/10.1371/journal.pone.0316724

Zaman, M., & Tanewski, G. (2024). R&D investment, innovation, and export performance: An analysis of SME and large firms. *Journal of Small Business Management*, *62*(6), 3053–3086. https://doi.org/10.1080/00472778.2023.2291363

Zemlyak, S. V., Kiyashchenko, L. T., & Ganicheva, E. V. (2022). Driving Technological Innovation through Intellectual Capital: Industrial Revolution in the Transportation Sector. *Economies, 10*(5), 100. https://doi.org/10.3390/economies10050100

Zhang, N., Ye, J., & Zhou, Q. (2026). Building Knowledge-Based Competitive Advantage in Knowledge-Driven Economy: Systematic Literature Review. *Sustainability*, *18*(1), 234. https://doi.org/10.3390/su18010234