Available online at www.sciencedirect.com

Borsa İstanbul Review

Borsa İstanbul Review xxx (xxxx) xxx

http://www.elsevier.com/journals/borsa-istanbul-review/2214-8450

Full Length Article

How do market capitalization and intellectual capital determine industrial investment?

Umar Farooq [a,*], Mosab I. Tabash [b], Suhaib Anagreh [c], Khurshid Khudoykulov [d]

[a] School of Economics and Finance, Xi'an Jiaotong University, Xi'an, Shaanxi, PR China
[b] College of Business, Al Ain University, Al Ain, United Arab Emirates
[c] Higher Colleges of Technology, Abu Dhabi, United Arab Emirates
[d] Tashkent State University of Economics, Department of Finance, Doctor of Science in Economics, Uzbekistan

Received 19 January 2022; revised 6 May 2022; accepted 6 May 2022
Available online ■ ■ ■

Abstract

Market capitalization and intellectual capital can be understood as two main that can play a dynamic role in multiple organizational decisions. Given that, the current study examines the role of market capitalization and intellectual capital in determining corporate investment decisions. In our empirical analysis, we use 10 years of financial information, from 2010 to 2019, for nonfinancial publicly listed corporations in three economies: China, India, and Pakistan. In our regression estimation, this study employs the panel-EGLS (estimated generalized least squares) and two-step system generalized method of moments techniques to address the problems of heteroskedasticity and endogeneity. The statistical analysis first reveals the positive significant effect of market capitalization on investment decisions because of the availability of sufficient funds for investment. It then substantiates the significant role of human capital, structural capital, and capital employed efficiency in protecting industrial investment. The empirical findings offer policy implications on how market capitalization (MC) and intellectual capital (IC) promote investment decisions.

JEL classification: E24; G31

Keywords: Intellectual capital; Industrial investment; Market capitalization; Human capital efficiency; Macroeconomic factors

1. Introduction

Because of the high probability of investment failure, firms require strong motivation to invest in long-term projects (Cholakova & Clarysse, 2015). Firm managers derive this motivation from different factors, including financial and nonfinancial factors. These factors reduce the systemic risk of investment and lead to substantially more investment (Chaney et al., 2012). Among others, the volume of market capitalization by firms is a vital financial factor that allows them to deliberately make some investments (Armstrong & Vashishtha, 2012). Similarly, firms that are rich in intellectual capital can make more investment because they have fewer problems with information asymmetry, maximum investment efficiency, and production cost efficiency (Oppong & Pattanayak, 2019). This description eventually led to maximum investment for obtaining physical assets in the form of property, plant, and equipment (PPE), commonly called capital investment. Recognizing the importance of market capitalization and intellectual capital in the intensification of industrial investment, this study tries to answer the following research questions:

- Does market capitalization boost the investment confidence of corporate managers?
- How does intellectual capital promote managerial confidence in capital investment?

* Corresponding author.
E-mail addresses: umerrana246@gmail.com (U. Farooq), mosab.tabash@aau.ac.ae (M.I. Tabash), sanagreh@hct.ac.ae (S. Anagreh), kh.khudoyqulov@tsue.uz (K. Khudoykulov).

Peer review under responsibility of Borsa İstanbul Anonim Şirketi.

https://doi.org/10.1016/j.bir.2022.05.002

Enterprises make different types of investment: short-term investment, long-term investment, and securities investment (Lin & Lee, 2011). Corporate investment behavior is based on multiple factors, such as the rate of return, a short payback period, and even the availability of financial sources (Hugonnier et al., 2015). The greater accessibility of financial resources enables firm managers to increase the volume of business by expanding the volume of investment. Corporate managers acquire different types of assets, for example, PPE, by keeping the growth objective in mind. Such assets are normally acquired for a long period, so they are considered capital investment. However, the scarcity of financial resources and incompetence in using these assets can make such investment difficult (Chen et al., 2017). Therefore, a company with a greater share of capital is optimistic about capital investment. For instance, Vo (2019) argues that financial resources have a positive influence on industrial investment. In addition, firms must have the capacity to employ these assets. A company with more knowledge workers is more prosperous and can achieve technical and cost efficiency through the proper utilization of available sources (Yanadori & Cui, 2013). Such companies are typically more successful and more profitable. Xu et al. (2019) comment on the importance of intellectual capital (IC) in shaping corporate financial performance and suggest that a positive relationship exists between IC and financial performance.

Therefore, this study explores the impact of market capitalization (MC) and IC on industrial investment. To measure industrial investment, this study uses the ratio of a firm's total expenses to acquire capital assets to total assets (Chen et al., 2019). This ratio further indicates the firm's intention to expand its existing business operations by acquiring these assets. The main explanatory variables include MC, the cumulative market worth of a firm, which demonstrates the total monetary value of a firm's stocks. Likewise, we use the extended model of Pulic (2000), known as the value-added intellectual coefficient (VAIC) model, to measure the IC. The VAIC methodology divides IC into three dimensions: human capital efficiency (HCE), structural capital efficiency (SCE), and capital employed efficiency (CEE). Our statistical analysis consists of nonmonetary financial data at publicly listed firms in China, India, and Pakistan for the period 2010 to 2019. We employ two econometric techniques, panel estimated generalized least squares (EGLS) and two-step system–generalized method of moments (GMM) models and present the results in Table 7. The statistical results of both models show that MC and IC have a significantly positive relation to industrial investment. This positive relationship is robust even after controlling for both firm-specific and country-level variables.

Consequently, we make the following contributions to the existing literature. First, this study supplements empirical evidence regarding the importance of MC in industrial investment. Industrial enterprises that have higher market capitalization enjoy positive investment growth. In addition, the empirical analysis demonstrates the investment behavior of firms that invest more in the development of their intellectual capital (IC). These firms have a positive attitude toward capital investment. Theoretically, this study adds new thinking about the role of MC and IC in increasing investment confidence among corporate managers. Most studies explain the role of IC in financial performance and innovation, but not how it influences industrial investment or the potential impact of MC on industrial investment. Thus, this study fills this gap in the literature by exploring the nexus between MC, IC, and industrial investment. Finally, our analysis offers corporate managers some policy guidance on how they can boost investment by focusing on the development of intellectual capital and by enhancing market capitalization. Both factors can drive enterprises to explore the use of venture capital.

After this introduction, the remainder of the paper is organized as follows. Section 2 outlines the background; Section 3 describes the theoretical literature while Section 4 reviews previous empirical literature and posits our hypotheses for testing. Section 5 offers a discussion on our research design, and Section 6 reports the statistical analysis and discussion. Lastly, Section 7 summarizes and concludes the paper.

2. Background

Many studies assert that market capitalization and intellectual capital have a dynamic impact on the financial efficiency of industry (Chen et al., 2017; Dias, 2013; Kweh et al., 2021). Other studies argue that intellectual capital has a potential impact on innovation investment (Hayaeian et al., 2021; Oppong & Pattanayak, 2019). However, the interlinkages among market capitalization, intellectual capital, and industrial investment have not been studied before. Therefore, this study examines the impact of marketization and intellectual capital on industrial investment.

Increasing market competition and the establishment of new business ventures create more frustration for existing business entities in enhancing their production system and quality. In doing so, the existing business ventures either enhance their investment in the acquisition of fixed capital or exercise product diversification to create more market space for their line of products (Jiang et al., 2015). Given that, many factors influence decisions on expanding business volume. Among other things, market capitalization shows that the market value of a company can help to enhance the volume of business by establishing more PPE activities. A company with more market capitalization has few financial problems and has enough financial resources for investment (Kuvshinov & Zimmermann, 2021). Additionally, these enterprises can collect more funds through the issuance of more stocks due to a good market reputation. When a company has high market capital, it can obtain funds more easily, which has positive spillover on engaging in physical projects. In addition to financing, market capitalization shows the market reputation of enterprises and helps in obtaining other benefits, for example, low information asymmetry between shareholders and firm managers, ease in trade activities (both purchasing and selling), and a first preference of wise brains (Mukherjee et al., 2018). In view of the cumulative benefits of market capital, high market capitalization provides important stimulus for capital investment.

Like capital marketization, intellectual capital plays an immediate role in boosting investment. IC represents employee expertise, process innovation, and competitive edge in the production process, and other intangibles that substantially enhance the value of the company (Bayraktaroglu et al., 2019). Therefore, a company that is rich in terms of intellectual capital may have a higher return on its existing assets. Among others, capital investment is a major asset that appears on the balance sheet of a company and is directly related to overall efficiency. A company with knowledgeable employees can get higher returns on its capital investment due to maximum utilization of assets and rapid returns (Beltramino et al., 2021). Similarly, process innovation, which is also a part of intellectual capital, enables firms to produce innovative products at comparatively low production costs and more efficiently. This range of innovative products eventually captures more of the market and ultimately increases the sale volume of a company. Firms with more intellectual capital are confident about recovery of their investment and thus increase their pace of investment. In short, intellectual capital raises the value of business through new business ideas, innovation in the line of products, cost reduction due to modification in production systems, and higher sale volume. All these factors have positive outcomes in terms of both profitability and investment growth.

3. Theoretical literature review

In the contemporary world of knowledge, it is necessary for every business entity to excel at process innovation in order to ensure growth. Process innovation is most likely to be related to intellectual capital, which allows organizations to equip themselves with modern technology (Beltramino et al., 2021). According to resource-based (RB) theory, the knowledge workers are firm assets and should be considered like other physical assets (Barney, 1991). Based on notions in RB theory, enterprises that have more intangible assets in the form of knowledge workers have better financial performance. In this regard, Lela and Nuryakin (2020) posit that a positive association exists between knowledge workers and corporate financial efficiency. This concept of human knowledge was set forth by Pulic (2000) in a novel model called the VAIC model, which quantifies IC by dividing firm efficiency into human capital, structural capital, and capital employed efficiency.

Several studies have documented the dynamic impact of IC on firm performance and innovation activities (Alrowwad et al., 2020; Qurashi et al., 2020; Xu et al., 2019). Specifically, Meca and Martínez (2007) performed an empirical study on the relevant role of intellectual capital in the investment recommendations of financial analysts. Their study found that firm strategy plays a significant role in the process and customer care in the investment recommendations of investment managers. Beltramino et al. (2021) illustrate the significant impact of all three aspects of IC in establishing the innovation process at enterprises. IC encourages enterprises to enhance their pace of innovation because of the presence of knowledgeable employees. These notions were later supported by Hayaeian et al. (2021), who found a positive spillover of knowledge management operations on both innovation and intellectual capital. However, few papers identify the direct impact of MC and IC on investment decisions. Thus, the current analysis enriches the existing literature by exploring the role of IC in making investment decisions. Additionally, this study considers market capitalization a potential determinant of investment decisions.

4. Empirical literature review and hypotheses development

The theoretical link between market capitalization, intellectual capitalization, and investment decisions can be built by reviewing the empirical findings of previous studies. The following subsections narrate empirical link among variables and hypotheses development.

4.1. Market capitalization and industrial investment

Using financial resources, firms make investments to expand their existing productive operations (Kumar & Ranjani, 2018). Greater availability of funds enables industries to invest in new ventures. These notions show the importance of finance in the expansion of industrial investment. Market capitalization is an important financial source through which enterprises finance their multiple operations (Buchuk et al., 2014). It also indicates the value of a company in the financial market and typically plays a vital role in multiple business decisions. In this regard, Polk and Sapienza (2009) studied the relationship between stock exchange performance and corporate investment. Testing the catering theory, they documented a positive relationship between discretionary accruals and abnormal investment, indicating the significance of the stock market in investment-related decisions. Bakke and Whited (2010) also confirm the role of the stock market in industrial investment. Despite the large number of studies that describe the potential role of funds in determining industrial investment (Hugonnier et al., 2015; Nnadi et al., 2021; Shiau et al., 2018; Yang et al., 2017), no study has clearly illustrated the linkages between market capitalization and firm investment decisions. Thus, our study is an early attempt to explore this relationship.

H1. There exists a positive and significant connection between high market capitalization and industrial investment.

4.2. Intellectual capitalization and industrial investment

The growing body of literature about IC and its dynamic role in multiple firm-level decisions motivates us to investigate its relation to industrial investment. For instance, Oppong and Pattanayak (2019) emphasized the role of IC in raising firm productivity. They conjectured that a firm could obtain competitive advantages and higher productivity by investing in IC. In the modern knowledge-based economy, competitive edges are no longer associated with intensive physical assets but, rather, with intangible assets—that is, knowledge workers

and innovative production techniques (Hayaeian et al., 2021). These assets can enhance the efficiency of physical investment—that is, investment in machinery and plants—and can make the enterprises more successful (Hashim et al., 2015). This factor boosts managerial confidence in investment in the expansion of physical investment, that is, acquisition of PPE. In this regard, Meca and Martínez (2007) found that financial analysts usually mention the firm's strategies regarding the process and product innovation to attract investors. They observed a significant impact of firm-level activities related to boosting IC on individual investment decisions.

Specifically, the discussion on IC can be divided into three components: HCE, SCE, CEE (Ståhle et al., 2011). Following this, Gamerschlag (2013) illustrates the significance of HCE in the accumulation of value by enterprises. Felício et al. (2014) find a positive association between organizational performance and HCE. Smriti and Das (2018) find a similar relationship between HCE and industrial performance. More successful firms are more enthusiastic about capital investment. In addition, many papers have documented the positive impact of both SCE and CEE on industrial performance (Bayraktaroglu et al., 2019; Joshi et al., 2013; Wang et al., 2014). The literature also shows that financial efficiency achieves more expansion in industrial investment (Almeida et al., 2011; Ding et al., 2013). However, the literature is still silent on identifying the relationship between IC and industrial investment decisions. Thus, the current analysis provides new insights by testing the following hypotheses.

H2a. HCE is positively and significantly related to industrial investment decisions.

H2b. There exists a positive significant correlation between SCE and investment decisions.

H2c. : CEE has a significant positive impact on corporate investment decisions.

5. Research design

5.1. Data and sample size

The financial information of firm-specific variables comes from Data Stream while the statistics of macroeconomic variables were obtained from World Development Indicators (WDI), The World Bank.[1] The sample size initially comprises 27,820 firm-level observations for the period 2010 to 2019 from China, India, and Pakistan. The sample period is chosen to exclude the effect of the global financial crisis in 2008 and the spread of Covid-19. During this period, firms may commence the dispersing investment strategies and thus the inclusion of these years might make the analysis biased. Given that, the study by Bo et al. (2014) illustrates the negative impact of the 2008 financial crisis on corporate investment by Chinese firms. Moreover, abnormal events like these create funding constraints and might reduce investment (Campello et al., 2010) and change consumption behavior (Sheth, 2020). In the final sample selection, we performed vigorous screening, excluding the firms with missing data for five years or more, with the SIC classification 6000–6999, and with extreme values for a specific variable (winsorizing at 5%). After these data-screening techniques were performed, the sample size was reduced to 23,420 firm-level observations. More information on the sample selection is in Appendix Table A1.

[1] https://databank.worldbank.org/source/world-development-indicators.

5.2. Definition of variables

- **Investment decisions (INV)** is an independent variable, measured as total expenditure to acquire the three types of assets, including PPE, divided by total assets. This ratio exemplifies a firm's expansion of its existing production activities using capital assets. Hugonnier et al. (2015) and Farooq et al. (2021) employ similar calculations of investment.
- **Market capitalization (MC)** is an explanatory variable, calculated by multiplying the total shares outstanding by the market value per share. It shows the financial wealth of a company in an open market. MC further shows the total funds available to a company to finance its business operations. Dias (2013) is based on a similar calculation of MC.
- **Intellectual Capital (IC)** included as an explanatory variable in the regression analysis. We follow the mathematical measurement by Pulic (2000) to calculate IC. It is a standard measurement of IC, divided into three components: HCE, SCE, and CEE (the details on the measurement of these components are in the next section). Despite some shortcomings with respect to IC as specified by Ståhle et al. (2011), this model has been repeatedly employed in studies to describe IC (Hayaeian et al., 2021; Oppong & Pattanayak, 2019; Xu et al., 2019).
- **Sales growth ratio (SGR)** is a control variable, showing the average increase in the total sales of a company over that in previous years. It also shows the growth of a firm in terms of the increase in sales.
- **Profitability (ROA)** is another firm-specific control variable. It depicts the ability of a firm to earn profits by exploiting total assets.
- **Leverage (LVG)** shows the volume of total bank loans acquired to finance assets. It is also included as a control variable at the firm level.
- **Foreign direct investment (FDI)** is a country-specific control variable that shows the total funds invested by foreign individuals in capital projects by the host country.
- **Inflation rate (IF)** is calculated with the gross domestic product (GDP) deflator, which shows the intensity of price volatility in the economy. The implicit price deflator shows the percentage change in the current value of GDP compared to the base year.
- **GDP growth rate (GDP)** shows the annual increase in the value of products produced by all producers in an economy.

Table 1
Detail of variables.

Sr no.	Variable name	Use as	Measurement	Reference
1	Industrial investment	DV	Fixed expenditures/total assets	Chen et al., (2017), Chen et al., (2019), Farooq et al., (2021)
2	Market capitalization	IV	Log (total market value of company's outstanding shares)	Dias, (2013), Kumar & Kumara, (2021)
3	Intellectual capitalization	IV	Value added intellectual capital coefficient (VAIC) • Human Capital Efficiency • Structural Capital Efficiency • Capital Employed Efficiency	Pulic, (2000), Kweh et al., (2021), Xu et al., (2019)
4	Sales growth ratio	CV	Percentage increment in total sales	Adelino et al. (2017)
5	Profitability	CV	EBIT/total assets	Ajide (2017)
6	Leverage	CV	Total debt/total assets	Vo (2019)
7	FDI	CV	Net inflow of funds into host country's capital projects	Farooq et al. (2021)
8	Inflation	CV	Inflation is measured by GDP deflator	Ciżkowicz and Rzońca (2012)
9	GDP growth rate	CV	Percentage increment in total value of products produced by all sources of economy	Farooq et al. (2021)

Source: previous studies. **Note:** this table shows the relevant measurement of variables and their role in formal analysis. It further provides reference information on extraction of variables measurement.

Many studies have specified the measurement of control variables (Ajide, 2017; Chen et al., 2019; Farooq et al., 2021). Table 1 defines all the variables in the study.

5.3. Econometric models

$$INV_{ijt} = \beta_{\circ} + \alpha_1 MC_{ijt} + \alpha_2 IC_{ijt} + \beta_1 SGR_{ijt} + \beta_2 ROA_{ijt} + \beta_3 LVG_{ijt} + \gamma_1 FDI_{jt} + \gamma_2 INF_{jt} + \gamma_3 GDP_{jt} + \mu_i + \delta_t + \varepsilon_{ijt} \quad \text{(Eq1)}$$

In equation (1), INV shows investment, MC is for market capitalization, IC is intellectual capital, SGR represents the sales growth ratio, ROA is an abbreviation of profitability, LVG is for leverage, FDI shows the foreign direct investment, INF indicates the inflation rate, and GDP is an abbreviation of GDP growth rate. Additionally, μ_i and δ_t illustrate the cross-section and time fixed effect where ε_{ijt} is an error term.

Additionally, we have considered the VAIC model proposed by Pulic (2000) to calculate the intellectual capital. The mathematical measurement of the VAIC model is as

$$IC = f(HCE,\ SCE,\ CEE) \quad \text{(Eq2)}$$

$$VA = OUT - IN \quad \text{(Eq3)}$$

$$HCE = \frac{VA}{HC} \quad \text{(Eq4)}$$

$$SCE = \frac{VA - HC}{VA} \quad \text{(Eq5)}$$

$$CEE = \frac{RC}{VA} \quad \text{(Eq6)}$$

As shown in equation (2), IC has three components i.e., HCE (human capital efficiency), SCE (structural capital efficiency), and CEE (capital employed efficiency). In equation (3), we measured the VA (values added) by deducting the OUT (total income) from IN (total expenditures). Equation (4) shows the calculation of HCE which is a fraction between VA and HC (human capital, indicating total expenditures on employee development). Similarly, equation (5) illustrates the mathematical measurement for SCE. It was calculated by dividing the net value received after subtracting the VA from HC to VA. Lastly, CEE ratio exemplifies the fraction between RC (relational capital, measured as total selling expenses) and VA.

5.4. Explanation of methodology

To display the empirical relationship between variables of the study, we begin our analysis with the basic econometric technique for panel data estimation called OLS (ordinary least squares) and confirm it by accounting for different assumptions, for example, heteroskedasticity and endogeneity. Additionally, we run the unit-root test and report the results in Table 2. The statistical results of the adjusted Dickey–Fuller (ADF; Dickey & Fuller, 1979) and Im et al. (2003) tests imply that data are stationary at normal.

Table 2
Unit root test.

Variables	ADF – Fisher Chi-square		Im, Pesaran and Shin W-stat	
	Statistic	Prob.	Statistic	Prob.
CI (investment)	2942.568	0.000***	−11.546	0.060**
MC (market cap.)	2620.610	0.000***	16.964	0.000***
HCE (human cap. efficiency)	2790.171	0.000***	−14.244	0.000***
SCE (structural cap. efficiency)	1862.572	0.000***	−12.403	0.000***
CEE (capital employed ratio)	2761.179	0.000***	−13.620	0.000***
SGR (sales growth ratio)	1834.233	0.011***	12.392	0.071**
ROA (profitability)	2483.600	0.000***	18.221	0.000***
LVG (leverage)	2661.700	0.000***	−5.829	0.000***
FDI (foreign direct investment)	2245.500	0.000***	−13.350	0.000***
INF (inflation rate)	2829.200	0.060**	−9.890	0.081**
GDP (GDP growth rate)	3018.500	0.000***	−70.132	0.000***

Note: *, **, *** represent the significance at 10, 5, and 1% level respectively. **Source:** self estimation. **Description:** probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Likewise, the significant p-value ($p > 0.05$) in the Breusch Pagan test (Breusch & Pagan, 1980) implies that there exists the issue of heteroskedasticity (as shown in Table 3). To cope with the problem of heteroskedasticity, this study employs the panel EGLS test in the regression analysis. Nonetheless, the potential for endogeneity issues is high when statistical analysis comprises both firm-level and macroeconomic variables. To identify the endogeneity, we use the Wald test and report the results in Table 4. Not surprisingly, the significant values of the restriction terms anticipate the existence of endogeneity issues. Finally, the current study employs the two-step system-GMM model proposed by Holtz-Eakin et al. (1988) in the regression analysis and to check robustness. The GMM model efficiently deals with the issue of endogeneity in panel data. The implications of both models give unbiased regression statistics. Irrespective of theoretical support, some previous studies also considered these techniques to estimate the regressions in similar empirical analyses (Kasoga, 2020; Oppong & Pattanayak, 2019; Sardo & Serrasqueiro, 2018). The regression results of both models are presented in Table 7.

6. Empirical results and discussion

6.1. Descriptive analysis

Table 5 exhibits the descriptive analysis for the variables of the study. The mean value of INV is 0.471 with a range value of 0.903, indicating the volume of investment of under-analysis companies in comparison with total assets. Corporate firms invest 47.1% of their total assets to acquire capital assets. The mean value of MC is 1.631 which shows the logarithmic value of total share owned by a company. If we split the discussion on intellectual capital ratio into three heads, it can be viewed that SCE has a highest mean value of 0.790 as compared to HCE (0.209) and SCE (0.124), illustrating that structural capital efficiency (SCE) is a main driving force which urges the enterprises on more investment. As for concern to control variables, the mean value of SGR is 0.064 while the average values of ROA and leverage are 0.134 and 0.304 relatively. These values depict the trends of average increment in sales, earning capacity, and loan volume of corporate firms. Similarly, the mean values of macroeconomic control variables i.e., FDI, INF, and GDP are 9.234, 5.011, and 3.983 respectively. These values give information on the macroeconomic condition of under-analysis countries.

Table 3
Heteroskedasticity diagnostic.

Test name	Statistics	d.f.	Prob.
Breusch–Pagan LM	1028.390	185	0.000
Pesaran scaled LM	68.982	–	0.000
Bias-corrected scaled LM	69.831	–	0.042
Pesaran CD	9.827	–	0.005

Source: author's self-estimation. **Note:** the significant p-value ($p < 0.05$) rejects the null hypothesis i.e., the variance in error term is not similar.

Table 4
Endogeneity diagnostic.

Test name	Wald Test		
	Value	Df	Probability
F-statistics	1832.558	(10,814)	0.000
Chi-square	18325.580	10	0.000
Null hypothesis summary			
Normalized restriction terms (=0)	**Value**	**Std. error**	
C (1)	0.085	0.026	
C (2)	0.022	0.008	
C (3)	0.077	0.078	
C (4)	−0.063	0.011	
C (5)	0.091	0.021	
C (6)	−0.049	0.067	
C (7)	0.108	0.024	
C (8)	−0.043	0.028	
C (9)	−0.002	0.001	
C (10)	−0.008	0.003	

Source: author's self-estimation. **Note:** null hypothesis assumed that restriction terms are not linearly correlated.

Table 5
Descriptive statistics.

	Mean	Median	Std. dev.	Range	N
INV	0.471	0.464	0.183	0.903	23,420
MC	1.631	1.589	0.052	2.910	23,420
HCE	0.209	0.148	0.162	0.821	23,420
SCE	0.790	0.851	0.112	0.840	23,420
CEE	0.124	0.082	0.123	0.980	23,420
SGR	0.064	0.055	0.043	0.622	23,420
ROA	0.134	0.115	0.085	0.786	23,420
LVG	0.304	0.298	0.084	0.645	23,420
FDI	9.234	9.239	0.140	1.501	23,420
INF	5.011	5.968	0.076	19.024	23,420
GDP	3.983	4.396	0.058	4.782	23,420

Source: author's own calculation. **Acronyms:** INV = investment decisions, MC = market capitalization, HCE = human capital efficiency, SCE = structural capital efficiency, CEE = capital employed efficiency, SGR = sales growth ratio, ROA = profitability, LVG = leverage, FDI = foreign direct investment, INF = inflation rate, GDP = GDP growth rate.

6.2. Correlation analysis

In Table 6, we present the correlation statistics among the variables of the study. Column 2 of Table 6 depicts the main correlation trends between INV and other variables of the study. The correlation value of MC is 0.146 while the correlation values of HCE, SCE, and CEE are 0.170, −0.176, and 0.091 relatively. These values predict the strength of association between INV and the main explanatory variables of the study. The correlation value of SGR is 0.020, ROA is −0.167, and LVG has a correlation value of 0.151. Likewise, FDI and GDP have negative correlation values as −0.033 and −0.009 while INF carries a positive correlation trend (0.009) with INV. These values suggest the degree and direction of association between INV and other variables of the study.

6.3. Regression analysis

In our regression analysis, we apply two econometric models—panel-EGLS and two-step system-GMM model

Table 6
Correlation statistics.

	INV	MC	HCE	SCE	CEE	SGR	ROA	LVG	FDI	INF	GDP
INV	1.000										
MC	0.146	1.000									
HCE	0.170	0.308	1.000								
SCE	−0.170	−0.308	0.670	1.000							
CEE	0.091	0.312	0.933	−0.823	1.000						
SGR	0.020	−0.116	0.048	−0.048	0.061	1.000					
ROA	−0.167	−0.154	0.477	−0.477	0.508	0.248	1.000				
LVG	0.151	−0.124	−0.356	0.356	−0.489	0.016	−0.344	1.000			
FDI	−0.033	0.155	0.090	−0.090	0.124	−0.029	−0.054	−0.098	1.000		
INF	0.009	−0.162	−0.068	0.068	−0.098	0.310	0.093	0.109	−0.320	1.000	
GDP	−0.009	0.163	0.087	−0.087	0.119	0.034	−0.022	−0.124	0.142	−0.658	1.000

Source: author's own calculation. **Acronyms:** INV = investment decisions, MC = market capitalization, HCE = human capital efficiency, SCE = structural capital efficiency, CEE = capital employed efficiency, SGR = sales growth ratio, ROA = profitability, LVG = leverage, FDI = foreign direct investment, INF = inflation rate, GDP = GDP growth rate.

(abbreviated as system-GMM)—and report the results in Table 7. The results of these two models address the problems of heteroskedasticity and endogeneity. In addition, they demonstrate the robustness of the main results. The statistical analysis of the system-GMM model shows that market capitalization has a positive coefficient of 0.147, which is significant at the 1 percent level. This value further illustrates that an increase of one percent in MC raises industrial investment by 14.7 percent. Similarly, the coefficient value of the proxies for intellectual capital, divided into HCE, SCE, and CEE, are 0.186, 1.643, and 0.496, respectively. All the values are significant at 1 percent and make a positive contribution to determining investment. Among the control variables, sales growth ratio and leverage have positive and significant coefficients of 0.031 and 0.163, respectively. However, ROA has a negative but significant coefficient of −1.485. Similarly, FDI and the inflation rate have a negative (coefficient values −0.159 and −0.026, respectively) whereas the GDP growth rate has a positive and significant relationship to investment decisions (coefficient values 0.042). In short, our analysis provides robust evidence on the positive relation of both MC and IC to industrial investment even after we control for endogeneity and several firm-specific and country-level factors.

In addition to the main regression analysis, Table 8 shows the path analyses. Giving the coefficient values of the main explanatory variables, we found that all alternative hypotheses (H1, H2a, H2b, and H2c) are accepted. The path coefficient of MC ($\beta = 0.147$, $p < 0.05$), HCE ($\beta = 0.186$, $p < 0.05$), SCE ($\beta = 1.643$, $p < 0.05$), and CEE ($\beta = 0.496$, $p < 0.05$) corroborate the acceptance of all alternative hypotheses.

Table 7
Impact of market capitalization and intellectual capital on investment.

Variables	Investment decisions					
	Panel EGLS (1)			2-step system GMM model (2)		
	Coefficient	Std. error	Prob.	Coefficient	Std. error.	Prob.
Constant	0.852***	0.266	0.001	1.703***	0.436	0.000
Market cap.	0.022***	0.008	0.005	0.147***	0.085	0.048
Human cap.	0.774***	0.078	0.000	0.186***	0.045	0.002
Structural cap.	0.492***	0.126	0.001	1.643***	0.136	0.002
Cap. emp. ratio	0.637***	0.111	0.000	0.496***	0.421	0.038
Sale growth ratio	0.091***	0.021	0.000	0.031***	0.138	0.000
Profitability	−0.493**	0.067	0.000	−1.485***	0.415	0.000
Leverage	0.108***	0.024	0.000	0.163***	0.136	0.030
FDI	−0.043*	0.028	0.108	−0.159***	0.053	0.003
Inflation rate	−0.002***	0.001	0.016	−0.026***	0.009	0.003
GDP growth rate	0.008***	0.003	0.005	0.042***	0.018	0.022
Adjusted R-square		0.261			0.674	
S.E. of regression		0.170			0.104	
Prob (F-statistic)		0.000			–	
Prob (J-statistic)		–			0.524	

Note: * significance at 10% level, ** significance at 5% level and ***significance at 1%. **Source:** author's own calculation. **Instrument specification:** INV (-1) MC (-1) HCE (-1) SCE (-1) CEE (-1) SGR (-1) ROA (-1) LVG (-1) FDI (-1) INF (-1) GDP (-1) MC (-2) HCE (-2) CEE (-2) SGR (-2).

6.4. Discussion

In this study, we examine the role of market capitalization and IC in boosting confidence in industrial investment. In our regression analysis, we consider panel-EGLS and system-GMM models and report the results in Table 7. The statistical results imply that market capitalization has a significant and positive impact on industrial investment. Higher market capitalization gives industrial managers investment confidence by revealing the financial soundness of an enterprise (Bakke & Whited, 2010). At the firm level, a company that has more market capitalization often makes more capital investment, leading to a larger market share and greater availability of intensive funds. Supporting this, Nnadi et al. (2021) highlights the positive role of funds in capital investment. Additionally,

Table 8
Path analyses.

Path	Statistical analysis		Decision
	Coefficients	Prob.	
H1: MC⇒INV	0.147***	0.048	Accepted
H2a: HCE⇒INV	0.186***	0.002	Accepted
H2b: SCE⇒INV	1.643***	0.002	Accepted
H2c: CEE⇒INV	0.496***	0.038	Accepted

Source: author's own calculation. **Notes:** *** indicating $p < 0.01$.

the availability of more funds is proportionate to greater market capitalization (Demirgüç-Kunt & Maksimovic, 2002). Hence, firms with greater market capitalization might make more capital investment. Similarly, the impact of IC on investment decisions is analyzed by dividing the discussion on IC into three components: HCE, SCE, and CEE. The positive and significant impact of HCE illustrates that a company with more knowledge workers has more investment confidence. By enhancing HCE, firms can maximize the output from investment (Hayaeian et al., 2021), which has a positive spillover effect on industrial investment.

Linked to the discussion on IC, the statistical results further reveal the positive relation of SCE to investment decisions. SCE, which is the accumulation of efficient procedures to perform different organizational operations efficiently, can help to achieve the maximum benefits from any capital project (Beltramino et al., 2021). A company with high SCE can reduce its operational costs by achieving cost effectiveness (Hsu & Fang, 2009) and thus obtain more returns on investment. This factor advances the growth of investment by advocating optimistic thinking. Lastly, CEE also makes a positive contribution to capital investment decisions. High CEE shows that firms attain the capacity for higher profitability by using the assets (Hashim et al., 2015). The effective level of CEE enables industrial managers to confidently invest in long-term projects based on the bright financial future of a company. The high CEE indicates that a company has enough capacity to effectively manage its capital assets and can derive more returns from such assets. This factor urges firm managers to acquire more capital assets, in other words, capital investment (Forbes & Kara, 2010).

Among the control variables, the sales growth ratio has a positive correlation with industrial investment. An adequate sales growth rate requires greater proliferation of production plants, which leads to an increase in demand for industrial products (Farooq et al., 2021). Moreover, a higher ratio of sales growth indicates the maximum utilization of PPE, which leads to managerial confidence in these assets. By contrast, the profitability ratio negatively impinges on industrial investment. Not surprisingly, more profitable firms might deem capital investment a less effective source and thus invest more in other options that offer high return rates (Peters & Taylor, 2017). This negative association further corroborates the investment behavior of profitable firms in the countries under consideration. The empirical results further reveal the positive relationship between leverage and investment, demonstrating the significance of bank loans in boosting industrial investment. Enterprises with greater access to bank loans to finance their assets maintain a positive attitude toward making capital investment (Vo, 2019). These empirical relationships are consistent with those in prior studies (Almeida et al., 2011; Chen et al., 2019; Farooq et al., 2021).

Our empirical results further show the negative impact of FDI and the inflation rate on corporate investment decisions. The inflow of FDI exaggerates unfavorable market competition and thus mitigates growth in the domestic industrial sector (Umer & Alam, 2013). In that situation, the investment behavior of corporate firms may become ambiguous. Similarly, the higher inflation rate might reduce the purchasing power of retail consumers, and thus they might reduce their demand for industrial goods (Ciżkowicz & Rzońca, 2012). By reducing the demand for industrial goods, this factor negatively impinges on industrial investment. Lastly, the positive effect of the GDP growth rate on investment decisions shows the significance of prosperous economic conditions in enhancing industrial investment. Under better economic conditions, the enterprises have positive capital investment growth because of higher returns on this type of investment (Chen et al., 2019). Our empirical analysis supports the hypothesis that market capitalization and intellectual capital have a growth-promoting role in industrial investment.

7. Summary and conclusion

Firms with a high market share and more intellectual capital are more likely than other firms to employ dynamic investment strategies. These two kinds of assets—tangible (market capitalization) and intangible (intellectual capital) assets—on the balance sheets of a company can augment physical investment. Given that, our study determines the impact of market capitalization and intellectual capital on corporate decisions regarding physical investment. The empirical analysis is based on ten years of annual data on nonfinancial publicly listed firms in China, India, and Pakistan. The statistical results of panel-EGLS and system-GMM models reveal the significant and positive impact of market capitalization on industrial investment. Firms with a higher market share are more confident about physical investment because they have larger financial reserves and the capacity to withstand financial shocks. The empirical analysis then implies the positive role of all three components of intellectual capital—HCE, SCE, and capital employed efficiency—in determining industrial investment. These factors enable an enterprise to confidently engage in investment because of the availability of knowledge workers, efficiency in internal business operations, and maximum utilization capacity of their internal resources. These factors might reduce investment inefficiency and enable firms to expand the volume of investment. In summary, the empirical results confirm all the hypotheses proposed (H1, H2a, H2b, H2c), and the objective of the research is achieved. The empirical findings are consistent even after heteroskedasticity and endogeneity issues are addressed, and several firm-level and country-specific variables are controlled for.

7.1. Policy suggestions and limitations

The empirical results lead us to make the following policy suggestions to firm managers. They should pay more attention to market capitalization in order to enhance industrial investment. More market capitalization expands the financial flexibility of firms, which further determines optimistic investment behavior. Likewise, they should increase intellectual capital following different strategies because doing so encourages firms to enhance their investment volume. Our results indicate that firms should

invest more in employee development, that is, in human capital, to raise the volume of investment. Similarly, maximum efficiency in accomplishing internal organizational operations (SCE) and better utilization of resources (CEE) can pay off regarding a positive investment attitude. Thus, they should be enthusiastic about increasing SCE and CEE and are recommended to develop multiple strategies—for example, performance and other bonuses and other monetary benefits—to encourage knowledge employees to make their maximum efforts. This factor substantially encourages talented employees to make more efforts. For their part, managers should consider the current economic conditions in the country as it also plays a potential role in determining investment. Our analysis is unable to test the underlying empirical framework in an individual country. Future studies should try to overcome this limitation and including other factors, such as cash-holding status and governance conditions. Both factors might have a potential role in determining market capitalization and intellectual capital that then have a significant impact on investment.

Research involving human participants and/or animals

In this research, no human being/animals involved in direct research or observation. Analysis purely based upon secondary data available on different data sites.

Funding detail

This research was supported by National Natural Science Foundation of China under grant number 72076174.

Authors' contribution

Mr. Umar Farooq has participated as conceptualization, data curation, writing and preparation of original draft. Mosab I. Tabash has participated in conceptualization, data curation, writing-original draft preparation. Suhaib Anagreh has participated in reviewing and editing while Khurshid has participated in methodology Data curation, Writing-revised draft preparation.

Conflict of interest

I (Umar Farooq), acting as corresponding author hereby declare on the behalf of my co-authors that we have no conflict of interest.

Informed consent

We hereby grant the consent and acknowledge that paper should be sent for peer review, or any other publication process required by journal.

Data availability statement

The data that support the findings of this study are available in "Thomson Reuters DataStream" and World Development Indicators (WDI), The World Bank. These data resources are publicly available on both monetary subscription and free of cost.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bir.2022.05.002.

References

Adelino, M., Ma, S., & Robinson, D. (2017). Firm age, investment opportunities, and job creation. *The Journal of Finance, 72*(3), 999–1038.

Ajide, F. M. (2017). Firm-specific, and institutional determinants of corporate investments in Nigeria. *Future Business Journal, 3*(2), 107–118.

Almeida, H., Campello, M., & Weisbach, M. S. (2011). Corporate financial and investment policies when future financing is not frictionless. *Journal of Corporate Finance, 17*(3), 675–693.

Alrowwad, A., Abualoush, S. H., & Masa'deh, R. (2020). Innovation and intellectual capital as intermediary variables among transformational leadership, transactional leadership, and organizational performance. *The Journal of Management Development, 39*(2), 196–222.

Armstrong, C. S., & Vashishtha, R. (2012). Executive stock options, differential risk-taking incentives, and firm value. *Journal of Financial Economics, 104*(1), 70–88.

Bakke, T. E., & Whited, T. M. (2010). Which firms follow the market? An analysis of corporate investment decisions. *Review of Financial Studies, 23*(5), 1941–1980.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99–120.

Bayraktaroglu, A. E., Calisir, F., & Baskak, M. (2019). Intellectual capital and firm performance: An extended VAIC model. *Journal of Intellectual Capital, 20*(3), 406–425.

Beltramino, N. S., Garcia-Perez-de-Lema, D., & Valdez-Juarez, L. E. (2021). The role of intellectual capital on process and products innovation. Empirical study in SMEs in an emerging country. *Journal of Intellectual Capital*, 1–24. https://doi.org/10.1108/JIC-07-2020-0234

Bo, H., Driver, C., & Lin, H.-C. M. (2014). Corporate investment during the financial crisis: Evidence from China. *International Review of Financial Analysis, 35*, 1–12.

Breusch, T., & Pagan, A. (1980). The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies, 47*(1), 239–253.

Buchuk, D., Larrain, B., Muñoz, F., & Urzúa, I. F. (2014). The internal capital markets of business groups: Evidence from intra-group loans. *Journal of Financial Economics, 112*(2), 190–212.

Campello, M., Graham, J. R., & Harvey, C. R. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics, 97*(3), 470–487.

Chaney, T., Sraer, D., & Thesmar, D. (2012). The collateral channel: How real estate Shocks affect corporate investment. *The American Economic Review, 102*(6), 2381–2409.

Chen, P. F., Lee, C. C., & Zeng, J. H. (2019). Economic policy uncertainty and firm investment: Evidence from the U.S. market. *Journal of Apllied Economics, 51*, 3423–3435.

Chen, N., Sung, H. C., & Yang, J. (2017). Ownership structure, corporate governance and investment efficiency of Chinese listed firms. *Pacific Accounting Review, 29*(3), 266–282.

Cholakova, M., & Clarysse, B. (2015). Does the possibility to make equity investments in crowdfunding projects crowd out reward–based investments? *Entrepreneurship: Theory and Practice, 39*(1), 145–172.

Ciżkowicz, P., & Rzońca, A. (2012). Does inflation harm corporate investment? Empirical evidence from OECD countries. *Economics*, 1–33. Retrieved from http://www.economics-ejournal.org/economics/discussionpapers/2012-63.

Demirgüç-Kunt, A., & Maksimovic, V. (2002). Funding growth in bank-based and market-based financial systems: Evidence from firm-level data. *Journal of Financial Economics, 65*(3), 337–363.

Dias, A. (2013). Market capitalization and value-at-risk. *Journal of Banking & Finance, 37*(12), 5248–5260.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*(366), 427–431.

Ding, S., Guariglia, A., & Knight, J. (2013). Investment and financing constraints in China: Does working capital management make a difference? *Journal of Banking & Finance, 37*(5), 1490–1507.

Farooq, U., Ahmed, J., & Khan, S. (2021). Do the macroeconomic factors influence the firm's investment decisions? A generalized method of moments (GMM) approach. *International Journal of Finance & Economics, 26*(1), 790–801.

Felício, J. A., Couto, E., & Caiado, J. (2014). Human capital, social capital and organizational performance. *Management Decision, 52*(2), 350–364.

Forbes, J., & Kara, S. M. (2010). Confidence mediates how investment knowledge influences investing self-efficacy. *Journal of Economic Psychology, 31*(3), 435–443.

Gamerschlag, R. (2013). Value relevance of human capital information. *Journal of Intellectual Capital, 14*(2), 325–345.

Hashim, M. J., Osman, I., & Alhabshi, S. M. (2015). Effect of intellectual capital on organizational performance. *Procedia – Social and Behavioral Sciences, 211*, 207–214.

Hayaeian, S., Hesarzadeh, R., & Abbaszadeh, M. R. (2021). The impact of knowledge management strategies on the relationship between intellectual capital and innovation: Evidence from SMEs. *Journal of Intellectual Capital*, 1–34. https://doi.org/10.1108/JIC-07-2020-0240

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating vector autoregressions with panel data. *Econometrica, 56*, 371–1395.

Hsu, Y.-H., & Fang, W. (2009). Intellectual capital and new product development performance: The mediating role of organizational learning capability. *Technological Forecasting and Social Change, 76*(5), 664–677.

Hugonnier, J., Malamud, S., & Morellec, E. (2015). Capital supply uncertainty, cash holdings, and investment. *Review of Financial Studies, 28*(2), 391–445.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*(1), 53–74.

Jiang, F., Kim, K. A., Nofsinger, j. R., & Zhu, B. (2015). Product market competition and corporate investment: Evidence from China. *Journal of Corporate Finance, 35*(December), 196–210.

Joshi, M., Cahil, D., Sidhu, J., & Kansal, M. (2013). Intellectual capital and financial performance: An evaluation of the Australian financial sector. *Journal of Intellectual Capital, 14*(2), 264–285.

Kasoga, P. S. (2020). Does investing in intellectual capital improve financial performance? Panel evidence from firms listed in Tanzania DSE. *Cogent Economics & Finance, 8*(1), 1–26.

Kumar, M. P., & Kumara, N. M. (2021). Market capitalization: Pre and post COVID-19 analysis. *Materials Today Proceedings, 37*(2), 2553–2557.

Kumar, S., & Ranjani, K. S. (2018). Financial constraints and investment decisions of listed Indian manufacturing firms. *Financial Innovation, 4*(1), 1–17.

Kuvshinov, D., & Zimmermann, K. (2021). The big bang: Stock market capitalization in the long run. *Journal of Financial Economics*. https://doi.org/10.1016/j.jfineco.2021.09.008. Retrieved from.

Kweh, Q. L., Lu, W. M., Tone, K., & Nourani, M. (2021). Risk-adjusted banks' resource-utilization and investment efficiencies: Does intellectual capital matter? *Journal of Intellectual Capital*. https://doi.org/10.1108/JIC-03-2020-0106

Lela, H., & Nuryakin, N. (2020). The relationship between organizational capability, organizational learning and financial performance. *Journal of Asian Finance, Economics and Business, 7*(8), 625–633.

Lin, S. J., & Lee, J. R. (2011). Configuring a corporate venturing portfolio to create growth value: Within-portfolio diversity and strategic linkage. *Journal of Business Venturing, 26*(4), 489–503.

Meca, E. G., & Martínez, I. (2007). The use of intellectual capital information in investment decisions: An empirical study using analyst reports. *The International Journal of Accounting, 42*(1), 57–81.

Mukherjee, D., Makarius, E. E., & Stevens, C. E. (2018). Business group reputation and affiliates' internationalization strategies. *Journal of World Business, 53*(2), 93–103.

Nnadi, M., Surichamorn, V., Jayasekera, R., & Belghitar, Y. (2021). Empirical analysis of debt maturity, cash holdings and firm investment in developing economies. *International Journal of Finance & Economics*, 1–28. https://doi.org/10.1002/ijfe.2324

Oppong, G. K., & Pattanayak, J. K. (2019). Does investing in intellectual capital improve productivity? Panel evidence from commercial banks in India. *Borsa Istanbul Review, 19*(3), 219–227.

Peters, R. H., & Taylor, L. A. (2017). Intangible capital and the investment-q relation. *Journal of Financial Economics, 123*(2), 251–272.

Polk, C., & Sapienza, P. (2009). The stock market and corporate investment: A test of catering theory. *Review of Financial Studies, 22*(1), 187–217.

Pulic, A. (2000). VAIC™ – an accounting tool for IC management. *International Journal of Technology Management, 20*(5–8), 702–714.

Qurashi, I. A., Khalique, M., Ramayah, T., Bontis, N., & Yaacob, M. R. (2020). Impact of intellectual capital on innovation in pharmaceutical manufacturing SMEs in Pakistan. *International Journal of Learning and Intellectual Capital, 17*(1), 61–76.

Sardo, F., & Serrasqueiro, Z. (2018). Intellectual capital, Growth opportunities, and financial performance in European firms: Dynamic panel data analysis. *Journal of Intellectual Capital, 19*(4), 747–767.

Sheth, J. (2020). Impact of Covid-19 on consumer behavior: Will the old habits return or die? *Journal of Business Reseaarch, 117*, 280–283.

Shiau, H. L., Chang, Y. H., & Yang, Y. J. (2018). The cash holdings and corporate investment surrounding financial crisis: The cases of China and Taiwan. *The Chinese Economy, 51*(2), 175–207.

Smriti, N., & Das, N. (2018). The impact of intellectual capital on firm performance: A study of Indian firms listed in COSPI. *Journal of Intellectual Capital, 19*(5), 935–964.

Ståhle, P., Ståhle, S., & Aho, S. (2011). Value added intellectual coefficient (VAIC): A critical analysis. *Journal of Intellectual Capital, 12*(4), 531–551.

Umer, F., & Alam, S. (2013). Effect of openness to trade and FDI on industrial sector growth: A case study for Pakistan. *The Romanian Economic Journal, 16*(48), 179–198.

Vo, X. V. (2019). Leverage and corporate investment – evidence from Vietnam. *Finance Research Letters, 28*, 1–5. https://doi.org/10.1016/j.frl.2018.03.005

Wang, Z., Wang, N., & Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. *Management Decision, 52*(2), 230–258.

Xu, J., Shang, Y., Yu, W., & Liu, F. (2019). Intellectual capital, technological innovation and firm performance: Evidence from China's manufacturing sector. *Sustainability, 11*(19). https://doi.org/10.3390/su11195328

Yanadori, Y., & Cui, V. (2013). Creating incentives for innovation? The relationship between pay dispersion in R&D groups and firm innovation performance. *Strategic Management Journal, 34*(12), 1502–1511.

Yang, X., Han, L., Li, W., Yin, X., & Tian, L. (2017). Monetary policy, cash holding and corporate investment: Evidence from China. *China Economic Review, 46*, 110–122.