NEXUS BETWEEN INTELLECTUAL CAPITAL AND FINANCIAL PERFORMANCE: AN INVESTIGATION OF CHINESE MANUFACTURING INDUSTRY

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Abstract. How to manage financial performance through the utilization of intellectual capital (IC) is an important issue in the knowledge economy. The objective of this study is to investigate the impact of IC on financial performance for manufacturing listed companies in the Chinese context. Financial performance is measured from two distinct aspects: (1) firm profitability, measured through earnings before interest, taxes, depreciation and amortization (EBITDA), net profit margin (NPM), and gross profit margin (GPM), and (2) corporate return, measured through return on investment (ROI), return on assets (ROA), and return on equity (ROE). The results show a positive relationship between NPM, GPM, ROI, ROA, ROE, and IC (measured through the market-to-book ratio). In addition, the more intangible-intensive manufacturing listed companies exhibit better financial performance. The study provides evidence that higher investment in IC can improve value creation in the emerging economies.

Keywords: intellectual capital, financial performance, firm profitability, corporate return, market-to-book ratio, manufacturing listed companies.

JEL Classification: O34, M41, M44.

Introduction

In the knowledge economy, experts and scholars have reached a consensus that intellectual capital (IC) can drive competitiveness and sustainability (Guthrie & Petty, 2000; Marr et al., 2003; Sonnier et al., 2009; Siboni et al., 2013; Crema & Verbano, 2016; Xu & Wang, 2018; Tonial et al., 2019; Gross-Golacka et al., 2020). IC is commonly considered as intangible assets that a firm possesses (Kennedy, 1998; Sullivan, 2000; Anghel, 2008). What's more, IC investment has a pivotal role in firms that seek to obtain sustainable competitive advantage (Bhasin, 2011; Xu & Wang, 2018; Hermawan et al., 2020). The IC-financial performance relationship is the main focus that attracts most researchers (Inkinen, 2015; Jordão & de Almeida, 2017;

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Xu & Wang, 2018; Xu & Liu, 2020). However, it is a challenge for researchers to accurately recognize, measure, and assess the value of organizational knowledge (Abdi et al., 2018). In addition, more attention should be paid to this challenge in a context where a firm's value relies on IC rather than conventional resources (e.g. land, capital, and labor) (Bontis et al., 1999). Measuring the role of IC is still a problem that needs further research, especially in emerging economies (Tseng & Goo, 2005; Sharma & Dharni, 2017; Dzenopoljac et al., 2017; Ferramosca & Ghio, 2018; Xu & Li, 2019; Xu & Liu, 2020).

China is currently in the process of economic transition, and manufacturing industry is undergoing industrial structure upgrade and energy-consuming equipment replacement with the implementation of the "Made in China 2025" strategy, which aims to turn "Made in China" into "Create in China" (Xu & Sim, 2017; Jin et al., 2018). However, one of the persistent problems in corporate governance is how to maintain long-term sustainable financial performance, which is one of the most difficult tasks for Chinese manufacturers. In its neighboring country, Xu and Wang (2018) concluded that IC is a contributor to sustainable growth of Korean manufacturing firms. Consequently, it is crucial to analyze how IC can contribute to financial performance in the context of this emerging market. This study designs an empirical study to evaluate the impact of IC on financial performance (i.e., firm profitability and corporate return) by using the data from Chinese manufacturing listed companies.

This research contributes to the IC literature in three ways. Firstly, this study provides empirical evidence of IC management and performance improvement in the context of China. Although a large body of IC literature has been carried out in various developed nations such as the U.S., the UK, and Italy, little has been done in emerging markets. The IC-financial performance relationship in emerging economies is still worth further analysis. This study attempts to analyze the role of IC in manufacturing sector in China that is experiencing an economic transition. Secondly, this study develops a systematic and comprehensive measurement for ascertaining financial performance from two aspects: firm profitability and corporate return. Actually, there still has been a hot debate on the use of the best indicators to assess financial performance at the firm level, and this study employs some new measurements such as earnings before interest, taxes, depreciation and amortization (EBITDA) and return on investment (ROI), which helps to better understand the IC's role in financial performance improvement. Finally, this study offers practical insights on how to maximize shareholders' value and protect the interests of other stakeholders by improving corporate performance. For corporate managers who seek to improve the firm's performance, they might not totally understand the IC-financial performance relationship. This paper will help them to effectively manage IC resources and achieve sustainable development.

The rest of this paper is organized as follows. Section 1 reviews the literature and develops two relevant hypotheses, along with Section 2 discussing the research methodology. The empirical results are presented in Section 3, and these results are discussed in Section 4. Finally, the conclusions and further research development are given in last section.

1. Literature review and hypotheses development

1.1. IC definition and measurement

Although knowledge management is believed to take a leading role in corporate governance by creating business value and achieving sustainable development, IC as an important concept has been hotly debated by academics (Rodov & Leliaert, 2002; Osinski et al., 2017; Tran & Vo, 2018). For example, Edvinsson and Sullivan (1996) simply defined IC as "knowledge that can be converted into value". Stewart (1997) defined IC as "intellectual material (e.g., knowledge, information, intellectual property, and experience) that can be used to create wealth". Marr and Moustaghfir (2005) stated that IC encompasses any valuable intangible resource obtained by experience and learning in the process of wealth generation. From the perspective of financial accounting, some researchers (Goebel, 2015; Dženopoljac et al., 2016; Forte et al., 2017; Jordão & de Almeida, 2017; Anghel et al., 2018) define IC in terms of its intangible asset nature, and consider that IC is the difference between a firm's market value and its accounting value (Edvinsson & Malone, 1997; Sharabati et al., 2010; Wang, 2013; Krstić & Bonić, 2016; Anghel et al., 2018). The knowledge-intensive companies tend to have higher value in the market (Stewart, 1997).

Most researchers (Chen et al., 2005; Goh, 2005; Wang, 2011; Lu et al., 2014; Vishnu & Gupta, 2014; Nimtrakoon, 2015; Tripathy et al., 2015; Ma et al., 2017; Urban & Joubert, 2017; Sardo & Serrasqueiro, 2018; Smriti & Das, 2018; Xu & Wang, 2018; Vidyarthi, 2019; Xu & Li, 2019) defined IC in relation to its components–human, structural, and relational capitals. They argued that IC includes the whole knowledge, abilities, and experience of human resource in line with its internal and external organizational structure. Human capital, a major capital, is employee's experience and expertise that can improve organizational performance (Chen et al., 2005; Phusavat et al., 2011; Nimtrakoon, 2015; Dzenopoljac et al., 2017; Allameh, 2018; Xu & Wang, 2018). Structural capital incorporates things like corporate culture, digital asset, and information management (Chen et al., 2005; Phusavat et al., 2011; Nimtrakoon, 2015; Dzenopoljac et al., 2017; Allameh, 2018; Xu & Wang, 2018). Relational capital deals with a company's associations with customers, suppliers, and other stakeholders (Chen et al., 2005; Phusavat et al., 2011; Nimtrakoon, 2015; Dzenopoljac et al., 2017; Allameh, 2018; Xu & Wang, 2018). Although companies are not required to disclose IC information in the financial statements, it indeed has an impact on financial performance.

Many methods of assessing IC have been put forward in the extent literature. They include the MTB, Tobin's Q ratio (Stewart, 1997), Skandia Navigator (Edvinsson & Malone, 1997), the balanced scorecard (Kaplan & Norton, 1996), the Intangible Asset Monitor (Sveiby, 1997), economic value added, and the Value Added Intellectual Coefficient (VAIC) (Pulic, 2000). Scholars explained that there does not exist the best tool for IC assessment and measurement. Among them, some researchers (Forte et al., 2017; Jordão & de Almeida, 2017; Anghel et al., 2018) considered that the MTB is a good proxy for IC measurement, given that IC is the "hidden value" of a company. The MTB is "well established in the literature and, although broad, readily identifies those organizations doing a better job with their knowledge assets" (Bramhandkar et al., 2007).

1.2. IC and financial performance

The vast majority of studies have confirmed that IC has a positive impact on financial performance. For instance, an early study by Chen, Cheng, and Hwang (2005) documented that IC is positively related to market value, financial performance measured by return on assets (ROA) and return on equity (ROE), growth in revenues, and employee productivity. In the study of Pal and Soriya (2012), involving Indian pharmaceutical and textile companies, the findings showed a positive relationship between IC and corporate return (ROA and ROE) but no relationship between IC and market value. Based on the data of companies in information technology (IT), manufacturing and real estate industries, Ma, Qiu, and Zhang (2017) found that human and structural capitals positively influence return on net assets of Chinese manufacturing companies. Taking 172 IT companies as a sample, Xu (2017) reported that IC and its components–organizational capital and relational capital–contribute significantly to business profitability (measured through profit margin). The findings of Sardo and Serrasqueiro (2018) revealed that IC efficiency in the current period positively affects corporate return (i.e., ROA) and growth opportunities of non-financial listed companies in 14 European countries. Xu and Wang (2018), collecting data of Korean manufacturing firms, concluded that IC is beneficial to the improvement of financial performance (measured by ROA, ROE, net profit margin, and gross profit margin) and sustainable growth. Vidyarthi (2019), using Data Envelopment Analysis (DEA) approach based on 38 listed Indian banks from 2004–2005 to 2015–2016, provided evidence that higher investment in IC can improve operating efficiency and value creation. Based on the survey of small and medium-sized enterprises (SMEs) in Pakistan, Khalique et al. (2020) argued that the overall IC has an effect on SMEs' performance. However, Firer and Williams (2003) failed to find any significant relationship between IC components and profitability. Using the data from Brazilian real estate companies, Britto, Monetti, and Lima (2014) found that IC has a negative impact on market value.

In the Chinese context, few studies have been done on the IC-financial performance relationship. Based on the data from the constituent companies of the Hang Seng Index of Hong Kong Stock Exchange, Chu, Chan, and Wu (2011) found that IC positively and significantly affects corporate profitability. Lu, Wang, and Kweh (2014) studied a sample of 34 Chinese life insurance companies during 2006–2010. Using the VAIC model, they argued that IC exerts a positive impact on firm operating efficiency. Li and Zhao (2018) estimated the relationship between IC (measured by human capital and organizational capital) and firm value, and found a strong association between organizational capital and firm value measured through ROA, ROE, growth in sales, and capital market return. Zhang et al. (2018) found that IC improves product innovation performance of manufacturers in China and India. The findings of Xu and Li (2019) also showed that IC improves firm performance in both high-tech and non-high-tech SMEs. Applying the extended VAIC model, Xu, Chen, and Zhang (2020) pointed out that executive human capital positively influence sustainable growth for China's high-tech agricultural listed companies. Therefore, the first hypothesis is stated as follows:

Hypothesis 1 (H1). IC positively contributes to financial performance of Chinese manufacturing listed companies.

According to Tseng and Goo (2005), tangible and intangible assets together constitute a firm's value. Goebel (2015) found that IC (measured through MTB, Tobin's q, and long-run

value to book) is positively related to leverage and motivational payments to employees. Forte et al. (2017), based on 140 Italian corporations during 2009–2013, also proved that IC (measured by MTB) is positively related with intangible assets and profitability. Jordão and de Almeida (2017) explored the relationship between IC and financial sustainability (measured by long-term corporate performance) of Brazilian companies. They concluded that the more intangible-intensive public companies have higher financial sustainability. On the contrary, Anghel et al. (2018) confirmed a significantly negative relationship between IC (measured through MTB) and ROA and ROE. Seo and Kim (2020) documented that intangible resources (human capital, advertising, and R&D) have a positive impact on Korean SMEs' profitability and value. Therefore, the second hypothesis is stated as follows:

Hypothesis 2 (H2). The intangible-intensive manufacturing listed companies have better financial performance than the less intangible-intensive manufacturing listed companies.

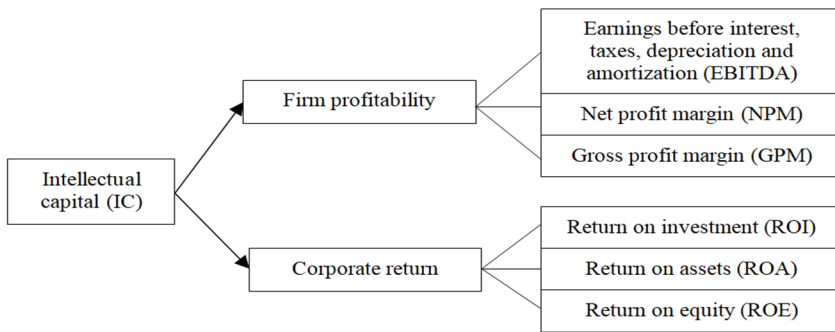Figure 1 shows the conceptual framework.

Figure 1. Conceptual framework

2. Research methodology

2.1. Sample selection

This study selects manufacturing companies listed on the Shanghai and Shenzhen stock exchanges as the sample and collects data from the CSMAR database and the RESSET database, covering the 2012–2017 period. Table 1 shows the procedure of sample selection. The initial sample includes 6528 firm-year observations. Then, companies with missing information on the MTB, profitability, and return are deleted. Finally, an unbalanced sample of 746 companies and 5166 firm-year observations are obtained.

Table 1. Details of research sample

Item	Firm-year observation
Manufacturing companies listed from 2012 to 2017	6528
Manufacturing companies with missing information	1362
Final observation	5166

2.2. Variables

(1) Dependent variables. In this study, financial performance is measured from two distinct aspects: firm profitability and corporate return.

Guided by Janošević, Dženopoljac, and Bontis (2013), Nimtrakoon (2015), Dzenopoljac et al. (2017), and Jordão and de Almeida (2017), firm profitability is evaluated by the chosen indicator: EBITDA, net profit margin (NPM), and gross profit margin (GPM). EBITDA is of particular interest for manufacturing companies that are subject to heavy depreciation charges of fixed assets. NPM and GPM are used to determine how well a company's management is generating profits. The calculation formulas are as follows:

$$NPM = Net\ income/Revenue; \tag{1}$$

$$GPM = (Revenue - cost\ of\ goods\ sold)/Revenue. \tag{2}$$

Corporate return is measured by the following performance indicators: ROI, ROA, and ROE (Chen et al., 2005; Wang & Chang, 2005; Wang, 2011; Vishnu & Gupta, 2014; Pucci et al., 2015; Tripathy et al., 2015; Jordão & de Almeida, 2017; Ginesti et al., 2018; Smriti & Das, 2018; Xu & Wang, 2018). First, ROI tries to directly measure the amount of return on a particular investment, which can be easily compared with returns from other investments. Second, ROA reflects how the firm utilizes total assets to generate revenue (Brealey et al., 2011). Third, ROE shows how much profit each dollar of common stockholders' equity generates. The calculation formulas are as follows:

$$ROI = Operating\ income/Investment; \tag{3}$$

$$ROA = Net\ income/Total\ assets; \tag{4}$$

$$ROE = Net\ income/Total\ equity. \tag{5}$$

(2) Independent variable. Guided by Sveiby (1997), Goebel (2015), Forte et al. (2017), Jordão and de Almeida (2017), and Anghel et al. (2018), the MTB is used to evaluate IC of Chinese manufacturing listed companies. Simply, an index (IC-index) is used to replace the MTB, indicating the level of intangibility for a company's assets. If this index is greater than 1, it suggests that IC is possessed by the company.

$$IC\text{-}index = MV/BV, \tag{6}$$

where MV – the average annual market value of the company × the number of its shares; BV – book value of the company from financial statements.

(3) Control variables. Guided by previous literature (Pal & Soriya, 2012; Nimtrakoon, 2015; Ma et al., 2017; Anghel et al., 2018; Xu & Wang, 2018; Xu & Li, 2019; Xu & Liu, 2020), SIZE (measured by the natural logarithm of total assets) and LEV (measured by the ratio of total liabilities to total assets) are chosen as control variables.

2.3. Methodology

Four levels of analysis are carried out in this study. This study starts the analysis with descriptive statistics. The second level of analysis, Spearman's correlation test, is conducted to

measure the intensity of the relationship between the dependent and independent variables used (Cohen, 1988). Next, Kruskal-Wallis' test is to analyze the quartiles, and graphics are used to check IC contribution to financial performance of manufacturing listed companies. To ensure the reliability and internal validity, the results from one analysis are compared with those from the others to examine the research hypotheses (Jick, 1979).

Finally, regression analysis, the fourth level of analysis, is carried out to examine the impact of IC on financial performance by using Models (1)–(6). This study uses EBI (measured by natural logarithm of EBITDA) when the EBITDA indicator is used as a proxy of financial performance in Model (1) (Eqs (7)–(12)). Because the EBITDA indicator may have negative values, the observations are less than those in other measurement indicators. Table 2 shows the definition of variables used in this study. In summary, H1 is tested using four levels of analysis, and H2 is tested by the first three levels.

$$EBI_{i,t} = \beta_0 + \beta_1 IC\text{-}index_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon_{i,t}; \tag{7}$$

$$NPM_{i,t} = \beta_0 + \beta_1 IC\text{-}index_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon_{i,t}; \tag{8}$$

$$GPM_{i,t} = \beta_0 + \beta_1 IC\text{-}index_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon_{i,t}; \tag{9}$$

$$ROI_{i,t} = \beta_0 + \beta_1 IC\text{-}index_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon_{i,t}; \tag{10}$$

$$ROA_{i,t} = \beta_0 + \beta_1 IC\text{-}index_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon_{i,t}; \tag{11}$$

$$ROE_{i,t} = \beta_0 + \beta_1 IC\text{-}index_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \varepsilon_{i,t}. \tag{12}$$

Table 2. Variable definition

Variable	Definition
EBI	Natural logarithm of EBITDA
NPM	Net income/Revenue
GPM	(Revenue – cost of goods sold)/Revenue
ROI	Operating income/Investment
ROA	Net income/Total assets
ROE	Net income/Total equity
IC-index	Market-to-book ratio
SIZE	Natural logarithm of total assets
LEV	Total liabilities/Total assets

3. Results

3.1. Descriptive statistics

Table 3 presents the descriptive statistics of financial performance with regard to firm profitability and corporate return. The full sample is divided into two groups: group 1 and group 2. In group 1, the value of IC-index is greater than 1, while its value is less than 1 in group 2. On the basis of the average in both two groups, it shows a significant variability of corporate

profitability and return, especially EBITDA, NPM and ROE. The values of the EBITDA indicator are collected in millions.

More emphatically, except the EBITDA indicator, companies that possess IC in group 1 yield greater profitability as well as greater return than the other companies. Unexpectedly, as for the EBITDA indicator, companies in group 1 have much lesser cash flow than those in group 2, inconsistent with Jordão and de Almeida (2017). The t-test shows that there are significant differences between group 1 and group 2 in terms of EBITDA, NPM, GPM, ROA, and ROE.

Table 3. Descriptive analysis

Measure	Variable	Group	N	Mean	Min	Max	S. D.	p-value (Difference t-statistics)
Firm profit-ability	EBITDA (million yuan)	1	3840	545.987	−4354.625	39806.100	1480.775	0.000
		2	1326	1420.876	−5208.216	63241.164	4259.135	
		Total	5166	770.552	−5208.216	63241.164	2535.632	−
	NPM	1	3840	0.079	−7.171	5.566	0.239	0.000
		2	1326	0.010	−8.911	0.483	0.262	
		Total	5166	0.061	−8.911	5.566	0.247	−
	GPM	1	3840	0.295	−0.482	0.929	0.171	0.000
		2	1326	0.165	−0.180	0.632	0.097	
		Total	5166	0.261	−0.482	0.929	0.166	−
Cor-porate return	ROI	1	3840	0.075	−0.746	3.417	0.103	0.511
		2	1326	0.054	−0.563	14.720	0.413	
		Total	5166	0.070	−0.746	14.720	0.227	−
	ROA	1	3840	0.052	−0.399	0.402	0.062	0.000
		2	1326	0.014	−0.463	0.244	0.041	
		Total	5166	0.042	−0.463	0.402	0.060	−
	ROE	1	3840	0.076	−1.868	1.467	0.122	0.066
		2	1326	0.019	−7.220	0.743	0.251	
		Total	5166	0.062	−7.220	1.467	0.167	−

3.2. Correlation test

The results of correlation test are shown in Table 4, including the sample of 746 manufacturing listed companies and total 5166 observations. Based on the results in Table 4, this study highlights the correlation of IC with all financial performance indicators. IC is observed to be positively correlated with NPM, GPM, ROI, ROA, and ROE. It is noticeable that IC is significantly and negatively correlated with EBITDA. Table 4 also shows high statistical significance (<1 percent).

Table 4. Results of correlation test

Spearman's correlation test	Firm profitability			Corporate return		
	EBITDA	NPM	GPM	ROI	ROA	ROE
Correlation coefficient	−0.084	0.117	0.398	0.044	0.261	0.115
Significance	0.000	0.000	0.000	0.000	0.000	0.000

The results corroborates and extends the findings of St-Pierre and Audet (2011), who linked IC to strategy and performance in 267 SMEs; Nimtrakoon (2015), who tested the relationship between IC, market value, and financial performance among ASEAN countries; Andreeva and Garanina (2016), who examined the impact of IC on Russian companies' performance; Li (2016), who found a positive relationship between intangible assets and the performance of Chinese listed companies; Anghel et al. (2018), who analyzed the IC-financial performance relationship in 24 biotech firms, using ROA, ROE, and debt-to-equity ratio; Xu and Wang (2018), who investigated whether IC affects financial performance and sustainable growth of Korean manufacturing companies; Xu and Liu (2020), who analyzed the role of IC in the performance improvement.

3.3. Kruskal-Wallis' test

In an attempt to attain the robustness, Kruskal-Wallis test, the third level of analysis, is to investigate whether the IC-intensive companies yield higher profitability and return than the less IC-intensive ones in China's manufacturing sector (H2). Descriptive statistics of the third level of analysis is shown in Table 5. In addition, Figure 2 and 3 show the contribution of IC in firm profitability and corporate return, respectively.

Table 5. Descriptive statistics of the Kruskal-Wallis' test

Indicator (Mean)	Q1	Q2	Q3	Q4
EBITDA	1420.8760	569.0178	493.5125	575.4314
NPM	0.009588	0.046261	0.080263	0.111743
GPM	0.164748	0.231106	0.292751	0.359716
ROI	0.053724	0.059715	0.074772	0.091531
ROA	0.014216	0.036056	0.051965	0.066846
ROE	0.018773	0.058599	0.078991	0.091714

Taking the IC-index as a reference, Figure 2 shows that this is the case for only two profitability indicators (NPM and GPM). In the Q1, companies with IC-index < 1 are referred to as non-IC-intensive companies; in the Q2, companies with 1.672312 > IC-index ≥ 1 are less IC-intensive companies; in the Q3, companies with 2.682216 > IC-index ≥ 1.672312 are IC-intensive companies; in the Q4, companies with IC-index ≥ 2.682216 are the most IC-intensive companies. In addition, Q1 consists of 1326 observations; Q2 1280 observations; Q3 1280 observations; and Q4 1280 observations.

Based on the average values, Figure 2 shows that companies in the Q2, Q3, and Q4 have higher profitability indicators (NPM and GPM) than companies in the Q1 over the period analyzed. In addition, it is observed that companies in the Q1 have higher values of EBITDA indicator than those in the Q2, Q3, and Q4.
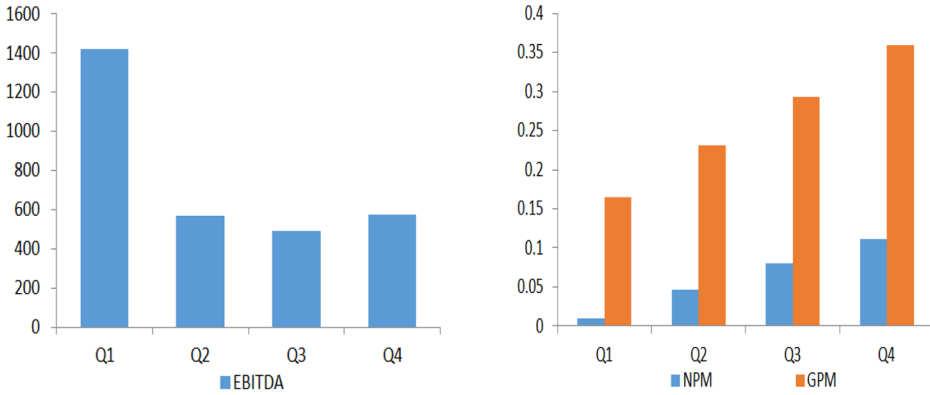

Figure 2. The contribution of IC in firm profitability

Figure 3 is to investigate whether IC can contribute to corporate return (ROI, ROA, and ROE), stressing that companies in the Q2, Q3, and Q4 with IC-index > 1 have greater return than those in the Q1 with IC-index <1 during the period 2012–2017. Generally, companies in the Q4 have higher corporate return indicators than those in the Q3; companies in the Q3 have higher corporate return indicators than those in the Q2; companies in the Q2 have higher corporate return indicators than those in the Q1.
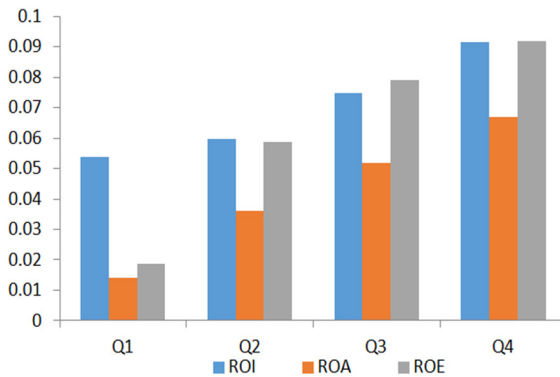

Figure 3. The contribution of IC in corporate return

The results show a clear difference between these quartiles, indicating that the IC-intensive companies tend to hold better financial performance compared to the others. This also reveals that the more intangible assets a manufacturing company has, the greater firm profitability and corporate return it presents in terms of NPM, GPM, ROI, ROA, and ROE. Overall, this complements the results obtained by Edvinsson and Malone (1997), Stewart

(1997), Sveiby (1997), Subramaniam and Youndt (2005), Jardon and Martos (2012), Nimtra-koon (2015), Andreeva and Garanina (2016), Jordão and de Almeida (2017), Anghel et al. (2018), Xu and Wang (2018), Xu and Li (2019), and Xu and Liu (2020).

3.4. Regression analysis

The values of variance inflation factor (VIF) are found to be less than 2, which suggests that multi-collinearity is not a serious issue. The regression results of Models (1)–(6) are shown in Table 6.

Table 6 tests the dependency between IC and financial performance (i.e., firm profitability and corporate return). The estimated coefficients for the interlinkages with NPM (0.009) and GPM (0.028) are positive and significant, while IC has a significant negative correlation with EBI ($\beta = -0.040$, $t = -20.966$). IC induces an increase in corporate return (as revealed by ROI, ROA, and ROE) of these companies, thus confirming H1. In addition, financial performance is positively related to firm size (SIZE). Table 6 also reveals a negative relationship between debt ratio (LEV) and financial performance except the EBI indicator.

Table 6. Regression results of Model (1)–(6)

Variable	Firm profitability			Corporate return		
	EBI	NPM	GPM	ROI	ROA	ROE
Constant	4.113*** (87.191)	−0.659*** (−8.179)	−0.283*** (−5.893)	−0.521*** (−6.814)	−0.367*** (−20.989)	−0.679*** (−12.522)
IC-index	−0.040*** (−20.966)	0.009*** (3.986)	0.028*** (21.864)	0.007*** (3.511)	0.007*** (15.374)	0.009*** (6.027)
SIZE	0.635*** (114.531)	0.089*** (10.527)	0.065*** (12.819)	0.065*** (8.134)	0.047*** (25.717)	0.086*** (15.065)
LEV	0.509*** (29.422)	−0.373*** (−18.530)	−0.333*** (−27.704)	−0.129*** (−6.743)	−0.147*** (−33.589)	−0.250*** (−18.453)
Adj. R^2	0.815	0.077	0.268	0.017	0.259	0.087
F	7221.208***	145.319***	630.243***	30.887***	602.345***	164.382***
D. W.	1.002	2.004	0.561	1.923	1.116	1.696
N	4930	5166	5166	5166	5166	5166

Note: *** $p < 0.01$. *t*-values are in parentheses.

4. Discussion

Although a majority of current IC research has examined the impact of IC and its components on organizational performance, little has been done in emerging markets. This study measures financial performance with six indicators, and thereby systematically demonstrates the relationship between IC and financial performance in China's manufacturing sector. In doing so, this research also provides important implications for corporate managers to take full advantage of IC resources and achieve high financial targets.

This study contributes to the literature on both asset management and corporate finance. The results of four levels of analysis are shown in Table 7, which helps to understand the role of IC in business performance improvement. H1, which predicts that IC positively contributes to financial performance of Chinese manufacturing listed companies, is supported except the EBITDA indicator. Moreover, Spearman's correlation test and Kruskal-Wallis' test also highlight the positive impact of IC on corporate profitability and return except EBITDA. According to the regression results, IC is positively related to five indicators of financial performance: NPM, GPM, ROI, ROA, and ROE. In the context of industrial structure adjustment, more investment in intangible resources (e.g. patents, trademarks, and copyrights) induces a potential decrease in their current earnings. The findings suggest that these resources will bring competitive advantages to manufacturing listed companies in the long run. Basso, Kimura, and de Aguiar (2010), using the data from the production and assembly of vehicles and auto-parts sector in Brazil, pointed out that there is a positive relationship between value creation and IC. In BRICS economies, IC efficiency is significantly associated with ROA and ROE (Nadeem et al., 2017). Xu, Haris, and Yao (2019) argued that IC positively affects ROA and ROE in banking sector in both China and Pakistan. In Indian pharmaceutical industry, Gupta, Goel, and Bhatia (2020) found a significant relationship between IC and firms' profitability as represented by ROA, ROE, and EBITDA.

This study also contributes to the understanding of the relationship between intangible capital and financial governance. Table 7 also provides a confirmation of H2. More intangible-intensive manufacturing companies have better financial performance compared with the others except EBITDA. The findings of Findik and Ocak (2016) revealed that intangible assets can improve ROA in Turkey. Muwardi et al. (2020) also confirmed that a higher level of intangible resources is an important predictor of organizational performance in Indonesia. However, this study shows that manufacturing listed companies with higher IC in the Q2, Q3, and Q4 have lower EBITDA than those in the Q1, contrary to the findings of Jordão and de Almeida (2017). The unexpected relationship between IC and EBITDA may result from the fact that manufacturing listed companies with higher IC tend to invest more in R&D activities and patents, and replace old equipments with low energy-consuming equipments during China's economic transition in order to achieve green growth and sustainable development, which leads to the decrease in the current net income (Chen et al., 2018). For long-term financial performance, intangible assets should be reasonably identified and allocated within the firm (Chareonsuk & Chansa-ngavej, 2008).

In summary, the results show that companies with more intangible assets have higher financial performance regarding firm profitability (NPM and GPM) and corporate return (ROI, ROA, and ROE) within the Chinese context. In addition, the results also suggest that the selection of financial performance indicators affects the contribution of IC to business financial sustainability. All in all, the results observed extend and complement previous work, taking into account the sample of Chinese manufacturing listed companies.

Table 7. Summary of hypothesis test

Hypo-theses	Indicators	Descriptive statistics	Correlation test	Kruskal-Wallis' test	Regression analysis	Conclusion
H1	EBITDA	No	No	No	No	No
	NPM	Yes	Yes	Yes	Yes	Yes
	GPM	Yes	Yes	Yes	Yes	Yes
	ROI	Yes	Yes	Yes	Yes	Yes
	ROA	Yes	Yes	Yes	Yes	Yes
	ROE	Yes	Yes	Yes	Yes	Yes
H2	EBITDA	No	No	No	N/A	No
	NPM	Yes	Yes	Yes	N/A	Yes
	GPM	Yes	Yes	Yes	N/A	Yes
	ROI	Yes	Yes	Yes	N/A	Yes
	ROA	Yes	Yes	Yes	N/A	Yes
	ROE	Yes	Yes	Yes	N/A	Yes

Conclusions

Although IC has been one of the hottest issues in academic communities, exploring IC measurement and its impact on financial performance is still a challenge in the knowledge era. For managerial theory and practice, this study proposes a systematic approach to measure financial performance on the basis of the information in the financial statements. By investigating Chinese manufacturing listed companies over the six-year period (2012–2017), this study draws the following main conclusions: (1) financial performance of Chinese manufacturing listed companies is strongly related to IC, that is, investment in intangible assets embodied in the IC can systematically contribute to improving firm profitability and corporate return over time; (2) the more intangible-intensive manufacturing listed companies exhibit financial performance superior to the less intangible-intensive counterparts.

Empirical findings offer the following theoretical contributions. First, this study expands the extant IC-financial performance research by using the data from Chinese manufacturing listed companies. The regression results suggest that Chinese manufacturing listed companies can take benefit from IC to achieve sustainable financial performance. Also, this study provides a systematic method to measure financial performance from two distinct aspects: firm profitability and corporate return. Second, this study can become the base study for future directions exploring the impact of IC on financial performance in the context of other emerging economies such as Brazil, Russia, and India.

In this sense, some implications are put forward for top managers of companies to effectively and efficiently manage IC. Firstly, the results show that manufacturing listed companies that possess IC exhibit better financial performance. To increase sustainable financial performance, manufacturing listed companies should keep aware of the importance of IC, as it has a positive effect on financial performance over time. If corporate managers aim to achieve financial sustainability, their efforts should focus on investment in IC. Secondly, for

analysts and investors, a set of financial performance indicators should be used to analyze the contribution of IC in the process of value creation, which is beneficial to business decisions. These indicators can be used as a benchmark to guide decision making from a sustainable long-term perspective. Finally, on the basis of the results, this is aligned with the goal of greater long-term financial performance. Therefore, decision makers should make continuous investment in IC and increase long-term financial performance, stimulating market value to overtake its book value.

This study provides valuable contributions, but one of the limitations is that the results should be compared with the findings in other emerging economies or regions. In addition, there are still no perfect tools for IC measurement that need to be comprehended in the future. Therefore, in-depth research is required to be conducted for IC research.

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Author contributions

JX conceived the study, collected data, performed the statistical analysis, and drafted the manuscript. FL participated in its design and coordination, helped draft the manuscript, and reviewed the manuscript. Both authors read and approved the final manuscript.

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APPENDIX

Abbreviations

IC   – Intellectual capital.
MTB   – Market-to-book ratio.
EBITDA – Earnings before interest, taxes, depreciation and amortization.
NPM   – Net profit margin.
GPM   – Gross profit margin.
ROI   – Return on investment.
ROA   – Return on assets.
ROE   – Return on equity.