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Intellectual Capital and Financial Performance of Chinese Manufacturing SMEs: An Analysis from the Perspective of Different Industry Types

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Abstract: In the knowledge era, intellectual capital (IC) has been recognized as the determinant of firm performance. The main goal of the current study is to analyze the relationship between IC and its elements and financial performance of Chinese manufacturing small and medium-sized enterprises (SMEs). We also examine whether industry type has an impact on this relationship. This study uses the data of 588 Chinese listed SMEs in the manufacturing industry between 2015 and 2020 and employs the modified value-added intellectual coefficient (MVAIC) model to assess IC. The results show that IC improves SMEs' financial performance, and physical and human capitals are the main contributor. In addition, the impact of IC and its elements on the financial performance of Chinese manufacturing SMEs is different in different types of industries. Specifically, capital-intensive SMEs have a greater impact of IC on financial performance than labor- and technology-intensive SMEs; labor-intensive SMEs have a higher efficiency of physical capital, while technology-intensive SMEs have higher human capital efficiency. The findings could help SMEs' managers improve corporate performance by the effective utilization of their IC.

Keywords: intellectual capital; financial performance; manufacturing SMEs; industry type

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1. Introduction

Intellectual capital (IC) with no physical form is generally recognized as the main source of firms' future growth and lasting competitive advantage [1–6]. Using the resource-based view (RBV) of the firm, IC is valuable, rare, inimitable and non-substitutable [7,8]. In recent years, IC research has caught more and more scholars' attention [9].

Small and medium-sized enterprises (SMEs) are the new force of China's national economy and social development [10]. It is reported that Chinese SMEs' contribution to gross domestic product (GDP) is over 60 percent. In addition, SMEs can provide employment opportunities and ensure stability in employment [11]. However, the outbreak of coronavirus disease 2019 (COVID-19) has caused the disruption of supply chain and production activities [12,13]. Unlike large corporations with sufficient funds and resources, Chinese manufacturing SMEs ceased their operations and suffered great losses during this pandemic. To survive and excel amid competition, Chinese manufacturing SMEs need to pay great attention to IC. The efficiency of IC in SMEs and large companies is not the same because of their different resource allocation policies [14]. Although the important role of IC has become evident, the research on the IC's impact on SMEs has rarely been carried out [15].

Gu et al. [16] found that the comparative advantage of state-owned enterprises in capital-intensive industries is declining, while private-owned enterprises have a high comparative advantage in labor-intensive industries. In the process of economic growth all over the world, it is generally believed that the contribution rate of science and technology is increasing, whereas the contribution rate of labor is gradually decreasing [17]. Firms in different industries have different production resources, and by effectively managing their resources, they can improve productivity and generate economic return [18]. SMEs are subject to resource limitations [15], and they have to take full advantage of their allocated resources, especially intangibles. Therefore, understanding the impact of industry type on the relationship between IC and SMEs' financial performance is critical.

This study intends to examine whether IC positively affects the financial performance of Chinese manufacturing SMEs, and we also explore the impact of industry type on this relationship. This study applies the modified value-added intellectual coefficient (MVAIC) model to measure IC with its comprehensive elements of IC including human capital (HC), structural capital (SC), relational capital (RC) and innovation capital. The original value-added intellectual coefficient (VAIC) model proposed by Pulic [19] only includes HC and SC.

The contributions of this study are as follows. Firstly, this is among the first studies to explore the impact of IC and its elements on SMEs' financial performance. Few studies have focused on SMEs in the emerging market, and our study enriches the current IC literature based on the data from a typical developing country (i.e., China). Secondly, little research has been carried out on the impact of different industry types on this relationship, and this study attempts to fill this void. According to industry type, SMEs are divided into labor-intensive SMEs, capital-intensive SMEs and technology-intensive SMEs. Finally, the research results might provide new insights for manufacturing SMEs' managers to enhance financial performance by effectively and efficiently utilizing IC resources.

The remainder of this study is as follows. Section 2 presents the literature review and develops the research hypotheses. Section 3 presents the research methodology, and Section 4 shows the empirical results. Section 5 discusses the results. Finally, conclusions are made in Section 6.

2. Literature Review and Hypotheses Development

2.1. IC Definition and Classification

The concept of IC was firstly developed by the economist John Kenneth Galbraith in 1969, and since the 1990s, a large and growing body of literature has focused on defining and classifying IC [20]. However, there is still no unified standard for IC definition [21]. From its intangible nature, Brooking [22] believed that IC is the sum of all intangible assets that enable enterprises to operate. Stewart [23] also defined IC as the sum of knowledge, information, experience, professional skills and customer relationship owned by enterprises. Sveibly [24] proposed that IC is a knowledge-based asset within firms. Edvinsson and Malone [25] considered IC as the difference between market value and book value of a firm.

Rational classification of IC can help deeply understand the concept of IC and provide an effective basis for the measurement of IC. At present, IC classification still has no unified standards. Its composition includes two-dimensional structure, three-dimensional structure and multi-dimensional structure. Edvinson and Malone [25] thought that IC includes HC and SC. Nahapiet and Ghoshal [26] pointed out that IC can be divided into HC and social capital. Stewart [23] claimed that IC includes HC, SC and customer capital. In some studies, customer capital is also referred to as RC [27,28]. This classification has been widely recognized by most researchers. In addition, Bassi and Van Buren [29] argued that HC, SC, RC, process capital and innovation capital constitute IC. Consistent with Xu and Liu [5], Xu and Wang [8], Ge and Xu [30], Liu et al. [31], Lu et al. [32], Xu and Zhang [33,34], Xu et al. [35,36] and Zhang et al. [37], in this study, we propose that IC is classified into HC, SC, RC and innovation capital.

HC refers to the knowledge, competence, experience and wisdom of employees in the firm [38]. Compared with large companies, HC in SMEs tends to behave differently [39]. SC refers to organizational structure, institutional norms, corporate culture, etc. [40]. SC is the supporting basis of HC [38]. HC as the most important asset will disappear with the leave of employees, while SC is possessed by the firm and will not disappear with the resignation of employees [41,42]. A good SC can provide a good environment for rapid knowledge sharing and innovative idea generation [43]. RC includes the relationship with different stakeholders inside and outside the industry [44]. Innovation capital is related to corporate research and development (R&D) activities [31,32]. Agostini et al. [45] defined innovation capital as the structure that can transform employees' valuable ideas into new products.

Physical capital refers to a factor of production (or input into the process of production), such as machinery, buildings or computers. Generally speaking, enterprise capital consists of physical capital and IC, and firm value is determined by these two types of capital. Each element of IC interacts and depends on each other to create firm value together with financial capital [27].

2.2. IC and Its Elements and Financial Performance

There is a large volume of published studies describing the important role of IC [9,35,46]. For example, Al-Musali and Ismail [47] found that IC is positively related to banks' financial performance in Gulf Cooperation Council (GCC) countries. Xu and Liu [48] argued that higher IC helps Chinese manufacturing companies to maintain their profitability and corporate return. For Brazilian listed firms, Jordão et al. [49] pointed out that IC positively influences sustainable economic and financial performance and value creation.

In terms of IC elements, the research results are inconsistent. Dženopoljac et al. [50] observed that only physical capital has a significant impact on firms' financial performance in the Serbian information communication technology sector. According to Andreeva and Garanina [51], HC and SC positively influence financial performance of Russian manufacturing firms, while RC does not have an impact. The findings of Nawaz and Haniffa [52] revealed that financial performance of Islamic financial institutions is highly determined by physical capital and HC. Using the VAIC model, Ozkan et al. [53] found that physical capital and HC positively affect financial performance of banks in Turkey. Sardo et al. [54] confirmed that human, structural and relational capitals exert a positive impact on hotel financial performance in Portugal. In a study conducted by Xu and Wang [8], it was shown that physical capital, HC and RC have a positive impact on firms' financial performance and sustainable development. Li et al. [55] found that physical capital and HC are the important components of IC in augmenting the profitability of innovative firms, while SC and RC are not related to it. Taking French fishing companies as the sample, Pavlovic et al. [56] found that these companies improve financial performance through two IC elements, namely, HC and SC. During the COVID-19 era, Xu et al. [57] reported that only human resources positively influence banks' profitability in China and Pakistan. Some recent studies (e.g., Xu and Liu [5]; Lu et al. [32]; Nadeem et al. [58]) have shown that innovation capital is a key factor of firm performance improvement. Therefore, we come to the following set of hypotheses:

Hypothesis 1a (H1a). *IC positively affects the financial performance of Chinese manufacturing SMEs.*

Hypothesis 1b (H1b). *Physical capital positively affects the financial performance of Chinese manufacturing SMEs.*

Hypothesis 1c (H1c). *HC positively affects the financial performance of Chinese manufacturing SMEs.*

Hypothesis 1d (H1d). *SC positively affects the financial performance of Chinese manufacturing SMEs.*

Hypothesis 1e (H1e). *RC positively affects the financial performance of Chinese manufacturing SMEs.*

Hypothesis 1f (H1f). *Innovation capital positively affects the financial performance of Chinese manufacturing SMEs.*

2.3. The Impact of Different Industry Types

Labor-intensive industries largely depend on the use of a large amount of labor force for production [59]. Capital-intensive industries have the characteristics of huge investment in technical equipment, less accommodation of labor force and slow capital turnover [60]. The development of technology-intensive industries reflects the level of national science and technology, which is conducive to the application of the latest scientific and technological achievements [61]. Much of the previous IC research has focused on a certain industry, and few studies have made a comparative analysis. For example, Lin et al. [62] pointed out that traditionally conceived 'capital- and labor-intensive' construction industry in Taiwan is highly intellectually capitalized. A study conducted by Li and Zhao [63] revealed that capital-intensive firms rely more on HC than labor-intensive ones. Öner et al. [64] claimed that IC and its components can generate superior performance in sectors that are more technology intensive. In addition, taking Chinese energy companies as the sample, Xu et al. [65] evidenced that innovation investment in the current period negatively influences financial sustainability in technology-intensive companies, while it has a positive impact in capital-intensive companies. We expect that IC and its components have different impacts on financial performance in different industries. Therefore, the second hypothesis is proposed as follows:

Hypothesis 2 (H2). *The impact of IC and its elements on the financial performance of Chinese manufacturing SMEs is different in different types of industries. That is, labor-intensive, capital-intensive and technology-intensive SMEs have different impacts of IC and its elements on their financial performance.*

3. Methodology

3.1. Sample Selection

Our initial sample includes 785 manufacturing SMEs listed on China's Growth Enterprises Market (GEM) from 2015 to 2020. GEM is designed to provide financing channels for SMEs that are unable to be listed on the main board market. Companies with missing information, companies with the change in main business during the observed period, delisted companies and special treatment (ST) companies are excluded from our sample. Finally, we get an unbalanced panel data of 2612 observations for 588 manufacturing SMEs. Panel data regression models are used in the analysis.

Based on industry type, manufacturing SMEs are divided into three sub-samples, namely, labor-intensive SMEs, capital-intensive SMEs and technology-intensive SMEs. Specifically, labor-intensive industries include the processing of food from agricultural products, manufacturing of foods, manufacturing of textile, manufacturing of textile, wearing apparel and accessories, manufacturing of leather, fur, feather and related products and footwear and manufacturing of furniture. Capital-intensive industries consist of the manufacturing of paper and paper products, manufacturing of articles for culture, education, arts and crafts, sport and entertainment activities, processing of petroleum, coal and other fuels, manufacturing of raw chemical materials and chemical products, manufacturing of chemical fibers, manufacturing of rubber and plastics products, manufacturing of non-metallic mineral products, smelting and pressing of non-ferrous metals and manufacturing of metal products. Technology-intensive industries comprise the manufacturing of medicines, manufacturing of general purpose machinery, manufacturing of special purpose machinery, manufacturing of railway, ship, aerospace and other transport equipment, manufacturing of electrical machinery and apparatus, manufacturing of computers, communication and other electrical equipment and manufacturing of measuring instruments and machinery.

Table 1 lists the sample distribution.

Table 1. Sample distribution.

Industry	Number of Companies	Percent of the Sample (%)
Processing of food from agricultural products	5	0.85
Manufacture of foods	11	1.87
Manufacture of textiles	7	1.19
Manufacture of textiles, wearing apparel and accessories	2	0.34
Manufacture of leather, fur, feather and related products and footwear	1	0.17
Manufacture of furniture	3	0.51
Manufacture of paper and paper products	1	0.17
Manufacture of articles for culture, education, arts and crafts, sport and entertainment activities	4	0.68
Processing of petroleum, coal and other fuels	1	0.17
Manufacture of raw chemical materials and chemical products	60	10.20
Manufacture of medicines	58	9.86
Manufacture of chemical fibres	3	0.51
Manufacture of rubber and plastics products	29	4.93
Manufacture of non-metallic mineral products	18	3.06
Smelting and pressing of non-ferrous metals	8	1.36
Manufacture of metal products	7	1.19
Manufacture of general purpose machinery	37	6.29
Manufacture of special purpose machinery	86	14.63
Manufacture of railway, ship, aerospace and other transport equipment	14	2.38
Manufacture of electrical machinery and apparatus	65	11.05
Manufacture of computers, communication and other electrical equipment	137	23.30
Manufacture of measuring instruments and machinery	31	5.27
Total	588	100

3.2. Variables

(1) Dependent variable. Financial performance (PER) is measured by two accounting indicators, namely, return on assets (ROA) and return on equity (ROE). ROA is the reflection of firms' efficiency in utilizing total assets, and ROE represents returns to shareholders of common stocks [66].

(2) Independent variables. Pulic [19]'s VAIC model evaluates total value creation efficiency of a firm. This model includes two components, namely, IC efficiency and capital employed efficiency (CEE). CEE measures the efficiency of capital employed. The wide application of VAIC model by a majority of researchers [56,57,66–76] is because the financial information is readily available and reliable. In addition, it is standardized, which allows us to make a comparison across firms and countries [77]. However, the VAIC model still has some limitations. First, it is reliant on historical data, and thus might not be appropriate to evaluate firms' future value-creating potential. Second, the measurement of IC elements is not complete in the traditional VAIC model that only includes HC and SC. Therefore, the MVAIC model as an advancement over Pulic [19]'s VAIC model is used in this study, which involves HC, SC,

RC and innovation capital for a board coverage. Different from previous literature using the MVAIC model, innovation capital as a neglected element is included in our study. In line with Xu and Zhang [34], Xu et al. [78] and Jin and Xu [79], the first step is to compute the value added (VA), which is a sum of net income, interest, tax and employee expenditure. The next step involves the calculation of the efficiency of HC, SC, RC and innovation capital through HC efficiency (HCE), SC efficiency (SCE), RC efficiency (RCE) and innovation capital efficiency (RDE). HCE measures the value added by each monetary unit invested in manpower, and SCE measures the value added by the utilization of SC. RCE and RDE indicate the efficiency of RC and innovation capital. The specific calculation is listed in Table 1.

(3) Control variables. In the current study, we use firm size (SIZE), debt ratio (LEV) and GDP growth rate (GDP) as control variables. In addition, a year dummy (YEAR) is also included in the regression model.

Table 2 shows the definition of all variables in this study.

Table 2. Variable definition.

Variable	Symbol	Measurement	Reference
Return on assets	ROA	Net income/average total assets	Xu and Liu [5], Xu and Wang [8,80], Xu and Li [9,46], Ge and Xu [30], Xu and Zhang [33,34], Xu et al. [35], Zhang et al. [37], Al-Musali and Ismail [47], Dženopoljac et al. [50], Nawaz and Haniffa [52], Ozkan et al. [53], Li et al. [55], Weqar et al. [81]
Return on equity	ROE	Net income/average shareholders' equity	Xu and Liu [5], Xu and Wang [8,80], Xu and Li [9,46], Ge and Xu [30], Xu and Zhang [33,34], Xu et al. [35], Zhang et al. [37], Al-Musali and Ismail [47], Dženopoljac et al. [50], Nawaz and Haniffa [52], Li et al. [55], Weqar et al. [81]
Capital employed efficiency	CEE	VA/book value of net assets, VA = Net income + interest + tax + employee expenditure	Xu and Liu [5], Ge and Xu [30], Liu et al. [31], Xu and Zhang [33,34], Xu et al. [35,36], Zhang et al. [37]
Human capital efficiency	HCE	VA/employee expenditure	
Structural capital efficiency	SCE	(VA-employee expenditure)/VA	
Relational capital efficiency	RCE	Marketing, selling, and advertising expenses/VA	
Innovation capital efficiency	RDE	R&D expenditure/VA	
Modified value-added intellectual coefficient	MVAIC	CEE + HCE + SCE + RCE + RDE	
Firm size	SIZE	Natural logarithm of total assets	Xu and Liu [5], Xu et al. [6], Xu and Wang [8,80], Xu and Li [9,46], Ge and Xu [30], Liu et al. [31], Lu et al. [32], Xu and Zhang [33,34], Xu et al. [35,36], Zhang et al. [37], Al-Musali and Ismail [47], Dženopoljac et al. [50], Nawaz and Haniffa [52], Ozkan et al. [53], Li et al. [55], Weqar et al. [81]

Table 2. *Cont.*

Variable	Symbol	Measurement	Reference
Debt ratio	LEV	Total liabilities/total assets	Xu and Liu [5], Xu et al. [6], Xu and Wang [8,80], Xu and Li [9,46], Ge and Xu [30], Liu et al. [31], Lu et al. [32], Xu and Zhang [33,34], Xu et al. [35,36], Zhang et al. [37], Dženopoljac et al. [50], Nawaz and Haniffa [52], Ozkan et al. [53], Li et al. [55]
GDP growth rate	GDP	Annual percentage change in GDP	Xu and Liu [5], Ge and Xu [30], Liu et al. [31], Xu et al. [35,36], Zhang et al. [37], Xu and Li [46]
Year dummy	YEAR	Dummy variable takes 1 for the test year, 0 otherwise	-

3.3. Models

Model (1) is employed to examine the impact of IC on the financial performance of Chinese manufacturing SMEs.

$$PER_{i,t} = \beta_0 + \beta_1 MVAIC_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 GDP_{i,t} + YEAR_i + \varepsilon_{i,t} \quad (1)$$

Model (2) is used to test whether IC elements have an impact on SMEs' financial performance in China's manufacturing sector.

$$PER_{i,t} = \beta_0 + \beta_1 CEE_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 RCE_{i,t} + \beta_5 RDE_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 LEV_{i,t} + \beta_8 GDP_{i,t} + YEAR_i + \varepsilon_{i,t} \quad (2)$$

where i is the firm; t is the year; β is the presumed parameter; and ε is the error term.

4. Results

4.1. Descriptive Statistics

Table 3 shows the descriptive statistics of full sampled SMEs. The mean values of ROA and ROE are 0.0561 and 0.0765, suggesting that manufacturing SMEs are able to earn profits during the observed period. MVAIC has a mean value of 3.3001, which implies that manufacturing SMEs create RMB 3.3001 for every RMB 1.00 utilized. HCE has the largest mean value among IC components, indicating that human resources are still the main contributor to SMEs' value. This is in accord with earlier research [9,46]. It is noticing that the mean values of HCE, SCE, RCE and RDE is larger than that of CEE, which suggesting manufacturing SMEs has begun to recognize the important role of IC resources rather than physical and financial capital in today's knowledge-based economy. These findings are consistent with Xu and Li [9]. In addition, the mean value of SIZE and LEV is 21.3748 and 0.3169, respectively.

Table 3. Descriptive statistics.

Variable	N	Mean	Median	Max	Min	S.D.
ROA	2612	0.0561	0.0566	0.8796	−0.6127	0.0826
ROE	2612	0.0765	0.0846	1.3193	−1.9101	0.1436
MVAIC	2612	3.3001	3.2150	62.5360	−29.9503	2.7733
CEE	2612	0.1871	0.1941	1.0272	−17.1215	0.4099
HCE	2612	2.0472	1.9410	20.6319	−30.0056	2.0242
SCE	2612	0.5571	0.5124	93.9573	−115.9540	3.5819
RCE	2612	0.3035	0.2173	93.7985	−62.5099	2.7008

Table 3. *Cont.*

Variable	N	Mean	Median	Max	Min	S.D.
RDE	2612	0.2051	0.1873	49.4146	−36.0358	1.7213
SIZE	2612	21.3748	21.3001	25.9116	19.2895	0.8130
LEV	2612	0.3169	0.2959	0.9901	0.0219	0.1665
GDP	2612	0.057	0.067	0.070	0.023	0.0184

Table 4 presents the descriptive statistics by industry type, and one-way ANOVA is chosen to test whether there are significant differences between the mean values of three or more groups of samples. Only ROA, MVAIC, HCE and SIZE differ significantly ($p < 0.05$). Labor-intensive SMEs are more profitable than capital- and technology-intensive SMEs, and they still depend more on tangible assets. Technology-intensive SMEs are likely to face higher risks in the process of R&D activities [61]. Capital-intensive SMEs have higher IC efficiency and HCE than those two types of SMEs. Interestingly, the mean values of RCE and RDE in technology-intensive SMEs are higher. We can notice that, in the process of China's economic transformation, the traditional production pattern has changed from labor oriented to technology oriented.

Table 4. Descriptive statistics by industry type.

Variable (Mean)	Labor-Intensive SMEs (1)	Capital-Intensive SMEs (2)	Technology-Intensive SMEs (3)	F	Sig.	Multiple Comparisons
ROA	0.0667	0.0628	0.0537	3.335	0.036	(1) > (2) > (3)
ROE	0.0887	0.0853	0.0734	1.806	0.165	–
MVAIC	3.2827	3.6004	3.2154	4.206	0.015	(2) > (1) > (3)
CEE	0.2557	0.1859	0.1844	1.261	0.283	–
HCE	2.0002	2.4624	1.9312	15.173	0.000	(2) > (1) >(3)
SCE	0.6334	0.5477	0.5564	0.022	0.979	–
RCE	0.2951	0.2157	0.3288	0.382	0.683	–
RDE	0.0984	0.1886	0.2145	0.222	0.801	–
SIZE	21.4554	21.2480	21.4073	8.847	0.000	(1) > (3) > (2)
LEV	0.3283	0.3067	0.3192	1.458	0.233	–
GDP	0.052	0.056	0.057	2.974	0.051	–
N (%)	87 (3.33)	559 (21.40)	1966 (75.27)		–	

Table 5 demonstrates the results of normality test. Table 5 shows that all variables do not have the normal data distribution ($p < 0.05$), which indicates that further analysis should use Spearman's correlation coefficient analysis [82].

Table 5. Normality test.

Variable	Statistic	df	Sig.
ROA	0.167	2612	0.000
ROE	0.215	2612	0.000
MVAIC	0.228	2612	0.000
CEE	0.301	2612	0.000
HCE	0.223	2612	0.000
SCE	0.409	2612	0.000
RCE	0.406	2612	0.000
RDE	0.406	2612	0.000
SIZE	0.042	2612	0.000
LEV	0.064	2612	0.000
GDP	0.348	2612	0.000

4.2. Correlation Analysis

Correlation results are shown in Table 6. ROA and ROE are positively correlated with MVAIC, CEE and HCE. SCE, RCE and RDE are not significantly correlated with the two financial performance indicators. All variance inflation factors (VIFs) are less than 6, which suggests that multi-collinearity is not a major issue in our study.

Table 6. Correlation matrix.

Variable	1	2	3	4	5	6	7	8	9	10	11
1 ROA	1	0.902 ***	0.605 ***	0.422 ***	0.746 ***	−0.025	0.022	0.016	−0.097 ***	−0.335 ***	0.012
2 ROE		1	0.594 ***	0.645 ***	0.690 ***	−0.030	0.022	0.021	−0.033 *	−0.224 ***	0.030
3 MVAIC			1	0.343 ***	0.780 ***	−0.143 ***	0.373 ***	0.325 ***	0.047 **	−0.174 ***	0.013
4 CEE				1	0.283 ***	−0.026	0.013	0.015	0.031	−0.068 ***	0.004
5 HCE					1	−0.013	0.016	0.016	0.049 **	−0.194 ***	0.018
6 SCE						1	−0.891 ***	−0.891 ***	0.004	−0.011	0.006
7 RCE							1	0.864	0.003	−0.005	0.008
8 RDE								1	−0.001	−0.005	−0.026
9 SIZE									1	0.415 ***	−0.119 ***
10 LEV										1	−0.093 ***
11 GDP											1

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3. Regression Results

Regression results are shown in Tables 7 and 8. The White's test suggests that our models are unlikely to have heteroscedasticity. Based on the Hausman's *p* values, the fixed-effect (FE) model or the random-effect (RE) model is chosen. In Table 7, the coefficients of MVAIC are positive and significant, supporting H1a. In the full sample of Table 8, the coefficients of CEE and HCE are positive and statistically significant, which leads to the acceptance of H1b and H1c. However, the coefficients of SCE and RCE are not significant at the 5% level. Therefore, H1d and H1e are not accepted. RDE only has a significant and negative impact on the ROA indicator. Therefore, H1f is not supported.

Table 7. Regression results of Model (1).

Variable	Full Sample		Labor−Intensive SMEs		Capital−Intensive SMEs		Technology−Intensive SMEs	
	ROA	ROE	ROA	ROE	ROA	ROE	ROA	ROE
	FE	FE	FE	FE	FE	FE	FE	FE
Constant	−0.613 *** (−6.70)	−1.197 *** (−6.68)	0.297 (0.81)	4.240 *** (4.51)	−0.672 *** (−4.62)	−1.744 *** (−6.81)	−0.565 *** (−5.04)	−1.344 *** (−6.04)
MVAIC	0.014 *** (31.98)	0.027 *** (30.76)	0.018 *** (9.88)	0.029 *** (6.28)	0.025 *** (28.39)	0.041 *** (26.41)	0.012 *** (24.29)	0.025 *** (24.47)
SIZE	0.029 *** (6.92)	0.057 *** (6.85)	−0.017 (−0.96)	−0.204 *** (−4.58)	0.031 *** (4.67)	0.079 *** (6.71)	0.027 *** (5.26)	0.064 *** (6.23)
LEV	−0.118 *** (−8.47)	−0.262 *** (−9.56)	0.079 (1.15)	0.419 ** (2.40)	−0.150 *** (−7.40)	−0.243 *** (−6.79)	−0.112 *** (−6.52)	−0.263 *** (−7.68)
GDP	0.914 *** (8.69)	1.469 *** (7.12)	1.032 ** (2.14)	−0.209 (−0.17)	0.623 *** (3.75)	1.609 *** (5.51)	0.949 *** (7.47)	1.554 *** (6.16)
YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2612	2612	87	87	559	559	1966	1966

Table 7. *Cont.*

Variable	Full Sample		Labor−Intensive SMEs		Capital−Intensive SMEs		Technology−Intensive SMEs	
	ROA	ROE	ROA	ROE	ROA	ROE	ROA	ROE
	FE	FE	FE	FE	FE	FE	FE	FE
R^2	0.4383	0.4151	0.7393	0.5769	0.7155	0.6973	0.3971	0.3867
F	196.65 ***	178.83 ***	17.72 ***	8.52 ***	132.04 ***	120.92 ***	125.89 ***	120.52 ***
Hausman test	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.0260	Prob > chi2 = 0.0003	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000

Notes: ** $p < 0.05$, *** $p < 0.01$. *t*-values are in parentheses.

Table 8. Regression results of Model (2).

Variable	Full Sample		Labor−Intensive SMEs		Capital−Intensive SMEs		Technology−Intensive SMEs	
	ROA	ROE	ROA	ROE	ROA	ROE	ROA	ROE
	FE	FE	RE	FE	FE	FE	FE	FE
Constant	−0.131 * (−1.86)	−0.206 * (−1.69)	−0.222 (−1.54)	2.865 *** (5.49)	−0.260 ** (−2.10)	−0.711 *** (−4.91)	−0.073 (−0.87)	−0.303 ** (−2.09)
CEE	0.028 *** (12.58)	0.149 *** (39.12)	0.337 *** (10.82)	0.615 *** (7.61)	0.145 *** (10.96)	0.451 *** (29.19)	0.025 *** (11.03)	0.142 *** (36.08)
HCE	0.026 *** (50.43)	0.038 *** (42.37)	0.010 *** (6.54)	0.009 ** (2.53)	0.023 *** (21.61)	0.026 *** (21.61)	0.026 *** (41.85)	0.039 *** (36.54)
SCE	−0.0005 (−0.79)	−0.001 (−0.54)	0.073 *** (4.83)	−0.087 (−0.93)	−0.0003 (−0.13)	−0.005 * (−1.83)	−0.0005 (−0.74)	−0.0001 (−0.09)
RCE	0.001 (0.93)	0.001 (0.44)	0.028 *** (3.03)	−0.027 (−1.35)	0.003 (0.55)	0.003 (0.46)	0.001 (0.87)	0.001 (0.59)
RDE	−0.002 * (−1.80)	−0.002 (−0.86)	0.127 *** (3.03)	−0.169 (−1.83)	−0.005 (−1.00)	−0.010 * (−1.68)	−0.002 * (−1.71)	−0.001 (−0.61)
SIZE	0.006 * (1.87)	0.009 (1.55)	0.008 (1.22)	−0.130 *** (−5.25)	0.013 ** (2.21)	0.032 *** (4.74)	0.003 (0.79)	0.013 * (1.88)
LEV	−0.060 *** (−5.66)	−0.119 *** (−6.40)	−0.207 *** (−5.81)	−0.079 (−0.71)	−0.117 *** (−6.91)	−0.155 *** (−7.83)	−0.038 *** (−2.88)	−0.079 *** (−3.54)
GDP	0.466 *** (5.80)	0.670 *** (4.81)	0.486 * (1.65)	−0.820 (−1.23)	0.231 (1.63)	0.609 *** (3.67)	0.469 *** (4.91)	0.737 *** (4.49)
YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2612	2612	87	87	559	559	1966	1966
R^2	0.6811	0.7397	0.8324	0.8951	0.8078	0.9097	0.6666	0.7470
F	358.03 ***	476.50 ***	465.26 ***	32.71 ***	145.71 ***	349.36 ***	254.04 ***	375.13 ***
Hausman test	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000	Prob > chi2 = 0.3597	Prob > chi2 = 0.0001	Prob > chi2 = 0.0000	Prob > chi2 = 0.0009	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. *t*-values are in parentheses.

It is worth noticing that, in Table 7, the impact of MVAIC on the financial performance in capital-intensive SMEs is the largest, followed by that in labor-intensive SMEs and that in technology-intensive SMEs. Regarding IC components, CEE has a greater impact on both ROA and ROE in labor-intensive SMEs than the other two sub-samples. The impact of HCE on financial performance is higher in technology-intensive SMEs than in labor- and capital-intensive SMEs. SCE, RCE and RDE only have a positive impact on the ROA indicator in labor-intensive SMEs, whereas SCE and RDE negatively influence ROE in capital-intensive SMEs. In technology-intensive SMEs, RDE only exerts a negative impact on ROA. Therefore, H2 is fully accepted.

In addition, there is a positive relationship between SIZE and GDP and performance indicators, while LEV has a negative impact on financial performance.

4.4. Robustness Check

We use the ratio of earnings before interest and taxes to net sales instead of ROA and ROE. All models are re-estimated, and the results are similar to previous findings in Tables 7 and 8, suggesting that our conclusion is robust.

5. Discussion

In Table 7, we report that IC spurs the financial performance of manufacturing SMEs regardless of industry type, which is in agreement with the findings of Xu and Li [9] and Crema and Verbano [83]. For SMEs that fail to accumulate enough capital, IC offers them a competitive advantage [84–86]. With regard to industry type, Gârdan et al. [87] found that biotechnology SMEs should maintain a minimum level of IC input and manage various forms of IC. According to Ferreira and Franco [88], an increase in IC will stimulate performance in technology-based SMEs from a long-term structural perspective.

Physical and human capitals have a significant and positive influence on the financial performance of manufacturing SMEs, which is consistent with Xu and Li [9]. It is worth mentioning that the impact of tangible and financial resources is greater than that of HC. SMEs have difficulty in getting access to market and qualified sources [89], and it is challenging for them to exploit the value of HC. Strengthening HC influences the development of SMEs in aspects of attitudes, skills and abilities. In addition, the findings of Aljuboori et al. [90] showed that HC only has a positive impact on the firm performance of Malaysian manufacturing SMEs. Gross-Gołacka et al. [91] and Faisol et al. [92] also found the same results. We also find that HC has the greatest impact on ROA and ROE in technology-intensive SMEs. This finding corroborates the ideas of Carmona-Lavado et al. [93], who suggested that HC is an unquestionable facilitator of innovation in technology-based knowledge-intensive business services firms.

SC has a negative and insignificant impact on financial performance of manufacturing SMEs. This may be explained by the fact that organizational structure and managerial systems of SMEs are informal. Leitner [94] documented a negative relationship between SC and SMEs' performance in Australia. In the case of Romania, gender-balanced SC with middle-aged managers leads to an increase in SMEs' performance [95]. For Brazilian SMEs, SC is the most significant element to the ROA indicator [96]. Suitable management of IC coupled with a focus on corporate innovation culture can make a significant contribution to SME performance. Zaragoza-Sáez et al. [97] found that initiative and autonomy are very important SC variables for knowledge creation in Spanish subsidiaries of foreign multinational firms belonging to high-tech sectors.

The impact of RC on SMEs' financial performance is not significant at the 5% level, which is consistent with the findings of Muda and Rahman [98]. Hudson et al. [99] maintained that SMEs have a small number of customers. However, they are active in the relationships with external stakeholders and the acquisition of knowledge from customers [100]. The relationship of SMEs with other parties, especially the government, is important in guiding them to be competitive [39]. European manufacturing SMEs have moderately developed RC, and it plays an important role. In the service-oriented industry (e.g., tourism industry), Khalique et al. [101] found that RC and technological capital have strong effect on the performance of SMEs. In today's complex business environment, any firm is increasingly involved in social activities [102], and RC is recognized as one of the main contributors to fostering growth and firm performance [103,104].

Regarding innovation capital, it has a negative and insignificant impact on financial performance. A possible explanation for this might be that innovation activities generally have high risks and long-term payback period. Similarly, Srikalimah et al. [105] found that creativity fails to determine SMEs' sustainability. Wang [106] proposed the innovation ecosystem for Chinese manufacturing SMEs and found that most of them lack the motivation for technological innovation and their R&D intensity is less than 1 percent of company sales. In addition, Si et al. [107] found that the shortage of technical professionals and the limitation of technological capability constrain the innovation of Chinese manufacturing SMEs. Indrawati et al. [108] also claimed that government support, the quality of HC, funding sources, economic conditions and business partners are the inhibiting factors of SMEs' innovation activities. However, Oliveira et al. [109] concluded that innovation positively influences the performance of SMEs in Brazil.

Regarding industry type, H2 is supported. Lin et al. [62] revealed that the Taiwanese traditional construction industry has high IC, which has already shifted to a knowledge-based industry. Contrary to our results, based on the data from Tunisian technology-intensive firms, Najar et al. [110] found that HC and innovation capital have a positive impact on inbound open innovation and RC has a positive impact on outbound open innovation. The findings of Delgado-Verde et al. [111] showed a positive relationship between HC and radical innovation. They also suggested that the increase in technological knowledge leads to more innovation output, while once a given point is reached, this impact will begin to lose its strength. In addition, Tovstiga et al. [112] concluded that internal resources determine enterprise performance in Russian small technology-intensive enterprises instead of external resources.

6. Conclusions

Taking 588 Chinese manufacturing SMEs between 2015 and 2020 as the research sample, this paper aims to investigate the relationship between IC and its components and SMEs' financial performance in China's manufacturing industry. In addition, we explore whether industry type influences this relationship. The MVAIC model is used to measure IC. The main conclusions are as follows. First, IC positively influences the financial performance of manufacturing SMEs, and this impact in capital-intensive SMEs is higher than that in labor- and technology-intensive SMEs. Second, physical and human capitals are the main driving forces of SMEs' performance improvement, while SC, RC and innovation capital have the smallest impact. Finally, labor-intensive SMEs are mainly dependent on the efficiency of physical assets, while technology-intensive SMEs largely rely on human resources.

The theoretical contributions of this paper are two-fold. First, most research studies have been focused on large companies; thus, this study enriches the current literature on IC research from the SMEs' perspectives in the case of China. In addition, there is a relatively small body of literature that is concerned with the role of industry type in the relationship between IC and corporate financial performance, and this study attempts to fill this gap. According to this study's results, labor-intensive, capital-intensive and technology-intensive SMEs have different impacts of IC and its elements on their financial performance. Thus, this study can become the base for more research on the role of industry type in emerging economies. Second, the insights gained from this study may be of assistance to manufacturing SMEs' managers who are seeking new channels to improve financial performance through the efficient utilization of IC resources. The current study additionally offers some insights for policymakers to issue some policies to improve SMEs' value-creation efficiency of IC.

This paper put forwards some practical implications. Firstly, since IC has become a distinctive asset, Chinese manufacturing SMEs should pay greater attention to it and make continuous investment. Although the results show that RC and innovation capital have no direct impact, SMEs' managers would still have to develop new high-tech products to retain their client base and gain customer loyalty, and they need to pay attention to customer feedback in the process of a new product. Meanwhile, SMEs should keep good relationships with banks, government agencies and research institutions to obtain funds and collaborations. Secondly, labor-intensive SMEs should transfer their production pattern by training HC. Talented and skilled employees can get together to share their professional knowledge and create collective knowledge. Thirdly, we advise that capital-intensive SMEs in the digital age should use digital technology to implement information systems to ensure that knowledge is efficiently acquired, created, shared, documented and applied. Fourthly, the study recommends that technology-intensive SMEs reinforce technological infrastructure and opt for open source software. They should have a favorable organizational routines and climate and encourage employees to share knowledge and innovate. Finally, policymakers should make preferential policies to promote institutional collaborations and more investment in IC to achieve higher efficiency and sustainable development.

This study has some limitations. First, our sample is restricted to the manufacturing industry; thus, further research should take into consideration other industries or make a comparison with other countries and regions. Second, future researchers may want to consider the long-term impact of IC. In addition, past research (e.g., Xu and Zhang [33]; Xu et al. [36]) has shown that IC and its components have a non-linear relationship with financial performance. As this paper only examines the linear relationship, future research may consider the non-linear relationship.

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