



Impact of Environmental Investment on Performance of Intelligent Manufacturing Enterprises in the Yangtze River Delta of China

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ABSTRACT

The rapid development of information technology has promoted the transformation of the manufacturing industry and the upgrading of Chinese intelligent manufacturing enterprises. Environmental protection and enterprise benefits have become the pursuit target. To explore the impact of environmental investment on the performance of intelligent manufacturing enterprises, an evaluation index system from the four dimensions of debt paying, operation, profitability, and growth ability was constructed. Then, factor analysis method was used to analyse the index data of 33 intelligent manufacturing enterprises in the Yangtze River Delta in 2018, and a multiple regression model was constructed to analyse the impact of environmental investment on enterprise performance. Results show a significant difference in the performance of intelligent manufacturing enterprises in the Yangtze River Delta and a positive correlation between environmental investment and enterprise performance. Finally, specific optimization measures are given to help the managers of intelligent manufacturing enterprises make scientific and reasonable decisions.

INTRODUCTION

The report of the 19th National Congress of the Communist Party of China emphasizes the implementation of the strictest ecological environment protection system. The promulgation of various laws and policies reflects the party and the state's attention to environmental protection and determination to control environmental pollution. Intelligent manufacturing enterprises inevitably pollute the environment in the process of production. Thus, they should improve the level of environmental governance and bear the responsibility for environmental protection (Xu 2020). The manner of pursuing the maximization of benefits and walking out of the win-win road of environmental protection and economic benefits is the key to the sustainable development of intelligent manufacturing enterprises (Huang 2019).

According to the intelligent manufacturing development plan (2016-2020), the proportion of R&D expenditure of the manufacturing industry above the designated size in the main business income will increase from 0.95% to 1.68% by 2025, and the number of effective invention patents per billion RMB of the main business income will increase from 0.36 to 1.10 (Wang et al. 2019). The Yangtze River Delta has a strong advantage based on industry. However, shortcomings remain evident in the intelligent manufacturing industry in the delta, especially in the cultivation of various enterprises, the layout of key nodes in the industrial chain, and the supply of core technologies (Fang et al. 2019). The

2019 Yangtze River Delta Intelligent Manufacturing Development White Paper was released in Nanjing. It aims to promote the Yangtze River Delta to explore the mechanism of intelligent manufacturing collaborative innovation, deploy and build a collaborative innovation network, and support the transformation and upgrading of small-and-medium-sized manufacturing enterprises.

PAST STUDIES AND RESEARCH HYPOTHESIS

The relationship between environmental investment and enterprise performance has always been the core issue of environmental management research. The three representative views in the academic community are negative correlation, positive correlation, and non-correlation (Zhang et al. 2019). Traditional economic theory holds that a negative correlation exists between environmental investment and enterprise performance. The implementation of environmental management increases the cost and burden of enterprises because enterprises cannot obtain profit while increasing important investment expenditure (Shan et al. 2018, Azadegan et al. 2018). Moreover, the increase of investment in environmental management squeezes the resources of other profitable projects, disperse time and manpower, and reduce the production efficiency of the enterprise, which is not conducive to the promotion of competitiveness and long-term development of the enterprise. Other scholars believed that environmental management is positively related to enterprise performance,

and investment in environmental management may increase enterprise cost in the early stage. In the long run, this cost can be made up by improving ecological efficiency and innovating environmental protection technology (Lopez et al. 2017, Xia et al. 2019). On the one hand, the excellent performance of enterprises in environmental protection meets the green demand of consumers, increases the sales volume of products, and improves the market share. On the other hand, it is conducive to the establishment of an attractive social image, the promotion of brand awareness, the enhancement of competitive advantage of enterprises, and the realization of a win-win situation between environmental management and enterprise development (Tang et al. 2019). Another view is that no correlation exists between environmental management and enterprise performance, and the improvement of environmental management does not affect the improvement of enterprise competitiveness (Gai 2019). Enterprises engage in environmental protection investment to reduce the level of environmental pollution, achieve the environmental protection indicators of the government, and gain the attention of the public and investors to environmental protection (Chen et al. 2017). Such investment minimizes the frequency of environmental supervision from the environmental protection department of the government, maintain the normal production and operation order of enterprises, and reduce the compliance cost of enterprise environmental regulations.

This study holds that, in the process of environmental investment, intelligent manufacturing enterprises need to integrate various resources, promote enterprises to innovate production processes, and improve organizational management capabilities. Thus, forming unique competitive advantage and improving the efficiency of resource allocation (Zhao 2018) and the profitability of enterprises environmental investment help enterprises establish a reputable social image, enhance brand value, increase product sales and market share, and reduce long-term risks related to the disposal costs of environmental pollution, energy price fluctuations, and product quality responsibility. Based on the above points of view, this study puts forward the following hypothesis: A positive correlation exists between environmental investment and the performance of intelligent manufacturing enterprises.

Many studies on enterprise performance evaluation exist, and the differences between evaluation indexes and evaluation methods are significant (Bravo-Macias et al. 2019). First, this study constructs the performance evaluation index system of intelligent manufacturing enterprises regarding relevant regulations of the Ministry of Finance, uses factor analysis method to analyse the index data of 33 intelligent manufacturing enterprises in 2018, and obtains the comprehensive performance score. According to the performance score, a multiple regression model is constructed to ana-

lyse the impact of environmental investment on corporate performance. Finally, according to the empirical results, the study puts forward the countermeasures to improve the performance of intelligent manufacturing enterprises.

MODELLING

Data Source

The annual financial reports of intelligent manufacturing enterprises in the Yangtze River Delta of China in 2018 are referred through Sina Finance, China Stock Market, and Accounting Research Database, and 33 sample enterprises are collected. The environmental protection input data of listed companies come from the environmental protection information disclosed by enterprises, which is included in the corporate social responsibility, environmental, and sustainable development reports. The information comes from the Shanghai Stock Exchange, the Shenzhen Stock Exchange, and official websites of enterprises. This study uses an Excel table to process the original data and SPSS19.0 software for processing and analysis.

Model

According to the above hypothesis, this study uses multiple linear regression models to examine the relationship between variables. In addition, it tests the relationship between environmental investment index and performance comprehensive score to analyse the impact of environmental investment on the performance of intelligent manufacturing enterprises in the Yangtze River Delta. The specific model is as follows:

$$Y = c + \alpha X + \beta_1 H10 + \beta_2 SIZE + \beta_3 AGE + \beta_4 RATE + \varepsilon \dots (1)$$

Where c is the intercept; X , $H10$, $SIZE$, AGE , and $RATE$ represent environmental investment, equity concentration, enterprise scale, enterprise age, and business income growth rate, respectively; α , β_1 , β_2 , β_3 , and β_4 are the coefficients of explanatory variables; ε is the error term.

Variables

Dependent variable: Enterprise performance evaluation refers to the objective, accurate, and comprehensive evaluation of the operating efficiency, manager ability, and performance of an enterprise within a certain period by using specific methods in the financial index system based on the enterprise financial data. This kind of evaluation can truly reflect the actual business situation and predict the future development prospect of the enterprise.

According to the relevant requirements of the revised operational rules for enterprise performance evaluation issued by the Ministry of Finance and by following the principles

of feasibility, importance, relevance, and effectiveness, the performance evaluation index system of listed companies in the household appliance industry is constructed from the four dimensions of solvency, operation ability, profitability, and growth ability, as shown in Table 1.

The idea of the factor analysis method can be expressed by a mathematical model, with the p variables x_1, x_2, \dots, x_p . The mean value after standardization is 0, and the standard deviation is 1. x_1, x_2, \dots, x_p are expressed in linear form by using k ($k < p$) factors, namely, f_1, f_2, \dots, f_k .

$$\begin{cases} x_1 = a_{11}f_1 + a_{12}f_2 + \dots + a_{1k}f_k + \varepsilon_1 \\ x_2 = a_{21}f_1 + a_{22}f_2 + \dots + a_{2k}f_k + \varepsilon_2 \\ \dots \\ x_p = a_{p1}f_1 + a_{p2}f_2 + \dots + a_{pk}f_k + \varepsilon_p \end{cases} \dots(2)$$

Equation (1) shows the linear equations of this method. The matrix expression is

$$x = af + \varepsilon' \dots(3)$$

In the above formula, f is the factor, and the correlation coefficient f_j ($j = 1, 2, \dots, k$) is 0. a is the factor load matrix and a_{ij} ($i = 1, 2, \dots, p, j = 1, 2, \dots, k$) is the factor load. ε' is a special factor, which is independent of f_j ($j = 1, 2, \dots, k$).

Independent variable: Environmental investment is set as a virtual variable in this study. If the enterprise has environmental investment, it is recorded as 1, otherwise 0. The existence of environmental protection investment is based on the summary of all environmental protection-related investment data disclosed by the enterprise, including the summary of environmental protection expenditure disclosed in terms of

environmental protection investment, environmental protection operation cost, environmental protection tax, pollution discharge fee, and greening fee. A virtual variable is taken because few companies disclose environmental investment information in the listed companies. Excluding the data of these companies that do not disclose environmental protection information causes a shortage of sample size, estimation error, and sample selectivity error.

Control variable: Equity concentration (*H10*): The relatively concentrated ownership structure can encourage shareholders to implement effective supervision. However, the further expansion of the ownership concentration may result in the phenomenon that large shareholders infringe on the interests of small shareholders, especially when large shareholders are “vacant.” Scholars mostly use the first, top five, top ten shareholders ratio, and Hefndal index to measure equity concentration. This study selects the shareholding ratio of the top ten shareholders to measure the degree of equity concentration.

Enterprise scale (SIZE): According to the review of previous literature, large-scale enterprises engaged in production and operation activities tend to have a considerable impact on society and the environment. They pay considerable attention to environmental protection and governance issues and seek the long-term development of enterprises. Moreover, large scale enterprises are better than smaller ones in terms of management level, sales ability, and production efficiency. Therefore, large-scale enterprises perform efficiently whether in the aspect of environmental investment or enterprise performance. This study uses the natural logarithm of total assets to measure the scale of enterprises.

Enterprise age (AGE): The establishment time, experience,

Table 1: Performance evaluation index system construction of intelligent manufacturing enterprises.

Primary index	Secondary index	Calculation formula	Variable
Solvency	Liquidity ratio	Current assets / current liabilities	X ₁
	Quick ratio	Quick assets / current liabilities	X ₂
	Asset liability ratio	Total liabilities / total assets	X ₃
Operational capability	Turnover rate of accounts receivable	Operating income / average balance of accounts receivable	X ₄
	Inventory turnover	Operating cost / average inventory balance	X ₅
	Turnover rate of total assets	Operating income / average balance of assets	X ₆
Profitability	Return on equity	Net profit / average net assets	X ₇
	Return on invested capital	Operating profit / invested capital before interest and after tax	X ₈
	Operating profit margin	Operating profit / revenue	X ₉
Growth ability	Growth rate of total assets	Total assets growth of the year / total assets at the beginning of the year	X ₁₀
	Growth rate of net intangible assets	Increase in net intangible assets / net intangible assets at the end of last year	X ₁₁
	rate of capital accumulation	Ending owner’s equity / beginning owner’s equity	X ₁₂

and reputation of the company affect the performance. They also have an indirect impact on environmental investment. This study takes the number of years of the establishment of the enterprise as a regulating variable.

Operating income growth rate (RATE): Fast-growing enterprises can often adapt quickly to policy changes and have the corresponding strength to increase environmental investment to ensure the sustainable, healthy, and green development of enterprises. All variables are given in Table 2.

RESULT ANALYSIS

Performance Appraisal

KMO test and Bartlett's spherical test: After testing, the KMO value is 0.53, which is higher than the critical value of 0.50, thus meeting the preconditions for factor analysis. The approximate chi-square value of Bartlett's spherical test results is 411.59. The corresponding probability value

is 0.00, which is less than the given significance level of 0.01, indicating that validity meets the requirements and the preconditions of factor analysis.

Factor analysis results: The variance contribution of the first common factor is 3.09, and the variance contribution rate after rotation is 25.73%. The extracted four common factors explain most of the information of the original variables, reaching 83.08%, as given in Table 3. Given the retention of two decimal places, a certain error exists but does not affect the whole.

In this study, the factor load matrix is rotated by the maximum variance method. Given that the current ratio (X_1), quick ratio (X_2), and asset-liability ratio (X_3) have a high load in common factor 1, the three indicators reflect the solvency. Thus, F_1 is named as the "solvency factor." Given that the inventory turnover rate (X_5), total asset growth rate (X_{10}), and capital value preservation and appreciation rate (X_{12}) have a high load in common factor 2, inventory turnover rate reflects

Table 2: Definition of variables.

Type	Name	Symbol	Measurement
Dependent Variable	Enterprise performance	Y	Comprehensive score or factor score of enterprise performance
Independent Variable	Turnover rate of account receivable	X	Virtual variable. If there is environmental investment, it is recorded as 1, otherwise it is recorded as 0
	Equity concentration	$H10$	Shareholding ratio of top ten shareholders
Control Variable	Enterprise scale	$SIZE$	Logarithm of total assets of enterprise
	Enterprise age	AGE	Age from establishment to data analysis
	Growth rate of operating revenue	$RATE$	Growth of operating revenue / total operating revenue of the previous year

Table 3: Characteristic value and variance contribution rate in 2018.

Factor	Initial eigenvalue			Extract square sum load			Rotate square sum load		
	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%
1	3.59	29.89	29.89	3.59	29.89	29.89	3.09	25.73	25.73
2	2.93	24.38	54.26	2.93	24.38	54.26	2.79	23.29	49.01
3	2.05	17.05	71.31	2.05	17.05	71.31	2.66	22.14	71.15
4	1.41	11.77	83.08	1.41	11.77	83.08	1.43	11.94	83.08
5	0.87	7.23	90.31						
6	0.57	4.78	95.09						
7	0.21	1.78	96.87						
8	0.21	1.72	98.59						
9	0.09	0.77	99.36						
10	0.05	0.45	99.82						
11	0.02	0.15	99.96						
12	0.00	0.04	100.00						

Note: Due to the retention of two decimal places, there is a certain error, but does not affect the whole.

operating capacity, and total asset growth rate; capital value preservation, and appreciation rate reflect growth capacity. Thus, F_2 can be named as the “growth operation factor.” Given that return on equity (X_7), return on invested capital (X_8), and operating profit rate (X_9) have a high load in common factor 3, the three indicators reflect profitability indicators. Thus, F_3 can be named as the “profit factor.” Given that the turnover rates of accounts receivable (X_4) and total assets (X_6) and the growth rate of net intangible assets (X_{11}) have a high load in common factor 4, the first two items reflect the operating capacity, and the growth rate of net intangible assets reflects the growth capacity. Thus, F_4 is named as the “operation growth factor.” In this study, the score function of each main factor after rotation can be written as

$$F_1 = 0.96X_1 + 0.97X_2 - 0.86X_3 + 0.07X_4 + 0.11X_5 - 0.48X_6 + 0.04X_7 - 0.01X_8 + 0.47X_9 - 0.01X_{10} - 0.05X_{11} - 0.03X_{12}$$

$$F_2 = -0.05X_1 - 0.02X_2 - 0.10X_3 - 0.22X_4 + 0.94X_5 + 0.24X_6 + 0.04X_7 + 0.10X_8 + 0.01X_9 + 0.91X_{10} - 0.06X_{11} + 0.97X_{12}$$

$$F_3 = 0.10X_1 + 0.08X_2 - 0.14X_3 - 0.05X_4 + 0.03X_5 + 0.09X_6 + 0.97X_7 + 0.99X_8 + 0.83X_9 + 0.04X_{10} + 0.02X_{11} + 0.07X_{12}$$

$$F_4 = 0.12X_1 + 0.11X_2 + 0.18X_3 + 0.70X_4 + 0.02X_5 + 0.60X_6 - 0.03X_7 + 0.06X_8 - 0.10X_9 - 0.04X_{10} - 0.71X_{11} - 0.02X_{12} \dots(4)$$

According to the weight determined by the variance contribution rate, the comprehensive score function of performance can be written as

$$F = (25.73\%F_1 + 23.29\%F_2 + 22.14\%F_3 + 11.94\%F_4) / 83.08\% \dots(5)$$

According to the factor score function of Formula (4) and the comprehensive score function of Formula (5), the common factor score and the financial performance comprehensive score of intelligent manufacturing enterprises in the Yangtze River Delta of China in 2018 can be calculated, as given in Table 4.

DISCUSSION

According to the performance score table of intelligent manufacturing enterprises in the Yangtze River Delta of China

Table 4: Public factor scores and rankings of intelligent manufacturing enterprises in the Yangtze River delta of China in 2018.

Stock name	F1	F2	F3	F4	F	Rank	Stock name	F1	F2	F3	F4	F	Rank
Zhongnan Construction	-0.95	-0.55	0.01	-0.32	-0.49	30	DragonNet Technology	2.30	-0.23	-0.39	-0.48	0.47	4
Miracle Automation	-0.70	-1.19	-0.07	0.21	-0.53	31	Ningbo Cixing	0.10	-0.17	-0.32	-2.35	-0.44	27
Dun'an Artificial	-0.69	0.12	-4.06	0.73	-1.15	33	SVG	-0.12	0.18	-0.28	-0.26	-0.09	19
Good-Ark Electronics	0.81	0.13	-0.10	1.01	0.40	5	Yinbang Clad Material	-0.67	-0.24	-0.87	0.21	-0.47	29
Haisum Engineering	-1.15	0.00	0.60	2.00	0.09	13	Digiwin Software	-0.32	-0.46	-0.10	0.92	-0.12	21
Tongfu microelectronics	-0.83	-0.34	-0.40	-1.94	-0.73	32	Lead Intelligent	-0.69	0.07	1.50	-0.47	0.14	10
Sanlux	2.06	-0.48	-0.47	2.11	0.67	3	Fullhan microelectronics	1.58	-0.42	-0.38	-0.91	0.13	11
Canny Elevator	-0.41	0.02	-0.65	-1.21	-0.47	28	RoboTechnik Intelligent	-1.25	0.22	2.07	-0.32	0.18	9
Sciyon Wisdom	1.49	-0.38	0.01	-0.98	0.21	7	NARI Technology	-0.38	0.15	0.94	-0.44	0.11	12
Great Star Industrial	0.30	-0.20	0.37	0.47	0.20	8	Joyson Electronic	-1.15	0.10	0.14	1.88	-0.01	16
Great Chinasoft	-0.92	0.18	-0.33	0.71	-0.22	24	Nanjing Panda	-0.34	-0.14	-0.18	0.22	-0.16	22
Shuanghuan Driveline	-0.50	0.66	-0.24	-0.51	-0.10	20	Mechanical & Electrical	-0.68	-0.46	0.57	0.85	-0.06	17
Morningstar Network	-0.49	0.06	-0.12	-0.49	-0.24	25	Baosight Software	0.17	-0.30	0.41	-0.05	0.07	14
Hangzhou Century	-0.08	-0.38	0.04	-0.83	-0.24	26	China Wafer	1.61	-0.41	-0.34	0.38	0.34	6
HAND Enterprise	0.62	5.24	0.18	0.08	1.72	1	Yijihe Technology	1.91	-0.63	1.99	0.59	1.02	2
Tofflon Science and	0.09	0.21	-0.47	-0.34	-0.09	18	Kelai Mecha-tronics	-0.41	-0.20	0.67	0.34	0.05	15
CSG Smart	-0.35	-0.14	0.26	-0.79	-0.19	23	-	-	-	-	-	-	-

in 2018, the top companies in the comprehensive score F are as follows: HAND Enterprise Solutions, Yijihe Technology, Sanlux, DragonNet Technology, Good-Ark Electronics, China Wafer Level CSP, Sciyon Wisdom Technology, Great Star Industrial, RoboTechnik Intelligent Technology, and Lead Intelligent Equipment. The number of enterprises with a comprehensive score of F less than 0 reached 18, accounting for 54.55%. HAND Enterprise Solutions scored the highest (1.72), whereas Dun'an Artificial Environment scored the lowest. The range was 2.87. The number of enterprises with debt service factor F_1 scores less than 0 reached 21, accounting for 63.64%. DragonNet Technology scored the highest (2.30), whereas RoboTechnik Intelligent Technology scored the lowest (-1.25). The range was 3.55. The number of enterprises with a growth operating factor F_2 scores less than 0 reached 20, accounting for 60.61%. HAND Enterprise Solutions scored the highest (5.24). The lowest score was -1.19. The range was 6.43. The number of enterprises with a profit factor F_3 scores less than 0 reached 18, accounting for 54.55%. RoboTechnik Intelligent Technology scored the highest (2.07). Dun'an Artificial Environment scored the lowest (-4.06). The range was 6.12. The number of enterprises with an operating growth factor F_4 scores less than 0 reached 17, accounting for 51.52%. Sanlux scored the highest (2.11). Ningbo Cixing scored the lowest was -2.35. The range was 4.46. In 2018, more than half of the enterprises scored less than 0 in terms of performance, debt service factor, operation growth factor, profit factor, and operation growth factor. The main reason is that the overall economic environment in 2018 was poor, the economic situation was declining, the financial market was turbulent, and most intelligent manufacturing enterprises were unable to obtain enough capital to support innovation investment. As a result, the overall profit, growth, and operation declined. In addition, corporate performance and revenue were underperforming.

Multiple Regression Analysis

Descriptive statistics: The average value of the environmental investment is 0.42, indicating that more than half of enterprises have not invested in environmental protection. The standard deviation is 0.50, which is greater than the average and median, indicating that the distribution of enterprise environmental investment is relatively scattered. The maximum value of $H10$ is 1.00, the minimum value is 0.32, and the average value is 0.59. Thus, the sample enterprises have a high concentration of equity. The average age of the company is 18.82 years, the longest time is 28 years, and the shortest time is 7 years. Therefore, the sample enterprises have a long period of continuous operation, and most of them have relatively stable development. From the perspective of the growth rate of business income, the maximum value is 1.32, the minimum value is -0.10, and the average value is 0.26, indicating that the sample enterprises have rapid overall growth and good market development, as given in Table 5.

Correlation analysis: Pearson correlation test results show that company size ($SIZE$), operating revenue growth rate ($RATE$), and debt service factor F_1 scores are significant at 1% and 5% levels. The correlation coefficients are -0.47 and -0.41, showing a negative correlation. Equity concentration ($H10$), operating revenue growth rate ($RATE$), and profit factor F_3 score are significant at 5% level. The correlation coefficients are 0.43 and 0.38, which show a positive correlation. A negative correlation exists between company size ($SIZE$) and comprehensive score F . The correlation coefficient is -0.35, which is significant at 5% level, as given in Table 6. This value may be due to the excessive enterprise size and consumption of enterprise profits and may ultimately lead to the decline of enterprise performance.

Regression results: According to Table 7, the maximum value of F test is 3.35, which is significant at 1% level. The

Table 5: Descriptive statistics.

Variable	N	Range	Minimum	Maximum	Mean	Standard deviation	
F_1	33	3.55	-1.25	2.30	0.00	1.00	
F_2	33	6.43	-1.19	5.24	0.00	1.00	
Y	F_3	33	6.12	-4.06	2.07	0.00	1.00
	F_4	33	4.46	-2.35	2.11	0.00	1.00
	F	33	2.87	-1.15	1.72	0.00	0.51
X		33	1.00	0.00	1.00	0.42	0.50
H10		33	0.68	0.32	1.00	0.59	0.14
SIZE		33	5.60	20.59	26.19	22.37	1.24
AGE		33	21.00	7.00	28.00	18.82	4.77
RATE		33	1.41	-0.10	1.32	0.26	0.31

minimum value is 2.07, which is significant at the 10% level. That is, a significant linear relationship exists between variables. The regression results of comprehensive score *F* show that environmental investment (*X*) has a positive correlation with enterprise performance, with a coefficient of 0.37, which is significant at 5% level, indicating that increasing environmental investment can promote the improvement of enterprise performance and the hypothesis is true. Among the control variables, enterprise size (*SIZE*) has a negative correlation with enterprise performance, with a coefficient of -0.16, which is significant at 5% level. That is, the larger the enterprise is, the more risks it faces in the process of environmental investment, the more aspects it needs to pay attention to, and the more constraints it receives, resulting in the decline of enterprise performance. Meanwhile, other variables are not significant. According to the regression results of the *F₁* score of the debt service factor, environmental investment (*X*) is positively correlated with it but not significantly. Enterprise size (*SIZE*) is negatively correlated with it at 1% level. The coefficient is -0.35. The rate of business income growth is also negatively correlated with it and significant at 5% level. The correlation coefficient is -1.03. The fast-growing enterprises choose to borrow further to expand the market scale, which leads to an increase in the debts undertaken by the enterprises and the decrease of the corresponding solvency. Only equity concentration (*H10*) has a negative correlation with the regression result of *F₂* score of growth operation factor, which is significant at 5% level. The correlation coefficient is -2.76, indicating that equity is highly concentrated. The development direction is affected by the factors of the decision-maker. Making mistakes is easy and blocks the growth of enterprises. Environmental investment (*X*) is positively correlated with the profit factor *F₃* score but not significantly. Equity concentration (*H10*) is positively correlated with the profit factor *F₃* score, with a coefficient

of 2.62, which is significant at 5% level. Thus, concentrated equity can enhance the profitability of enterprises and place limited resources into high-profit products. The rate of growth of business income (*RATE*) is also positively correlated with the profit factor *F₃* score, with a coefficient of 1.14, which is significant at 5% level. That is, the faster the growth of business income, the greater the profits the enterprise obtains. Environmental investment (*X*) is positively correlated with the *F₄* score of operation growth, with a coefficient of 0.6, which is significant at 10% level, indicating that enterprises can increase environmental investment, optimize the operation environment, gain the support of the government and society, and contribute to the operation and growth of enterprises. The rate of growth of business income (*RATE*) is also positively correlated with the *F₄* score of operation growth with a coefficient of 1.04, which is significant at the 10% level. This rate also shows that the increase of business income can increase capital investment in environmental protection, continuously optimize the business environment, and ensure the good operation of enterprises.

CONCLUSION

This study designs the performance evaluation index system of enterprises in Yangtze River Delta from four aspects: solvency, operation ability, profitability, and development ability. It selects 12 indexes, extracts four common factors by factor analysis, and calculates the comprehensive performance score. Environmental investment is taken as the independent variable. The study selects equity concentration, size, age, and rate of revenue growth as the control variables to analyse the impact of environmental investment on corporate performance. The conclusions obtained in this study as follow: there is a positive correlation between environmental investment and corporate performance. Increasing

Table 6: Correlation test between variables.

	F1	F2	F3	F4	F	X	H10	SIZE	AGE	RATE
F ₁	1									
F ₂	0.00	1								
F ₃	0.00	0.00	1							
F ₄	0.00	0.00	0	1						
F	0.60**	0.55**	0.52**	0.28	1					
X	0.09	0.16	0.15	0.21	0.27	1				
H10	-0.23	-0.29	0.43*	-0.21	-0.13	0.16	1			
SIZE	-0.47**	-0.04	-0.09	0.00	-0.35*	0.11	0.06	1		
AGE	-0.10	-0.14	-0.12	0.25	-0.13	0.02	-0.17	0.34	1	
RATE	-0.41*	0.03	0.38*	0.19	0.03	-0.12	0.18	0.10	-0.12	1

Note: ** Significant correlation at 0.01 level (bilateral), * Significant correlation at 0.05 level (bilateral).

Table 7: Multiple regression results.

	Y				
	F ₁	F ₂	F ₃	F ₄	F
c	8.70*** (3.10)	1.82 (0.56)	1.12 (0.38)	2.05 (0.66)	3.76** (2.39)
X	0.24 (0.78)	0.46 (1.27)	0.31 (0.95)	0.60* (1.74)	0.37** (2.12)
H10	-1.25 (-1.07)	-2.76** (-2.05)	2.62** (2.14)	-1.90 (-1.48)	-0.73 (-1.12)
SIZE	-0.35*** (-2.61)	0.01 (0.10)	0.15 (1.05)	-0.12 (-0.79)	-0.16** (-2.11)
AGE	0.01 (-0.14)	-0.04 (-1.05)	0.01 (0.27)	0.06 (1.56)	-0.01 (-0.11)
RATE	-1.03** (-2.03)	0.32 (0.54)	1.14** (2.15)	1.04* (1.87)	0.23 (0.81)
F _{test}	3.35***	2.07*	2.57**	2.21*	2.44*

Note: *** indicates a significant correlation at 1% level, ** indicates a significant correlation at 5% level, and * indicates a significant correlation at 10% level.

differences in the performance of intelligent manufacturing enterprises are observed, and their environmental investment status is not the same. The development should be balanced and coordinated from the aspects of profitability, solvency, operation ability, growth ability, and environmental investment. Moreover, the performance level of enterprises should be constantly improved to achieve the sustainable development of intelligent manufacturing enterprises.

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