



Internationalization and Sustainable Operations: A Broad Investigation of China's Manufacturing Firms with Implications for Emerging Markets

Tiansen Liu (Corresponding Author)

School of Social and Behavioral Sciences, Nanjing University, Nanjing, China

State Key Laboratory of Pollution Control and Resource Reuse, Nanjing University, Nanjing, China

School of Economics and Management, Harbin Engineering University, Harbin, China

Email: tiansen0328@hrbeu.edu.cn**Yue Zhu**

School of Management, Harbin Institute of Technology, Harbin, China

Xinpeng Xing

School of Business, Jiangnan University, Wuxi, China

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Abstract

We investigate if internationalization behaviors encourage sustainable operations of China's manufacturing firms due to their substantial impact on climate change and special governance modes, and organize a heterogeneity test to clarify what kind of internationalization behaviors can robustly influence such operations. We find that firms with abundant assets and heavy-polluting feature are more committed to sustainable operations. Getting close to international sustainability standards, international auditing standards, and international business all improve sustainable operations. Heterogeneity test further shows that compared with international standards, the positive impact of international business on sustainable operation lacks a robustness, which responds to an argument that for one country, international business acts as a double-edged sword. Overall, this paper reveals internationalization as a key indicator significantly influencing economic, ecological, and social spheres in manufacturing sectors of emerging markets, and complying with well-accepted international standards can be significantly embodied in a more optimistic sustainable operations. However, how to deal with international business in a right manner is a research highlight worthy of ongoing discussion. We focus on different types of internationalization behaviors, and this indicator can theoretically inspire future study to dialectically evaluate the role of internationalization in addressing sustainability problems in emerging markets' pillar industries.

Keywords: Sustainable operations; International standards; International business; China's manufacturing firms; Emerging markets; Implications.

1. Introduction

Manufacturing firms, which are economy's mainstays in emerging markets, always encounter problems in sustainable development, and researchers are methodically exploring possible solutions. With the progress of globalization, emerging markets are striving to establish sustainability modes at the industry level, and recent research focused on how to use internationalization indicators to improve manufacturing firms' sustainability [1-4]. In this process, a systematic international standard and involving in international business are suggested to reduce the harm caused by an improper even illegal operations management in key industrial sectors [5, 6]. Sustainable operations, which can be achieved by using management concepts, embed business practices into firm performance relevant to economic, ecological, and social spheres, i.e. a concept of operations management with sustainability features to meet firms' and stakeholders' needs for sustainable development [7, 8]. For this reason, firms often seek the way to improve sustainable operations by using the merit of their available resources, especially in energy-intensive industries and emerging markets. What's more, international business research suggested internationalization strategies to help firms organize sustainable operations activities, which is of great significance to the sustainability of manufacturing firms in emerging markets [9-11].

In recent years, some international sustainability standards, e.g. Global Reporting Initiative (GRI) standard and Environmental, Social and Governance Reporting (ESG), are used to evaluate firms' sustainability. Recent research found that emerging markets are increasingly dependent on these sustainability standards, and using such standards can create new performance, while this favorable situation does not exist in most of emerging markets [12-14]. Worldwide, sustainability standards help industrial sectors establish a new social identity [15], while some small-and medium-firms encounter difficulties of adopting international sustainability standards because they have to focus on more fields of sustainable operations [16]. At the same time, international business does not always positively influence firms' ecological sphere because to firms that have less relevance to high-technology and multinational corporations, rash internationalization strategies are rather obstructive to their sustainable development [17]. Above academic explorations suggest that achieving a well-rounded internationalization in manufacturing firms of emerging markets has a challenge, which encourages to investigate the relationship between internationalization and

sustainable operations with a broader survey of manufacturing firms in one country or in one unified economy. To show how different internationalization behaviors lead to sustainable operations in emerging markets, this paper surveys China's manufacturing firms and divides internationalization indicators into international sustainability standards, international auditing standards, and international business. We aim to establish a benchmark for other emerging markets in terms of their internationalization strategies selection in economic, ecological, and social spheres of manufacturing firms, and thus better deal with dilemmas of linking internationalization and sustainability issues.

To address existing knowledge gaps in firms' sustainable operations, this paper will contribute to following aspects. First, we expand the knowledge of firms' internationalization behaviors within the context of China's business modes that can characterize much of emerging economies, especially under the initiative of *Made in China 2025* and *The Belt and Road* [9, 18, 19]. At the same time, given the substantial impact on climate change and special governance modes of China's manufacturing firms, the merits and demerits of China will provide the implications in internationalization for sustainable operations in other less-developed economies, thereby illuminating how to enhance firms' sustainability by varied globalization actions. Second, we expand the theory development between internationalization and sustainable operations from the perspective of different kinds of internationalization behaviors. This consideration helps understand what profiles of internationalization should be more concerned by manufacturing firms in emerging markets since it will take a long time for these firms to fully step into internationalization. What's more, the purpose of separately testing international sustainability standards, international auditing standards, and international business is to clarify the impact of internationalization from aspects of regular operations management modes, financial accounting methods, and market expansion strategies, thereby providing some grounds for bridging internationalization and sustainable operations. Third, we will also contribute to top management's decision-making orientations of firms that are in similar business environments. Considering the development demand of pillar industries in less-developed economies, a profound analysis of value of varied internationalization phenomena will become a key premise to get close to the interdependency between internationalization and sustainable operations. We hope to remind relevant stakeholders to see internationalization as a key indicator in keeping firms' sustainable operations by depicting the overall state of China's manufacturing firms with a further analysis derived from firms' basic profiles. Accordingly, we can suggest future research to incorporate these two types of variables into more theory development frameworks, e.g. the institutional, resources-based, and strategic levels [6, 11, 20].

The rest of this paper is structured as follows. Section 2 reviews the relevant literature and develop research hypotheses. Section 3 introduces the research methodology, and empirical results are shown in Section 4. Research implications targeting at our key findings are discussed in Section 5, and Section 6 concludes this paper with clarifying research limitations and future research.

2. Literature Review

2.1. International Sustainability Standards and Sustainable Operations

Unlike sustainability standards that only can be used to one country, international sustainability standards have a broader applicability. For example, the Sustainability Reporting Guidelines compiled by GRI illuminates that their core indicators can apply to almost all institutions worldwide, while additional indicators also apply to most institutions. More importantly, these international sustainability standards focus on almost all aspects relevant to organizations' sustainable operations, and elaborates how organizations should implement these standards and disclose necessary data. Accordingly, firms implementing international sustainability standards require to invest more resources to deal with different profiles of sustainable operations, and such operations performance will be more easily recognized by a broader range of stakeholders.

With respect to relationships between implementing international sustainability standards and sustainable operations performance, prior studies argued that following such standards indicates that firms are willing to promote their sustainability in an all-round way, thereby building a global prestige [5, 21, 22]. Even if using international sustainability standards does not necessarily rapidly improve economic, ecological, and social spheres, multi-country samples reveal that firms sustainably implementing international standards are more likely to create varied performance and then to be recognized by overseas markets [23]. Specific to China, the emergence of international standards enhances the role of human rights, labor safety, and community support in firms' sustainable operations, which also suggests that for emerging markets, their firms usually evolve from complying with basic requirements of international sustainability standards to implementing all indicators [24, 25]. Given the significant difference in asset size and operations capability among China's manufacturing firms, we infer that implementing international sustainability standards can improve sustainable operations as H1.

H1: International sustainability standards improve sustainable operations of China's manufacturing firms.

2.2. International Auditing Standards and Sustainable Operations

The public is holding an increasing expectations for firms' information disclosure. On one hand, transparent financial information can show firms' self-confidence in the operations management. On the other hand, it can also enhance stakeholders' investment or consumption willingness [26, 27]. To emerging markets, a high-quality disclosure of environmental or financial information shows an effective firm governance, and hiring international certified accounting firms, e.g. Big 4 auditor, is an exploratory attempt to expand their international influences [28].

Following international auditing standards means that firms' environmental or financial disclosure should achieve international leading level, and hiring world-renowned certified accounting firms, which is a high-cost behavior, shows that firms are willing to disclose their operations information to stakeholders worldwide. At the same time, given that accounting firms as a third-party assurance need to honestly audit firms' information rather than maliciously fake, adopting international auditing standards will encourage firms to improve their sustainable operations level. Specific to China, some indirect evidence shows that the institutional constraints on firms' top management, e.g. the accountability, encourage some firms to be evaluated by a more professional third-party institution. That is, firms can gain a broader social recognition by disclosing highly specialized and transparent internal information [14]. Accordingly, we hypothesize:

H2: International auditing standards improves sustainable operations of China's manufacturing firms.

2.3. International Business and Sustainable Operations

International business, which can be seen as a strategic resources allocation, shows the extent to which firms' products/services enter international markets. While for different firms, whether international business will be beneficial or costly has not been agreed because when it creates competitive edges for firms, it also requires firms to invest more resources, including scale and category levels [29-31]. As a kind of market-oriented behavior, international business provide firms a backing to establish stable business modes, and the involvement of broader groups will make firms focus more on their sustainability.

As far as China is concerned, the internationalization of China's firms has been less observed with piecemeal theoretical explorations. At the same time, the distinctive governance mode of China's manufacturing firms as well as their limited international business show following interesting findings. For example, the international diversification of China's listed firms is influenced by domestic industrial and regional diversification, and top management's international experiences will improve the impact of domestic diversification on international diversification, while the effect of their political connections is negative [32]. This finding shows that state-owned power sometimes focuses more on protecting domestic markets rather than entering global markets. Further, some emerging markets that are handicapped by less-developed economy level also show a distinctive role of firms' ownership structure and multi-stakeholders involvements in international business initiatives [1]. The research two decades ago showed that multinational corporation often observe the sustainable operations of China's firms when importing China's products [33]. Following studies further divided China's firms into different types of internationalization clusters, i.e. the mature, emergent, and domestic-focused internationalization, and concluded that international business degree is usually accompanied by an excellent sustainable operations [6, 34]. Thus we finally hypothesize:

H3: International business improves sustainable operations of China's manufacturing firms.

3. Methodology

3.1. Data Collection

We fully survey Shanghai Stock Exchange and Shenzhen Stock Exchange that totally publish more than 7000 corporate social responsibility (CSR) reports spanned from 2007-2019, but only less than 20 reports published in 2007-2009, and thus we investigate such reports in 2010-2019. Considering the data availability, we analyze 3502 firm-year observations of China's manufacturing firms. Almost all CSR reports declare that they strictly fulfill social responsibilities following policy regulations and industry standards, with promising to truthfully disclose relevant information. Therefore, we believe that the published data of these CSR reports is credible.

With respect to data source, following variables are surveyed from CSR reports: sustainable operations level, and whether firm publishing sustainable operations following international sustainability standards, e.g. GRI or ESG. Following variables are surveyed from firms' annual reports: total assets, the total proportion of state-holding owned by top 10 shareholders, whether firms' comprehensive performance audited by international certified accounting firms, and products export scale. What's more, we determine the pollution level of main business's pollution level by the Guideline for Environmental Information Disclosure of Listed Firms published by Ministry of Ecology and Environment of the People's Republic of China, and this indicator (heavy-polluting or not) is surveyed from <http://www.eastmoney.com/> that is a professional financial website publishing basic profile and stock market quotation of China's firms.

3.2. Variables

Dependent variable: Sustainable operations (SO) is dependent variable that is quantified by multiplying the total page of CSR reports (It describes the extent to which firms have a desire to show sustainable development information to the public) and the number of disclosed sustainable operations indicators complying with GRI 3.1 version (It describes the extent to which firms broadly engage in sustainability issue). We are motivated by prior research in evaluating the disclosure quality of firms' sustainability/environmental information. Iatridis [28] and Plumlee, *et al.* [26] defined a high-quality disclosure as releasing a limpid signal to the public in seeing firms' sustainable development, in order to make informed decisions. Therefore, we use these two sub-indicators to show the overview of firms' sustainable operations. Specifically, GRI3.1 version includes 7 aspects, i.e. institutions' strategies and profiles (strategic analysis, basic profiles, reports' parameter, governance mode, commitment and stakeholders involvement, and management performance indicators), economic impacts on stakeholders,

environment protection, labor practice and decent work, human right, community construction, and products liability.

Accordingly, we calculate the number of aspect that each firm-year observation well engages in based on the contents of CSR reports (well engaged in=1; otherwise=0), and then add the score of all aspects well engaged in. GRI3.1 introduces the link of each aspect with institutions' sustainability, and if a CSR report publishes data and then elaborates its impact on firms' sustainable development, we see it as the well engaged in.

Independent variable: As explained in Section 2, we describe internationalization degree from three aspects, including international sustainability standards, international auditing standards, and international business. Specifically, we judge (1) whether firms publishing sustainable operations information following international standards (ISS); (2) whether firms hiring international certified accounting firms (IAS), e.g. Big 4 auditor; and (3) the proportion of products exported to overseas markets in total products sales (IB), including Hong Kong, Macao, and Taiwan.

Control variables: We contextually consider the feature of China's manufacturing firms, and thus design the following three control variables that can influence our independent and dependent variables as well as their relationship, in order to make our empirical results truly show the antecedents of firms' sustainable operations. (1) Total assets (ASSET). Given a large number of manufacturing firms in China and different stock boards of these listed firms (including main-board, second-board, small-and medium-sized firm board, and new OTC), their total assets often vary greatly. Prior studies found that in emerging markets, total assets is a key indicator because compared with developed economies, abundant assets is usually a scarce resource. Large-sized assets can help firms to organize business and society activities, thereby creating favorable conditions to address the problems in the economic, ecological, and social spheres [1, 35]. (2) State-holding scale (SHS). Substantial evidence shows that state-holding can bring an advantage in political-tie and more resources in China's manufacturing firms, which triggers a disparity of internationalization intensity and motivations for sustainable operations between state-owned and non-state-owned firms [36-38]. (3) Firms' pollution level (POL). The problems relevant to sustainable operations in heavy-polluting and less-heavy-polluting firms should be addressed in different ways, and the former firms are required to organize more sustainable operations activities. To China's manufacturing firms, policy priorities in heavy-polluting sectors are implemented to encourage less energy use and more climate-friendly strategies [39].

Table 1 shows the overview of all variables, and standard deviation (S.D.) shows an obvious disparity in total assets, state-holding scale, and sustainable operations level. The average of ISS, IAS, and IB indicates that only a few firms have engaged in internationalization behaviors. That is to say, operations management process of most China's manufacturing firms still has localization features. What's more, the average state-holding in our sample firms is not very high. Considering a large S.D. of this indicator, we infer that state-holding more gather in a few manufacturing firms, and it may result in monopoly or oligopoly in some industries.

Table-1. The overview of variables (N=3502)

Variables	Definitions	Min.	Max.	Mean	S.D.
SO	<i>The product of total page of annual CSR reports and number of SO indicators published in detail following GRI3.1 version</i>	9.00	1530.00	179.08	194.39
ASSET	<i>Total assets (100 million RMB)</i>	1.40	11200.00	306.30	766.42
SHS	<i>Measured by "the proportion of state-holding owned by top10 shareholders (%)"</i>	0.00	95.26	27.91	25.85
POL	<i>Heavy-polluting firm=1; Less-heavy-polluting firm=0;</i>	0.00	1.00	0.53	0.50
ISS	<i>Organizing sustainable operations following international sustainability standards=1; otherwise=0</i>	0.00	1.00	0.20	0.40
IAS	<i>Hiring international certified accounting firm=1; otherwise=0</i>	0.00	1.00	0.12	0.33
IB	<i>Measured by "the proportion of products export sales in total sales annually (%)"</i>	0.00	100.00	13.14	19.75

3.3. Data Processing and Model Design

Due to different measuring units of our variables, we standardize all raw data, in order to reduce the negative interference of few outliers on empirical results [12]. Further, we separately examine to firms with different basic profiles, what differences in the impact of internationalization on sustainable operations, and thus propose more targeted implications for driving paths of sustainable operations in emerging markets.

We do a robustness test for our data by using OLS estimation model, Fixed Effect model, and Random Effect model to show variables' causality in both full data and heterogeneity test, and find that the empirical results from these three models have a high similarity. Since the general OLS estimation cannot well deal with possible unobserved heterogeneity of panel data caused by time-and-individual disparity, we also test the applicability of Fixed Effect model and Random Effect model by Hausman test, and find that Fixed Effect model is applicable to our testing process. We further estimate the cluster robust standard errors of each variable to show spatial correlations of error terms because it is usually assumed that the disturbance terms of different observations are mutually

independent in the panel data. What's more, we develop D.W. test to show the serial correlation of variables, and find all of D.W. values around 2, which shows that the residual of our variables obeys normal distribution. Then we design the following measuring model.

$$Y_{it} = \alpha + \beta_1 C_{it} + \beta_2 X_{it} + \varepsilon_{it} \quad (1)$$

Here, we define X_{it} as the independent variable and C_{it} as the control variable. Further, α is the constant term, and ε_{it} is the random error term. i denotes the firm-level observation ($i=1\ldots3502$), and t is the time-level observation ($t=2010\ldots2019$).

4. Empirical Results

4.1. Correlation Analysis

Table 2 shows that China's heavy-polluting firms with more total assets, more state-holding, heavy-polluting feature, following international sustainability standards, hiring international certified firms, or involving in international business all better engage in sustainable operations. Further, all internationalization indicators have a significantly mutually positive correlation. Our correlation analysis preliminarily can indicate that such internationalization behavior is of great importance to sustainable operations of manufacturing sectors, while firms with different basic profiles usually show different levels of such operations. Then we examine variables' causality to verify our research hypotheses.

Table-2. Correlation coefficients (Spearman coefficients, N=3502)

Variables	1	2	3	4	5	6	7
SO	1						
ASSET	0.381***	1					
SHS	0.126***	0.363***	1				
POL	0.037**	0.093***	0.169***	1			
ISS	0.570***	0.339***	0.096***	0.023	1		
IAS	0.218***	0.362***	0.105***	0.026	0.225***	1	
IB	0.033*	0.046***	-0.099***	-0.200***	0.038**	0.047***	1

Note: * $p \leq 0.10$ (Two-tailed), ** $p \leq 0.05$ (Two-tailed), *** $p \leq 0.01$ (Two-tailed), with the same as following Tables.

4.2. Empirical Results of Full Sample

Table 3 shows the impact of antecedents variables on sustainable operations. The mutual correlation among three internationalization indicators indicates that firms, which are willing to engage in internationalization, also focus more on broader internationalization indicators. However, considering the meanings of these three indicators are theoretically independent of each other and actually, it is not to say that international operations management standards must be implemented with the emergence of international business. Accordingly, we separately examine the impact of each internationalization indicator to avoid their real roles being disturbed.

Table-3. Empirical results of full sample (N=3502)

Variables	Model 1	Model 2	Model 3	Model 4
ASSET	0.367*** (0.039)	0.171*** (0.014)	0.295*** (0.042)	0.367*** (0.040)
SHS	0.015 (0.012)	0.012 (0.009)	0.013 (0.012)	0.018 (0.013)
POL	0.026* (0.008)	0.010 (0.007)	0.021 (0.008)	0.030* (0.008)
ISS		0.556*** (0.016)		
IAS			0.202*** (0.028)	
IB				0.027* (0.010)
R^2	0.150	0.427	0.185	0.151
F -Value	191.75***	619.89***	189.57***	144.65***
$D.W.$	1.919	1.976	1.935	1.920

Note: Robust standard errors in parentheses are the cluster standard error at year-level, and *Firm* and *Year* variables are both controlled with the same as following Tables.

Table 3 shows following pictures. First, total assets and heavy-polluting feature significantly promote firms to engage in sustainable operations, while the positive role of state-holding is not statistically-significant. This case suggests that asset strength and the pressure from heavy-polluting feature can drive manufacturing firms to engage in sustainable operations in China. Further, the weaker role of state-holding release a positive signal that state-holding does not always dominate the sustainable operations of manufacturing firms, and non-state-owned firms are also willing to involve in industrial sustainable development. Generally, the voice of promoting firms' sustainable operations by state power is weakening, and more initiatives are that non-state-owned firms should be encouraged to develop sustainable operations. Recent studies found that the nature of state-holding and government control will pounder on the sustainable development of small-and medium-sized firms [9, 40]. At the same time, non-state-owned even small-and medium-sized firms in China can actually better gain knowledge/ideas about how to achieve the modernization of operations management. Therefore, moderately reducing political-tie may offer non-state-owned firms more free spaces to pursue their own reasonable sustainable operations modes [38]. It can be inferred

that in emerging markets, abundant material resources, firms' basic features, and flexible policy involvements can more help sustainable operations of manufacturing firms.

With respect to the impact of internationalization on sustainable operations, it is obvious that the positive impact of implementing international standards on sustainable operations is better than that of international business. On one hand, implementing international standards profoundly shows that firms will organize their operations management with higher and more broadly-recognized standards. On the other hand, international business scale positively influence sustainable operations of China's manufacturing firms, while its regression coefficient is small. To a certain extent, it confirms prior research findings that international business actually has a possible double-edged sword function for firms' operations management. This phenomenon may be due to the lower level of international business of our sample firms. At the same time, achieving an appreciable international business scale requires some supportive conditions [32, 38, 41]. In additional, international business provides an access channel to attract private shares, which allows firms to enrich their governance modes. In this case, operations management of China's manufacturing firms will tend to be market-oriented rather than policy-oriented. Globally, significant implications from high socially-normative firms are impressive that market (or market alliance) that includes the valuable products/ services will broadly create firms' competitive edges that enable firms to benefit from foreign markets [42, 43]. We thus believe that with the involvement of more private shares, the market-oriented business selection gives firms more flexibility to involve in international business, thereby enhancing the enthusiasm of their sustainable operations. Based on above analysis, H1, H2, and H3 can be verified, while it should be noted that international business as a common indicator often dynamically influences sustainable operations of manufacturing firms in emerging markets because of the relative scarce available resources and lack of vitality of private shares.

4.3. Heterogeneity Test

To visualize the impact of internationalization on sustainable operation under different firms' basic features, we divide ASSET into higher and lower ASSET, and SHS into higher and lower SHS by their averages, with POL into heavy-polluting and less-heavy-polluting firms following Table 1. Our heterogeneity test helps clarify how our sample firms with different basic features should deal with the relationship between internationalization and sustainable operations with empirical results in Table 4.

Table-4. Heterogeneity test
Table-4a. Heterogeneity test based on firms' total assets scale

Variables	Higher ASSET (771)			Lower ASSET (2731)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
SHS	0.001(0.038)	0.053(0.039)	0.056(0.039)	0.026(0.023)	0.003(0.029)	0.016(0.029)
POL	-0.041(0.027)	-0.030(0.023)	-0.017(0.029)	0.018(0.008)	0.018(0.009)	0.024(0.007)
ISS	0.637*** (0.018)			0.520*** (0.015)		
IAS		0.191*** (0.026)			0.256*** (0.034)	
IB			0.063*(0.047)			0.031(0.012)
R ²	0.429	0.036	0.007	0.280	0.067	0.001
F-Value	177.87***	10.72***	1.59***	341.39***	65.50***	1.51***
D.W.	1.951	1.860	1.821	2.001	1.933	1.946

Table-4b. Heterogeneity test based on firms' state-holding scale

Variables	Higher SHS (1767)			Lower SHS (1735)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
ASSET	0.226*** (0.019)	0.392*** (0.049)	0.450*** (0.047)	0.124*** (0.026)	0.222*** (0.036)	0.302*** (0.031)
POL	-0.005(0.008)	0.020(0.013)	0.018(0.013)	0.031(0.014)	0.036(0.014)	0.056**(0.014)
ISS	0.545*** (0.018)			0.553*** (0.020)		
IAS		0.155*** (0.027)			0.234*** (0.027)	
IB			- 0.008(0.012)			0.047**(0.015)
R ²	0.471	0.239	0.219	0.381	0.152	0.106
F-Value	493.17***	173.56***	152.98***	337.03***	95.32***	60.16***
D.W.	1.983	1.964	1.934	1.975	1.971	1.980

Table-4C. Heterogeneity test based on firms' pollution level

Variables	Higher POL (1844)			Lower POL (1658)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
ASSET	0.149*** (0.013)	0.348*** (0.013)	0.398*** (0.009)	0.193*** (0.025)	0.270*** (0.048)	0.362*** (0.046)
SHS	-0.020(0.010)	-0.015(0.010)	-0.026(0.015)	0.045***(0.014)	0.013(0.018)	0.045*(0.020)
ISS	0.581*** (0.017)			0.528*** (0.026)		
IAS		0.126*** (0.017)			0.273*** (0.029)	
IB			-0.004(0.010)			0.057***(0.021)
R ²	0.446	0.177	0.164	0.409	0.218	0.158
F-Value	466.77***	125.86***	113.55***	362.31***	144.64***	93.42***
D.W.	2.100	2.045	2.036	1.993	1.956	1.935

It can be found that no matter what kind of firms' basic features, international sustainability standards and international auditing standards positively influence sustainable operations, while the impact of international business is fluctuating. What's more, firms with higher ASSET, lower SHS, or less-heavy-polluting features have a more positive impact of international business on sustainable operations. On one hand, it indicates that such international standards robustly influence sustainable operations, but international business can contextually positively influences such operations. On the other hand, it describes following pictures targeting at emerging markets. First, a higher total assets provide robust resources for internationalization and sustainability issues. Second, firms with lower state-holding usually have a weaker political-tie, which implies that their operations management is more focused on business purpose, i.e. the purer operations goal. Finally, less-heavy-polluting firms usually encounter fewer obstacles in organizing sustainable operations, and they thus have more energy to coordinate the relationship between internationalization and sustainable operations. Above results suggest that manufacturing firms in emerging markets with a more positive relationship between these two indicators should own more financial resources, more inclusive ownership structure, or less environmental barriers.

5. Research Implications

5.1. Theoretical Implications

This paper examines how internationalization behaviors as a key indicator influence sustainable operations with considering manufacturing firms' basic features in emerging markets, particularly indicating a necessity of expanding the effect of internationalization in improving industrial sectors' sustainability in less-developed economies. Following our broad investigations, sustainable operations can be holistically influenced by varied internationalization indicators, while the impact of international business is not always positive, which poses a key question around how to improve firms' sustainable operations by adjusting their international business structure. Following prior literature that investigated the relationship between internationalization and sustainable operations, we further investigate the impact of different kinds of internationalization indicators based on the broad survey of China's manufacturing firms that can be qualified for the advanced level of emerging markets, which clarifies that to manufacturing firms with different basic features, what they should work for sustainable operations by the aid of internationalization indicators in a systematic way. Generally, this work makes the role of internationalization in sustainability-related issues explicit. Our theoretical model provides two theoretical implications for future research, especially in emerging markets. First, we try to emphasize the driving role of internationalization in sustainable operations, in order to enhance the values of international recognition and institutional tools in sustainability problems that manufacturing firms need to urgently address. Exploring the way to improve such firms' sustainable operations based on relevant theories, e.g. the Institutional Theory, the Resource-based View, the Accountability Theory, and the Stakeholder Theory [14, 20], can help contextually understand how specific types of firms need to use tools in internationalization areas to improve sustainable operations. Second, we also try to wake emerging markets up that in the less-developed economy level, it needs to explore possible external variables to overcome demerits of economic environment. Internationalization, which is a still new thing in emerging markets, actually involves quite a lot of aspects. We compare the role of international standards and international business, and a more robust role of international standards responses to the call for using international standards to normalize the holistic framework of firms' sustainable operations as suggested by constructive initiatives [15, 22].

5.2. Managerial Implications

Based on our findings, following managerial implications are viable for improving sustainable operations of manufacturing firms in emerging markets. First, firms should identify the positive role of internationalization in their sustainability initiatives, and even if international business has a fluctuating influence, it generates a rosy prospect as a whole. Currently, the average of all three internationalization indicators is low. Considering that the development quality of China's manufacturing industries is at the leading level in emerging markets, other countries may need to be more international. Second, it can be seen that there is no significant disparity in the level of sustainable operations between firms with higher and lower SHS (192.95 vs 164.95) as well as heavy-polluting and less-heavy-polluting (182.36 vs 175.43), while such disparities between higher and lower ASSET are quite large (308.22 vs

142.62). This phenomenon shows that financial or material resources often directly contribute to sustainability issues, while such contribution is difficult to appear from the indicator that is less related to firms' production factors. Accordingly, the Resource-based View helps explain the demand of basic resources by emerging markets' business sustainability, but the application prospect of the Institutional Theory in such markets can be further discussed because of the less-perfect of market-driven system and less-moderate government control [9, 35]. Therefore, emerging markets should fully grasp their resources advantages in business sustainability, while the market system construction is still a problem to be reconciled.

Second, our findings also release a positive signal that heavy-polluting and less-heavy-polluting firms have no significant disparity in sustainable operations performance, while less-heavy-polluting firms have a higher international business level. It shows that heavy-polluting firms are undergoing more difficulties in expanding international business and sustainable operations than less-heavy-polluting firms. To improve it, it needs more incentive policies in heavy-polluting firms' economic, ecological, and social spheres in emerging markets, and recent studies also provide some evidence that to such sectors, the priority of incentive policies lies in that top management can more broadly address the problems caused by the industrial features of heavy-polluting firms [39, 44]. What's more, such government involvement will promote the top management's initiative in balancing negative impacts of heavy-pollution and expected sustainable operations results with a quicker response.

5.3. International Implications

This paper sets a benchmark for other emerging markets to get involved in international business and then improve their industrial contexts. China's manufacturing firms, which have an increasing focus on sustainable operations, usually have a strong political-tie, different accesses to resources, specific financing channels, and higher public concerns in CSR, with a rising international status [14, 45]. Nowadays, more and more China's manufacturing firms voluntarily implement the internationally-accepted standards in sustainable operations. Considering internationalization as a key indicator in business sustainable operations as well as the significant implications in theory and in practice in their relationships, we embark on this paper to emphasize the role of international standards and international business. From the perspective of emerging markets, it needs a great effort to explore possible indicators as a solid backing of business sustainability. This initiative with practical examples of *Made in China 2025* and *The Belt and Road* suggest more emerging markets making ambitious plans for internationalization strategies. Besides the resource-based backing, institutional change and social cognition should also be included as a premise in exploring the indicator of sustainability of manufacturing firms in emerging markets [46, 47].

6. Conclusion

This paper investigates if internationalization can be as a key indicator of improving sustainable operations of manufacturing firms in emerging markets based on the distinctive features of China's business environment. We find that international sustainability standards and international auditing standards can robustly motivate sustainable operations no matter in what basic features of firms, while international business has a less-stable positive role. Our study supports the significance of implementing international standards, and then suggests enhancing the status of international business in emerging markets.

In addition to the theoretical and practical implications we suggest, the following research limitations need to be progressed. First, the indicators related to internationalization can be expanded, e.g. FDI, in order to show more indicators that may encourage sustainable operations. Second, because of the limited space, we have not designed moderating or mediating variables to enrich theoretical underpinnings. It suggests further designing proxy variables to more completely describe the profiles of internationalization. Third, more contextual factors can be arranged as control variables to understand the influence of particularity of country contexts. Based on this contextual and targeting study, we therefore provides an useful while also a preliminary insight for future study in exploring the way for emerging markets' business sustainability, which may help to frame the practice mainly from internationalization contexts.

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