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Effects of Sustainability and Technology Orientations on Firm Growth: Evidence from Chinese Manufacturing

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Abstract: Prior literature from a cognitive perspective analyzing the effects of different content and structure of managerial cognition on sustainability are lacking. This study attempts to fill this gap by examining the relationship between technology orientation, sustainability orientation, and firm growth. Sustainability development has received unprecedented attention in the 12th five-year plan of China, who is the world's largest energy consumer. This study tested the model of Chinese manufacturing in the year when the 12th five-year plan was published. Under the conditions of transforming economy, this study also considers how distinct institutional and industrial contexts could affect the relations between strategic orientations and firm growth, thereby clarifying the context-based adoption of different strategic orientations for realizing high levels of firm growth.

Keywords: sustainability orientation; technology orientation; firm growth; industry growth; institutional environment

Our mission is to be the leading global innovator, developer and provider of cleaning, sanitation and maintenance products, systems, and services. As a team, we will achieve aggressive growth and fair return for our shareholders. We will accomplish this by exceeding the expectations of our customers while conserving resources and preserving the quality of the environment.

—Mission statement of Ecolab INC

1. Introduction

Driven by the importance of managing global environmental problems like climate change, substantial attention has been paid to the environmental sustainability issue. Additionally, for any firm surviving in the modern competitive environment, new product development has been paid increasing importance [1]. However, both sustainability-related practices and technology exploration call for a large amount of resource investment, which must be guaranteed to have some impact on corporate economic performance. Companies are seeking opportunities to tap into creative and entrepreneurial potential by encouraging their employees to develop valuable products or services for both the company and society.

Firms incur costs from sustainability-related practices [2], but during the past 40 years, literature on the relationship between corporate sustainability and financial performance has not reached an agreement [3] as to whether it is positive [4], negative [5], U-shaped [6], inverted U-shaped [7], or insignificant [8]. Although these studies were conducted based on different contexts, it is difficult for managers to make decisions as to whether to adopt sustainability-related practices. Similarly, although the view that technology is the determinant for success in the marketplace has been widely recognized in the existing literature [9], the conditions under which firms' technology strategy leads to superior performance remain a matter of speculation.

Scholars in strategic management have discussed the close association between managerial cognition and strategy formulation and implementation [10]. Specifically, due to the existence of bounded rationality, it is impossible for decision makers to achieve a complete understanding of strategic situations and they use cognitive structure to “develop subjective representations of the environment that, in turn drive their strategic decisions and subsequent firm action” [11] (pp. 1395). Given the limited cognitive capability, firms do not necessarily adopt only one orientation or one orientation as an alternative of another, and it is difficult for firms to pursue different high level orientations simultaneously. However, previous studies from a cognitive view analyzing the effects of different content and structure of managerial cognition on sustainability are still lacking [12]. Additionally, from the resource-based view, both the sustainability-related practices and technology exploration call for large amount of resource investments. Therefore, it calls for analysis to look into the issue of whether pursuing sustainability and technology orientations simultaneously is meaningful for firm growth. Accordingly, we developed and tested a model in a transforming economy—China, which is the world’s largest emitter of greenhouse gas (GHG) and energy consumer, seeking to address these gaps in the literature. Being a transforming economy, manufacturers in China face many institutional and market challenges. The strategic orientation of firms has been widely studied by scholars in the fields of management, marketing, and innovation [13]. Thus, under such a context, this study seeks a deeper understanding of the relationship among technology orientation, sustainability orientation, and firm growth. With this framework, we also consider how distinct institutional and industrial contexts could affect the relationship between strategic orientations and firm growth, thereby clarifying the context-based adoption of different strategic orientations for realizing high levels of firm growth.

We contribute to the managerial cognition and environmental sustainability literature in three major ways. First, studies from a cognitive view analyzing the effects of different content and structure of managerial cognition on sustainability are still lacking [12]. By examining the role of sustainability orientation for firm growth, our research deepens the understanding of corporate sustainability in managerial cognition for firm development. Second, our research further supports the positive view that both sustainability and technology orientations could promote firm growth, suggesting the importance of sustainability-oriented innovation. Finally, by using the computer-aided text analysis, our study completes the measurements of strategic orientation, mainly through surveys, for capturing managerial cognition in the past.

This paper is structured as follows. After the introduction, Section 2 reviews the background literature and presents the hypotheses development. This is followed by Section 3, which describes methodology including data collection, measures, and analysis for testing our hypotheses. Section 4 reports the results and findings. Finally, Section 5 focuses on the implications of the results and the limitations of this study, as well as directions for future research.

2. Theoretical Background and Hypotheses

2.1. What is Strategic Orientation?

Strategic orientation has attracted widespread attention in research, but there is no universally accepted definition yet [14]. In line with the cognitive stream, we adopted the definition describing strategic orientation as the specific information domain that a cognitive structure pertains to [15,16], which selectively and actively enables organizations to make sense of the environment [17]. Therefore, strategic orientation will influence strategic choices through the different types of information used to assess and navigate gaining competitive advantage [13]. There are different typologies of strategic orientations: Market related orientations describe the information domains of the competitive environment (market, customers, and competitor) [14]; when investigating the processes of matching resources to the environment, scholars usually look into entrepreneurial and learning orientations [18]; from the view of determining the success or failure of new products, Gatignon and Xuereb analyzed

three different strategic orientations: Customer, competitive, and technological orientations [19]; and in the field of international business, it could be divided into global and local orientations [20].

In this study, we will mainly discuss two orientations, both of which seem to be uncertain in regards to short-term firm growth. First is the technology orientation, or the closely related term of product orientation [16], which represents how a firm is inclined to explore and develop new technologies to achieve product differentiation and cost advantages [19,21]. Recently, technology orientation has been intensively discussed for its role in facilitating innovation. The second is sustainability orientation. Building on previous research, the term ‘sustainability orientation’ is used in our research to describe organizational willingness to act on a variety of sustainability-related issues in their operations [22].

2.2. Strategic Orientations and Firm Growth

Cognitive frame determines the domains that managers allocate their scarce attentional resources to, and the way they interpret this information [23,24], hence managerial cognition influences firm performance by promoting effective strategic actions [25]. We summarized the prior literature in Table 1, and it shows that the majority of prior literature in the field of strategic orientations focused on a particular strategic orientation and its effect on firm performance, among which entrepreneurial orientation and market orientation have received most attention [21,26,27]. Firms with a market orientation are able to capture market opportunities and customer demand, resulting in better firm performance [28,29]. However, it may also have an adverse effect on firm performance after a crisis [30]. Firms pursuing a high entrepreneurial orientation, who are innovative, proactive, and open to risk when exploring new products, services, and markets [31] also perform better [32], especially for family businesses or small and medium-sized enterprises [27,33]. However, research on technology and sustainability orientations are relatively lacking.

Table 1. Prior literature on the association between strategic orientations and firm performance.

Author	Year	Journal	Key Findings
Prior Studies Investigating Parallel Direct Influences of Strategic Orientations on Firm Performance			
Al-Ansaari, Bederr, & Chen	2015	MD	MO has a positive influence on firm performance compared to TO and AO.
Frambach, Fiss, & Ingenbleek	2016	JBR	MO has a positive effect on superior performance.
Grewal & Tansuhaj	2001	JOM	MO has an adverse effect on firm performance after a crisis. The main effect is moderated by demand and technological uncertainty, and could be enhanced by competitive intensity.
Hortinha, Lages, & Lages	2011	JIM	Exporters with poor past performance may achieve higher export performance when they have a high MO compared to a high TO.
Laukkanen et al.,	2013	IMR	For SMEs in both Hungary and Finland, EO and MO have positive effects on business growth.
Schepers et al.,	2014	SBE	EO has a positive effect on firm performance for family business.
Prior Studies Investigating Influences of SO on Firm Performance			
Cheng	2018	JBE	With a high SO, firms are more likely to have better green innovation performance.
Danso et al.,	2019	JBR	The relation between stakeholder integration and firm’s financial performance is mediated by SO.
Roxas, Ashill, & Chadee	2017	JSBM	SO positively associates with the performance of small businesses under a developing country context, and it mediates the effects of EO on the performance.
Prior Studies Investigating Parallel Direct Influences of PO/TO on Firm Performance			
Lau	2011	JBR	Strategic orientations on product innovation are positively related to higher firm performance.
Lee, Dedahanov, & Rhee	2015	AJTI	Innovation performance mediates the relationship between TO and firms’ financial performance.

Table 1. Cont.

Author	Year	Journal	Key Findings
Kocak Carsrud, & Oflazoglu	2017	MD	TO had a negative effect on firm performance in the sample of SME firms.
Voss & Voss	2000	JoM	The results offered little support for the positive relationship between PO and firm performance

Note: MO, market orientation; TO, technology orientation; AO, alliance orientation; EO, entrepreneurship orientation; SO, sustainability orientation; PO, product orientation. MD, management decision; JBR, Journal of Business Research; JOM, Journal of Management; JIM, Journal of International Management; IMR, International Marketing Review; SBE, Small Business Economics; JBE, Journal of Business Ethics; JSBM, Journal of Small Business Management; AJTI, Asia Journal of Technology Innovation; JoM, Journal of Marketing; SME, small and medium enterprises.

2.2.1. Technology Orientation and Firm Growth

For the technology orientation, Gatignon and Xuereb examined its role in enhancing the success of new products' development, and they suggested that firms with high technology orientation are more likely to develop new products and processes [19]. However, the direct relationship between technology orientation and firm performance has received less attention in the literature compared to market orientation [28], and the associations between these two constructs remains inconclusive. Specifically, Lee, Dedahanov, and Rhee argued that the level of technology orientation has a positive relationship with firm's innovation performance [34]; the results in the study by Voss and Voss offered little support for a positive association between technology orientation and firm performance [16]; With the sample of SME, Kocak, Carsrud, and Oflazoglu found that technology orientation has a negative effect on firm performance [35].

From the resource-based view (RBV), firms guided by technology orientation accumulate rich technological knowledge through the collection of up-to-date technological information, which could be used to form a new technological solution to meet new market demand [19]. Therefore, technology orientation could be regarded as a valuable resource for a firm by incorporating advanced technology into its decision-making and organizing process, and firms with this resource could reconfigure resources to capture opportunities generated from the emerging, or potential, technological trends, thus, performing better [36]. Additionally, from the viewpoint of organizational learning, firms guided by technology orientation pay more concern to exploratory learning, and they are more likely to develop or adapt to new technologies to realize product differentiation in market competition [1]. These lead to the following hypothesis:

Hypothesis 1 (H1). *Technology orientation is positively associated with firm growth.*

2.2.2. Sustainability Orientation and Firm Growth

Different from other orientations (e.g., customer-, market-, entrepreneurship-), the sustainability orientation contains distinct elements of institutional motivation and pressure from stakeholders and regulations [37]. Prior research has shown that firms who place relatively high importance on sustainability in organizational cognitive frameworks assign a high priority to social, environmental, and economic issues [12], and corporate sustainability is perceived as an opportunity rather than a threat [38]. Considering the firm's capability development, Grewatsch and Kleindienst found that the relative importance of corporate sustainability in a firm's cognitive framework encourages the development of three organizational capabilities, namely, stakeholder integration, market sensing, and organizational learning [3]. Similarly, Adams et al. argued that the level of sustainability orientation will promote organizational learning, through being more aware of and effectively integrating societal and environmental needs into the new product development process, rather than considering economic needs only [13]. Then, extended from the RBV, the natural resource-based view [39] suggested that firms that integrate environmental constraints into organizational processes will be enabled to acquire valuable, rare, and inimitable new resources, constituting the basis of firm's long-term competitive

advantage [40]. Additionally, given the legitimacy issue, firms driven by a sustainability orientation will develop and design products more for the sustainability of global systems [41], which help them facilitate better reputation and greater legitimacy, consequently increasing the accessibility to greater market share and revenues [42]. Based on the above analysis, we propose that:

Hypothesis 2 (H2). *Sustainability orientation is positively associated with firm growth.*

2.3. The Contextual Mechanism on Strategic Orientations

The value of managerial cognition for firms also depends on many features, such as the environment within which the top management team operates, the type of tasks to be accomplished, the relation among team members, and the developing stage of teams and tasks [43]. Empirical results also support that the strength of the relationship between strategic orientation dimensions and performance may vary depending on both external and internal factors [44]. External factors that have been examined include the competitive intensity, market turbulence, and technological change [16,41], and internal factors include top management profiles and competitive strategies [45]. While these studies provide evidence that both external and internal factors play important roles in moderating the orientation–performance relationship, most extant research on strategic orientations has been conducted in Western countries. Thus, moderation roles from the context of transitional economies are still unclear for their unprecedented changes in the social, institutional, and economic environment [46]. Therefore, under the context of Chinese manufacturing, we will analyze the moderating roles of industry growth and regional institutions in this study.

The institution-based view of the firm captures the “rules of the game” which enable or constrain firm behavior [47]. Varying from the view that institutions are similar within a nation, emerging countries such as China have shown notable cross-regional variation in the development of institutional environment [48]. With the uneven regional development, especially in the constructing of legal systems and law enforcement, the institutional environment of the Eastern coastal regions of China are better developed than that in the Central and Western regions. The well-developed institutional environment is supported by better market-intermediated institutions and legal systems, including the completed protection of business, intellectual rights, and consumer’s right [49].

Firms operating in a well-established regional institutional environment are exposed to better market-based rules, suggesting that the competitive environments are more likely to support business initiatives. Therefore, firms operating in such environment must learn to satisfy increasing customer expectations to compete with increasingly differentiated products, through adapting to new technologies. The innovation literature suggests that the differences in firms’ performances are because of varying technological knowledge resources and the heterogeneous ability to turn technological knowledge into commercially successful products [13]. The well-established regional institutional environments could promote firm development by reducing the uncertainty and decreasing the costs of economic exchanges [50]. For example, the development of factor markets and institutional protection of IPRs could influence the availability of innovation inputs and the protection of innovation outputs [51]. Accordingly, it proposes that:

Hypothesis 3a (H3a). *A well-developed regional institutional environment will positively moderate the relationship between the technology orientation and firm growth.*

Regulatory compliance is a key driving force for firms’ environmental performance. However, little is known about the impact of the institutional environment on the relationship between sustainability orientation and firm growth, particularly under the context of a developing country [52]. Thus, there is a great opportunity for institutional level studies to research how political factors shape the outcomes of sustainability-related adaptations. The prominent anchor in this discussion is legitimacy theory, which grants firms a “license to operate”. In regions with a well-developed institutional

environment, there are established clear rules and legal routines to guide social entities [53]. Then, firms with a high sustainability orientation could get higher political legitimacy, that is “the extent to which the government views the firm’s actions as being in accordance with norms and laws” [54] (pp. 127). The well-developed institutional system decreases the evaluation uncertainty during the legitimacy judgment process of firms’ sustainability-related adaptations, and business stakeholders also find it much easier to decide whether a firm indicates its concern for the business community. Additionally, political legitimacy means that firms with a high sustainability orientation gained from a well-developed institutional environment could earn government resources, helping them avoid significant government interference. Based on the above analysis, it proposes that:

Hypothesis 3b (H3b). *A well-developed regional institutional environment will positively moderate the relationship between the sustainability orientation and firm growth.*

Growth rate is a variable in defining stages of product life cycles. Based on the growth rate, Porter identifies that firms compete in emerging, maturing, and declining industries. In earlier high growth stages, the rate of technological change in product design is higher. According to the research of Abernathy and Utterback [55], firms would be expected to invest more heavily in product development in this stage, and then the investment would shift to process design when the industry growth rate slowing down. Therefore, in the fast-growing industry, firms with high technology orientation will be able to develop and adapt to new technologies in the market competition, allowing them to pursue the industrial leadership. These lead to the following hypothesis:

Hypothesis 4a (H4a). *Fast-growing industry will positively moderate the relationship between the technology orientation and firm growth.*

In the fast-growing industry, firms are also located in the situation of intensive market competition. With many competitors entering simultaneously into the fast-growing industry, the munificence of such an industry, defined as the abundance and availability of external resources supporting organizational growth, decreases, which leads the incumbent firms to lose confidence in developing a long-term strategy and invest in environmental routines. Since the “sustainability” might add other costs into product development in the short run [56], the high sustainability orientation may lower profits margins if these part of the costs cannot be covered by the customers. Therefore, firms have to make trade-offs between economic and ecological or social objectives, especially in the short term. Based on the above analysis, we propose the hypothesis that:

Hypothesis 4b (H4b). *Fast-growing industry will negatively moderate the relationship between the sustainability orientation and firm growth.*

3. Methodology

3.1. Empirical Setting

As the world’s largest emitter of greenhouse gas (GHG) and energy consumer, China is responsible for about 20% of global GHG emissions [57]. Under great pressure from international community, the issue of climate change which was largely ignored by the Chinese government has become a high national priority [58]. Climate change has received unprecedented attention in the 12th five-year plan. Specifically, it contains the compulsory target for carbon emissions per unit of GDP to be reduced by 17% in 2015 compared to 2010, and it also has a dedicated chapter discussing this issue. According to the plan, during the 12th five-year period, China would comprehensively utilize various measures to reduce the energy consumption intensity and carbon dioxide emission intensity to a large extent, such

as adjusting industrial energy structures, energy conservation and energy efficiency, and increasing forest carbon sinks [59].

The cognitive structure is the lens through which decision makers interpret information and translate related information into organizational actions, and it is a relatively stable construct. Manufacturing is the backbone of the economic development in China and green manufacturing is enforced in the national plan “Made in China 2025”, which aims to transform China from a manufacturing giant into a world manufacturing power. Therefore, in this study we will analyze the managerial cognitive structure of Chinese manufacturing firms in the starting year of the 12th five-year plan, that is the year 2011, here.

3.2. Data

Surveys are usually adopted in the research of strategic orientations, but it is difficult to perform dynamic analysis since conducting surveys on the same population at different points of time always results in low response rates [60]. To measure the cognitive orientation more directly, we used the textual analysis of letters to shareholders, which is the most widely adopted approach. Specifically, under the Chinese context, we analyzed the Management Discussion and Analysis (MD&A) in the annual reports for each firm, which reflects the perceptions of the top management team. Given the time point of the year 2011 for analyzing managerial cognition after the publishing of the 12th five-year plan, only manufacturing firms publicly listed in 2010 and before were considered. Then, considering the firm growth issue, sustainable growth is an especially important issue for industrial leaders, thus we chose our samples from firms occupying the champion position in their industries. We referred to the list of champions firms issued by the Ministry of Industry and Information Technology, China in November 2016 and other industrial research reports to identify industry leaders. The detailed selection standards are shown in Table 2. After sorting for missing data, we finally got 103 sample firms.

Table 2. Selection standards of sample firms.

Selection Standards	
Market position	Operating in industries with 4-digit SCI code;
Leadership	No.1 in China or Top 3 in the world market;
Sales	Less than 10 billion RMB in 2016;
Industry	Manufacturing in SCI code (C13–C43);
Listed company	IPO before 2010;

3.3. Measures

3.3.1. Dependent Variable

The dependent variable employed in this paper was firm growth. Sales is the most commonly used growth indicator in prior studies [61], and we measured the logarithm transformations of sales change as the indicator of firm growth. Then, considering the endogeneity issue between managerial cognition and firm performance, which means that past performance may feed back into current cognitive frames and then stimulate the change of managerial cognition, the orientation-related variables were lagged over 3 years by following the study of Narayanan and Nadkarni [62]. For example, we analyzed the relation between strategic orientations in 2011 and the sales change in 2014.

3.3.2. Independent Variables

Before using the computer-aided coding method, we should construct the coding scheme first. Refer to the coding scheme of Nadkarni and Narayanan [62], we adapted their typology of strategic actions to which managerial cognition is paid, into six different types: Service-related strategic actions, new product-related actions, marketing strategic actions, low cost/pricing actions, capacity-related strategic action, and sustainability-related strategic action. We computed the proportion of concepts

from each of the six different strategic directions that appeared in the MD&A to measure the importance of specific strategic orientation for a sample firm.

The orientation of technology-related actions included the following concepts: New product introduction, product development, R&D expenditures, adaptation to new technologies, fast introduction of products, and product technology focus. The value of product orientation was computed as the proportion of R_T/R_{TL} , where R_T is the word frequency of the above technology-related concepts that appeared in one MD&A, and R_{TL} is the total word frequency of concepts from all the six strategic directions. Similarly, the orientation of sustainability-related actions included the following concepts: Green development, emission and consumption reduction, recycling manufacturing, social responsibility, and climate change adaptation. The value of the sustainability orientation was computed as the proportion of R_s/R_{TL} , where R_s is the word frequency of the above sustainability-related concepts appeared that in the MD&A of a sample firm, and R_{TL} is the total word frequency of concepts from all the six strategic directions. The higher the value meant that the sample firm paid more cognitive attention to product-related or sustainability-related fields.

3.3.3. Moderator Variables

Following Kim and Lee [63], industry growth is measured by the rate of industry sales growth at the four-digit level of Industrial Classification for National Economic Activities in China. We adopted the measurement of development of intermediate institutions and the legal environment in the marketization index developed by the National Economic Research Institute (NERI) of China [64] to measure the development of regional institutional environments in China. The higher the value meant the institutional environment of a specific province is well developed [65].

3.3.4. Control Variables

First, we included firm age and firm size as controls. Firm size was indicated by the logarithm of the number of employees, and firm age was measured by the number of years since its establishment. Then, given that prior studies show that the differentiation of concepts in a cognitive structure and the interconnectedness between concepts also influence the competitive success of firms [66], we also included the comprehensiveness and connectedness of cognitive structures as control variables. Comprehensiveness was measured by the number of concepts (N_c) that appear in the cognitive structure, while the connectedness is measured by the ratio of the total number of connections in the cognitive structure to the total number of concepts (N_L/N_c).

4. Results

4.1. Descriptive Statistics

Table 3 reports means, standard deviations, and correlations for all the variables included in our model. The correlation matrix suggests that the probability of multicollinearity is low, and we further verify this issue through analyzing variance inflation factors. The variance inflation factors were in the range of 1.03–1.46, with a mean of 1.21, well below the accepted threshold of 10, suggesting that there is no serious multicollinearity problem among the variables.

Table 3. Descriptive statistics and correlation matrix.

	Mean	SD	1	2	3	4	5	6	7	8	9
1. Firm Growth	19.113	1.244	1								
2. Size	7.570	0.802	0.417 ***	1							
3. Age	9.636	4.084	0.019	0.166 *	1						
4. Institution	7.502	3.860	0.066	−0.116	−0.013	1					
5. Industry Growth	0.113	0.197	0.058	0.182 **	0.093	−0.066	1				
6. Comprehensiveness	0.822	0.099	−0.174 *	−0.01	−0.037	0.047	−0.229 ***	1			
7. Connectedness	0.427	0.160	−0.037	−0.178 **	−0.036	0.026	−0.234 ***	0.461 ***	1		
8. Sustainability Orientation	0.089	0.106	0.170 *	0.128	0.192 **	0.190 **	−0.01	0.119	−0.029	1	
9. Technology Orientation	0.302	0.127	−0.038	−0.183 **	−0.129	−0.094	−0.107	0.177 **	0.190 **	−0.308 ***	1

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4.2. Results on Strategic Orientations and Firm Growth

As firm growth is a continuous variable, this study used a series of ordinary least squares (OLS) regression to test our research hypotheses. Table 4 presents the regression results between the strategic orientations and firm growth. Model 1 includes control variables only. Model 2 includes the effect of sustainability orientation and technology orientation. Then, Model 3 and Model 4 introduce the moderated effects of institutional development and industry growth, respectively.

Table 4. Regression results on the effect of strategic orientations on firm growth.

	Model 1	Model 2	Model 3	Model 4
Size	0.723 *** (0.146)	0.738 *** (0.147)	0.742 *** (0.145)	0.712 *** (0.148)
Age	−0.00919 (0.0311)	−0.0144 (0.0315)	−0.0145 (0.0311)	−0.00776 (0.0318)
Institution	0.0276 (0.0304)	0.0227 (0.0301)	0.0145 (0.0300)	0.0189 (0.0299)
Industry Growth (IG)	−0.308 (0.634)	−0.199 (0.624)	−0.251 (0.613)	−0.650 (0.661)
Comprehensiveness	−3.218 ** (1.252)	−4.143 *** (1.285)	−3.822 *** (1.278)	−4.003 *** (1.276)
Connectedness	1.351 * (0.780)	1.490 * (0.771)	1.440 * (0.757)	1.479 * (0.772)
Technology Orientation (TO)		1.670 * (0.983)	1.685 * (0.982)	1.695 * (0.974)
Sustainability Orientation (SO)		2.452 ** (1.142)	2.723 ** (1.133)	2.860 ** (1.155)
Institution × SO			−0.113 (0.271)	
Institution × TO			−0.638 ** (0.268)	
IG × SO				−21.37 * (11.64)
IG × TO				−7.048 (5.812)
Constant	15.60 *** (1.427)	16.24 *** (1.458)	16.03 *** (1.432)	16.33 *** (1.449)
N	103	103	103	103
R ²	0.2341	0.2796	0.3228	0.3079
ΔR ²	/	0.0455	0.0432	0.0283
F-Value	4.89 ***	4.56 ***	4.38 ***	4.09 ***

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

From the result of Model 1, shown in Table 4, we found that firm growth was positively associated with firm size. This indicates that larger firms own richer resources to support their sustainable development [67]. In addition, we found that the two dimensions of cognitive structure were significantly associated with firm growth. Firm growth was positively associated with connectedness, indicating that higher connectedness between different concepts in the cognitive structure can promote strategic flexibility [63] for organizational adaptation. However, it is surprising that comprehensiveness was negatively associated with firm growth. We also controlled the influence of institutional and industrial environments by adding the two moderators in Model 1.

Hypothesis 1 predicted that firms with high technology orientation would be more likely to achieve high firm growth. As shown by Model 2 in Table 3, technology orientation was positively and significantly associated with firm growth ($\beta = 1.670$, $p < 0.1$). Then, Hypothesis 2 predicted that firms with high sustainability orientation would also be more likely to achieve high firm growth. We found

from Model 2 that sustainability orientation was positively and significantly associated with firm growth ($\beta = 2.452, p < 0.05$). Therefore, the results strongly support Hypothesis 1 and Hypothesis 2.

4.3. Results on the Moderation of External Environment

We centered all main effect variables (technology orientation and sustainability orientation) and the moderators (institutional development and industry growth) prior to constructing the interaction terms to avoid collinearity problem. Hypothesis 3 proposed that the institutional environment development would moderate the relation between strategic orientations and firm growth. In Table 3, we added the interaction terms to our model. From the results of Model 3, we saw that the institutional development negatively moderated the association between technology orientation and firm growth ($\beta = -0.638, p < 0.05$). We present this relationship in Figure 1 to facilitate interpretation, which clearly shows the negative moderating role of the development of regional institutional environment. Specifically, for regions with better developed institutional environments, those are the Eastern coastal regions of China in our study, the role of the technology orientation for firm growth was weakened. However, its moderation role is not significant for sustainability orientation. Therefore, Hypothesis 3b is supported by the results.

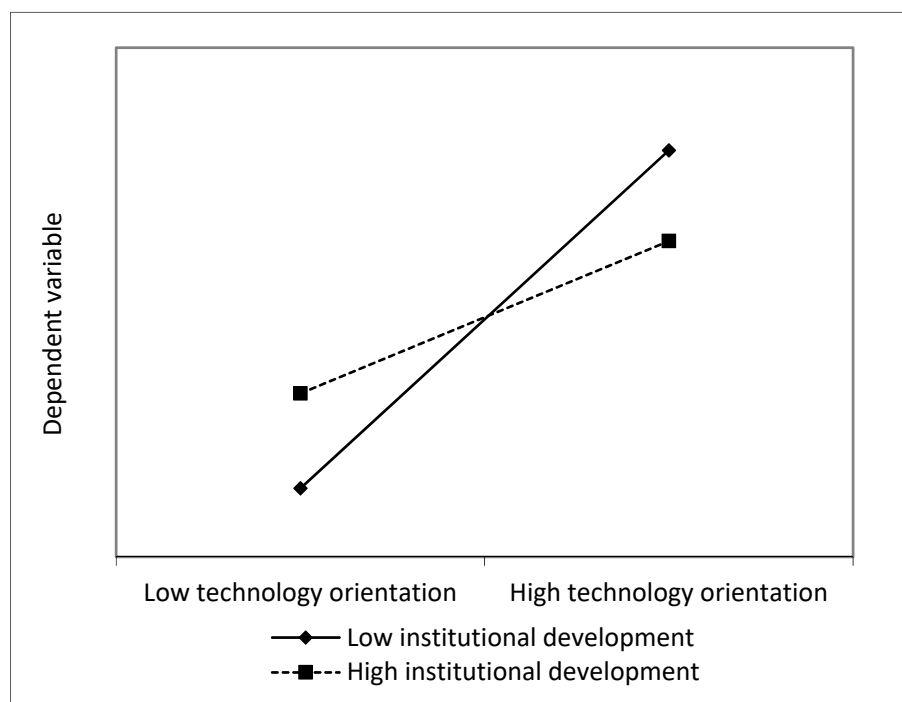


Figure 1. Technology orientation and firm growth—the moderating role of institutional development.

Next, for testing the moderating role of industry growth proposed in Hypothesis 4, we added the interaction terms to Model 4. Based on the results shown in Table 3, we found that the industry growth negatively moderated the association between sustainability orientation and firm growth ($\beta = -21.37, p < 0.1$). Thus, Hypothesis 4b was supported. As shown in Figure 2, the relationship between sustainability orientation and firm growth was weaker for firms operating in fast-growing industries. However, the results did not support the argument that the relation between technology orientation and firm growth would be strengthened in fast-growing industry.

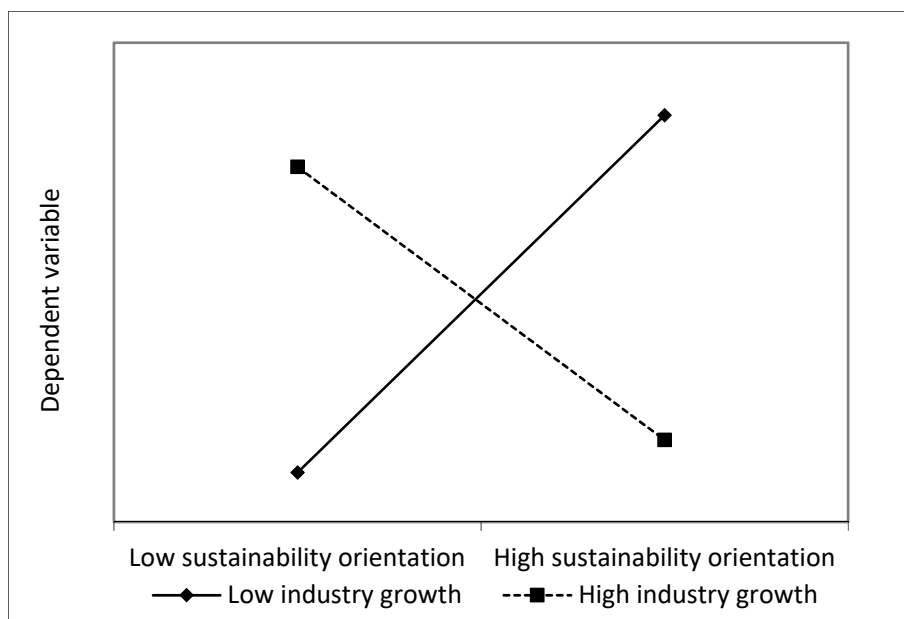


Figure 2. Sustainability orientation and firm growth—the moderating role of industry growth.

5. Discussion and Conclusions

In this study, we investigated the relationship between strategic orientation and firm growth. Specifically, we examined whether the dimensions of strategic orientation, technology orientation, and sustainability orientation are related to firm growth, and how institutional development and industry growth moderate those relationships. As the world's largest emitter of greenhouse gas (GHG) and energy consumer, the environmental protection and sustainability-related issues have received unprecedented attention in China's 12th five-year plan, which published by the State Council showing a more general guideline for both economic and social policy. Thus, using the data for Chinese manufacturing firms in the year 2011 when the 12th five-year plan published, we found that both sustainability orientation and technology orientation were positively related to firm growth, which has got less attention in the existing literature. Moreover, the positive association between technology orientation and firm growth would be weakened when located in a well-developed institutional environment. We also found that in fast-growing industries, firms with high sustainability orientation had lower levels of firm growth to some extent.

Our study makes both theoretical and empirical contributions to different streams of the management literature. First, it deepens the understanding of the importance of corporate sustainability in managerial cognition for firm development. Studies from a cognitive view analyzing the effects of different content and structure of managerial cognition on sustainability are still lacking [12]. By examining the role of sustainability orientation for firm growth, our study suggests that sustainability-oriented firms will achieve better financial performance, especially when their industry enters into the mature stage, which generates a better understanding of the underlying cognitive determinants around sustainability issues. Additionally, as the effects of manager's cognitive frames will be moderated by a range of contextual factors in the decision-making process, this study further analyzes the cross-sectional and cross-regional nature on the performance outcomes of different strategic orientations.

Second, though the prior discussion on the relationships between sustainability and technology orientations and corporate financial performance has been inconsistent [3], our research further supports the positive view that both sustainability and technology orientations could promote firm growth. Considering the resource limitation, our findings suggest the importance of sustainability-oriented innovation, by encouraging employees to develop new products or services that create value for both the company and society.

Finally, a major challenge for the research of managerial cognition is the measurement, and our work complements prior research in the measurements of strategic orientations through computer-aided analysis. The majority of prior research on strategic orientation were conducted by surveys [13,20]. However, it is difficult to capture cognition in the past through surveys, and researchers face the situation of a low response rate when conducting surveys on the same population at different points of time [68]. With computer-aided textual analysis, we used the words frequently used by CEOs in their letters to stakeholders in annual reports to indicate which domains get more attention, as a complement measurement for the existing strategic orientation studies. Then for the causality between strategic orientations and firm performance, researchers have repeatedly called for taking a time separation between independent and dependent variables into consideration [69]. Our study answers the calls by incorporating a three-year time lag into the examination of the roles that sustainability orientation and technology orientation play in firm growth. Practically, the outcomes of sustainability and technology orientations also require time to materialize [40].

This study also has several limitations that indicate opportunities for future research. First, as the measurements of strategic orientation here use the annual report of listed firms as the raw materials, our findings may not be generalizable to non-listed firms. That is because public firms, as required by the stakeholders and the social visibility, may be more rigorous in responding to the sustainability issue. Future research could rectify the relations by extending our analysis to other types of firms. Second, this study only focuses on the direct relationship between sustainability and technology orientations and firm growth, but the processes of how they influence the strategic formulation may be further examined through longitudinal methods. Finally, this study only emphasizes the importance of technology orientation and sustainability orientation, and links them to firm growth, but it does not systematically investigate other strategic orientations (e.g., entrepreneurial, learning, and market orientations). Therefore, this is also a topic for future research to systematically examine the effect from strategic orientation, or combined orientations, for firm growth.

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