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Examining green supply chain management and financial performance: roles of social control and environmental dynamism

***Abstract*—The literature examining the relationship between green supply chain management and firm performance has expanded greatly in recent years. Although researchers maintain that green supply chain management can bring positive financial performance, to date they have ignored the moderating role of the social control mechanism, especially in the context of China. Drawing on social exchange theory, this study aims to contribute to the literature in this field by proposing social control as an effective mechanism to strengthen the impact of green supply chain management on firms' financial performance. Today, most empirical literature in the field of green supply chain management adopts the static view and overlooks the contextual factors. This study addresses the gap by investigating the green supply chain management in an environment characterized by frequently unavoidable disruptions, and the effectiveness of social control that accommodates this complexity and dynamism. By examining green supply chain management under conditions of environmental dynamism, this study contributes to the literature of interface of green supply chain and resilience. Using a sample of 185 Chinese manufacturers, the theoretical model is empirically verified. The research findings indicate that in a dynamic environment, the joint effect of social control and green supply chain management practices is positive and significant. This paper also discusses the theoretical contribution and managerial implications of the study, outlines the research limitations, and provides recommendations for future research.**

***Managerial relevance statement*- Based on the empirical results, this research suggests the managers should notice the integrative use of green supply chain management practices and social control mechanism could be an available option in the context of China. Moreover, this study offers the manager a more in-depth statement to explain the relationship between green supply chain management and firm performance by investigating the contingency role of environmental dynamism. This research suggests that when a company's external environment is dynamic, it is necessary for the practitioners to apply social control with both green supply chain practices, i.e. green purchasing, and GCC, to promote their financial performance. However, practitioners should realize that the combination of green supply chain and social control might not be efficient in a stable environment. In this case, if managers cannot correctly assess the external environment factors, they might not get the expected return from investing in such a combination. In particular, our measures of the environmental dynamism could assist managers to evaluate their external environment factors for ensuring the efficiency of implementing the combination of green supply chain management and social control.**

***Index Terms* – Green supply chain management (GSCM), social control, environmental management, contingency theory, environmental dynamism**

I. INTRODUCTION

THE issues of climate change, environmental pollution and resource depletion all contribute to increasing global concern over our environment. In December 2015, the Paris Agreement concluded under the United Nations Framework Convention on Climate Change intensified the focus on reducing carbon emissions and now impacts on all manufacturers [1]. Consequently, firms are keen to develop a range of corporate strategies that can effectively reduce environmental impacts and contribute to improving the environmental quality. Moreover, due to increased customer demand for environmentally friendly products, and tighter regulation regarding environmental protection, it has become the norm for manufacturers to adopt related environmental management practices.

Integrating these environmental concerns with the supply chain management, practitioners and academics have paid considerable attention to green supply chain management (GSCM) [2]. Many scholars have examined the association between GSCM and supply chain performance/firm performance, but the results remain inconclusive [3]. Focusing only on the direct effect of GSCM may not provide a complete picture of how GSCM facilitates the financial performance. Chan et al. [4] argue that to understand the effect of environmental management on firm performance, it is necessary to consider a combination of many factors.

To fill the gap, this study integrates the insights from social exchange theory (SET) with the GSCM-performance relationship and examine the extent to which the social control mechanism, viewed as the mechanism by which supply chain partners utilize trust to encourage desirable behaviours [5], impacts on the GSCM-performance relationship. According to the SET, the conduct of a company is not explained solely by economic factors, but also takes account of social factors [6-8]. Given that the social control mechanism is a significant way to manage the supply chain relationship and cooperation in the emerging market [5], it is surprising that very few researchers provide empirical support for its effect on the implementation of GSCM. Hence, whether the social control mechanism and GSCM can jointly affect the financial performance is our first research question.

According to Sousa and Voss [9], when there is empirical support for the value of best management practices, the next step for the researcher is to understand under what contextual factors (such as environmental dynamism) the management practices are more efficient, or even detrimental. For example, when the company is facing a highly uncertain environment, some suggested “best practice” could negatively impact on the performance. According to contingency theory (CT), no theory or management practice can work in all instances [10]. Rather, the basic assertion of CT is that organizations will adapt their structure to “fit” or “match” with their contextual factors, such as the environment they operate within, to facilitate performance [11]. Further, when investigating the implementation of GSCM in an emerging market such as China, it is not reasonable to assume that a company’s external environment is always stable [4]. However, only a small number of GSCM studies have considered the contingency role of environmental dynamism, which could be a possible contextual factor [4]. Environmental dynamism refers to changes in technologies, variations in customer preferences, fluctuations in product demand and shifts in government policy [12]. In this study, the second research question is whether the combination of GSCM and social control is still efficient under a dynamic environment. Through the lens of CT, the three-way interaction effect of GSCM, social control and environmental dynamism on firms’ financial performance is examined.

To answer the two research questions, a theoretically derived model is proposed to explain the relationships among the GSCM practices, social control, environmental dynamism and financial performance. Given the increasing concerns about environmental issues in developing countries, there is a strong need for more empirical GSCM research in emerging markets, such as China [2]. Thus this study tests the model using the cross-sectional data from 185 Chinese manufacturers with a set of reliable measurement scales. Based on the empirical results, this study provides three theoretical contributions. First, the environmental management research is advanced by re-examining the common assertion that the implementation of GSCM could improve the focal firm’s financial performance. Although this assertion is widely accepted in the literature, empirical results are still inconclusive. Second, extending the research that explores the moderators between GSCM and performance [4, 13-16], this study contributes to the literature by adding social control as a moderator of that relationship. Third, using a three-way interaction analysis, this study is the first to integrate CT to discover under what circumstances social control could be helpful or harmful to the relationship between GSCM and financial performance.

The rest of the paper comprises six sections. Section II proposes the research model and develops hypotheses. Section III describes the data collection method and provides the details of the measurement scales for each concept. The data analysis and results are presented in Section IV, and discussed further in Section V, which also provides the managerial and theoretical implications of the study. The limitations to the study and recommendations for future research are discussed in Section VI.

II. LITERATURE AND THEORTICAL DEVELOPMENT

Drawing GSCM literature, social exchange theory and environmental dynamism, a theoretical model is developed (Figure 1). Initially, this study hypothesizes that GSCM, which includes green purchasing (GP) and green customer cooperation (GCC), has a positive impact on the focal firm’s financial performance (H1 and H2). Then H3 and H4 are proposed to explain the positive moderating effect of social control on the relationship between GSCM and financial performance, i.e. two-way interaction. The last two hypotheses (H5 and H6) propose the contingency effects of environmental dynamism on the interaction

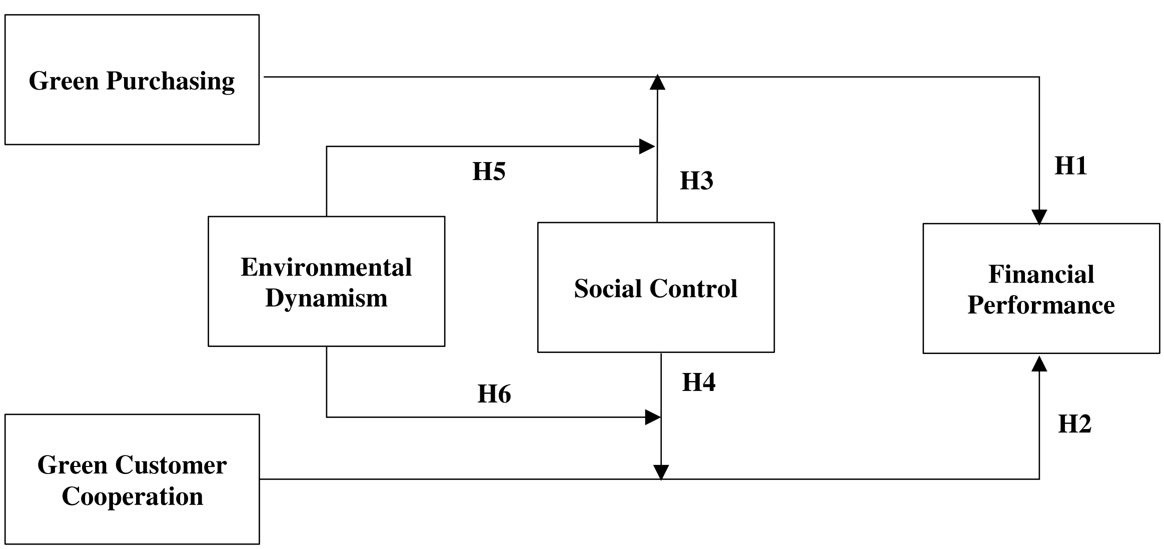

Fig. 1. Hypothesized Model

between social control and GSCM, i.e. three-way interaction.

A. Green supply chain management and financial performance

Promoting financial performance is an important reason why a company would seek to implement GSCM practices [17]. In the South East Asian context, companies with green supply chain practice have increased competitiveness and economic performance [18]. According to Rao [19], some "leading-edge corporations" among South East Asian companies (such as Nestle Philippines, PT Aryabhatta in Indonesia, Philip DAP in Singapore, Nestle Jakarta and Seagate Thailand) have adopted GSCM practices (such as greening of suppliers' programs) and received positive results. Zhu et al. [17] have also verified the relationship between GSCM and firm performance for Chinese organizations, and their empirical study provides significant results. Following existing literature, GSCM is defined as the external supply chain practices, namely upstream monitoring (i.e. GP or environmental procurement) and downstream cooperation (i.e. GCC) [20].

GP refers to the management practices whereby the focal firm assesses suppliers' environmental performance, while monitoring the suppliers to check that they take the required actions to ensure environmental quality [21]. As purchasing is the starting point of the value chain, a firm cannot succeed in its environmental efforts until managers integrate the environmental goal with the purchasing activities [21]. Rao and Holt [18] consider that GP can help the company to reduce waste produced by the supplier and to minimize waste of hazardous materials. In so doing, GP can promote the firm's financial performance. For example, the company can ask suppliers to commit to the waste reduction goal, for example by minimizing packaging and using recyclable or reusable packaging, pallets and containers. Furthermore, in China, violating the government's environmental regulations could lead to the enterprise being shut down. Hence, by implementing GP that results in preventing suppliers violating environmental regulations, such as by discharging pollutants in excess of emission standards, the focal company can reduce its financial costs or liability.

Following Green et al. [22] and Zhu et al. [23], GCC is defined as *"working with customers to design cleaner production processes that produce environmentally sustainable products with green packaging."* Drawing upon the natural resource-based view (NRBV) theory, the company is encouraged to incorporate the environmental consideration into their strategic planning, in order to survive in the marketplace where there is growing governmental and societal concern over environmental pollution [24]. The viewpoint of NRBV is in line with the assertion of Hansmann et al. [25] that success in addressing the environmental issue may provide more opportunity for business competition. A firm with better GCC can acquire a high ecological reputation from customers. Since China joined the World Trade Organization, more Chinese manufacturers have sought to become suppliers to developed country enterprises, which select their suppliers according to high environmental standards [13]. Therefore, maintaining a good ecological reputation may help Chinese manufacturers to win more international opportunities. Based on a panel of Finnish firms, Laari, et al. [26] found that an environmental collaborative approach with customers is key to improving financial performance.

Although numerous researches have indicated the positive effect of GSCM on FP, the debate as to whether this effect is valid is still ongoing. Some neoclassical economics researchers hold an opposite view, whereby the adoption of environmental management practices may consume more resources and incur additional cost, and thus result in negative FP [27]. Moreover, the empirical research results on the relationships between two GSCM practices (i.e. GP and GCC) and FP are inconclusive. For example, Green, et al. [22] found that the effect of GCC on economic performance is insignificant, and Laari, et al. [26] indicate that the association between GP and financial performance is not significant. Furthermore, although several studies have investigated GSCM in the context of China [14], it should be noted that over the past few years China has experienced dramatic changes in terms of government policy and business environment; hence it is necessary to use a more up-to-date sample to re-examine the concepts. Therefore, to contribute to filling the gaps in the literature, we propose the following two hypotheses:

Hypothesis 1: *Green Purchasing positively impacts on financial performance.*

Hypothesis 2: *Green Customer Cooperation positively impacts on financial performance.*

B. The moderating effect of the social control mechanism

This research follows Li et al. [5] to define social control as *"the mechanism by which supply chain partners utilize trust to encourage desirable behaviors*." In particular, social control takes forms such as *"joint problem solving, mutual decision making, information sharing and fulfilment of promises"* [5]. Instead of using formal rules or agreements to govern business partners, social control focuses on creating informal pressure to strengthen or preserve the cooperation [5]. In China, social factors such as *"repeated exchanges, future obligations and the belief that each party will fulfil its liabilities"* are critical in business cooperation [6]. According to Li, et al. [5], Chinese managers tend to adopt social control in interfirm cooperation. Using a survey of managing Chinese supplier relationships, Giannakis et al. [28] stress the importance of the social control of governance structure. Moreover, Li et al. [5] find that social control is a substantial factor that contributes to the cooperation performance in China's buyer-supplier relationship.

The concept of social control is highly relevant to the context of SET. Social exchange, which is the focus of SET, can be defined as *"voluntary actions of exchange parties that are motivated by the returns they are expected to obtain"* [7, 29]. According to Larson [30], SET suggests that the collaborative initiatives in the inter-organizational relationship are not solely governed by the formal mechanism. SET can shed light on the social components governing exchange relationships, which include the "give-and-take" between entities, reciprocity and cooperation [31]. Furthermore, from the perspective of SET, the exchange parties follow the rules of reciprocity voluntarily, because they wish to avoid punishment in social relationships [7]. According to Tachizawa and Wong [32], the GSCM practices can represent different social exchanges in a supply chain relationship due to the interaction between focal company and supplier or between focal company and customer. Therefore, SET should give important insights into the role of social control in the relationship between GSCM and FP, because the use of social control, focusing on interfirm trust, joint problem solving and shared norms, can provide the foundation for the successful implementation of GSCM practices so as to foster FP.

The argument that social control plays a positive moderating role is supported by SET. From the perspective of SET, commercial companies interact with each other for a reward or with the expectation of a reward for their cooperation with others [8]. The business transactions along the supply chain governed by a strong social control can be said to provide more stability and predictability for the interfirm cooperation, due to the reliance on shared norms and trust [31]. Suppliers in the environmental cooperation activities can thus expect that the focal company will reciprocate different benefits in the future. This expectation is based on two SET assumptions, namely that actors behave rationally and that gratification is dependent on others [31]. SET suggests that with the expectation of a reward, exchange parties will regularly discharge their obligations and make efforts to strengthen their reputation to show the business parties their commitment to the relationship [29]. This may be especially applicable to cost reduction in the activities of GP with the use of social control. Due to the strong social ties and predictable reciprocity, suppliers should offer better service or more cost-effective solutions for the green cooperation with their focal company, and thus contribute to better FP of the focal company. For example, information transparency is always a challenge for the focal company when conducting the environmental audit for the second-tier supplier [33]. With greater social control, the company should find it easier to get the expected information, because the first-tier supplier may be more willing to share the environmental information from their suppliers (i.e. second-tier). This is because, when social control is high, they wish to maintain and strengthen the relationship with the focal company. In addition, Sarkis [34] highlights that one of the difficulties in GP as an interfirm cooperation practice is that there are conflicting goals between the buyer and supplier. According to Li et al. [35], social control emphasizes the mutual benefits and common norms. In such a case, social control might help to overcome the barrier of goal conflict to interact with GP and contribute to better financial performance. Thus, the following hypothesis is proposed:

Hypothesis 3: *The positive effect of green purchasing on financial performance is positively moderated by social control.*

Few researches have explicitly examined the moderating effect of social control on the positive effect of GCC on financial performance. However, there is recent empirical evidence that if the company needs to improve financial performance through green innovation, enhancing reciprocity and cooperation with the customer is necessary, which is also well supported by SET [15]. The assumption that the effectiveness of GCC increases when social control is high is reasonable. The activities of GSCM require multiple social resources and are costly [36]. According to Zhu et al. [14], Chinese companies recognize the critical nature of their environmental mission, due to the incentive of attracting more business opportunities from the downstream supply chain. If the focal companies are unable to ensure that they will receive the benefits from the greening activities with their customers, it will be difficult to bring about significant improvements in financial performance. A basic SET assumption is that building social "*credit*" is preferred to social "*indebtedness*" [37]. In the Chinese context, the focal firm's efforts towards green cooperation with customers can be seen as a form of favor offered to the client. As argued by Kaufmann and Carter [38], the social control mechanism can help to form the informal pressure in the buyer-supplier relationship to sustain the supply chain cooperation. Drawing upon the SET, we argue that with greater SC, the benefits the customer company receives from the GCC activities, which can be seen as a favor [39], should place more informal pressure on the customer to offer more business opportunities or other financial benefits. Therefore, this study proposes the following moderation hypothesis:

Hypothesis 4: *The positive effect of green customer cooperation on financial performance is positively moderated by social control.*

C. The contingency effect of environmental dynamism

The highly dynamic environment is characterized by great speed and change [40] and by less clarity of information [41]. Jansen et al. [42] define environmental dynamism as "*change in technologies, variations in customer preferences, and fluctuations in product demand or supply of materials.*" Here, this study sets the scope of the concept by specifying that the uncertainties arise from the external environment of the focal company. Within the supply chain context, a number of arguments have been put forward to stress that environmental uncertainty is an unavoidable contextual factor, because the flow of materials and information exchange involves complex communication and multiple lines of tasks across chain members [11, 43]. This highly uncertain environment provides challenging tasks for the company to tackle, and as Khandwalla [44] points out, the higher the market dynamism, the lower the ability of managers to predict the future of their companies. However, there might be an interesting twist to environmental dynamism. In the context of China, Li and Liu [45] find empirical evidence that companies are provided with greater dynamic capability to sustain their competitive advantages when environmental dynamism is high. Likewise, based on an empirical research in China, Jiao et al. [46] suggest that environmental dynamism enables companies to achieve better opportunity-sensing capability and hence better business performance. This study posits that the moderating effect of the social control mechanism on the GSCM-performance relationship will be strengthened in a dynamic environment, i.e. high environmental dynamism.

To explain the three-way intereaction effect (i.e. moderated moderation), this study applies the CT. According to the CT, a contingency paradigm includes three kinds of variables, namely *contextual variables*, *response variables* and *performance variables* [9]. Environmental dynamism can be viewed as a *contextual variable* [4], which is hard for companies to control or manipulate. Drawing from our proposed model, this study views the *interactive effect* of GSCM and social control as a form of *response factor* in the contingency paradigm. In line with the CT, environmental dynamism is not treated as an activator or a motivator. Theoretically, this research focuses on the impact of environmental dynamism on the strength of the relationship between the GSCM-social control interactive effect and FP (i.e. dependent variable) [11].

From the perspective of CT, when companies are facing uncertainty in the external environment, they usually respond through a series of externally oriented strategies [11, 47]. In line with the CT, this study argues that the interactive effect of social control and GP should "fit" with a highly dynamic environment. According to Stonebraker and Liao [48] and Koufteros, et al. [49], a highly dynamic market requires companies to acquire and process additional and rich information. Thus, the information asymmetry that arises in the activities of GP might be more significant. Sitkin et al. [50] argue that under a highly dynamic market, a company needs to facilitate flexible response and quick decision-making. As a motivator of the effect of GP on FP, the social control mechanism, which can further enhance the flexibility in the supply chain, should be more efficient in an unstable market. In contrast, a stable environment can provide manufacturers with more predictability, and enables manufacturers more easily to anticipate, prepare for and respond to change [51]. As suggested by Anand and Ward [52], organizations in a stable environment should develop routines to handle the possible scenarios. Therefore, when a company faces a relatively stable environment, social control may not be necessary, as a manufacturer can rely on existing policies and regulations to perform environmental compliance audit toward its suppliers.

Hypothesis 5: *The interaction effect of social control and green purchasing is more highly and positively associated with financial performance in a more dynamic environment.*

CT theorists argue that to foster organizational performance, selecting an appropriate organizational structure to "fit" the external environment is critical [53, 54]. According to Thompson [55], the effects of firms' actions are partially determined by the *"actions of elements of the environment"*. Therefore, from the perspective of CT, Germain, et al. [53] suggest that, *"a firm must determine when and how to act, and its cues must be taken primarily from the environment"* (p. 561). In a dynamic environment, the market is unstable due to rapid changes in product demand, customer preference and technology innovation [4]. In such an environment, there is a greater likelihood that opportunism will arise in the buyer-supplier relationship [56, 57]. For example, government policies providing incentives for companies to engage in environmental activities could change in a dynamic environment. This situation may encourage opportunism on the part of the customer company, manifested in behavior such as occupying all the benefits or reward from the government without sharing these benefits with the focal company. However, with greater social control, the customer company might be more willing to share the reward or even share the risk with the focal company, given that goal concurrence and mutual benefit are critical elements of social control [5]. Unlike a dynamic environment, a stable environment can hinder the opportunism that arises in business relationships [58]. Accordingly, if opportunism is not a major threat between partners, the use of social control will hardly be economical. Hence, the moderating effect of social control should be less positive in a stable environment. Also, Chan, et al. [16] argue that a highly competitive market should strengthen the adoption of GCC, as the focal company needs to make more effort to satisfy the customer's increasing environmental demands. Extending this finding, this research assumes that the use of social control, which emphasizes information exchange and joint problem solving [5], enables the company to understand and respond to their customers more efficiently under a highly dynamic market. Hence, complementing Hypothesis 4 with the contextual variable, the following hypothesis of three-way interactions is proposed:

Hypothesis 6: *The interaction effect of social control and green customer cooperation is more highly and positively associated with financial performance in a more dynamic environment.*

III. METHOD

A. *Data Collection*

TABLE I
DEMOGRAPHIC INFORMATION

	Number of firms	Percentages (%)
Industry Sector		
Electronic and other electrical equipment and components, except for computer equipment	110	59.5
Pharmaceutical industry	4	2.2
Automotive industry	39	21.1
Other	32	17.3
Firm Size		
100-299	57	30.8
300-2000	112	60.6
>2000	16	8.6
Region		
Pearl River Delta	87	47
Yangtze River Delta	68	36.8
Circum-Bohai-Sea Region	30	16.2

To ensure the data quality, this study employed a Chinese research survey sampling company (SJ company) to manage the data collection. SJ is a professional research company that helps business studies academics across a range of disciplines, such as marketing [59], business ethics [60] and innovation management [61], to collect data in China. This research first specified our requirements regarding respondents, such as the targeted sample size (n>150), targeted industries (manufacturing) and job position (middle manager or higher). This study also set criteria to filter unengaged responses, such as short completion time and invariable selection of the same extreme values. Specifically, those questionnaires finished within ten minutes were regarded as unengaged responses, because the average time needed to complete the questionnaire in our pilot study was around twelve minutes. The survey was conducted using online communication tools popular in China, such as Wechat, QQ and email. From among 325 completed online questionnaires, 185 met our requirements and were free from unengaged response issues. These 185 valid responses were then subject to data analysis. Table 1 reports the demographic information of our respondents. The non-response bias was assessed by comparing the early respondents (n=102) and late respondents (n=83) with regard to firm size, category of industries and regions. According to the X^2 difference test there are no significant results, which implies that the non-response bias is not a threat to this study [62].

B. Measures

Based on a thorough review of the key literature in the field of Operations Management (OM), where most of the GSCM research appears, we first selected the appropriate measurement instruments that matched with our proposed constructs. The English version of the measurement scale was developed by the authors and then translated into Chinese by an experienced OM expert in China. Informed by comments from a semi-structured interview with our expert panel[1], we modified the original items and created some new ones. Then the refined Chinese version was translated back into English by the expert to ensure accuracy. The measurement items were all measured according to a seven-point Likert scale. The constructs in theoretical model were measured by the mean value of their corresponding items.

1) Dependent Variable: Financial Performance (of the focal company)

In line with the key OM empirical literature (e.g., [62, 63]), we measure the financial performance of the focal company by five indicators: return on asset, growth of sales, return on investment, growth in return on investment and profit margin on sales. The respondents were asked to compare their company performance regarding these indicators over the last three years (i.e. 2013 - 2015). The 7-point Likert scale for financial performance ranges from 1, for "decreased significantly" to 7, for "increased significantly." Because most of the respondents do not represent listed companies, the audited financial data is not available to us. Therefore, using the perception scale is a more reasonable option for our investigation. Moreover, the measures for financial performance have been widely adopted in previous studies and the construct reliability of the measures is confirmed with Cronbach's alpha = 0.855. In summary, the indicators of financial performance adopted in this study are reliable.

2) Independent Variable: Green Purchasing and Green Customer Cooperation

The measures for both GP and GCC were adopted from the existing literature [14, 64], and have been used in many other recent OM studies across different country contexts (such as [22], [16]). Moreover, because this study focuses on Chinese manufacturers, Zhu et al.'s [14, 23, 64] green practice measures for Chinese manufacturers should be applicable in our study. Although the measures of green practices from existing studies are well developed and widely accepted, we modified and updated some contents based on the pilot research and comprehensive literature review. For example, this study obtained one item in GP (denoted as GP1) from the IBM Environmental Report [65]; this concerns preventing upstream suppliers from transferring the responsibility for environmentally sensitive

[1] The expert panel comprised three academics and three top managers. They are all from China and have expertise in the manufacturing industry.

operations to other unqualified companies. Regarding customer cooperation, our expert panel members reflected that the description of the item - *"cooperation with customers for using less energy during product transportation"* was vague. Therefore, based on the experts' comment, this study modified the description to – "*cooperation with customers for maximizing the use of logistics resources (e.g. good planning in product transportation route plan)*." The level of adoption of the green practice is assessed by a seven-point Likert scale with descriptors from 1, for "strongly disagree" to 7, for "strongly agree." The values of Cronbach's alpha are 0.855 and 0.826 for GP and customer cooperation respectively. Hence, the constructs are reliable, as they exceed the recommended value of 0.7.

3) Contextual Factor and Moderator: Environmental Dynamism and Social Control Mechanism

The scales for measuring the environmental dynamism were adopted from the previous literature [4]. The indicators of the item pool reflect the dynamism of the external environment in the following aspects: degree of market uncertainty, evolving technologies, end-consumer demand uncertainty and frequent changes in government environmental regulations. Items are assessed by respondents' perceived level of agreement, ranging from 1, for "strongly disagree" to 7, for "strongly agree." The construct is reliable, as its Cronbach's alpha exceeds 0.7, at 0.866.

Regarding the social control mechanism toward the supply chain members (i.e. upstream suppliers and downstream industrial customers), this study uses the scale from Li, et al. [5]. The respondents were asked to indicate whether their supply chain relationship is controlled through: a. reliance on the supply chain partners to keep promises; b. joint problem-solving with supply chain members; c. participatory decision-making, or d. fine-grained information exchange. As in the case of the green practices constructs, the scale ranged from 1, for "strongly disagree" to 7, for "strongly agree." As shown by the Cronbach's alpha = 0.831, this construct was also reliable.

4) Control Variables

This study also adopts four control variables that might have impacts on the firm's financial performance, namely firm size, industry sector and geographic location. Most existing OM researches consider firm size as a control variable on the financial performance. According to Zhao et al. [66], larger firms may have more resources to engage in supply chain activities so as to enhance performance. Also, the firm size might represent the company's ability to leverage resources to manage external uncertainties. Following Zhu and Sarkis [13], this study measures firm size by the number of full-time employees according to a three-point scale ("1" represents fewer than 300 employees; "2" more than 300 but fewer than 2000 employees, and "3" more than 2000 employees). Regarding industry sector, we code electronic and other electrical equipment and components, except for computer equipment, as "1", the pharmaceutical industry as "2", and the automobile industry as "3" and other industry as "4." The study also controls for the geographic locations of respondents. We collected the data from three major economic zones in China, namely Pearl River Delta (labelled as "1"), Yangtze River Delta (labelled as "2") and Circum-Bohai-Sea Region (labelled as "3").

IV. DATA ANALYSIS AND RESULTS

A. Assessing Reliability and Validity of Indicators

Because this study uses multiple items to measure each construct, a rigorous process was conducted to assess the construct reliability, uni-dimensionality, discriminant validity and convergent validity. The Cronbach's alpha of our constructs all exceeded the benchmark value of 0.7, thus providing initial confirmation of the construct reliability. To further assess the construct reliability, the corrected item-total correlations (CITC) were checked. As shown in the Appendix A, all the CITC values were greater than 0.453 and exceeded the recommended value of 0.30 [67].

In order to assess the uni-dimensionality of the indicators, we used two widely accepted methods, namely exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) [68]. For EFA, principal component analysis with Varimax rotation was observed to initiate the factor structure . EFA confirmed the measures of adequacy of sampling, because the Kaiswer-Meyer-Olkin (KMO) was greater than 0.5, at 0.834, and the Bartlett's test of sphericity was significant at 0.001 level with $X^2 = 2027.482$ and degree of freedom (*df*) = 210. Hence, the data were

TABLE II
DISCRIMINANT VALIDITY

Variable	1	2	3	4	5
1. Green Customer Cooperation	**0.744**	197.116	259.187	84.656	189.263
2. Financial Performance	0.398	**0.733**	525.159	248.496	84.254
3. Environmental Dynamism	0.143	0.090	**0.850**	316.112	264.889
4. Green Purchasing	0.705	0.375	0.054	**0.782**	241.615
5. Social Control	0.424	0.697	0.106	0.258	**0.752**

a. The value in bold in the diagonal of the table is the square root of AVE. b. The lower triangle shows the correlation. c. The upper triangle shows the X^2 difference between the pairwise factor model and single factor model. All X^2 difference test with 1-degree freedom, so if X^2>11, the p-value is significant at 0.001 level.

suitable to proceed with factor analysis. This study obtained five factors with eigenvalues greater than one, explaining 68.34% of the total variance. The indicators were strongly linked to our proposed latent variable, where the size of the factor loadings were all higher than 0.652. Moreover, there was no significant cross loading (the difference between respective factor loadings less than 0.10), which also indicates that the *"items were unidimensional with regard to our proposed constructs"* [68]. Also, to further confirm the uni-dimensionality, the overall model fit indices of the measurement model (i.e. CFA) were assessed, such as comparative fit index (CFI), non-normed fit index (NNFI), root mean square error of approximation (RMSEA) and normed chi-square (X^2/df). In the measurement model, this research established links between the indicators and respective constructs then freely estimated the covariance among all five constructs. Using SPSS AMOS 23, we found that the model fit indices indicated that the measurement model was a good fit (CFI = 0.977; NNFI = 0.972; RMSEA = 0.037; X^2/df = 1.250) [69]. In summary, both EFA and CFA demonstrated good uni-dimensionality of our measurement items.

Regarding the convergent validity, this study assessed the significance of the indicators with their corresponding constructs by *t-value* and average extracted variance (AVE). All *t-values* of the factor loadings in the measurement model were greater than the benchmark value of 2.0, ranging from 8.429 to 14.645 [69]. Additionally, the AVE values ranged from 0.538 to 0.723, thus exceeding the recommended value of 0.5. These results indicate the convergent validity. The discriminant validity was tested by comparing the square root of AVE for each construct with the inter-construct correlations. Chin [70] suggests that the square root of AVE should be greater than the inter-construct correlations. As shown in Table 2, the measurement model meets the criterion of discriminant validity. Furthermore, this research built CFA models for every possible paired latent variable. Then, X^2 difference test was used to compare the paired model with the result of the one-factor model [23]. As shown in the upper triangle of Table 2, the differences in the X^2 test of paired CFA models were all significant at 0.01 level, suggesting that the measurement model satisfies discriminant validity.

B. Common Method Bias and Endogeneity

Owing to the fact that data were collected from a single respondent per firm, and were perceptual, common method bias might be a concern for this study. To check for the common method bias, three different tests were conducted. First, Harman's one-factor test was used [71]. There were five factors with eigenvalues exceeding 1.0, accounting for 68.34% of the total variance. Among these the first factor accounted for 30.06%, which is not the majority of the total variance [62]. Secondly, this study used CFA to further perform Harman's single factor test. We established a single factor model linking all the indicators. This single factor model was unfit (CFI = 0.428; NNFI = 0.364; RMSEA = 0.117; X^2/df = 6.774), and its results were much worse than the results of the measurement model, indicating that a single factor model was not acceptable, and the likelihood of common method bias was small [62, 63]. To reinforce the results of Harman's one-factor test, this research operated an additional test following Paulraj et al. [72] and Widaman [73]. Two CFA models were tested, of which one had only the traits and one added a method factor in addition to the traits [62, 72]. The factor loadings were not much different between the two models and the t-values remained significant despite the inclusion of the method factor. Moreover, the method factor accounted for 16.81% of the common variance and marginally improved the model fit [CFI by 0.04, NNFI by 0.05 and RMSEA by -0.004].

Finally, this study applied the "Marker-Variable" method as an alternative approach to further assess the potential common method bias [74]. The research adopted the recommended procedures and formulas provided by Malhotra, et al. [75]. First, firm's supply chain position [76] was chosen as a marker variable (i.e. a variable that is theoretically unrelated to at least one variable in the model). As shown in Appendix B, the correlations between the marker variable and other constructs were small and insignificant at $p<0.05$. Then, this study used the lowest positive correlation between marker variable and other variables (r_a = 0.024) to compute the adjusted correlation [75]. The results indicated that none of the significant correlations in zero-order correlations became insignificant after the adjustment (See Appendix B). In summary, common method bias is unlikely to be a threat to this study.

Antonakis, et al. [77] argue that common method bias and simultaneity (reverse causality) are two of the major concerns in endogeneity. As verified in the previous section, common method bias was not a critical issue in this study. Regarding simultaneity, the problem exists when dependent variable and independent variable simultaneously impact on each other and have reciprocal feedback loops [78]. There is a substantial body of theoretical literature and logical arguments reflecting that the GSCM practices are linked with FP [14, 22]. Moreover, by reviewing 50 GSCM empirical studies in the emerging markets, and carrying out a rigorous meta-analysis, the positive effects of GP and GCC on FP were further confirmed [79]. Hence, simultaneity (reverse causality) is unlikely to be a problem in this context. This study also empirically tested whether endogeneity was a potential issue in the relationship between GSCM and FP. The Durbin-Wu-Hausman (DWH) test (i.e. augmented regression test) was performed to examine whether the GP and GCC were endogenous to the model [80]. Following Dong, et al. [81], this research first regressed GP and GCC on all controls respectively to obtain the residuals of each regression. Then, two augmented regressions were performed by using the residuals as additional independent variables. The results showed that the parameters estimated for the residual (β_r) in

TABLE III.
HIERARCHICAL REGRESSION RESULTS

Variables	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 5b
Controls						
Industry Sector	0.037	0.028	0.019	0.027	0.027	0.024
Region	-0.030	-0.042	-0.022	-0.021	-0.011	-0.013
Firm Size	0.063	0.085	0.015	0.007	0.000	0.001
Main Effects						
Green Purchasing (**H1**)		0.186*	0.141†	0.151†	0.142†	0.159*
Green Customer Cooperation (**H2**)		0.235**	0.080	0.101	0.101	0.095
Social Control			0.537**	0.532**	0.514**	0.504**
Environmental Dynamism				-0.036	-0.004	-0.025
Two-way interactions						
Green Purchasing × Social Control (**H3**)			0.236*	0.238*	0.262*	0.236*
Green Customer Cooperation × Social Control (**H4**)			-0.183	-0.165	-0.063	-0.034
Green Purchasing × Environmental Dynamism				-0.038	-0.086	-0.023
Green Customer Cooperation × Environmental Dynamism				0.101	0.143†	0.123†
Social Control × Environmental Dynamism				-0.080	-0.077	-0.080
Three-way interaction						
Green Purchasing × Social Control × Environmental Dynamism (**H5**)					0.190*	
Green Customer Cooperation × Social Control × Environmental Dynamism (**H6**)						0.197*
ΔR^2 (Financial Performance)		0.142	0.249	0.009	0.015	0.013
R^2 (Financial Performance)	0.008	0.386	0.631	0.638	0.649	0.648
F Change		14.886**	24.261**	0.636	4.371*	3.972*

Note: † $p<0.1$ * $p<0.05$ ** * $p<0.01$

augmented regression were not significantly different from zero (for GCC: β_r was insignificant as p = 0.6176; for GP: β_r was insignificant as p = 0.0721). This indicates that both GP and GC were not endogenous [81].

B. Results

A multiple-step hierarchical regression model was established to test the hypotheses. In the regression model, this study first introduced three control variables in Model 1. Then the main effects of GP and GCC on financial performance (i.e. H1 and H2) were examined in Model 2. H3 and H4 were tsested in Model 3. Following and Liu [82], Model 4 was built as a basis for the comparison among models to obtain the significance of the change of R^2 and F hierarchical value. The three-way interaction among GSCM practices, environmental dynamism and social control were tested in Model 5a and Model 5b. As suggested by previous studies, in order to minimize the threat of multi-collinearity, each variable in our model was mean-cantered before calculating all the interaction products [82]. Also, this study used variance inflation factor (VIF) and tolerance value to assess the potential multi-collinearity issue. The VIF values of our results are all below the threshold of 10 and the lowest tolerance value is greater than the benchmarking value of 0.1 [69]. Therefore, multi-collinearity is not a significant threat to our regression analysis. The results with standardized path coefficients, R^2 and F value are reported in Table 3.

In Model 1, no significant relationships between the control variables and financial performance were found. The model explains only 0.08 percent of the variance. Then, the control variables and two main effects variables were added into Model 2. GP (b = 0.186, p < 0.05) and GCC (b = 0.235, p < 0.01) both positively impact on financial performance, indicating that Hypothesis 1 and Hypothesis 2 are both supported. Model 2 also makes a significant contribution over and above Model 1 (F hierarchical value = 14.886, p < 0.001). Model 3, which tests the interaction between the GSCM practices and social control mechanism, makes a significant contribution over Model 2 (F hierarchical value = 24.261, p < 0.001). The interaction between GP and social control mechanism has a positive and significant coefficient (b = 0.236, p < 0.05) on the financial performance. However, the moderating effect of social control on the relationship between GCC and financial performance is not significant (b = -0.183, n.s.).

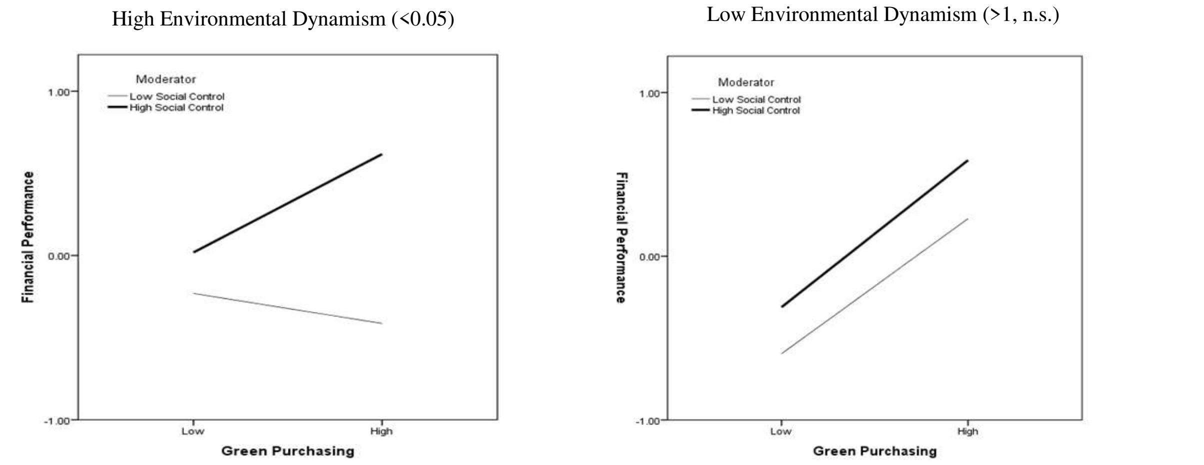

Fig. 2. Three-way interaction: Green Purchasing, Social Control and Environmental Dynamism

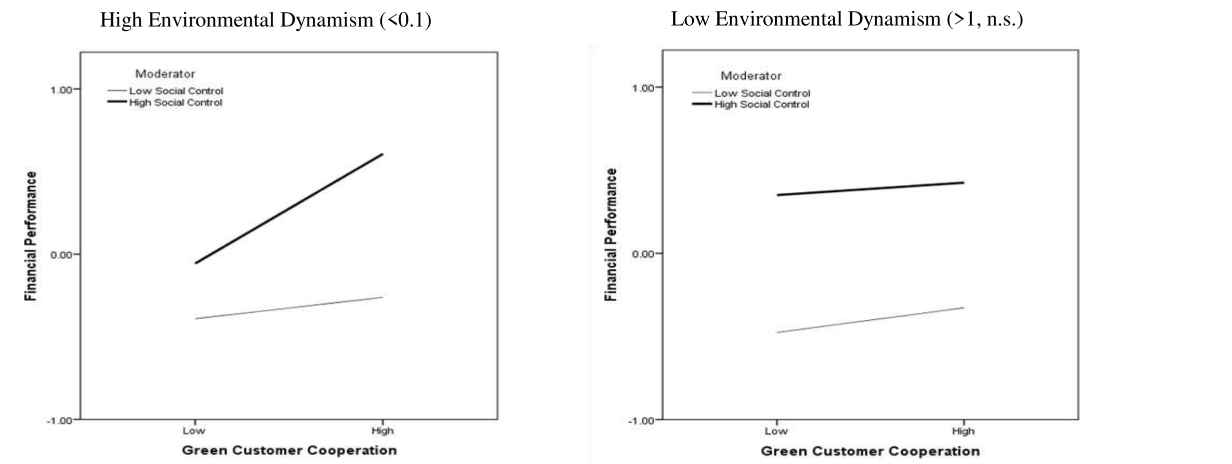

Fig. 3. Three-way interaction: Green Customer Cooperation, Social Control and Environmental Dynamism

Thus, Hypothesis 3 is supported, while Hypothesis 4 is not supported. Following Aiken and West [83], a simple slope test was performed to further confirm the moderating effects. The moderator was assigned the value of one standard deviation above and below its mean to indicate two levels of social control. According to the simple slope analysis, GP was more efficient when the company has higher social control. Specifically, the path coefficient of GP was highly significant under high social control (b = 0.2426, $p < 0.05$), while it was not significant under low social control (b = 0.0545, *n.s.*).

Finally, in Models 5a and 5b, this study found significant and positive three-way interaction among GSCM practices, social control and environmental dynamism (GP: b = 0.190, $p < 0.05$; GCC: b = 0.197, $p < 0.05$). Also, the three-way interaction models (i.e. 5a and 5b) made a significant contribution over Model 4 in that the F hierarchal values were all significant at 0.05 level. Once again, this study used a simple slope test to check the three-way interactions. The conditional effect of the interaction between social control and GP was highly significant at high level of environmental dynamism (t = 2.5258, $p < 0.05$), while it was insignificant at low level of environmental dynamism (t = 0.3804, *n.s.*), supporting Hypothesis 5. However, we found only a marginally significant interaction between social control and GCC at high level of environmental dynamism (t = 1.8125, $p < 0.1$). The two-way interaction is also insignificant at low level of environmental dynamism (t = -0.5138, *n.s.*), which is similar to the result for GP. Therefore, this study conclude that Hypothesis 6 is also supported. Graphs for the three-way interactions appear in Figure 2 and Figure 3.

Further, due to the relatively small sample size, Gpower v3.1 software was used to conduct power analysis as a robustness check to identify the required sample size for the hierarchical regression model. Following Engelen, et al. [84], this study conducted a post hoc statistical test for given alpha value, sample size and effect size. To explain the effect size of 0.2 [84], with an alpha of 0.5 and sample size of 185, an ideal statistical power of 99% from our most complex models (Model 5a and 5b) was received, which include thirteen predictors. This implies that the regression model has less than 1% probability of a non-significant finding that is actually significant [84]. Therefore, it can be concluded that the sample size of this research has sufficient power to explain the models.

V. DISCUSSION

The significant and positive results for the main effects of GSCM (i.e. H1 and H2) on financial performance are in line with our expectation and support the findings of prior research examining the relationship between GSCM and firm performance [13-15]. Although the potential value of implementing GSCM in the context of the emerging markets has been widely recognized by both academics and practitioners, this study further justifies the economic value of GSCM in the manufacturing industry. Specifically, this research finds that GP could bring firms better financial performance, which is consistent with Vachon and Kalessen and Rao and Holt [18]. Supporting the notion of Laari et al. [26], our result also shows that firms' financial performance is significantly and positively associated with GCC. The above findings indicate that it is important to implement GSCM in the form of upstream monitoring and downstream cooperation in order to achieve greater financial performance. Moreover, this study shows that the effect of GCC on financial performance is greater than that of GP, which indicates that GCC might be a more significant driver of firms' financial performance. This finding is consistent with Zhu et al.'s [17] assertion that GCC is an efficient factor within the GSCM practices to improve a company's economic performance.

Further, considering the characteristics of the business environment in China, this study examines the moderating role of social control in the relationship between GSCM and financial performance. This proposition is in line with the SET that the economic transaction focuses not only on the economic factor, but also on the social factor. The result of multiple regression analysis shows that the moderating effect of social control on the relationship between GP and financial performance is positive and significant. This suggests that when the company is implementing activities of GP, strengthening social control over their chain members is helpful to maximize the economic outcome of that GP. A possible explanation is that Chinese companies normally do not have advanced information systems to exchange information with their local suppliers [85], so they might have alternative ways to communicate with each other, such as carrying out information exchange on an informal relationship basis rather than through formal systems [86]. As GP is a monitoring practice that is highly information-driven, the greater social control might ensure the efficiency of information exchange in the activities of GP so as to enhance the financial performance. Moreover, contrary to our expectation, this study does not detect a significant moderating effect of social control on the relationship between GCC and financial performance. This surprising result indicates that the social control mechanism might not be a necessary motivator of GCC to bring greater financial performance. The insignificant moderating effect of social control highlights the fundamental role of GCC in achieving better economic performance, which is consistent with the finding of Larri et al. [26]. It seems that the motivating effect of social control on the GSCM-financial performance relationship is not supported. However, this study argues that such an unexpected result needs to be further investigated from the perspective of CT.

In order to get a deeper understanding of the joint effect of social control and GSCM, this study also examines a contextual factor, namely, environmental dynamism. As expected, the significant results of the three-way interaction show that the positive moderating effect of social control on the relationship between GSCM (including both GP and GCC) and financial performance is strengthened when the environmental dynamism is high. According to Yeung et al. [87], the fundamental need of any company in a dynamic manufacturing environment is to "*apply an effective process assurance system and to be proactive in taking the initiative to make improvements.*" This study suggests that the success of GSCM in the dynamic environment requires social control to improve financial performance. On the other hand, based on the simple slope analysis, this study finds that the moderating effects of social control in the GSCM-performance relationship are insignificant in a stable environment (i.e. low level of environmental dynamism). This result provides a fascinating perspective for understanding the role of social control in GSCM. Regarding GCC, the result implies that in a stable environment (i.e. low level of environmental dynamism), applying social control might not be efficient to promote financial performance. A possible explanation is that using social control to cooperate with business partners could be costly in a stable environment. Such a conclusion partially supports Zhu et al. [15], who find an inconclusive moderating effect of customer relational governance on the relationship between GSCM and economic performance. In addition, to avoid financial loss, the result demonstrates the necessity of using social control in monitoring the supplier's green activities. As shown in Figure 2, surprisingly this study finds a negative association between GP and financial performance in a dynamic environment when a company invests less effort in social control. A possible explanation is that if the buyer lacks social control over their suppliers, the highly unstable environment may encourage the suppliers' opportunism in green activities, such as by fraudulently reporting the "carbon emission level" or even deliberately hiding the information regarding pollutant discharge. It is not difficult to imagine that if there is no trust-based relationship between buyer and supplier in an uncertain environment, the supplier might engage in more opportunistic behavior to pursue their own benefit, resulting in a negative impact on the buyer's financial performance.

A. Contribution to the Literature

This study makes several contributions to the literature on GSCM and designing a sustainable and resilient supply chain. First, prior studies mainly assess the association between the GSCM and environmental performance [88]. However, only a handful of studies provide evidence that integrating environmental concerns in supply chain management could bring the company better financial performance [4]. This study contributes to the GSCM literature by further examining the relationship between GSCM and financial performance. Specifically, our significant evidence adds to the generalizability of the GSCM-performance studies.

Second, by identifying the interactive effect between social control and GSCM practices, the research findings contribute to the existing GSCM literature from the perspective of SET. Although the supply chain management literature has widely recognized the importance of informal relationships, such as trust and cooperation [5, 6], very few studies or theories have attempted to explain this in the field of GSCM [15]. In line with the SET, this study adds to the GSCM literature by investigating social control as a moderator in the relationship between GSCM and performance. While recent studies have highlighted the roles of informal relationship and trust in facilitating the green supply chain management to improve firm performance [15], this study finds mixed results for the moderating effect of social control. Specifically, this study finds a significant joint effect on financial performance only in the case of social control and GP.

Third, by investigating the contextual factor of environmental dynamism, this research responds to the call of Sousa and Voss [9] for more sophisticated theorizing and tests in the area of OM. Also, in the environmental management context, to the best of our knowledge, there is no research examining the interrelationship among uncertainty, GSCM, social control and firm performance. Drawing from the CT, Chan et al. [4] find that under a high level of environmental dynamism, the effect of green innovation on a company's financial performance would be strengthened. This study provides further support and extends the research of Chan et al. [4] by examining the joint effects of GSCM and social control in a contingency paradigm. Furthermore, our significant three-way interaction results also offer a possible answer to the question raised by Sarkis et al. [2], regarding *"How to reduce the uncertainty that arises from implementing the GSCM activities and guide system function*." This study suggests that social control could be an effective governance to facilitate the implementation of GSCM under a highly uncertain environment.

Fourth, this study also responses the call for integrating sustainability with supply chain resilience, which characterized by "*business continuity*" [89]. This study argues that to ensure the design of sustainable supply chain remain unaffected or minimally affected in an environment that characterized by frequently avoidable disruptions, it is necessary for the firms to embrace social control. By integrating the effective governance mechanism like social control in planning the sustainable supply chain, the result of our three-way interaction analysis provides empirical evidence that not only could firms ensure the business continuity when environmental dynamism is high, but firms could even take the advantages of highly dynamic environment to improve their performance.

B. Managerial Implications

The present study also offers several suggestions for practitioners based on the research findings. First, although all GSCM can be effective in achieving high financial performance, practitioners should understand the characteristics of each practice. In order to avoid potential penalties from the government, managers should prioritize the implementation of GP. On the other hand, to enhance the company's green image or win more business opportunities in the market, investing in GCC might bring more significant and direct financial returns. Second, managers should realize that the integrative use of GSCM practices and social control could be an available option in the context of China. Given that informal relationships and trust play an important role in Chinese business [90], practitioners may enjoy more benefits by exerting social control over their chain members when implementing green practices. The success of GSCM relies heavily on shared vision, frequent information exchange and inter-organizational coordination [2]. Therefore, social control could be an optimal governance mechanism when implementing GSCM.

Last but not least, managers should understand how to adopt social control effectively in the implementation of GSCM under the contextual factor of a dynamic environment, which is characterized by frequent and rapid changes induced by technology, government policy, customers, and suppliers. Literature suggests that in order to reflect the real world situation, managers and researchers should extend their research model by including these contextual factors, since a bivariate or even trivariate relationship may not be comprehensive [9]. This study offers practitioners a more in-depth statement to explain the GSCM-performance relationship. It suggests that when a company's external environment is dynamic, it is necessary for the managers to apply social control with both GSCM practices, i.e. GP and GCC, to promote their financial performance. On one hand, this study recommends that managers should take advantage of the positive aspect of a dynamic environment. However, the effectiveness of social control in GSCM might be contingent on external circumstances. Practitioners should realize that the combination of GSCM and social control might not be efficient under a stable environment (as shown in Figure 2 and Figure 3). If managers cannot correctly assess their external environment, they might not get the expected return from investing in such a combination. In this case, our items that measure the environmental dynamism could assist managers to evaluate their external environment.

VI. CONCLUSION

The purpose of this study is to verify the joint effect of social control and GSCM on firms' financial performance, especially in a highly dynamic environment, in the specific context of China. From the perspective of CT and SET, this paper develops a research model and empirically verifies the complex inter-relationship among GP, GCC, environmental dynamism and financial performance. This study contributes to a major topic in the GSCM literature, that of how GSCM impacts on the firm's financial performance. This study finds that GP and GCC have positive effect on financial performance. Drawing from the SET, this study investigates the joint effect of GSCM and social control on financial performance. In particular, we find that social control positively moderates the effect of GCC. Also, this study explains how and why the impact of the GSCM-social control combination on financial performance can be strengthened in a dynamic environment. We suggest that social control could be a significant motivator of GSCM to promote financial performance, especially in a dynamic environment.

Although this study offers some important contributions, the research findings and implications should be considered in the light of several limitations. First, we need to clarify that although social control is a governance mechanism that primarily relies on the informal means, it is not same with the concept of Guanxi, which is which is a unique people based connection aspect in Chinese business [91]. Second, similar to other relevant studies in GSCM [22], this paper is limited by a relatively small sample size. Although the power analysis indicates that our sample has sufficient statistical power to explain the regression model, the future research is recommended to verify our model in a larger sample. A third limitation is that when empirically testing the causality, this study investigates only the cross-sectional data. Future research could conduct a longitudinal study to investigate the dynamic relationships among the concepts studied in this paper. Moreover, in our paper, we have addressed endogeneity by the augmented regression approach. However, given growing consideration on endogeneity in survey study, we suggest future research could also adopt other advanced approach, for example, the matched control groups method [92, 93]. Forth, as this research investigates only the Chinese manufacturing industry, the generalizability of the results is another limitation. Future research could resolve this issue by examining our model in different regions to improve the generalizability. Fifth, this research consider only social control as a motivator of GSCM. As an alternative to social control, formal control that emphasizes the contractual system could also be a significant governance mechanism in GSCM. Therefore, future research may benefit from exploring the moderating roles of different governance systems in the relationship between GSCM and firm performance. Sixth, the selection of the variables that deviated from SET and CT is incomprehensive. Many other elements of SET can be considered in the future research, such as reciprocity, solidarity, trust, power and commitment, *etc.* [94, 95]. Moreover, to more precisely measure the dynamic environment, we suggest the future research can take multiple constructs (such as supply and demand uncertainty, competitive intensity and technological turbulence) into account [96, 97]. Finally, the adoption of a subjective scale to measure firm's FP, due to issues regarding data availability, represents a possible limitation of this study. Although the scales used to measure FP in this study have been widely adopted in previous literature, future researches should address this concern by adopting objective data (i.e. audited and published financial data), or by using a multi-informant approach to improve the validity.

APPENDIX A

The respondents were asked to indicate the extent to which they agree or disagree with the below statements as applicable to their firm: (1 = strongly disagree – 7 = strongly agree)

		Loading	Reliability and Validity
Green Purchasing			
GP1	We strive to prevent first-tier suppliers from transferring responsibility for environmentally sensitive operations to unqualified companies.	0.759	AVE=0.612 α=0.855 CITC range: 0.573-0.686
GP2	We regularly conduct environmental audit for suppliers' internal management.	0.704	
GP3	We evaluate the environmentally-friendly practice of second-tier suppliers.	0.804	
GP4	We have close cooperation with our suppliers regarding the environmental objectives.	0.855	
Green Customer Cooperation			
GCC1	We have cooperation with customers to maximize the use of logistics resources (e.g. good planning in product transportation route plan).	0.759	AVE=0.554 α=0.826 CITC range: 0.508-0.615
GCC2	We have close cooperation with customers to achieve cleaner production.	0.829	
GCC3	We have close cooperation with customers to develop environmentally-friendly packaging.	0.656	
GCC4	We have close cooperation with customers for eco design.	0.722	
Environmental Dynamism			
ED1	Prices for the product of our industry are volatile.	0.969	AVE=0.723 α=0.866 CITC range: 0.442-0.797
ED2	A high rate of innovation.	0.821	
ED3	Frequent and major changes in government regulations.	0.769	
ED4	The market for our product is dynamic.	0.830	
Social Control			
SC1	We rely on our partners to keep their promises.	0.780	AVE=0.566 α=0.831 CITC range: 0.523-0.590
SC2	Our partners are always frank and truthful in their dealings with us.	0.708	
SC3	Without monitoring, the partners would fulfil their obligations.	0.797	
SC4	We have fine-grained information exchange with our supply chain members.	0.720	

The respondents were asked to indicate the level of changes in their firm over the past three years (1= decreased significantly; 4= no change; 7= increased significantly)

		Loading	Reliability and Validity
Financial Performance			
FP1	Return on asset	0.652	AVE=0.538 α=0.855 CITC range: 0.453-0.595
FP2	Growth of sales	0.752	
FP3	Return on investment	0.773	
FP4	Growth in return on investment	0.754	
FP5	Profit margin on sales	0.730	

APPENDIX B. Marker-Variable Method

Variable	1	2	3	4	5
1 Green Purchasing		0.592**	0.197**	0.306**	0.100
2 Green Customer Cooperation	0.602**		0.336**	0.325**	0.148*
3 Social Control	0.216**	0.352**		0.574**	0.095
4 Financial Performance	0.323**	0.341**	0.584**		0.067
5 Environmental Dynamism	0.122	0.168*	0.117	0.089	
6 MARKER Variable	-0.072	-0.064	-0.016	0.024	0.068

The uncorrected correlations are below the diagonal; the adjusted correlations are above the diagonal.

Notes:

** $p < 0.01$

* $p < 0.05$

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