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

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

30
 31 **Managerial relevance statement**- Based on the empirical
 32 results, this research suggests the managers should notice the
 33 integrative use of green supply chain management practices
 34 and social control mechanism could be an available option in
 35 the context of China. Moreover, this study offers the manager
 36 a more in-depth statement to explain the relationship between
 37 green supply chain management and firm performance by
 38 investigating the contingency role of environmental dynamism.
 39 This research suggests that when a company's external
 40 environment is dynamic, it is necessary for the practitioners to
 41 apply social control with both green supply chain practices, i.e.
 42 green purchasing, and GCC, to promote their financial
 43 performance. However, practitioners should realize that the
 44 combination of green supply chain and social control might
 45 not be efficient in a stable environment. In this case, if
 46 managers cannot correctly assess the external environment
 47 factors, they might not get the expected return from investing
 48 in such a combination. In particular, our measures of the
 49 environmental dynamism could assist managers to evaluate
 50 their external environment factors for ensuring the efficiency
 51 of implementing the combination of green supply chain
 52 management and social control.

53

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

57

58

I. INTRODUCTION

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

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

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

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

29 To answer the two research questions, a theoretically
 30 derived model is proposed to explain the relationships
 31 among the GSCM practices, social control, environmental
 32 dynamism and financial performance. Given the increasing
 33 concerns about environmental issues in developing
 34 countries, there is a strong need for more empirical GSCM
 35 research in emerging markets, such as China [2]. Thus this
 36 study tests the model using the cross-sectional data from
 37 185 Chinese manufacturers with a set of reliable
 38 measurement scales. Based on the empirical results, this

39 study provides three theoretical contributions. First, the
 40 environmental management research is advanced by re-
 41 examining the common assertion that the implementation of
 42 GSCM could improve the focal firm’s financial
 43 performance. Although this assertion is widely accepted in
 44 the literature, empirical results are still inconclusive.
 45 Second, extending the research that explores the moderators
 46 between GSCM and performance [4, 13-16], this study
 47 contributes to the literature by adding social control as a
 48 moderator of that relationship. Third, using a three-way
 49 interaction analysis, this study is the first to integrate CT to
 50 discover under what circumstances social control could be
 51 helpful or harmful to the relationship between GSCM and
 52 financial performance.

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

62

63 II. LITERATURE AND THEORETICAL 64 DEVELOPMENT

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

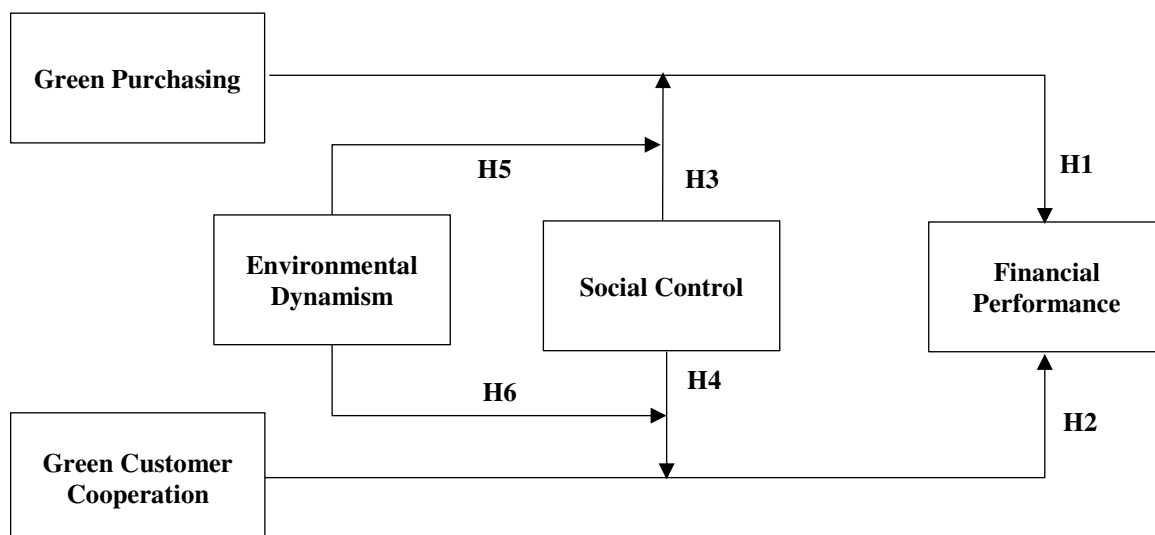


Fig. 1. Hypothesized Model

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

3 A. *Green supply chain management and financial* 4 *performance*

5 Promoting financial performance is an important reason
6 why a company would seek to implement GSCM practices
7 [17]. In the South East Asian context, companies with green
8 supply chain practice have increased competitiveness and
9 economic performance [18]. According to Rao [19], some
10 “leading-edge corporations” among South East Asian
11 companies (such as Nestle Philippines, PT Aryabhata in
12 Indonesia, Philip DAP in Singapore, Nestle Jakarta and
13 Seagate Thailand) have adopted GSCM practices (such as
14 greening of suppliers’ programs) and received positive
15 results. Zhu et al. [17] have also verified the relationship
16 between GSCM and firm performance for Chinese
17 organizations, and their empirical study provides significant
18 results. Following existing literature, GSCM is defined as
19 the external supply chain practices, namely upstream
20 monitoring (i.e. GP or environmental procurement) and
21 downstream cooperation (i.e. GCC) [20].

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

43 Following Green et al. [22] and Zhu et al. [23], GCC is
44 defined as “*working with customers to design cleaner*
45 *production processes that produce environmentally*
46 *sustainable products with green packaging.*” Drawing upon
47 the natural resource-based view (NRBV) theory, the
48 company is encouraged to incorporate the environmental
49 consideration into their strategic planning, in order to
50 survive in the marketplace where there is growing
51 governmental and societal concern over environmental
52 pollution [24]. The viewpoint of NRBV is in line with the
53 assertion of Hansmann et al. [25] that success in addressing
54 the environmental issue may provide more opportunity for
55 business competition. A firm with better GCC can acquire a
56 high ecological reputation from customers. Since China
57 joined the World Trade Organization, more Chinese

2 interaction.

58 manufacturers have sought to become suppliers to
59 developed country enterprises, which select their suppliers
60 according to high environmental standards [13]. Therefore,
61 maintaining a good ecological reputation may help Chinese
62 manufacturers to win more international opportunities.
63 Based on a panel of Finnish firms, Laari, et al. [26] found
64 that an environmental collaborative approach with
65 customers is key to improving financial performance.

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

86
87 ***Hypothesis 1: Green Purchasing positively impacts on***
88 ***financial performance.***

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

91

92 B. *The moderating effect of the social control mechanism*

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

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

24 The argument that social control plays a positive
 25 moderating role is supported by SET. From the perspective
 26 of SET, commercial companies interact with each other for
 27 a reward or with the expectation of a reward for their
 28 cooperation with others [8]. The business transactions along
 29 the supply chain governed by a strong social control can be
 30 said to provide more stability and predictability for the
 31 interfirm cooperation, due to the reliance on shared norms
 32 and trust [31]. Suppliers in the environmental cooperation
 33 activities can thus expect that the focal company will
 34 reciprocate different benefits in the future. This expectation
 35 is based on two SET assumptions, namely that actors
 36 behave rationally and that gratification is dependent on
 37 others [31]. SET suggests that with the expectation of a
 38 reward, exchange parties will regularly discharge their
 39 obligations and make efforts to strengthen their reputation
 40 to show the business parties their commitment to the
 41 relationship [29]. This may be especially applicable to cost
 42 reduction in the activities of GP with the use of social
 43 control. Due to the strong social ties and predictable
 44 reciprocity, suppliers should offer better service or more
 45 cost-effective solutions for the green cooperation with their
 46 focal company, and thus contribute to better FP of the focal
 47 company. For example, information transparency is always
 48 a challenge for the focal company when conducting the
 49 environmental audit for the second-tier supplier [33]. With
 50 greater social control, the company should find it easier to
 51 get the expected information, because the first-tier supplier
 52 may be more willing to share
 53 the environmental information from their suppliers (i.e.
 54 second-tier). This is because, when social control is high,
 55 they wish to maintain and strengthen the relationship with
 56 the focal company. In addition, Sarkis [34] highlights that
 57 one of the difficulties in GP as an interfirm cooperation

58 practice is that there are conflicting goals between the buyer
 59 and supplier. According to Li et al. [35], social control
 60 emphasizes the mutual benefits and common norms. In
 61 such a case, social control might help to overcome the
 62 barrier of goal conflict to interact with GP and contribute to
 63 better financial performance. Thus, the following
 64 hypothesis is proposed:

65
 66 **Hypothesis 3:** *The positive effect of green purchasing on*
 67 *financial performance is positively moderated by social*
 68 *control.*

69
 70 Few researches have explicitly examined the moderating
 71 effect of social control on the positive effect of GCC on
 72 financial performance. However, there is recent empirical
 73 evidence that if the company needs to improve financial
 74 performance through green innovation, enhancing
 75 reciprocity and cooperation with the customer is necessary,
 76 which is also well supported by SET [15]. The assumption
 77 that the effectiveness of GCC increases when social control
 78 is high is reasonable. The activities of GSCM require
 79 multiple social resources and are costly [36]. According to
 80 Zhu et al. [14], Chinese companies recognize the critical
 81 nature of their environmental mission, due to the incentive
 82 of attracting more business opportunities from the
 83 downstream supply chain. If the focal companies are unable
 84 to ensure that they will receive the benefits from the
 85 greening activities with their customers, it will be difficult
 86 to bring about significant improvements in financial
 87 performance. A basic SET assumption is that building
 88 social “credit” is preferred to social “indebtedness” [37]. In
 89 the Chinese context, the focal firm’s efforts towards green
 90 cooperation with customers can be seen as a form of favor
 91 offered to the client. As argued by Kaufmann and Carter
 92 [38], the social control mechanism can help to form the
 93 informal pressure in the buyer-supplier relationship to
 94 sustain the supply chain cooperation. Drawing upon the
 95 SET, we argue that with greater SC, the benefits the
 96 customer company receives from the GCC activities, which
 97 can be seen as a favor [39], should place more informal
 98 pressure on the customer to offer more business
 99 opportunities or other financial benefits. Therefore, this
 100 study proposes the following moderation hypothesis:

101
 102 **Hypothesis 4:** *The positive effect of green customer*
 103 *cooperation on financial performance is positively*
 104 *moderated by social control.*

105
 106 **C. The contingency effect of environmental dynamism**

107 The highly dynamic environment is characterized by
 108 great speed and change [40] and by less clarity of
 109 information [41]. Jansen et al. [42] define environmental
 110 dynamism as “change in technologies, variations in
 111 customer preferences, and fluctuations in product demand
 112 or supply of materials.” Here, this study sets the scope of
 113 the concept by specifying that the uncertainties arise from

1 the external environment of the focal company. Within the
 2 supply chain context, a number of arguments have been put
 3 forward to stress that environmental uncertainty is an
 4 unavoidable contextual factor, because the flow of
 5 materials and information exchange involves complex
 6 communication and multiple lines of tasks across chain
 7 members [11, 43]. This highly uncertain environment
 8 provides challenging tasks for the company to tackle, and
 9 as Khandwalla [44] points out, the higher the market
 10 dynamism, the lower the ability of managers to predict the
 11 future of their companies. However, there might be an
 12 interesting twist to environmental dynamism. In the context
 13 of China, Li and Liu [45] find empirical evidence that
 14 companies are provided with greater dynamic capability to
 15 sustain their competitive advantages when environmental
 16 dynamism is high. Likewise, based on an empirical
 17 research in China, Jiao et al. [46] suggest that
 18 environmental dynamism enables companies to achieve
 19 better opportunity-sensing capability and hence better
 20 business performance. This study posits that the moderating
 21 effect of the social control mechanism on the GSCM-
 22 performance relationship will be strengthened in a dynamic
 23 environment, i.e. high environmental dynamism.

24 To explain the three-way interaction effect (i.e.
 25 moderated moderation), this study applies the CT.
 26 According to the CT, a contingency paradigm includes
 27 three kinds of variables, namely *contextual variables*,
 28 *response variables* and *performance variables* [9].
 29 Environmental dynamism can be viewed as a *contextual*
 30 *variable* [4], which is hard for companies to control or
 31 manipulate. Drawing from our proposed model, this study
 32 views the *interactive effect* of GSCM and social control as a
 33 form of *response factor* in the contingency paradigm. In
 34 line with the CT, environmental dynamism is not treated as
 35 an activator or a motivator. Theoretically, this research
 36 focuses on the impact of environmental dynamism on the
 37 strength of the relationship between the GSCM-social
 38 control interactive effect and FP (i.e. dependent variable)
 39 [11].

40 From the perspective of CT, when companies are facing
 41 uncertainty in the external environment, they usually
 42 respond through a series of externally oriented strategies
 43 [11, 47]. In line with the CT, this study argues that the
 44 interactive effect of social control and GP should “fit” with
 45 a highly dynamic environment. According to Stonebraker
 46 and Liao [48] and Koufteros, et al. [49], a highly dynamic
 47 market requires companies to acquire and process
 48 additional and rich information. Thus, the information
 49 asymmetry that arises in the activities of GP might be more
 50 significant. Sitkin et al. [50] argue that under a highly
 51 dynamic market, a company needs to facilitate flexible
 52 response and quick decision-making. As a motivator of the
 53 effect of GP on FP, the social control mechanism, which
 54 can further enhance the flexibility in the supply chain,
 55 should be more efficient in an unstable market. In contrast,
 56 a stable environment can provide manufacturers with more
 57 predictability, and enables manufacturers more easily to

58 anticipate, prepare for and respond to change [51]. As
 59 suggested by Anand and Ward [52], organizations in a
 60 stable environment should develop routines to handle the
 61 possible scenarios. Therefore, when a company faces a
 62 relatively stable environment, social control may not be
 63 necessary, as a manufacturer can rely on existing policies
 64 and regulations to perform environmental compliance audit
 65 toward its suppliers.

66

67 ***Hypothesis 5: The interaction effect of social control and***
 68 ***green purchasing is more highly and positively associated***
 69 ***with financial performance in a more dynamic environment.***
 70

71 CT theorists argue that to foster organizational
 72 performance, selecting an appropriate organizational
 73 structure to “fit” the external environment is critical [53,
 74 54]. According to Thompson [55], the effects of firms’
 75 actions are partially determined by the “*actions of elements*
 76 *of the environment*”. Therefore, from the perspective of CT,
 77 Germain, et al. [53] suggest that, “*a firm must determine*
 78 *when and how to act, and its cues must be taken primarily*
 79 *from the environment*” (p. 561). In a dynamic environment,
 80 the market is unstable due to rapid changes in product
 81 demand, customer preference and technology innovation
 82 [4]. In such an environment, there is a greater likelihood
 83 that opportunism will arise in the buyer-supplier
 84 relationship [56, 57]. For example, government policies
 85 providing incentives for companies to engage in
 86 environmental activities could change in a dynamic
 87 environment. This situation may encourage opportunism on
 88 the part of the customer company, manifested in behavior
 89 such as occupying all the benefits or reward from the
 90 government without sharing these benefits with the focal
 91 company. However, with greater social control, the
 92 customer company might be more willing to share the
 93 reward or even share the risk with the focal company, given
 94 that goal concurrence and mutual benefit are critical
 95 elements of social control [5]. Unlike a dynamic
 96 environment, a stable environment can hinder the
 97 opportunism that arises in business relationships [58].
 98 Accordingly, if opportunism is not a major threat between
 99 partners, the use of social control will hardly be economical.
 100 Hence, the moderating effect of social control should be
 101 less positive in a stable environment. Also, Chan, et al. [16]
 102 argue that a highly competitive market should strengthen
 103 the adoption of GCC, as the focal company needs to make
 104 more effort to satisfy the customer's increasing
 105 environmental demands. Extending this finding, this
 106 research assumes that the use of social control, which
 107 emphasizes information exchange and joint problem
 108 solving [5], enables the company to understand and respond
 109 to their customers more efficiently under a highly dynamic
 110 market. Hence, complementing Hypothesis 4 with the
 111 contextual variable, the following hypothesis of three-way
 112 interactions is proposed:

113

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

5 III. METHOD

6 A. Data Collection

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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

37 B. Measures

38 Based on a thorough review of the key literature in the
 39 field of Operations Management (OM), where most of the
 40 GSCM research appears, we first selected the appropriate
 41 measurement instruments that matched with our proposed
 42 constructs. The English version of the measurement scale
 43 was developed by the authors and then translated into
 44 Chinese by an experienced OM expert in China. Informed
 45 by comments from a semi-structured interview with our
 46 expert panel¹, we modified the original items and created
 47 some new ones. Then the refined Chinese version was
 48 translated back into English by the expert to ensure
 49 accuracy. The measurement items were all measured
 50 according to a seven-point Likert scale. The constructs in
 51 theoretical model were measured by the mean value of their
 52 corresponding items.

53

54 1) *Dependent Variable: Financial Performance (of the* 55 *focal company)*

56 In line with the key OM empirical literature (e.g., [62,
 57 63]), we measure the financial performance of the focal
 58 company by five indicators: return on asset, growth of sales,
 59 return on investment, growth in return on investment and
 60 profit margin on sales. The respondents were asked to
 61 compare their company performance regarding these
 62 indicators over the last three years (i.e. 2013 - 2015). The 7-
 63 point Likert scale for financial performance ranges from 1,
 64 for “decreased significantly” to 7, for “increased
 65 significantly.” Because most of the respondents do not
 66 represent listed companies, the audited financial data is not
 67 available to us. Therefore, using the perception scale is a
 68 more reasonable option for our investigation. Moreover, the
 69 measures for financial performance have been widely
 70 adopted in previous studies and the construct reliability of
 71 the measures is confirmed with Cronbach’s alpha = 0.855.
 72 In summary, the indicators of financial performance
 73 adopted in this study are reliable.

74

75 2) *Independent Variable: Green Purchasing and Green* 76 *Customer Cooperation*

77 The measures for both GP and GCC were adopted from
 78 the existing literature [14, 64], and have been used in many
 79 other recent OM studies across different country contexts
 80 (such as [22], [16]). Moreover, because this study focuses
 81 on Chinese manufacturers, Zhu et al.’s [14, 23, 64] green
 82 practice measures for Chinese manufacturers should be
 83 applicable in our study. Although the measures of green
 84 practices from existing studies are well developed and
 85 widely accepted, we modified and updated some contents
 86 based on the pilot research and comprehensive literature
 87 review. For example, this study obtained one item in GP
 88 (denoted as GP1) from the IBM Environmental Report [65];
 89 this concerns preventing upstream suppliers from
 90 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.

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

16

17 3) Contextual Factor and Moderator: Environmental 18 Dynamism and Social Control Mechanism

19 The scales for measuring the environmental dynamism
 20 were adopted from the previous literature [4]. The
 21 indicators of the item pool reflect the dynamism of the
 22 external environment in the following aspects: degree of
 23 market uncertainty, evolving technologies, end-consumer
 24 demand uncertainty and frequent changes in government
 25 environmental regulations. Items are assessed by
 26 respondents’ perceived level of agreement, ranging from 1,
 27 for “strongly disagree” to 7, for “strongly agree.” The
 28 construct is reliable, as its Cronbach’s alpha exceeds 0.7, at
 29 0.866.

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

42

43 4) Control Variables

44 This study also adopts four control variables that might
 45 have impacts on the firm’s financial performance, namely
 46 firm size, industry sector and geographic location. Most

47 existing OM researches consider firm size as a control
 48 variable on the financial performance. According to Zhao et
 49 al. [66], larger firms may have more resources to engage in
 50 supply chain activities so as to enhance performance. Also,
 51 the firm size might represent the company’s ability to
 52 leverage resources to manage external uncertainties.
 53 Following Zhu and Sarkis [13], this study measures firm
 54 size by the number of full-time employees according to a
 55 three-point scale (“1” represents fewer than 300 employees;
 56 “2” more than 300 but fewer than 2000 employees, and “3”
 57 more than 2000 employees). Regarding industry sector, we
 58 code electronic and other electrical equipment and
 59 components, except for computer equipment, as “1”, the
 60 pharmaceutical industry as “2”, and the automobile industry
 61 as “3” and other industry as “4.” The study also controls for
 62 the geographic locations of respondents. We collected the
 63 data from three major economic zones in China, namely
 64 Pearl River Delta (labelled as “1”), Yangtze River Delta
 65 (labelled as “2”) and Circum-Bohai-Sea Region (labelled as
 66 “3”).

67

68 IV. DATA ANALYSIS AND RESULTS

69 A. Assessing Reliability and Validity of Indicators

70 Because this study uses multiple items to measure each
 71 construct, a rigorous process was conducted to assess the
 72 construct reliability, uni-dimensionality, discriminant
 73 validity and convergent validity. The Cronbach’s alpha of
 74 our constructs all exceeded the benchmark value of 0.7,
 75 thus providing initial confirmation of the construct
 76 reliability. To further assess the construct reliability, the
 77 corrected item-total correlations (CITC) were checked. As
 78 shown in the Appendix A, all the CITC values were greater
 79 than 0.453 and exceeded the recommended value of 0.30
 80 [67].

81 In order to assess the uni-dimensionality of the indicators,
 82 we used two widely accepted methods, namely exploratory
 83 factor analysis (EFA) and confirmatory factor analysis
 84 (CFA) [68]. For EFA, principal component analysis with
 85 Varimax rotation was observed to initiate the factor
 86 structure. EFA confirmed the measures of adequacy of
 87 sampling, because the Kaiswer-Meyer-Olkin (KMO) was
 88 greater than 0.5, at 0.834, and the Bartlett’s test of
 89 sphericity was significant at 0.001 level with $X^2 = 2027.482$
 90 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.

1 suitable to proceed with factor analysis. This study obtained
 2 five factors with eigenvalues greater than one, explaining
 3 68.34% of the total variance. The indicators were strongly
 4 linked to our proposed latent variable, where the size of the
 5 factor loadings were all higher than 0.652. Moreover, there
 6 was no significant cross loading (the difference between
 7 respective factor loadings less than 0.10), which also
 8 indicates that the “*items were unidimensional with regard*
 9 *to our proposed constructs*” [68]. Also, to further confirm
 10 the uni-dimensionality, the overall model fit indices of the
 11 measurement model (i.e. CFA) were assessed, such as
 12 comparative fit index (CFI), non-normed fit index (NNFI),
 13 root mean square error of approximation (RMSEA) and
 14 normed chi-square (X^2/df). In the measurement model, this
 15 research established links between the indicators and
 16 respective constructs then freely estimated the covariance
 17 among all five constructs. Using SPSS AMOS 23, we found
 18 that the model fit indices indicated that the measurement
 19 model was a good fit (CFI = 0.977; NNFI = 0.972; RMSEA
 20 = 0.037; $X^2/df = 1.250$) [69]. In summary, both EFA and
 21 CFA demonstrated good uni-dimensionality of our
 22 measurement items.

23 Regarding the convergent validity, this study assessed
 24 the significance of the indicators with their corresponding
 25 constructs by *t-value* and average extracted variance (AVE).
 26 All *t-values* of the factor loadings in the measurement
 27 model were greater than the benchmark value of 2.0,
 28 ranging from 8.429 to 14.645 [69]. Additionally, the AVE
 29 values ranged from 0.538 to 0.723, thus exceeding the
 30 recommended value of 0.5. These results indicate the
 31 convergent validity. The discriminant validity was tested by
 32 comparing the square root of AVE for each construct with
 33 the inter-construct correlations. Chin [70] suggests that the
 34 square root of AVE should be greater than the inter-
 35 construct correlations. As shown in Table 2, the
 36 measurement model meets the criterion of discriminant
 37 validity. Furthermore, this research built CFA models for
 38 every possible paired latent variable. Then, X^2 difference
 39 test was used to compare the paired model with the result of
 40 the one-factor model [23]. As shown in the upper triangle
 41 of Table 2, the differences in the X^2 test of paired CFA
 42 models were all significant at 0.01 level, suggesting that the
 43 measurement model satisfies discriminant validity.
 44

45 B. Common Method Bias and Endogeneity

46 Owing to the fact that data were collected from a single
 47 respondent per firm, and were perceptual, common method
 48 bias might be a concern for this study. To check for the
 49 common method bias, three different tests were conducted.
 50 First, Harman’s one-factor test was used [71]. There were
 51 five factors with eigenvalues exceeding 1.0, accounting for
 52 68.34% of the total variance. Among these the first factor
 53 accounted for 30.06%, which is not the majority of the total
 54 variance [62]. Secondly, this study used CFA to further
 55 perform Harman’s single factor test. We established a
 56 single factor model linking all the indicators. This single

57 factor model was unfit (CFI = 0.428; NNFI = 0.364;
 58 RMSEA = 0.117; $X^2/df = 6.774$), and its results were much
 59 worse than the results of the measurement model, indicating
 60 that a single factor model was not acceptable, and the
 61 likelihood of common method bias was small [62, 63]. To
 62 reinforce the results of Harman’s one-factor test, this
 63 research operated an additional test following Paulraj et al.
 64 [72] and Widaman [73]. Two CFA models were tested, of
 65 which one had only the traits and one added a method
 66 factor in addition to the traits [62, 72]. The factor loadings
 67 were not much different between the two models and the *t*-
 68 values remained significant despite the inclusion of the
 69 method factor. Moreover, the method factor accounted for
 70 16.81% of the common variance and marginally improved
 71 the model fit [CFI by 0.04, NNFI by 0.05 and RMSEA by -
 72 0.004].

73 Finally, this study applied the “Marker-Variable” method
 74 as an alternative approach to further assess the potential
 75 common method bias [74]. The research adopted the
 76 recommended procedures and formulas provided by
 77 Malhotra, et al. [75]. First, firm’s supply chain position [76]
 78 was chosen as a marker variable (i.e. a variable that is
 79 theoretically unrelated to at least one variable in the model).
 80 As shown in Appendix B, the correlations between the
 81 marker variable and other constructs were small and
 82 insignificant at $p < 0.05$. Then, this study used the lowest
 83 positive correlation between marker variable and other
 84 variables ($r_a = 0.024$) to compute the adjusted correlation
 85 [75]. The results indicated that none of the significant
 86 correlations in zero-order correlations became insignificant
 87 after the adjustment (See Appendix B). In summary,
 88 common method bias is unlikely to be a threat to this study.
 89 Antonakis, et al. [77] argue that common method bias
 90 and simultaneity (reverse causality) are two of the major
 91 concerns in endogeneity. As verified in the previous section,
 92 common method bias was not a critical issue in this study.
 93 Regarding simultaneity, the problem exists when dependent
 94 variable and independent variable simultaneously impact on
 95 each other and have reciprocal feedback loops [78]. There
 96 is a substantial body of theoretical literature and logical
 97 arguments reflecting that the GSCM practices are linked
 98 with FP [14, 22]. Moreover, by reviewing 50 GSCM
 99 empirical studies in the emerging markets, and carrying out
 100 a rigorous meta-analysis, the positive effects of GP and
 101 GCC on FP were further confirmed [79]. Hence,
 102 simultaneity (reverse causality) is unlikely to be a problem
 103 in this context. This study also empirically tested whether
 104 endogeneity was a potential issue in the relationship
 105 between GSCM and FP. The Durbin-Wu-Hausman (DWH)
 106 test (i.e. augmented regression test) was performed to
 107 examine whether the GP and GCC were endogenous to the
 108 model [80]. Following Dong, et al. [81], this research first
 109 regressed GP and GCC on all controls respectively to
 110 obtain the residuals of each regression. Then, two
 111 augmented regressions were performed by using the
 112 residuals as additional independent variables. The results
 113 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: † $p < 0.1$ * $p < 0.05$ ** $p < 0.01$

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

5

6 B. Results

7 A multiple-step hierarchical regression model was
8 established to test the hypotheses. In the regression model,
9 this study first introduced three control variables in Model 1.
10 Then the main effects of GP and GCC on financial
11 performance (i.e. H1 and H2) were examined in Model 2.
12 H3 and H4 were tested in Model 3. Following and Liu
13 [82], Model 4 was built as a basis for the comparison
14 among models to obtain the significance of the change of
15 R^2 and F hierarchical value. The three-way interaction
16 among GSCM practices, environmental dynamism and
17 social control were tested in Model 5a and Model 5b. As
18 suggested by previous studies, in order to minimize the
19 threat of multi-collinearity, each variable in our model was
20 mean-centered before calculating all the interaction
21 products [82]. Also, this study used variance inflation factor
22 (VIF) and tolerance value to assess the potential multi-
23 collinearity issue. The VIF values of our results are all

24 below the threshold of 10 and the lowest tolerance value is
25 greater than the benchmarking value of 0.1 [69]. Therefore,
26 multi-collinearity is not a significant threat to our
27 regression analysis. The results with standardized path
28 coefficients, R^2 and F value are reported in Table 3.

29 In Model 1, no significant relationships between the
30 control variables and financial performance were found.
31 The model explains only 0.08 percent of the variance. Then,
32 the control variables and two main effects variables were
33 added into Model 2. GP ($b = 0.186$, $p < 0.05$) and GCC (b
34 = 0.235, $p < 0.01$) both positively impact on financial
35 performance, indicating that Hypothesis 1 and Hypothesis 2
36 are both supported. Model 2 also makes a significant
37 contribution over and above Model 1 (F hierarchical value
38 = 14.886, $p < 0.001$). Model 3, which tests the interaction
39 between the GSCM practices and social control mechanism,
40 makes a significant contribution over Model 2 (F
41 hierarchical value = 24.261, $p < 0.001$). The interaction
42 between GP and social control mechanism has a positive
43 and significant coefficient ($b = 0.236$, $p < 0.05$) on the
44 financial performance. However, the moderating effect of
45 social control on the relationship between GCC and
46 financial performance is not significant ($b = -0.183$, n.s.).

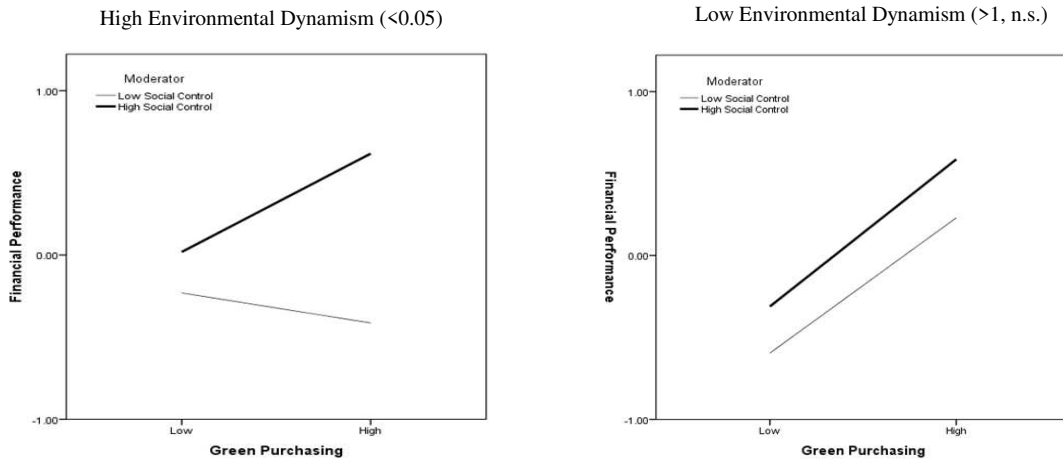


Fig. 2. Three-way interaction: Green Purchasing, Social Control and Environmental Dynamism

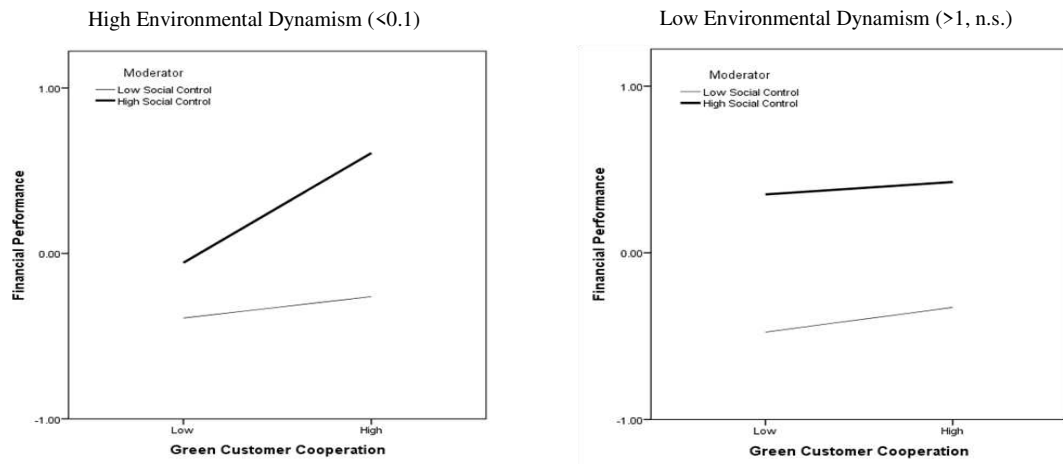


Fig. 3. Three-way interaction: Green Customer Cooperation, Social Control and Environmental Dynamism

1 Thus, Hypothesis 3 is supported, while Hypothesis 4 is not
 2 supported. Following Aiken and West [83], a simple slope
 3 test was performed to further confirm the moderating
 4 effects. The moderator was assigned the value of one
 5 standard deviation above and below its mean to indicate
 6 two levels of social control. According to the simple slope
 7 analysis, GP was more efficient when the company has
 8 higher social control. Specifically, the path coefficient of
 9 GP was highly significant under high social control ($b =$
 10 $0.2426, p < 0.05$), while it was not significant under low
 11 social control ($b = 0.0545, n.s.$).

12 Finally, in Models 5a and 5b, this study found significant
 13 and positive three-way interaction among GSCM practices,
 14 social control and environmental dynamism (GP: $b = 0.190,$
 15 $p < 0.05$; GCC: $b = 0.197, p < 0.05$). Also, the three-way
 16 interaction models (i.e. 5a and 5b) made a significant
 17 contribution over Model 4 in that the F hierarchal values
 18 were all significant at 0.05 level. Once again, this study
 19 used a simple slope test to check the three-way interactions.
 20 The conditional effect of the interaction between social
 21 control and GP was highly significant at high level of
 22 environmental dynamism ($t = 2.5258, p < 0.05$), while it

23 was insignificant at low level of environmental dynamism
 24 ($t = 0.3804, n.s.$), supporting Hypothesis 5. However, we
 25 found only a marginally significant interaction between
 26 social control and GCC at high level of environmental
 27 dynamism ($t = 1.8125, p < 0.1$). The two-way interaction is
 28 also insignificant at low level of environmental dynamism
 29 ($t = -0.5138, n.s.$), which is similar to the result for GP.
 30 Therefore, this study conclude that Hypothesis 6 is also
 31 supported. Graphs for the three-way interactions appear in
 32 Figure 2 and Figure 3.

33 Further, due to the relatively small sample size, Gpower
 34 v3.1 software was used to conduct power analysis as a
 35 robustness check to identify the required sample size for the
 36 hierarchical regression model. Following Engelen, et al.
 37 [84], this study conducted a post hoc statistical test for
 38 given alpha value, sample size and effect size. To explain
 39 the effect size of 0.2 [84], with an alpha of 0.5 and sample
 40 size of 185, an ideal statistical power of 99% from our most
 41 complex models (Model 5a and 5b) was received, which
 42 include thirteen predictors. This implies that the regression
 43 model has less than 1% probability of a non-significant
 44 finding that is actually significant [84]. Therefore, it can be

1 concluded that the sample size of this research has
2 sufficient power to explain the models.

3

4

V. DISCUSSION

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

29 Further, considering the characteristics of the business
30 environment in China, this study examines the moderating
31 role of social control in the relationship between GSCM
32 and financial performance. This proposition is in line with
33 the SET that the economic transaction focuses not only on
34 the economic factor, but also on the social factor. The result
35 of multiple regression analysis shows that the moderating
36 effect of social control on the relationship between GP and
37 financial performance is positive and significant. This
38 suggests that when the company is implementing activities
39 of GP, strengthening social control over their chain
40 members is helpful to maximize the economic outcome of
41 that GP. A possible explanation is that Chinese companies
42 normally do not have advanced information systems to
43 exchange information with their local suppliers [85], so
44 they might have alternative ways to communicate with each
45 other, such as carrying out information exchange on an
46 informal relationship basis rather than through formal
47 systems [86]. As GP is a monitoring practice that is highly
48 information-driven, the greater social control might ensure
49 the efficiency of information exchange in the activities of
50 GP so as to enhance the financial performance. Moreover,
51 contrary to our expectation, this study does not detect a
52 significant moderating effect of social control on the
53 relationship between GCC and financial performance. This
54 surprising result indicates that the social control mechanism
55 might not be a necessary motivator of GCC to bring greater

56 financial performance. The insignificant moderating effect
57 of social control highlights the fundamental role of GCC in
58 achieving better economic performance, which is consistent
59 with the finding of Larri et al. [26]. It seems that the
60 motivating effect of social control on the GSCM-financial
61 performance relationship is not supported. However, this
62 study argues that such an unexpected result needs to be
63 further investigated from the perspective of CT.

64 In order to get a deeper understanding of the joint effect
65 of social control and GSCM, this study also examines a
66 contextual factor, namely, environmental dynamism. As
67 expected, the significant results of the three-way interaction
68 show that the positive moderating effect of social control on
69 the relationship between GSCM (including both GP and
70 GCC) and financial performance is strengthened when the
71 environmental dynamism is high. According to Yeung et al.
72 [87], the fundamental need of any company in a dynamic
73 manufacturing environment is to "*apply an effective*
74 *process assurance system and to be proactive in taking the*
75 *initiative to make improvements.*" This study suggests that
76 the success of GSCM in the dynamic environment requires
77 social control to improve financial performance. On the
78 other hand, based on the simple slope analysis, this study
79 finds that the moderating effects of social control in the
80 GSCM-performance relationship are insignificant in a
81 stable environment (i.e. low level of environmental
82 dynamism). This result provides a fascinating perspective
83 for understanding the role of social control in GSCM.
84 Regarding GCC, the result implies that in a stable
85 environment (i.e. low level of environmental dynamism),
86 applying social control might not be efficient to promote
87 financial performance. A possible explanation is that using
88 social control to cooperate with business partners could be
89 costly in a stable environment. Such a conclusion partially
90 supports Zhu et al. [15], who find an inconclusive
91 moderating effect of customer relational governance on the
92 relationship between GSCM and economic performance. In
93 addition, to avoid financial loss, the result demonstrates the
94 necessity of using social control in monitoring the
95 supplier's green activities. As shown in Figure 2,
96 surprisingly this study finds a negative association between
97 GP and financial performance in a dynamic environment
98 when a company invests less effort in social control. A
99 possible explanation is that if the buyer lacks social control
100 over their suppliers, the highly unstable environment may
101 encourage the suppliers' opportunism in green activities,
102 such as by fraudulently reporting the "carbon emission
103 level" or even deliberately hiding the information regarding
104 pollutant discharge. It is not difficult to imagine that if there
105 is no trust-based relationship between buyer and supplier in
106 an uncertain environment, the supplier might engage in
107 more opportunistic behavior to pursue their own benefit,
108 resulting in a negative impact on the buyer's financial
109 performance.

110

1 A. Contribution to the Literature

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

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

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

53 Fourth, this study also responds the call for integrating
54 sustainability with supply chain resilience, which
55 characterized by "*business continuity*" [89]. This study
56 argues that to ensure the design of sustainable supply chain

57 remain unaffected or minimally affected in an environment
58 that characterized by frequently avoidable disruptions, it is
59 necessary for the firms to embrace social control. By
60 integrating the effective governance mechanism like social
61 control in planning the sustainable supply chain, the result
62 of our three-way interaction analysis provides empirical
63 evidence that not only could firms ensure the business
64 continuity when environmental dynamism is high, but firms
65 could even take the advantages of highly dynamic
66 environment to improve their performance.

67

68 B. Managerial Implications

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

90 Last but not least, managers should understand how to
91 adopt social control effectively in the implementation of
92 GSCM under the contextual factor of a dynamic
93 environment, which is characterized by frequent and rapid
94 changes induced by technology, government policy,
95 customers, and suppliers. Literature suggests that in order
96 to reflect the real world situation, managers and researchers
97 should extend their research model by including these
98 contextual factors, since a bivariate or even trivariate
99 relationship may not be comprehensive [9]. This study
100 offers practitioners a more in-depth statement to explain the
101 GSCM-performance relationship. It suggests that when a
102 company's external environment is dynamic, it is necessary
103 for the managers to apply social control with both GSCM
104 practices, i.e. GP and GCC, to promote their financial
105 performance. On one hand, this study recommends that
106 managers should take advantage of the positive aspect of a
107 dynamic environment. However, the effectiveness of social
108 control in GSCM might be contingent on external
109 circumstances. Practitioners should realize that the
110 combination of GSCM and social control might not be
111 efficient under a stable environment (as shown in Figure 2
112 and Figure 3). If managers cannot correctly assess their

1 external environment, they might not get the expected
 2 return from investing in such a combination. In this case,
 3 our items that measure the environmental dynamism could
 4 assist managers to evaluate their external environment.

5

6

VI. CONCLUSION

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

27 Although this study offers some important contributions,
 28 the research findings and implications should be considered
 29 in the light of several limitations. First, we need to clarify
 30 that although social control is a governance mechanism that
 31 primarily relies on the informal means, it is not same with
 32 the concept of Guanxi, which is which is a unique people
 33 based connection aspect in Chinese business [91]. Second,
 34 similar to other relevant studies in GSCM [22], this paper is
 35 limited by a relatively small sample size. Although the
 36 power analysis indicates that our sample has sufficient
 37 statistical power to explain the regression model, the future

38 research is recommended to verify our model in a larger
 39 sample. A third limitation is that when empirically testing
 40 the causality, this study investigates only the cross-sectional
 41 data. Future research could conduct a longitudinal study to
 42 investigate the dynamic relationships among the concepts
 43 studied in this paper. Moreover, in our paper, we have
 44 addressed endogeneity by the augmented regression
 45 approach. However, given growing consideration on
 46 endogeneity in survey study, we suggest future research
 47 could also adopt other advanced approach, for example, the
 48 matched control groups method [92, 93]. Forth, as this
 49 research investigates only the Chinese manufacturing
 50 industry, the generalizability of the results is another
 51 limitation. Future research could resolve this issue by
 52 examining our model in different regions to improve the
 53 generalizability. Fifth, this research consider only social
 54 control as a motivator of GSCM. As an alternative to social
 55 control, formal control that emphasizes the contractual
 56 system could also be a significant governance mechanism
 57 in GSCM. Therefore, future research may benefit from
 58 exploring the moderating roles of different governance
 59 systems in the relationship between GSCM and firm
 60 performance. Sixth, the selection of the variables that
 61 deviated from SET and CT is incomprehensive. Many other
 62 elements of SET can be considered in the future research,
 63 such as reciprocity, solidarity, trust, power and commitment,
 64 *etc.* [94, 95]. Moreover, to more precisely measure the
 65 dynamic environment, we suggest the future research can
 66 take multiple constructs (such as supply and demand
 67 uncertainty, competitive intensity and technological
 68 turbulence) into account [96, 97]. Finally, the adoption of a
 69 subjective scale to measure firm's FP, due to issues
 70 regarding data availability, represents a possible limitation
 71 of this study. Although the scales used to measure FP in
 72 this study have been widely adopted in previous literature,
 73 future researches should address this concern by adopting
 74 objective data (i.e. audited and published financial data), or
 75 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:

** $p < 0.01$

* $p < 0.05$

RERERENCE

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