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Abstract

From a task-technology fit perspective, green SCM and green IS are likely to have synergistic effects on corporate sustainability. Yet, the exact mechanisms through which their perceived alignment by employees may exert influences on organizational performances are unclear. This study captures potential enablement and coverage routes at different development stages of sustainability with fit-as-mediation and fit-as-moderation, respectively. The results based on the observations collected from more than 400 organizations in the USA and China suggest that the perceived fit gradually shifts from a moderator role to a mediator role as the two green endeavors integrate with each other.

Keywords: green supply chain management; green information systems; corporate sustainability; fit-as-moderation; fit-as-mediation; development stages.

Introduction

Essential to competitive advantage and social responsibility, corporate sustainability aims to conserve resources and reduce pollutions in production and distribution processes (Andersen and Skjoett-Larsen, 2009; Khan et al., 2017). For this purpose, many organizations implement green supply chain management (GSCM), which also enhances productivity in the long run (Rao and Holt, 2005). The success of such green innovation is indispensable from the use of information technology (Melville, 2010; Sarkis, Zhu and Lai, 2011). In particular, green information systems (GIS) support a variety of organizations' activities for corporate sustainability (Dedrick, 2010; Nanath and Pillai, 2017; De Camargo Fiorini and Jabbour, 2017). Within an organization, the establishment of GIS allows it to allocate resources more efficiently for daily operations (e.g., product design, manufacturing, and logistics) to achieve environmental goals (Chen, Boudreau and Watson, 2008). Beyond internal operations, the information flows facilitated by information and communication technologies (ICT) enable companies to extend GSCM to external cooperation with upstream suppliers and downstream customers (Green, Zelbst, Bhadauria and Meacham, 2012).

Separately, researchers have examined how GSCM or GIS affect organizational performances. For instance, it is recognized that GSCM may significantly improve the environmental performance, as well as corporate image and competitive advantage (Rao and Holt, 2005; Chiou, Chan, Lettice and Chung, 2011). Meanwhile, the relationship between GIS and corporate sustainability increasingly draws the attention from researchers (Watson, Boudreau, and Chen, 2010; De Camargo Fiorini and Jabbour, 2017; Frehe and Teuteberg, 2017). However, few

have examined how GIS and GSCM together influence the outcomes of green endeavors (Asadi and Dahlan, 2017).

The understanding of the interplay between GSCM and GIS is important for the optimization of corporate sustainability. In an organization, GSCM and GIS are implemented by different departments, but the coordinated effort of employees is likely to maximize the effectiveness of both. To streamline different activities in supply chain management, for instance, Walmart uses an IT aggregation strategy to locate servers in a single data center or running several systems on one server based on virtualization, and such an alignment between GSCM and GIS contributes to positive environmental outcomes (Boudreau, Chen and Huber, 2008). Except for a few case studies, however, there lacks empirical evidence to convince decision-makers of the importance to align GSCM and GIS.

The motivation of this study is to find out how the perceived fit between two different but interconnected green endeavors by employees affects the effectiveness of their effort on both. The premise is that employees are more likely to engage in GSCM and GIS endeavors when they find the two aligned with each other. Yet, the effect of alignment may take various theoretical routes, such as fit-as-mediation and fit-as-moderation, which has different implications for practices (Venkatraman, 1989). Hence, the research question is which mechanism works the best for an organization at a particular development stage of sustainability to optimize sustainability outcomes?

To answer the question, the study consults the literature on GSCM and GIS, as well as task-technology fit and organizational alignment studies. Based on different alignment

conceptualizations, it discusses the potential roles that the perceived fit between GSCM and GIS by employees may play in organizational green endeavors. Then, it describes the natural experiment methodology to collect empirical observations from organizations at different development stages of sustainability. Based on the results of statistical analyses, theoretical and practical implications of the findings are discussed.

Research Background

Researchers introduced the concept of alignment in the field of management to investigate the fit between business strategy and organizational structure (Jordan and Tricker, 1995; Grøgaard, 2012). IS researchers extended the construct to study the alignment between task requirements and system characteristics in the form of task-technology fit (Goodhue and Thompson, 1995; Lin and Huang, 2008). The basic premise of task-technology fit model (TTFM) is that when an information system is capable of meeting task needs, both technology use and task performance are enhanced (Goodhue and Thompson, 1995).

Although the level of analysis is individual in the original TTFM, scholars have applied the model in group-level (Fuller and Dennis, 2009) and organization-level studies (Strong and Volkoff, 2010). In those studies, tasks are organizational endeavors instead of individual assignments, and technologies pertain to enterprise systems rather than single-user applications (e.g., Microsoft Office). The extension is theoretically sound as the task-technology fit construct is rooted in the alignment concept at the organizational level.

Researchers view GSCM as a strategic move for an organization to improve its capability

of environment protection and corporate sustainability (Srivastava, 2007). The implementation of GSCM has a far-reaching impact on how organizations run their business (Sarkis et al., 2011). Meanwhile, GIS provides the technical means to support such a long-term mission (Chen et al., 2008; Melville, 2010). Most organizations that are successful in GSCM have also implemented strong IT infrastructure (Boudreau et al., 2008). Based on the premise of TTFM, therefore, the alignment between GSCM endeavor and GIS technology is likely to enhance organizational performances.

Despite the lack of empirical evidence in the impact of such an emerging form of technology-task fit, researchers have examined how GSCM and GIS influence organizational performances separately. In the operation and production management literature, for instance, it is found that GSCM enhances the economic performance and competitive advantage of organizations in addition to its positive impact on the environment (Rao and Holt, 2005). On the technology side, the initial focus is on the energy conservation aspect directly related to organizational computing (Velte, Velte and Elsenpeter, 2008). From a socio-technical perspective, the adoption of information technology leads to structural and even cultural changes in organizations (Eason, 2005). Correspondingly, it is found that the implementation of GIS has profound impacts on a company's operation, management, and strategy (Loos et al., 2011). However, it remains a question how the interplay between GSCM and GIS may affect organizations in their pursuit of traditional business goals and the fulfillment of additional environmental responsibilities.

GSCM aims to reengineer the whole supply chain from upstream procurement and

production to downstream logistics and recycling to improve the efficiency of resource utilization and reduce environmental footprints (Min and Galle, 1997). In recent years, researchers pay attention to the impacts of GSCM on organizational performances, especially from the economic and environmental aspects (Green, Zelbst, Meacham and Bhadauria, 2012). The implementation of green strategy with GSCM requires the support of ICT (Ozturk et al., 2011). Even before the environmental movement, researchers have recognized the critical role that information systems play in facilitating information flow to improve the efficiency of supply chain activities, including procurement, production, distribution, and recycling (Darnall, Jolley and Handfield, 2008). More recently, researchers suggest that the implementation of GIS is closely related to corporate strategy, managerial structure, and business operations (Olson, 2008), and the actual use is embedded in both internal and external contexts, such as organizational cultures, market competitions, and business partnerships (Chen et al., 2011).

Despite the valuable insights that they provide, prior discussions on GSCM and GIS are largely separated from each other. They share the common sustainability mission, but it is unclear how their alignment may affect organizational performances. There is a need for theoretical discussions on the mechanisms involved, as well as empirical observations to find out which prevails in each circumstance. The next section examines different ways to conceptualize the roles that perceived GSCM–GIS fit may play in green endeavors.

Perceived Fit and Green Efforts

From the perspective of contingency theory, an organization needs to achieve alignment

among its subsystems as well as with the environment (Weill and Olson, 1989; Huo, Zhang and Zhao, 2015). GSCM and GIS can be viewed as two important subsystems that fit with each other to cope with external pressures (e.g., regulation and competition). The term of “fit” implies that such related subsystems are the objects of design to be matched for synergy in context (Livari, 1992). There are different ways to conceptualize alignment, in particular fit-as-moderation, fit-as-mediation, fit-as-matching, fit-as-gestalts, fit-as-profile-deviation, and fit-as-covariation, with distinct theoretical meanings and specific analytical schemes (Venkatraman, 1989).

Among them, fit-as-profile-deviation and fit-as-matching are directly related to how alignment itself is operationalized. Based on such approaches, a few studies operationalize fit by comparing the characteristics of task and technology (e.g., Schniederjans and Cao, 2009; Yang et al., 2018). The most common perceived task-technology fit construct, on the other hand, captures the extent to which the technology in question matches the demand of a task from the user perspective (e.g., Fuller and Dennis, 2009). Most studies that employ the construct focus on how it influences user performance without looking into the specific task and technology characteristics (Koch, 2011; Orlikowski and Iacono, 2001). The modeling of the direct fit-performance relationship is simple and straightforward but leads to some unexpected findings in empirical studies, such as the negative correlation between perceived fit and user performance (Davern, 1996). Therefore, the motivation of this study is to find out whether the perceived alignment between GSCM and GIS by employees matters to an organization that implements them, and if so, how?

The key element of inquiry lies in the modeling of the relationships concerning perceived

GSCM–GIS fit that truly reflects the roles that it may play, especially in association with relevant employee efforts. This study goes beyond simplistic modeling by including both GSCM and GIS efforts to control for the effect of their perceived fit and model possible mediating and moderating relationships corresponding to its different roles. In addition, external pressures may come into play as a motivating force as the contingency theory claims (Weill and Olson, 1989). For corporate sustainability, the development stage of the country in which an organization operates largely determines its competitive and regulatory environment (Cummings and Worley, 2014). It is possible that employees behave differently under different circumstances despite similar levels of perceived fit. Therefore, this study compares different relationships to find out which one is more salient in each context.

Mediation and moderation have different implications for theory development regarding the role that perceived fit plays. In a study of the alignment between organization and enterprise system, Strong and Volkoff (2010) suggest that there are two routes of influence: 1) enablement – the implementation of technology makes certain business operations possible; and 2) coverage – the technology provides the features that complement the business operations in question. Fit-as-mediation captures the enablement route as the alignment is necessary for both task endeavor and technology facilitation to take effect on organizational performances. Meanwhile, fit-as-moderation captures the coverage route as the alignment may strengthen or weaken the effectiveness of task- and/or technology-related effort.

The corresponding relationship between the theoretical conceptualization and statistical modeling of enablement and coverage roles that GSCM–GIS fit may play makes it possible to

compare their salience in different circumstances with empirical observations. Organizations may follow a strategy corresponding to the primary mechanism through which such an alignment takes effect. If GSCM–GIS fit mainly plays an enablement role, it is important to integrate GSCM activities and GIS functions into business processes that employees carry out on a daily basis. If the coverage role is dominant, however, organizations may focus on the implementation and training of GIS functions that support GSCM activities.

GSCM and GIS are for the common ecological goal, and the implementation of both may yield synergistic effects. At an initial development stage of sustainability, an organization may implement two independently. When an organization implements GSCM first, for instance, employees are likely to continue related practices even if the later implementation of GIS appears somewhat misaligned. If so, the alignment between GSCM and GIS is likely to play a moderator role that implies their complementary coverage. In terms of behavioral explanation, moderation suggests that employees are more willing to participate in GSCM- and GIS-related activities when they perceive a higher degree of alignment.

On the other hand, mediation implies that employees are hesitant to put their efforts into GSCM and GIS unless they find the fit between them. This occurs when GSCM and GIS are closely knitted together through mutual adaptation. At such a mature development stage of sustainability, people may find it difficult to carry out effective green endeavors without the employment of both GSCM and GIS. In this case, the perceived fit between them is likely to play a mediator role that implies interdependent enablement. Therefore, the specific mechanisms through which perceived fit between GSCM and GIS takes effects depend on the maturity of

corporate sustainability.

Research Model

A moderating/mediating relationship involves the direct relationships that the independent variable and moderator/mediator have with the dependent variable in question (Baron and Kenny, 1986; Preacher, Rucker and Hayes, 2007). The research model in Figure 1 depicts the direct relationships that GSCM effort and GIS effort have with sustainability-related performance, the moderating effects that perceived GSCM–GIS fit has on the direct relationships from the beginning, as well as the mediating relationships that emerge later.

- Figure 1 about here -

Driven by the pressures from the external stakeholders including clients/customers, government, shareholders, nongovernmental organizations, and the community, the implementation of GSCM leads to the optimization of supply chain and operational performance (Laosirihongthong et al., 2013; Wolf, 2014; Tseng, 2015). In particular, GSCM effort is conducive to corporate sustainability from both economic and environmental aspects by saving energy and materials and reducing waste and emission (Chiou et al., 2011; Geng et al., 2017). Meanwhile, most enterprises engaging in ecological endeavors are socially responsible and care about their social image (Shaukat et al., 2016). Based on the external communication and collaboration through GSCM, organizations have a better understanding of public needs and provide safer and more environment-friendly products and services (De Giovanni, 2012; Wolf, 2014; Khan and Qianli, 2017). Hence, the following hypothesis:

H1: GSCM effort enhances sustainability performance.

Bharadwaj's (2000) resource-based view of information systems suggests that organizations acquire, configure, deploy, and leverage IS resources to support business strategy and enhance value chain capability. Accordingly, GIS can be viewed as a resource that an organization uses to promote its green strategy by streamlining information flow and sharing it among functional units and business partners (De Camargo Fiorini and Jabbour, 2017). The resulted organizational changes, especially business process design and reengineering, often lead to the improvement of productivity and efficiency, as well as faster responses to the ecological needs from customers and society for environment-friendly products and services (Bergenwall, Chen and White, 2012; Masa'deh et al., 2017). Thus, the use of GIS is found positively associated with corporate sustainability (Yang et al., 2017). Below is the second hypothesis:

H2: GIS effort enhances sustainability performance.

Leonard-Barton (1998) considered technology–organization fit as a process of mutual adjustment between the implementation and adaptation of technology and the determination and execution of organizational strategies. As a strategic endeavor, GSCM comprises complex managerial activities that are almost impossible without IT support (Ruppel, 2004). The basic premise of TTFM is that the fit between task characteristics and technology features influences not only technology use but also task performance (Goodhue and Thompson, 1995). Extending TTFM to the organizational level, researchers found that how IT infrastructure/capability is aligned with organizational mission/strategy makes a big difference in organizational effectiveness (Wilden, Gudergan, Nielsen and Lings, 2013). As the basis for modeling both moderating and mediating

relationships, a direct relationship is hypothesized between the alignment between GSCM and GIS and outcome variable:

H3: GSCM–GIS fit enhances sustainability performance.

It is found that the alignment between business and IT moderates their relationships with organizational performances (Byrd et al., 2006). Studies show that business-IT alignment influences the operations of organizations as it reflects how well the technological resources are utilized to support business activities (Henderson and Venkatraman, 1999; Tallon, Kraemer and Gurbaxani, 2000; Ryoo and Koo, 2013). GSCM and GIS activities involve different stakeholders within and across organizations along the upstream and downstream of a supply chain, such as suppliers, manufacturers, distributors, and customers (Zhang, Xue and Dhaliwal, 2016). The alignment between them, therefore, is a dynamic process of adaptation between the environment-oriented business operations and IT support functions (Luftman and Brier, 1999; Peppard and Breu, 2003). If there is a high level of perceived fit between GSCM and GIS, the relationship between each and sustainability performance is likely to be strengthened.

H3.1mod: GSCM–GIS fit moderates the relationships between GSCM effort and sustainability performance.

H3.2mod: GSCM–GIS fit moderates the relationships between GIS effort and sustainability performance.

Most existing studies treat the alignment between business and IT in organizations as a mediator that depends on the effort of both. On the technology side, Reich and Benbasat's (2000) study found that IT implementation is critical to business-IT alignment. On the business side,

however, it is less obvious that GSCM effort leads to its alignment with GIS effort as the latter is supposed to support the former. When the implementation of GSCM and GIS deepens, nevertheless, it is possible that organizations identify the misalignment between two and figure out the ways to improve their fit from both sides for better sustainability performance (Luftman, Papp and Brier, 1999). Such a trend that both sides of alignment have significant effects on their fit becomes salient when GSCM effort and GIS effort integrate with each other.

H3.1med: GSCM–GIS fit mediates the effects of GSCM effort on sustainability performance.

H3.2med: GSCM–GIS fit mediates the effects of GIS effort on sustainability performance.

Finally, contextual factors make a difference in the relationship between green endeavors such as GSCM and sustainability performance (Wolf, 2014). Organizations are at different development stages of sustainability in emerging and mature economies that have distinct emphases on industrial ecology (Morse, 2008). Companies in developed countries are likely to implement GSCM and GIS earlier than those in developing countries. When SCM and IS practices are well in place, they tend to integrate with each other in terms of process, partnership, and reliability to cope with environmental uncertainty for performance enhancement (Vijayasarathy, 2010). Through the alignment between GSCM and GIS as a mediator, therefore, employee efforts on both sides take effect on sustainability performances. When both are still under development, however, how willing employees are to participate in each may vary based on the perceived fit between them, suggesting a primary moderator role. Thus, the development stages of sustainability are likely to make differences in the relative salience of moderating and mediating

effects of GSCM–GIS fit.

Methodology

To test the hypothesized relationships, a natural experiment was conducted to collect survey observations from organizations that vary in the maturity of their green endeavors. The target population includes organizations in the USA and China, the biggest mature and emerging economies, respectively. Despite their common ecological concerns, the two countries are at different development stages of sustainability. According to the latest report on the environmental performance index of all the countries, the USA was ranked 26th with the score of 84.72, whereas China was ranked 109th with the score of 65.1 (Hsu et al., 2016). As an emerging industrial powerhouse, China faces an enormous challenge to strike a balance between economy and environment (Dou, Sarkis and Bai, 2015). For organizations in different industries, sustainability is not just a buzzword but may determine their future of success or failure due to tightening law enforcement and market competition (Zhang, 2011). Compared with the on-going development in China, corporate sustainability in the USA has evolved over the years yet still remains challenging because of large cross-border and overseas business operations (Peng, 2016).

Construct Measurement

Both GSCM effort and GIS effort comprise multiple aspects of activities. The main activities of GSCM include eco-design (ECO), supply chain process (SCP), and internal environment management (IEM), and each is measured with multiple items adapted from Lee,

Kim, and Choi’s (2012) study. GIS is mainly used for pollution prevention (PP), product stewardship (PS), and sustainable development (SD), and their measures are adapted from Gholami et al. (2013) and Daugherty et al. (2005).

Similarly, sustainability performance has multiple aspects. In particular, environmental performance, economic performance, and social performance correspond to the triple bottom lines of sustainability in terms of planet, profits, and people (Savitz and Weber, 2014). Environmental performance measures were adapted from Gholami et al.’s (2013) and Chiou et al.’s (2011) studies. Economic performance was measured with the items developed by Daugherty et al. (2005). The measurement of social performance was based on Albinger and Freeman’s (2000) and Greening and Turban’s (2000) studies.

Finally, the measurement of GSCM–GIS fit is developed based on the perceived task-technology fit scale from Lin and Huang (2008). The Appendix gives the measurement items used in this study, among which all the Likert-scale items have five levels. For GSCM- and GIS-related items, the levels indicate the extent to which participants agree with a statement (i.e., 1- strongly disagree, 2-disagree, 3-uncertain, 4-agree, and 5-strongly agree). For performance measures, the levels stand for the degrees of impacts that explanatory variables have on organizational performances (i.e., 1-no impact at all, 2-little impact, 3-some impact; 4-significant impact, and 5-very significant impact).

Table 1 summarizes the definitions of constructs and their dimensions for examining the content validity of individual measurement items, as well as their relationships with latent constructs/dimensions. GSCM effort and GIS effort are multidimensional constructs, whereas the

other constructs are unidimensional. The indicators of a multidimensional construct are formative by nature as they contribute differently to construct formation (Edwards, 2001; Petter, Straub and Rai, 2007). In contrast, reflective indicators are “caused” by latent constructs, all of which are supposed to be unidimensional (Jarvis, MacKenzie and Podsakoff, 2003). For instance, GSCM–GIS fit is a reflective latent variable as participants' responses to its measurement items manifest how well they perceive that two organizational endeavors align with each other. Similarly, economic performance, environmental performance, and social performance are unidimensional, and the items of each indicate employee perception of sustainability performance from each aspect.

A close look at the instruments of GSCM effort and GIS effort suggest that there are common dimensions of their corresponding components along which they may be aligned with each other. The items of ECO and PP deal with resource consumption, waste control, and hazardous materials. SCP and PS scales capture input acquisition of, output distribution and remanufacturing process. The instruments of IEM and SD cover the aspects of cross-functional integration, managerial support, and legal compliance. As different dimensions contribute to overall GSCM and GIS efforts, this study adopts the formative-first-order-and-formative-second-order approach. As shown in Figure 2, the measurement model contains the higher order formative constructs that predict different sustainability performances together with perceived GSCM–GIS fit (unlike a confirmatory factor analysis model that correlates all reflective constructs).

- Figure 2 about here -

Sample

Based on the initial contacts drawn from two industrial park directories as well as three executive and online MBA programs, 598 participants were elicited. The invitation letter or email asked participants whether their organizations had implemented any GSCM and GIS functions, and if not, to provide other contacts. About two thirds of the observations were collected with onsite interviews and the rest through an online survey with follow-up email reminders. There were a total of 462 completed questionnaires, and the response rate was 77%. Among them, 417 were valid as the respondents reported that their organizations indeed used information systems for green purposes. Thus, the final sample accounted for 70% of total questionnaires distributed and 90% of all the responses collected.

Among the observations, 311 were collected in China and 106 in the USA. The two country samples allow the comparison of the moderating and mediating roles that perceived GSCM–GIS fit plays at different development stages of sustainability with the multi-group analysis (MGA). The main statistical tool used, structural equation modeling (SEM) based on partial least squares (PLS), is more capable of handling both formative and reflective latent constructs than covariance-based SEM, especially the formative-formative hierarchical component models (HCM) for GSCM and GIS efforts (Wetzels, Odekerken-Schröder and van Oppen, 2009; Hair, Hult, Ringle and Sarstedt, 2016). According to Hair et al.'s (2016) 10-times rules, the sample size for PLS needs to be at least 10 times the largest number of formative indicators used to measure one construct or structural paths directed at a particular construct in the

structural model. With the formative-first-order-and-formative-second-order HCM approach, there are nine formative indicators for either GSCM or GIS effort using the repeated-indicator approach. The required sample size is 90, and the smaller USA sample still exceeded it by a margin of 16.

With the estimated effect size from PLS, this study assesses the sample size adequacy following Hair et al.'s (2016, p. 26) recommendation based on Cohen's power theory. For the estimated model based on the smaller USA sample, the minimum *R*-squared value was 0.501. With the maximum 9 exogenous variables (i.e., formative indicators), minimum *R*-squared of 0.50 and significance level of 0.05, a sample size of 26 is adequate to achieve an 80% statistical power. In addition, a post-hoc G*Power analysis indicated that the statistical power was well above the 0.8 threshold.

To assess potential nonresponse bias, Chi-square tests were conducted to compare participating organization profiles (i.e., industry, years in business, and size) across the onsite interview group (which had a higher response rate over 90%) and online survey group (which had a lower response rate close to 60%). None of the tests were statistically significant at the 0.05 level, indicating that the profile distributions of participating organizations were mostly independent of the data collection methods associated with different response rates. Thus nonresponse bias is not evident in the observations.

Table 2 reports the profile of participating organizations that indicates a good mixture of sizes, industries, and years in business. In the China sample, a little bit less than 50% of them were small and medium businesses that have less than 500 employees, and another half were larger

companies that have more than 500 employees (almost 15%) or even 1000 or more (almost 40%). Just one out of seven organizations came from the manufacturing industry, doubled by those from other traditional industries including energy, real estate, and transportation. The rest 55% were from the emerging IT industry, service industry, and other industries. Almost 40% of the organizations were in business for 10 to 20 years. Among the rest, about half were relatively new (i.e., under 10 years) and the others were rather established (i.e., more than 20 years).

- Table 2 about here -

In the USA sample, the organizations were relatively mature with over 70% in business for more than 20 years. The participating organizations were mostly of service-oriented industries (e.g., logistics and distribution, and service), compared to those in the China sample that were more production-oriented (e.g., manufacturing, energy, real estate, and IT). Similarly, however, about 40% were large organizations that have more than 1000 employees, and the rest were small and medium enterprises.

Survey Design

For the questionnaires used in China, the authors translated all measurement items into Chinese. Then, a certified translation service translated them back to English. The back-translated questionnaires were reviewed by several native English speakers and none of them indicated difficulty to understand the questions. They also read the original English questionnaire and they did not see any significant deviations between the two versions.

In this study, over 90% of the participants were the managers in supply-chain-related areas

(e.g., sales, manufacturing, R&D, and logistics) and they were familiar with GSCM activities but not necessarily aware of all kinds of GIS activities. To elicit more accurate responses, the questionnaire included check-box questions on common GIS activities at the beginning for participants to identify which ones were actually implemented in their organizations. Compared with other Likert scale items, the check-box questions have more objective connotations, which help to mitigate the common method bias (CMB) associated with the survey methodology to some extent (Podsakoff, MacKenzie and Podsakoff, 2012). What is also recommended for controlling CMB is to elicit responses from diversified participants who know the subject well through appropriate procedures (Podsakoff et al., 2012). The survey instruction informed the participants from different industries that there were no right or wrong answers, and their responses would be kept anonymous and confidential.

Results

The main statistical analysis tool used in this study is SmartPLS 3.2.7 (Ringle et al., 2015). This study follows the recommended two-step approach to validate measurement models before testing structural models (Hair, Ringle and Sarstedt, 2011). The first step evaluates the aforementioned integrated measurement model in Figure 2 with combined observations from the USA and China, and the second step tests hypothesized relationships of different natures involving one outcome variable at a time with each country sample. Model estimation at both steps utilizes the factor weighting scheme recommended for HCM (as GSCM effort and GIS effort are higher-order constructs) rather than the default path weighting scheme (Hair, Sarstedt, Ringle and

Gudergan 2017). The regression weights of formative indicators and factor loadings of reflective indicators remained about the same across two samples as well as two steps, providing supporting evidence of measurement model robustness.

Table 3 reports the estimates of the measurement model. All regression weights for formative indicators were positively significant at the 0.01 level (one-tailed), suggesting that every one of them was important and ineliminable. Meanwhile, the formative indicators of each construct are not supposed to be highly correlated with each other or they should be merged. None of the variance inflation factors (VIFs) were greater than 5, indicating that the multicollinearity was not a concern (O'Brien, 2007; Hair et al., 2016). At the higher level, not much multicollinearity was detected among ECO, SCP, and IEM for GSCM effort as well as PP, PS, and SD for GIS effort. The results supported the measurement validity of both variables as formative-first-order-and-formative-second-order constructs.

For reflective indicators, all factor loadings were above 0.7, leading to the average variance extracted (AVE) above 0.5 and composite reliability (CR) as well as Cronbach's alpha above 0.7 for each construct. This provides supporting evidence of convergent validity. For the assessment of other aspects of measurement validity, Table 4 reports the descriptive statistics of latent constructs and their correlations. Across the two country samples, the response patterns were generally consistent: participants gave relatively positive scores with reasonable variability, and correlations exhibited similar patterns. For almost all the constructs, the average responses from the USA were more positive and correlated than those from China to some extent, which reflects the different development stages of sustainability at which the two countries are.

- Table 4 about here -

For reflective constructs, the assessment of discriminant validity is based on the comparison between the square roots of AVEs and correlation coefficients. In each of China and USA samples, the largest correlation coefficient (0.71 and 0.83, respectively) was lower than the smallest squared root of AVE (0.83 and 0.86, respectively). This suggests that the shared variance among indicators within each construct outweighed its shared variance with other constructs, supporting discriminant validity. For the two higher-order formative constructs, each was more correlated with its own components (i.e., eco design, supply chain process, and internal environment management for GSCM effort, and pollution prevention, product stewardship, and sustainable development for GIS effort) than with the other's, and the components of the same construct exhibited relatively large correlations among themselves.

To assess CMB, this study conducted Harman's test with principal component analysis (PCA) (Podsakoff, MacKenzie and Podsakoff, 2012). The result of this preliminary test did not suggest strong CMB, as no dominant component emerged in PCA. In addition, this study adopts two methods based on the marker variable approach (Lindell and Whitney, 2001). One method directly examines the correlations between a theoretically independent variable and other variables in the research model, and the other uses the second-smallest positive correlation among the manifest variables as a conservative estimate of CMB. Not assuming particular measurement theories (e.g., formative vs. reflective), these methods have been used recently by researchers (e.g., Loeser et al., 2017; Huang et al., 2017; Durcikova, 2018; Leonidou et al., 2017).

Following the common practice in recent publications (e.g., Bala and Bhagwatwar, 2017),

this study includes the participant's tenure in an organization as a post hoc marker variable in the survey questionnaire and examines its correlations with other manifest and latent variables. Its largest correlations with manifest and latent variables were 0.083 and 0.148, respectively, with the China sample, and 0.210 and 0.213, respectively, with the USA sample. As none of them were greater than 0.3, the marker variable was not much correlated with other variables. In addition, there was no change in the significance of the correlation coefficients after partial correlation adjustments, and the estimation and significance of each structural paths remained about the same when the marker variable was included in PLS analyses. With the second method, this study adjusted the correlations among all manifest variables in the research model with the second-smallest positive correlation (China: 0.019; USA: 0.227). After the removal of proxy CMB influence, most of the significant correlations still remained significant (China: 96.1%; USA: 91.6%). The consistent results largely dismissed the threat of CMB.

The hypothesized relationships between explanatory variables and each outcome variable (i.e., economic, environmental, or social performance) were tested by steps to benchmark the moderating and mediating effects of GSCM–GIS fit with the direct effects of GSCM effort and GIS effort. This incremental approach is similar to hierarchical regression analysis in which independent variables are entered in blocks. Through the controlling of the variables entered previously, the additional explanatory power of newly entered variables can be evaluated. For comparison, the statistical models include both moderating and mediating relationships as shown in Figure 3. They predict the outcome variables one at a time: environment performance (EnP), economic performance (EcP), and social performance (SoP). It is possible to model moderation

and mediation simultaneously (Edwards and Lambert, 2007), and this study examines their effects separately as well as together to compare relative effect sizes.

- Figure 3 about here -

Tables 5 and 6 report the results of hierarchical PLS analysis for the China sample and USA sample, respectively. For each outcome variable, the baseline model includes the GSCM and GIS variables, the mediation model enters GSCM–GIS fit as a mediator, the moderation model incorporates it as a moderator and the mixed model treats it as both. The formative indicators of GSCM and GIS require the use of two-stage method in the calculation of the interaction terms with the reflective indicators of GSCM–GIS fit, rather than the default product indicator method (Hair, Sarstedt, Ringle and Gudergan 2017).

- Tables 5 and 6 about here -

In terms of model fit in PLS, standardized root mean square residual (SRMR) taps the difference between reproduced and observed correlation matrices, and the rule of thumb is that SRMR 0.08 or below indicates adequate goodness-of-fit (Henseler, Hubona and Ray, 2016; Hair et al., 2016). Excluding the baseline models' SRMR values, the average of the others' met the criteria for both samples (China: 0.079; USA: 0.080). The higher SRMR averages of baseline models (China: 0.084; USA: 0.085) confirmed the importance of mediating and/or moderating relationships involving GSCM–GIS fit.

In the China sample, mediation, moderation, and mixed models yielded the same level of goodness-of-fit (i.e., SRMR = 0.079 on average for three performance variables). In the USA sample, the mediation model somewhat outperformed the moderation model (0.079 vs. 0.082),

with the mixed model in between (0.080). The result suggests that the shift in the role that perceived GSCM–GIS fit plays as a company takes time to integrate both GSCM and GIS into business processes: from the moderating role associated with the coverage route at an earlier development stage of sustainability to the mediating role pertaining to the enablement route at a later stage.

The explanatory power of each model is indicated by the variance explained (i.e., *R*-squared) for its outcome variable. The average *R*-squared of baseline, mediation, moderation, and mixed models were 0.093, 0.143, 0.162, and 0.162 for the China sample and 0.598, 0.611, 0.631, and 0.617 for the USA sample, respectively. Though the USA sample yielded higher explanatory power, the China sample exhibited higher importance of perceived GSCM–GIS fit. In the China sample, the average *R*-squared change from the baseline model was 0.050 (54.12%) for the mediation model, 0.069 (74.55%) for the moderation model and 0.069 (74.55%) for the mixed model. In the USA sample, the changes were 0.012 (2.06%), 0.033 (5.46%), and 0.019 (3.18%), respectively, smaller in both absolute and percentage values.

Consistent across two samples, moderation models boosted up more explanatory power than mediation models, largely due to the fact that the former had more predictors (i.e., interaction terms) than the latter. Compared with the moderation-only model, the mixed model that treated GSCM–GIS fit as both moderator and mediator did not give further lift but slight drawdown (especially for the USA sample) due to the fact that the two models had the same number of predictors and the mediator took some explanatory power of its antecedents from the outcome variable (i.e., more endogenous variables). Whereas the absolute *R*-squared values confirmed that

organizations in the USA sample were generally more advanced in the environmental sustainability than those in the China sample, the *R*-squared changes across different models exhibited an opposite pattern for the relative importance of perceived GSCM–GIS fit as a moderator or mediator.

Baseline models were used to test the direct effects of GIS effort and GSCM effort on performance variables. Except for the path from GSCM effort to social performance in the China sample, all the direct relationships (i.e., H1 and H2) were found significant. In addition, all the components of GSCM and GIS contributed significantly to the formation of both. Controlled for the direct effects of GSCM and GIS, the other models estimated the mediating and moderating effects of perceived GSCM–GIS fit. What is in common for the PLS modeling of moderation and mediation is the direct path from moderator/mediator to the outcome variable (Henseler and Fassott, 2010). The standardized path coefficient estimates indicated that GSCM–GIS fit had significant effects on all the performance variables for the China sample, but only on economic performance for the USA sample.

For the mediation model, the USA sample yielded significant paths from both GIS effort and GSCM effort to GSCM–GIS fit. Together with the aforementioned effects of GSCM–GIS fit, this indicated the partial mediation on both GSCM and GIS sides for economic performance, but no mediation for environmental performance and social performance. Regarding the China sample, the path from GIS effort to GSCM–GIS fit was significant but that from GSCM effort to GSCM–GIS fit was not for each performance measure, indicating the partial mediation on the GIS side but no mediation on the GSCM side. The result suggests that the enabling route becomes complete

concerning the mediating role of GSCM–GIS fit (H3.1med and H3.2med) at a higher level of corporate sustainability.

Compared with mediating relationships, moderating relationships were more distinct between the two countries. For the China sample, GSCM–GIS fit had significant interactions with GIS effort on economic performance and social performance. For the USA sample, the interaction term between GSCM effort and GSCM–GIS fit had a significant effect on social performance. Similar to its mediating relationships, perceived GSCM–GIS fit tends to interact with GIS effort at an earlier development stage of sustainability, but with GSCM effort at a later stage. Environmental performance received the strongest direct impacts from GSCM effort and GIS effort, which provided an explanation to the lack of additional moderating effects that they had with their fit.

Figure 4 compares the significant moderating effects with their nonsignificant counterparts. For significant moderations, the regression lines between an independent variable (i.e., GSCM or GIS) and an outcome variable (i.e., economic or social) exhibited more positive slopes for higher levels of perceived GSCM–GIS fit, whereas they were more parallel for insignificant moderations. Thus, GSCM–GIS fit served as a positive moderator when it significantly interacted with GSCM or GIS effort.

- Figure 4 about here –

The specific effect size of a moderating relationship can be measured with *f*-squared, which is the ratio between the variance explained by the interaction term and the total variance with error (Aiken and West, 1991). A meta-analysis suggests that the average effect size of moderation is

0.9%, lower than that of small direct effects of around 2% (Aguinis, Beaty, Boik and Pierce, 2005). In this study, all the significant moderating effects were above the average: 1.72% and 1.18% for the interaction between GIS and fit on economic performance and social performance respectively in the China sample, and 2.53% for the interaction between GSCM and fit on social performance in the USA sample. The significant moderating effects of GSCM–GIS fit in this study, therefore, can be considered at least medium.

To find out whether the development stages of sustainability make differences in the hypothesized direct and moderating relationships, this study conducted MGA. First, it examined the measurement model across the two country samples and confirmed partial measurement invariance that is required for structural model MGA (Hair, Sarstedt, Ringle and Gudergan, 2017). Then, it statistically tested the cross-sample difference in the estimate of each path coefficient. The observed significance levels remained about the same across four different methods: permutation (two-tailed test) with all observations, permutation with more balanced samples (i.e., random half China sample and full USA sample), parameter (one-tailed test assuming equal variance), and Welch–Satterthwait (one-tailed test not assuming equal variance). As shown in Table 7, some of the relationships were significantly different. On environmental performance, the direct effects of GSCM and GIS were stronger with the USA sample than with the China sample, but it was the other way around for their fit (i.e., more positive estimates with the China sample than the USA sample). In addition, the USA sample yielded a stronger impact of GSCM on social performance than the China sample. Consistent across all three outcome variables, GSCM effort had a stronger effect on GSCM–GIS fit in the USA sample than in the China sample, contributing to the complete

enablement route as aforementioned.

- Table 7 about here -

Conclusion and Implications

This study examines the role that the alignment between GSCM and GIS plays in the corporate sustainability. Based on the coverage and enablement routes in theory, it hypothesizes that perceived GSCM–GIS fit may moderate and mediate the effects of GSCM effort and GIS effort on corporate sustainability, and their relative salience is subjected to the development stages of sustainability. The hypothesized relationships were tested with the observations collected from the USA and China, the largest mature and emerging economies in the world. The results of hierarchical and multi-group PLS analyses confirm that the development stages of sustainability make differences in hypothesized relationships. In particular, the direct effects of GSCM effort and GIS effort are stronger for organizations at a more advanced development stage of sustainability, but the moderating effect of perceived GSCM–GIS fit is stronger for those still undergoing such organizational changes. Whereas perceived GSCM–GIS fit plays the role of a moderator from the beginning, its mediator role becomes stronger as the integration between two green endeavors deepens.

Compared with the typical conceptualization of perceived fit between task and technology as their aggregate to predict user performance, this study includes GSCM and GIS in statistical analyses together with their alignment. It allows the control for the effects of GSCM and GIS in the estimation of that of fit, as well as the modeling of moderating and mediating relationships

corresponding to the coverage and enablement routes in theory. The yielded findings are more meaningful and insightful than those based on the direct relationship between fit and performance, such as their negative correlation (Davern, 1996).

The perceived fit construct is often criticized for its subjectivity in measurement, yet it has been found that users are capable of reliably evaluating fit (Goodhue, 1995). Thus, the real issue is not about measurement validity, but the ambiguity in the way how exactly it influences user behavior. For instance, it is speculated that users may cease learning when they perceive sufficient task-technology fit, leading to stagnant performance (Davern, 1996). This study attempts another solution by modeling how employees' perception of the alignment between GSCM and GIS affects their relevant efforts for corporate sustainability.

The main reason why this study does not model perceived fit as the aggregate between GSCM and GIS is because of the fact that they are relatively independent of each other, especially at the initial development stage of sustainability. The findings from the China sample support fit-as-moderation more than fit-as-mediation, suggesting the "coverage" route for perceived GSCM–GIS fit to take effect. When an organization implements GIS functions more recently, employees are likely to explore how to use them to facilitate the existing GSCM practices. The perception of a good fit is likely to boost up GIS usage to support GSCM, leading to better sustainability performance. In the China sample, therefore, the interaction term of GIS × fit was found mostly positive and significant, and the mediating role of GSCM–GIS fit was only salient on GIS side.

In the long run, however, GSCM effort and GIS effort tend to integrate with each other for

the common ecological goal. As corporate sustainability gets mature, therefore, the perceived alignment between them may switch to the "enablement" route gradually. In the USA sample, perceived fit mediated the effects of both GSCM and GIS on sustainability performances. The mediating relationships suppressed the moderating relationships, as the only salient interaction term GSCM × fit on social performance became less significant from the moderation model to the mixed model. At the beginning, employees pay more attention to the supporting role of GIS to GSCM; when green innovation deepens, they tend to view both as a whole.

Researchers have compared the moderating and mediating effects of perceived fit (e.g., Bergeron, Raymond and Rivard, 2001), but this study bases statistical modeling (i.e., moderation vs. mediation) upon theory development (i.e., coverage vs. enablement). In addition, it compares the strengths of relationships across different development stages of sustainability. Consistent with the premise of contingency theory, the findings suggest that the alignment among subsystems plays different roles in different contexts. Therefore, perceived GSCM–GIS fit does matter to individual effort and organizational performance as a moderator and/or a mediator depending on how GSCM and GIS practices are integrated with each other.

The findings regarding the effects of GSCM, GIS, and their alignment on performance measures yield some useful insights for practitioners. First of all, the results reassure organizations of the importance to coordinate their GSCM effort and GIS effort. Although GSCM alone may help organizations improve their performances to some extent, the implementation of GIS can greatly enhance its effectiveness, especially when they fit each other and integrate in the long run. To successfully carry out complex green endeavors (e.g., global or inter-organization GSCM and

GIS), it is worth the resources for organizations to evaluate and improve GSCM–GIS alignment based on employee perceptions. If fit-as-moderation is dominant, for instance, an organization may focus on employee training on how to use GIS functions to support GSCM activities. When fit-as-mediation becomes more salient, it may integrate employee efforts on both sides with business process reengineering.

This study has limitations and they point to the future directions of research. First of all, it only includes samples from two major economies in the world. Though the USA and China are the largest developed and developing countries, respectively, the organizations in them may not represent those in other countries, which limit the generalizability of specific findings. In addition to the development stages of sustainability, the differences in other factors such as culture and education may come into play. The natural experiment of this study is unable to rule out such a possibility. In future studies, longitudinal observations may be collected to keep track of the changes in organizations when they move from one development stage of sustainability to the next. Another limitation is that most participants were supply chain managers who might not be knowledgeable about green IS despite the examples of relevant functions given in the questionnaire. Future studies may obtain personal feedback from participants regarding their experiences of how perceived GSCM–GIS fit regulated their participation in respective efforts. Such interview data may supplement the quantitative analyses to further back up fit-as-moderation and fit-as-mediation arguments at different stages.

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Table 1. Construct Definitions

Construct/Dimension	Definition
GSCM Effort	Organizational endeavor on sustainable development through green supply chain management
- Eco Design (ECO)	Effort to improve the environment-friendliness of product design
- Supply Chain Process (SCP)	Effort to streamline supply chain for ecological effectiveness
- Internal Environment Management (IEM)	Effort to enhance sustainability-oriented internal management
GIS Effort	Organizational endeavor to utilize green information systems for corporate sustainability
- Pollution Prevention (PP)	Effort to monitor and minimize pollution with GIS
- Product Stewardship (PS)	Effort to oversee product lifecycle with the help of GIS
- Sustainable Development (SD)	Effort to enhance the sustainability of business operations using relevant GIS functions
Perceived GSCM–GIS Fit	Employee perception of the alignment between GSCM and GIS efforts
Economic Performance (EcP)	The economic aspect of corporate sustainability performance in terms of revenue and profit growth
Environmental Performance (EnP)	The environmental aspect of corporate sustainability performance in terms of consumption and emission reduction
Social Performance (SoP)	The social aspect of corporate sustainability performance in terms of community safety and engagement

Table 2. Profiles of Organizations

Characteristics	China (n = 311)		USA (n = 106)	
	Number	%	Number	%
Size (# of employees)				
1-49	35	11.3	18	17.0
50-99	42	13.5	12	11.3
100-499	69	22.2	16	15.1
500-1000	40	12.9	17	16.0
Above 1000	122	39.2	43	40.6
Not reported	3	1.0		
Industry				
Manufacturing	45	14.5	13	12.3
Energy	41	13.2	2	1.9
Real Estate	37	11.9	10	9.4
Logistics & Distribution	15	4.8	15	14.2
IT	65	20.9	8	7.5
Service	56	18.0	40	37.7
Other	49	15.8	18	17.0
Not reported	3	1.0		
Years in business				
0-5	38	12.2	7	6.6
6-10	49	15.8	8	7.5
11-20	115	37	13	12.3
Above 20	96	30.9	77	72.6
Not reported	13	4.2	1	0.9

Table 3. Measurement Validation

Construct	Indicator/component	Scale type	Loadings/weights	VIF	α	CR	AVE
ECO	Consumption	Formative	0.51	1.86	NA	NA	NA
	Waste		0.21	1.96			
	Hazard		0.45	1.56			
SCP	Acquisition	Formative	0.32	2.45	NA	NA	NA
	Distribution		0.34	1.85			
	Remanufacturing		0.48	2.06			
IEM	Integration	Formative	0.41	2.01	NA	NA	NA
	Support		0.37	2.31			
	Compliance		0.35	2.19			
GSCM	ECO	Formative	0.32	1.80	NA	NA	NA
	SCP	(2nd-order)	0.36	2.92			
	IEM		0.44	2.86			
PP	Consumption	Formative	0.36	2.33	NA	NA	NA
	Waste		0.27	2.17			
	Hazard		0.55	1.49			
PS	Acquisition	Formative	0.33	2.00	NA	NA	NA
	Distribution		0.47	2.30			
	Remanufacturing		0.33	2.18			
SD	Integration	Formative	0.46	2.13	NA	NA	NA
	Support		0.25	2.09			
	Compliance		0.44	1.76			
GIS	PP	Formative	0.29	2.56	NA	NA	NA
	PS	(2nd-order)	0.38	3.57			
	SD		0.41	2.96			
Fit	Fit1	Reflective	0.90	NA	0. 93	0.95	0.78
	Fit2		0.90	NA			
	Fit3		0.89	NA			
	Fit4		0.84	NA			
	Fit5		0.88	NA			
Ecp	EcP1	Reflective	0.86	NA	0. 92	0.94	0.76
	EcP2		0.89	NA			
	EcP3		0.88	NA			
	EcP4		0.87	NA			
	EcP5		0.85	NA			
EnP	EnP1	Reflective	0.81	NA	0. 91	0.93	0.74
	EnP2		0.88	NA			
	EnP3		0.90	NA			
	EnP4		0.85	NA			
	EnP5		0.85	NA			
SoP	SoP1	Reflective	0.89	NA	0. 80	0.91	0.83
	SoP2		0.94	NA			

Note: All loadings and weights were significant at 0.01 level.

Table 4. Response Patterns across Samples

Variable	Mean (SD)	1.1	1.2	1.3	1	2.1	2.2	2.3	2	3	4	5	6
1.1 ECO	4.19 (.73)	NA											
1.2 SCP	3.85 (.76)	.57	NA										
1.3 IEM	3.94 (.77)	.57	.74	NA									
1 GSCM	3.99 (.65)	.80	.89	.91	NA								
2.1 PP	3.93 (.72)	.46	.47	.47	.54	NA							
2.2 PS	3.83 (.68)	.40	.53	.53	.56	.76	NA						
2.3 SD	3.84 (.72)	.36	.50	.55	.55	.68	.77	NA					
2 GIS	3.87 (.64)	.44	.55	.57	.61	.89	.93	.91	NA				
3 Fit	3.38 (.81)	.07^{ns}	.16	.24	.19	.23	.30	.31	.32	**.86**			
4 EcP	3.32 (.94)	.19	.23	.25	.27	.21	.24	.25	.26	.31	**.85**		
5 EnP	3.40 (.91)	.24	.19	.27	.27	.26	.26	.30	.31	.28	.71	**.83**	
6 SoP	3.17 (1.03)	.10^{ns}	.22	.25	.23	.22	.26	.30	.29	.31	.66	.59	**.89**
1.1 ECO	4.24 (.99)	NA											
1.2 SCP	3.86 (1.14)	.76	NA										
1.3 IEM	3.94 (1.14)	.71	.86	NA									
1 GSCM	4.01 (1.01)	.86	.92	.96	NA								
2.1 PP	4.22 (1.01)	.57	.45	.50	.56	NA							
2.2 PS	4.20 (.97)	.57	.53	.57	.62	.75	NA						
2.3 SD	4.19 (1.01)	.51	.50	.56	.59	.72	.82	NA					
2 GIS	4.21 (.91)	.60	.55	.62	.66	.85	.94	.94	NA				
3 Fit	3.94 (1.14)	.63	.71	.68	.72	.51	.60	.64	.65	**.89**			
4 EcP	4.06 (.97)	.55	.57	.69	.68	.46	.61	.64	.66	.73	**.90**		
5 EnP	4.38 (.85)	.62	.61	.71	.73	.64	.75	.71	.77	.58	.68	**.86**	
6 SoP	4.26 (.96)	.52	.62	.64	.67	.57	.64	.70	.71	.58	.64	.83	**.91**

Note: The top half of the table is for the China sample, and the bottom half is for the USA sample. As there are both formative and reflective constructs, the correlation matrices are based on the standardized latent variable scores obtained from the PLS estimates of the measurement model. NA – Not Applicable. ^{ns} – not significant at 0.05 level, all other correlation coefficients were significant at 0.01 level. The bold on the diagonal of correlation matrix indicates the squared root of AVE.

Table 5. Partial Least-Square Estimates of Structural Paths: China Sample

	Baseline Models			Mediation Models			Moderation Models			Mixed Models		
Coefficient	EcP	EnP	SoP	EcP	EnP	SoP	EcP	EnP	SoP	EcP	EnP	SoP
R-Squared	.085	.106	.088	.143	.143	.144	.163	.163	.161	.162	.163	.162
H1: GSCM→Perf	.176***	.134*	.086	.171***	.136**	.082	.165***	.157**	.089	163***	.160**	.083
- ECO→GSCM	.353***	.367***	.338***	.336***	.350***	.322***	.353***	.367***	.338***	.336***	.350***	.322***
- SCP→GSCM	.393***	.372***	.400***	.388***	.367***	.394***	.393***	.372***	.400***	.388***	.367***	.394***
- IEM→GSCM	.404***	.413***	.411***	.424***	.433***	.432***	.404***	.413***	.411***	.424***	.433***	.432***
H2: GIS→Perf	.149**	.226***	.237***	.070	.160**	.165**	.099*	.169**	.180**	.101*	.169**	.189**
- PP→GIS	.352***	.359***	.345***	.331***	.337***	.324***	.353***	.359***	.345***	.331***	.337***	.324***
- PS→GIS	.376***	.364***	.373***	.385***	.373***	.381***	.376***	.364***	.373***	.385***	.373***	.381***
- SD→GIS	.371***	.377***	.381***	.382***	.388***	.393***	.371***	.377***	.381***	.382***	.388***	.393***
H3: Fit→Perf				.257***	.203***	.245***	.229***	.189***	.220***	.224***	.185***	.215***
H3.1med: GSCM→Fit				.001	.002	-.002				.001	.002	-.002
H3.2med: GIS→Fit				.318***	.319***	.324***				.318***	.319***	.324***
H3.1mod: GSCM×Fit→Perf				-	-	-	-.065	.067	-.026	-.064	.079	-.026
H3.2mod: GIS×Fit→Perf				-	-	-	.147***	.051	.122**	.146***	.042	.122**
SRMR	.082	.083	.087	.077	.078	.082	.077	.078	.082	.077	.078	.082

Note: * - Significant at 0.1 level; ** - Significant at 0.05 level; *** - Significant at 0.01 level. EcP – Economic Performance; EnP – Environmental Performance; SoP – Social Performance; Perf – one of the three performance variables; GSCM – green supply chain management implementation; GIS – green information system implementation; ECO – Eco Design; SCP – Supply Chain Process; IEM – Internal Environment Management; PP – Pollution Prevention; PS – Product Stewardship; SD – Sustainable Development.

Table 6. Partial Least-Square Estimates of Structural Paths: USA Sample

	Baseline Models			Mediation Models			Moderation Models			Mixed Models		
Coefficient	EcP	EnP	SoP	EcP	EnP	SoP	EcP	EnP	SoP	EcP	EnP	SoP
R-Squared	.539	.675	.581	.600	.673	.559	.618	.683	.592	.608	.676	.568
H1: GSCM→Perf	.435***	.387***	.362***	.225**	.447***	.359**	.164	.471***	.406***	.165	.472***	.411***
- ECO→GSCM	.329***	.347***	.304***	.315***	.329***	.293***	.329***	.347***	.303***	.315***	.329***	.293***
- SCP→GSCM	.274***	.278***	.375***	.314***	.318***	.400***	.274***	.278***	.375***	.314***	.318***	.400***
- IEM→GSCM	.477***	.456***	.400***	.451***	.433***	.385***	.477***	.456***	.400***	.451***	.433***	.386***
H2: GIS→Perf	.374***	.518***	.483***	.236**	.570***	.459***	.279**	.481***	.426***	.297**	.512***	.424***
- PP→GIS	.274***	.316***	.313***	.270***	.299***	.288***	.273***	.316***	.313***	.270***	.299***	.288***
- PS→GIS	.386***	.412***	.349***	.368***	.397***	.340***	.386***	.412***	.349***	.368***	.397***	.340***
- SD→GIS	.422***	.357***	.423***	.440***	.387***	.455***	.422***	.357***	.424***	.440***	.387***	.455***
H3: Fit→Perf				.400***	-.141	.007	.407***	-.099	.064	.381***	-.143	.035
H3.1med: GSCM→Fit				.483***	.500***	.512***				.483***	.500***	.513***
H3.2med: GIS→Fit				.383***	.359***	.348***				.383***	.359***	.348***
H3.1mod: GSCM×Fit→Perf				-	-	-	-.103	.044	.128*	-.114	.031	.111
H3.2mod: GIS×Fit→Perf				-	-	-	.064	-.073	-.065	.077	-.059	-.051
SRMR	.084	.082	.088	.080	.077	.081	.082	.080	.085	.080	.078	.081

Note: * - Significant at 0.1 level; ** - Significant at 0.05 level; *** - Significant at 0.01 level. EcP – Economic Performance; EnP – Environmental Performance; SoP – Social Performance; Perf – one of the three performance variables; GSCM – green supply chain management implementation; GIS – green information system implementation; ECO – Eco Design; SCP – Supply Chain Process; IEM – Internal Environment Management; PP – Pollution Prevention; PS – Product Stewardship; SD – Sustainable Development.

Table 7. Multi-group Analysis (China-USA) on Path Estimate Differences

Path	Economic	Environmental	Social
H1: GSCM→Performance	-.003	-.312**	-.328**
- ECO→GSCM	.021	.020	.029
- SCP→GSCM	.074	.049	-.006
- IEM→GSCM	-.026	0	.047
H2: GIS→Performance	-.197	-.344***	-.235
- PP→GIS	.062	.039	.036
- PS→GIS	.017	-.023	.042
- SD→GIS	-.058	.001	-.062
H3: Fit→Performance	-.157	.329**	.180
H3.1med: GSCM→Fit	-.482***	-.499***	-.514***
H3.2med: GIS→Fit	-.066	-.041	-.024
H3.1mod: GSCM×Fit→Performance	.050	.047	-.137
H3.2mod: GIS×Fit→Performance	.070	0.100	.173

Note: * - Significant at 0.1 level; ** - Significant at 0.05 level; *** - Significant at 0.01 level.

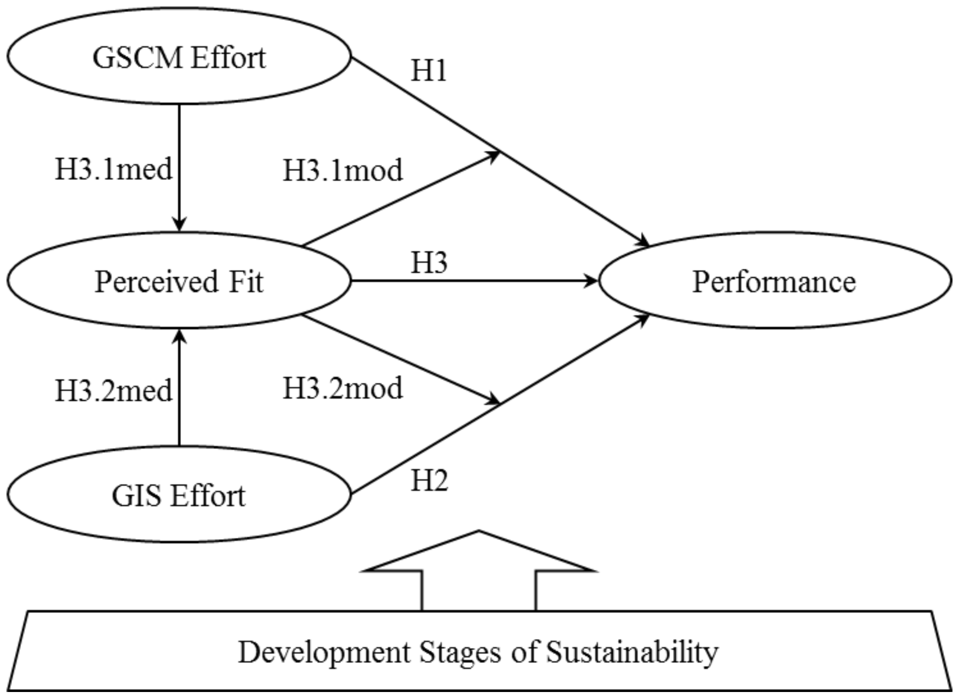
Figure Captions

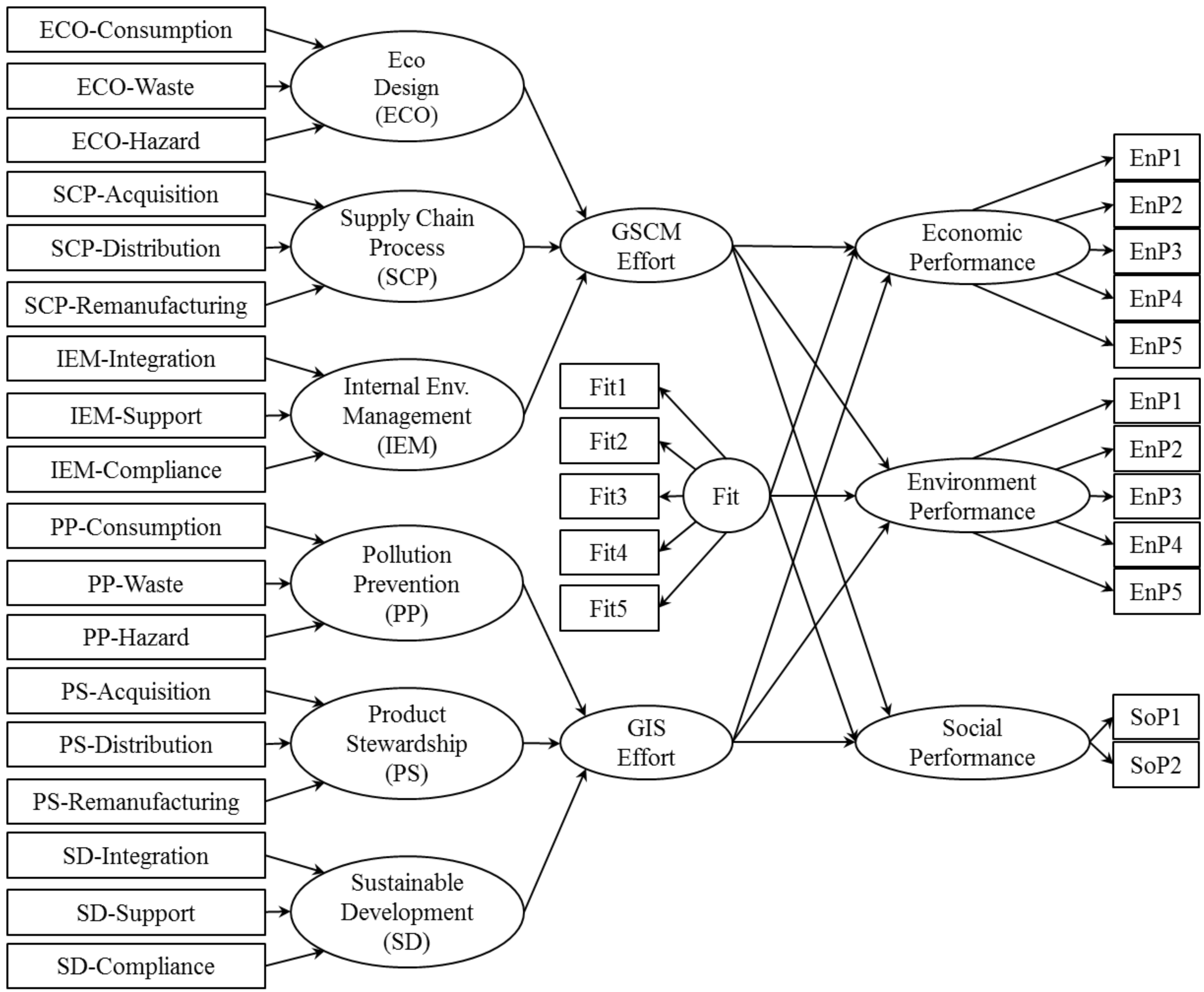
Figure 1. Research Model

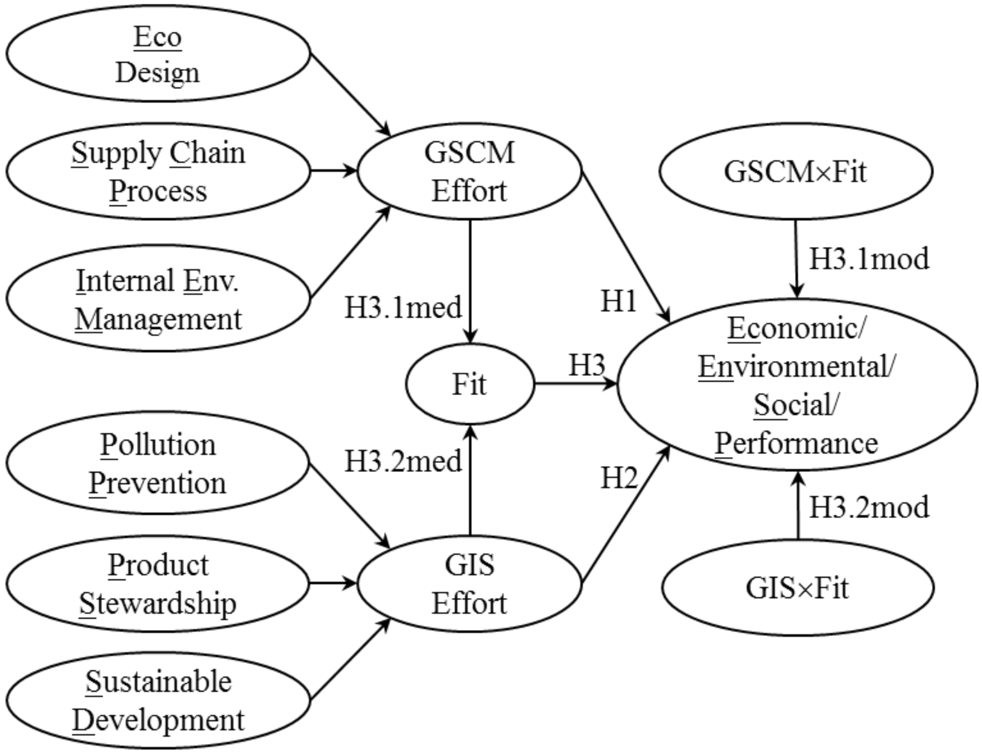
Figure 2. Measurement Model

Figure 3. Structure Model

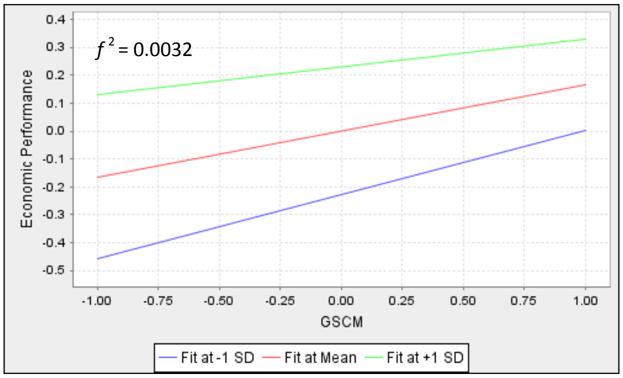
Figure 4. Comparison of Moderation Effects

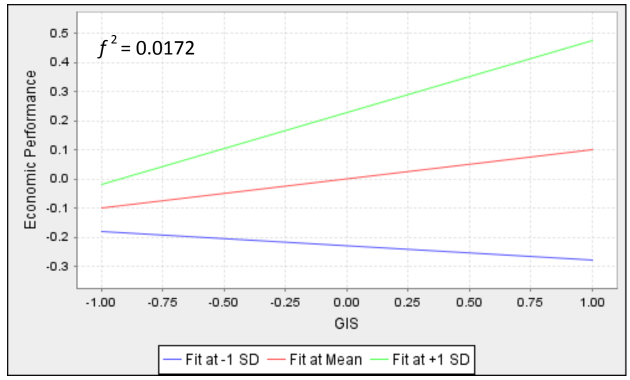

GSCM Effort
H1
H3.1med
H3.1mod
H3
Perceived Fit
Performance
H3.2med
H3.2mod
GIS Effort
H2
Development Stages of Sustainability


ECO-Consumption
ECO-Waste
ECO-Hazard
SCP-Acquisition
SCP-Distribution
SCP-Remanufacturing
IEM-Integration
IEM-Support
IEM-Compliance
PP-Consumption
PP-Waste
PP-Hazard
PS-Acquisition
PS-Distribution
PS-Remanufacturing
SD-Integration
SD-Support
SD-Compliance
Eco Design (ECO)
Supply Chain Process (SCP)
Internal Env. Management (IEM)
Pollution Prevention (PP)
Product Stewardship (PS)
Sustainable Development (SD)
GSCM Effort
GIS Effort
Fit
Fit1
Fit2
Fit3
Fit4
Fit5
Economic Performance
Environment Performance
Social Performance
EnP1
EnP2
EnP3
EnP4
EnP5
EnP1
EnP2
EnP3
EnP4
EnP5
SoP1
SoP2

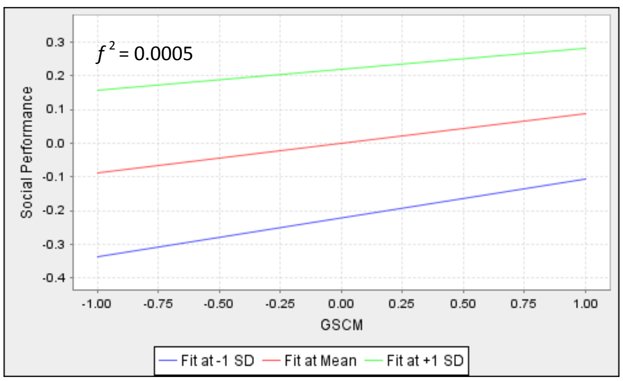

Eco
Design
Supply Chain
Process
Internal Env.
Management
GSCM
Effort
H3.1med
Fit
Pollution
Prevention
Product
Stewardship
Sustainable
Development
H3.2med
GIS
Effort
H1
H3
H2
GSCM×Fit
H3.1mod
Economic/
Environmental/
Social/
Performance
H3.2mod
GIS×Fit

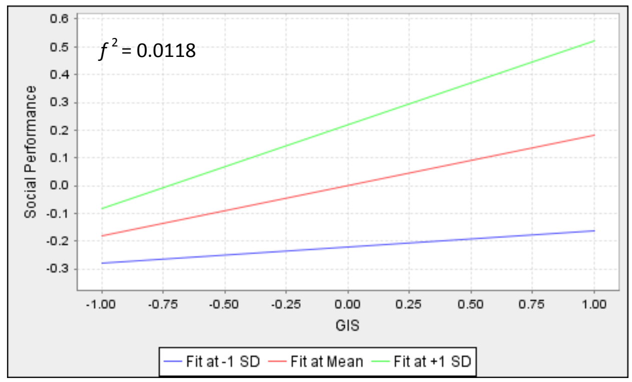
GSCM×Fit GIS×Fit



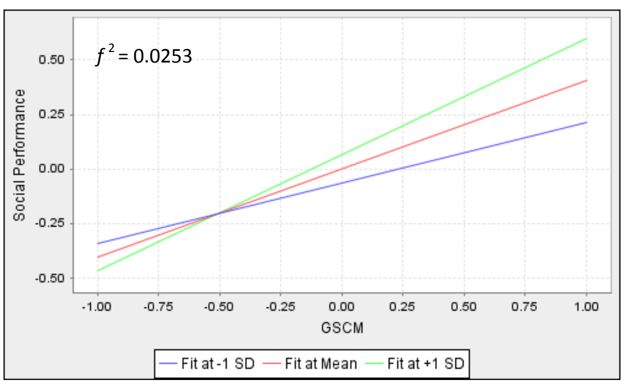


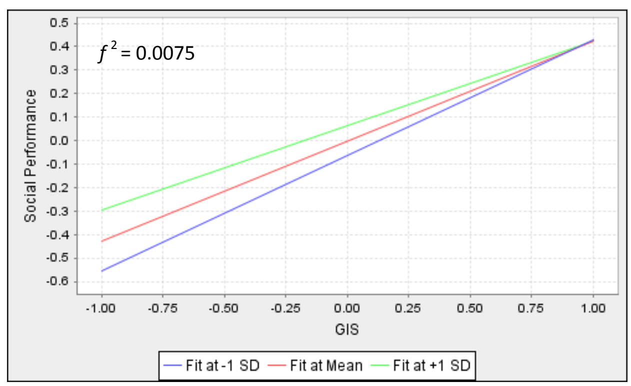
Economic Performance in China Sample





Social Performance in China Sample





Social Performance in USA Sample

Appendix: Measurement Items

Filtering Question on GIS Functions
Please check the boxes corresponding to the green IS functions that are currently used in your organization for environmental protection and sustainable development:

☐ Energy saving
☐ Paperless office (e.g., email, workflow, ERP)
☐ Online collaboration
☐ Remote meetings
☐ Pollution control
☐ Environmental monitoring
☐ Emissions audit
☐ Green procurement and logistics
☐ Green manufacturing and packaging
☐ Others (please specify): ________________

1. Green Supply Chain Management (GSCM) Effort
Our organization utilizes green supply chain management practices to…
1.1 Eco Design (ECO)
ECO-Consumption: ...reduce material/energy consumptions.
ECO-Waste: ...reuse, recycle, and recover materials.
ECO-Hazard: ...reduce the use of hazardous/toxic materials.
1.2 Supply Chain Process (SCP)
SCP-Acquisition: ...collaborate with suppliers for environmental objectives.
SCP-Distribution: ...collaborate with customers for green delivery.
SCP-Remanufacturing: ...facilitate products disassembly and remanufacturing.
1.3 Internal Environment Management (IEM)
IEM-Integration: ...enhance cross-functional cooperation for environmental improvements.
IEM-Support: ...obtain management commitment and support for green operations.
IEM-Compliance: ...implement environmental compliance and auditing programs.

2. Green Information Systems (GIS) Effort
Our organization utilizes green information system practices to…
2.1 Pollution Prevention (PP)
PP-Consumption: ...reduce overall consumption and emissions.
PP-Waste: ...reduce overall waste.
PP-Hazard: ...reduce overall use of hazardous and toxic materials.
2.2 Product Stewardship (PS)
PS-Acquisition: ...make material sourcing and acquisition more environmentally friendly.
PS-Distribution: ...make product distribution and delivery more environmentally friendly.
PS-Remanufacturing: ...make product disassembly and remanufacturing routings more

environmentally friendly.
2.3 Sustainable Development (SD)
SD-Integration: ...facilitate green operations across the organization.
SD-Support: ...facilitate management support and control for sustainable development.
SD-Compliance: ...facilitate environmental compliance and auditing.

3. Perceived GSCM–GIS Fit
The GIS functionalities concerning how information systems are used to support green practices in my company:
Fit1: …are adequate to GSCM tasks.
Fit2: …are appropriate for GSCM tasks.
Fit3: …are compatible with GSCM tasks.
Fit4: …make GSCM tasks easy.
Fit5: …fit GSCM tasks in general.

4. Organizational Performances
4.1 Economic Performance (EcP) is enhanced in terms of:
EcP1: …investment recovery
EcP2: …cost containment
EcP3: …profitability
EcP4: …labor productivity
EcP5: …inventory reduction
4.2 Environmental Performance (EnP) is enhanced in terms of:
EnP1: …material reuse
EnP2: …environmental compliance
EnP3: …environment preservation
EnP4: …reduction of hazardous wastes and emissions
EnP5: …reduction of resource consumptions (e.g., energy, water, electricity, gas, and petrol)
4.3 Social Performance (SoP) is enhanced in terms of:
SoP1: …product liability and safety
SoP2: …community outreach (e.g., education and charitable giving)