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Sustainable Supply Chain Capabilities: Accumulation, Strategic Types and Performance

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Abstract: This paper explores the cumulative sustainable supply chain (SC) capabilities and their effects on supply chain performance, including economic, environmental, and social performance. Using empirical analyses with data from 198 small- and medium-sized suppliers in Korea, this paper provides evidence about the cumulative sustainable SC capabilities, indicating that economic, social, and environmental capabilities in the supply chain mutually reinforce each other rather than traded off. This study also presents the positive effect of cumulative sustainable SC capabilities on supply chain sustainability performance. This paper identifies four distinctive groups of cumulative capabilities: the laggard, environmental-focused, social-cautious, and all-round. This study provides a better understanding about sustainable capabilities and important guidelines for managers of suppliers and buyers who wish to build strong social/environmental management capabilities without compromising economic capability throughout the entire supply chain.

Keywords: sustainable supply chain capability; triple bottom line; cumulative capabilities; sustainability performance; supply chain management; empirical study

1. Introduction

The last decade has witnessed the emergence of sustainability issues as one of the most important business concerns in a firm's supply chain. An increasing number of firms have realized that what it may go wrong if the supply chain is ignored when facing global sustainability challenges [1]. The leading international brands, such as Nike, Marks and Spencer (M&S), and IKEA have increasingly reexamined their supply chains and moved forward in their effort to build a more sustainable supply chain, by not only monitoring their suppliers' compliance, but also fostering their capabilities to properly address various environmental and social challenges [2].

The triple bottom line, indicating the combination of economic, social, and environmental performances, continues to spread out throughout the industries [3]. To increase such triple bottom line, environmental and social criteria must be integrated into performance objectives for the management of not only individual firms, but also the entire supply chain [4] because firms' performance heavily relies on their supply chain. This is why the management of environmental and social issues in the supply chain, namely sustainable supply chain management (hereafter sustainable SCM), has been increasingly paid much attention. A number of researchers have examined sustainable SCM on the environmental side [5–9] and on the social side [10], and also on both sides [11,12]. However, several important aspects have received relatively little attention.

First, although evidence has been documented that sustainable SCM linked to performance for both supplier management [13] and the broader supply chain [14], little research has explicitly considered sustainable SCM as "capabilities" that can create a firm's competitive advantage. Recently, a few studies appeared to address sustainable SCM based on the resource-based view, in terms of social management capabilities [10] and supplier environmental capabilities [5,6,15]. Second, few studies have considered environmental, social, and economic aspects in SCM, simultaneously [16–18]. Sustainable SCM exists as a separate stream of research, indicating the majority of ongoing SCM research overlooks the environmental and social consequences of supply chain actions [18]. Moreover, sustainable SCM research barely addresses the economic dimension in the sustainable SCM literature because the economic side of sustainability has generally been assumed as being covered by conventional management publications. However, sustainable SCM should simultaneously capture these three intrinsically related dimensions of the triple bottom line: economic, social, and environmental aspects.

Third, previous studies have focused on examining the effects of sustainable SCM, in particular green SCM on firm performance. However, the relationships between those three economic, social, and environmental dimensions of sustainable SCM have been neglected. Such relationships can be an important element of sustainable SCM strategy. For example, if high performance in the social dimension is necessarily traded off for low performance in the (conventional) economic dimension, and the firms should decide which dimension of sustainability has to be achieved. However, sustainable SCM might have cumulative capabilities; each of them reinforces the development of the other capabilities. This unexplored question is analogous to the debate about the cumulative capabilities theory in operations management [19,20].

Given these gaps in the literature, the focus of this study is on whether those economic, social, and environmental supply chain (SC) capabilities are cumulative capabilities, existing simultaneously in a mutually reinforcing fashion, or traded off. This paper also explores other relevant important research questions. For example, what is the relationship between cumulative sustainable SC capabilities and supply chain performance? Are there particular sequences of the development of such cumulative sustainable capabilities? In addressing these questions, this paper makes three contributions. First, drawing from related literatures, including operations strategy, SCM, and sustainable SCM, this study develops the concept of sustainable SC capabilities. Second, some propositions, regarding cumulative sustainable capabilities and their effects on performance, are suggested. Third, the study provides an empirical analysis of these relationships.

2. Literature Review and Propositions

2.1. Sustainable Supply Chain Capabilities

This study leverages the resource-based view (RBV) and adjacent theoretical lenses, such as dynamic capability theory, absorptive capacity, and social capital, to emphasize the competitive nature of sustainable SCM. First, the RBV, arguing that the differences in firms' behaviors and performance are fundamentally dependent on the unique assembly of internal resources and capabilities, which are valuable, rare, imperfectly inimitable and non-substitutable [21,22], has been extended to explain whether, how and when SCM can be source of sustained competitive advantage [23,24]. For example, Barney [25] argues that heterogeneous purchasing and supply chain management capabilities can be a resource that firms can use to generate more accurate expectations about the future value, by noting there are numerous examples of where this has occurred, such as Wal-Mart and Toyota. Second, Hunt and Davis [26] clarify the possibility of SCM as a valuable resource by extending a firm's internal resources to external ones such as relational resources, which can be productive launching points for SCM research. Their "resource-advantage" theory is quite parallel to the relational view or social capital theory [27] because all of them propose that a firm's critical resources and capabilities may extend beyond a firm's boundaries [23]. For example, supply chain capabilities, referring to a firm's ability to

identify, utilize, and assimilate external resources to facilitate the entire supply chain activities [28], can accumulate valuable assets and resources embedded within, available through, and derived from the network of relationships. Such inter-organizational assets, namely social capital and/or relational resources, result in a firm's competitive advantage and higher performance [23,26]. Third, recent studies increasingly emphasize the dynamic nature of supply chain capabilities. From a supply network perspective, dynamic capabilities can be understood as the unique sets of inter-organizational routines, processes, relationships and special skills derived from exchanges of information and knowledge between supply chain partners [24]. For example, the supply management alignment capability, referring to the ability of procurement to formally define internal needs and ensure communication and understanding of these expectation by key suppliers [29], and supply chain absorptive capacity, referring supply chain information acquisition, new product development assimilation, supply chain transformation, and operational application of this information [30] are positively related to a firm's financial performance as well as network agility performance. Overall, supply chains vary in critical competences such as their ability to learn, innovate, and respond quickly to changing market conditions. Differences organizational resources can explain why some supply chains outperform competitors [26]. A recent preliminary survey [31] also reports that a number of leading SCM scholars strongly agree that resources possessed by a firm and even more so, within a firm's supply chain, are important to effective SCM and thus to higher performance of the entire supply chain.

By extending these arguments on (conventional) supply chain capabilities to the social and environmental dimensions, this paper proposes three sustainable supply chain (SC) capabilities: the economic, environmental, and social SC capabilities. First, based on the supply chain capability literature, the economic SC capability can be characterized as a set of important activities involved in the supply chain process, such as information sharing and collaboration, as well as essential elements of inter-organizational relationships, such as mutual trust and long-term partnership. Information sharing is usually identified as one of the most fundamental abilities in the supply chain process and integration [30,32,33], because it is very effective in enabling buyers and suppliers to share and communicate expectations and performance, and thus, in motivating supply chain partners to enhance their capabilities [29,34]. A collaborative capability, involving more direct interactions and integrated activities between buyers and suppliers [24,28], such as technology co-development and collaborative problem solving practices has been reported as critical means to effectively transfer operational and organizational knowledge to other supply chain partners [35] and implement various improvement initiatives [34].

Second, environmental SC capability refers to a firm's ability to manage environmental issues in the supply chain [36]. Third, social SC capability can also be defined as being analogous to the environmental SC capability [10]. As Pagell and Shevchenko [18] point out, extant sustainable SCM research has been focused on harm reduction in unsustainable supply chains rather than harm elimination such as zero emission throughout the entire supply chain (*i.e.*, a truly sustainable supply chain). Zero emission or regenerative impacts on social and environmental systems would be the ultimate goal of sustainable SCM; however, this could be achieved stepwise, from currently unsustainable supply chains to less unsustainable supply chains and to truly sustainable supply chains. In this study, we characterized environmental and social SC capabilities as the extents of inter-organizational activities between a buyer and its supplier in response to the social and environmental issues in order to generate positive impacts as well as reduce current negative impacts on social and environmental systems. Collectively, these activities encompass monitoring and collaboration practices [6,8]. Monitoring practices include the gathering and processing of supplier information, the establishment of supplier assessment criteria, and the evaluation of the environmental and the social performance of supply chain partners and their products. In terms of the social SC capability, establishing a supplier code of conduct and auditing represent the most widely used activities. Many global firms have introduced a supplier code of conduct that generally addresses child labor, forced labor, human rights, diversity and safety, and used it as one of the most

important criteria for evaluating suppliers [37]. Recent years have witnessed a number of suppliers pursing certification related to social responsibility, such as Social Accountability (SA) 8000 [10]. In terms of the environmental SC capability, adopting environmental procurement policies is a typical practice. Environmental supplier selection processes facilitates communication between supply chain partners, and therefore, enhance supply chain responsiveness to surging environmental issues, such as climate change. Suppliers have also implemented environmental management systems (EMSs), and validated them by securing international certifications, such as ISO 14001, the international standard of environmental management [36].

Collaborative practices composing of the environmental and social SC capabilities tend to focus more on building the supply chain's potential capability than on achieving short-term results [8]. Collaboration requires direct interaction between the supply chain partners to improve their social and environmental performance, and involves knowledge and experience sharing, and co-development of environmental friendly products/processes. In addition, large buying firms sometimes provide their suppliers with environmental education programs and technical assistance to improve the environmental and social performance of the supply chain [10,36].

2.2. Cumulative Sustainable Supply Chain Capabilities

The cumulative capabilities theory was proposed as an alternative to the "trade-off theory" in explaining the patterns of manufacturing capability development in operations strategy research. These capabilities usually represent quality, cost, dependability, speed, and flexibility [38]. Cumulative capabilities describe high performance in multiple capabilities simultaneously, whereas the term "trade-off" represents that high performance in one capability is necessarily traded off for low performance in others [20]. Tradeoffs between capabilities, even though not all, have been still reported and retained its importance in the literature [39]; however, this perspective is considered less than universal todays mainly because of the necessitates of global competition and development of advanced manufacturing technologies [40].

The term "cumulative sustainable SC capabilities" is used here to describe a situation in which a supply chain has a high level of sustainable SC capabilities more than one dimension. It is worth noting that there are often tradeoffs among the three sustainable SC capabilities at the level of the individual initiative. For instance, newly adopted monitoring and/or support activities in environmental and social areas may increase the cost of enforcement, coordination, and compliance in the initial stages [11,16]. Supply chains often face a situation in which they have to satisfy the different, sometimes conflicting demands of their stakeholders; many of whom, such as NGOs and local communities may not interested in the economic performance, but rather are focused on the chain's impact on society or the environment [18]. We, however, focus on the synergistic view on sustainable SC capabilities based on the relevant literature, offering numerous cases of companies and supply chains who achieve both economic and noneconomic performance [9]. Cumulative capabilities build upon each other and are mutually reinforcing [41]. Improvement in certain capabilities enables improvements to be made more easily in other capabilities, which in turn, result in cumulative capabilities [42]. By synthesizing the cumulative theory, the natural RBV [43] and other studies regarding sustainable SCM, we can conjecture that sustainable SC capabilities are also mutually reinforcing, and therefore, can be cumulative capabilities rather than being traded off.

First, the natural RBV [43] indicates that capabilities in continuous improvement or cross-functional management (*i.e.*, capabilities in the economic dimension) enable a firm to more quickly accumulate the resources necessary for pollution prevention and product stewardship (*i.e.*, capabilities in the environmental dimension). In addition, synergistic effects between operational and environmental capabilities, referred to as "lean and green" [44–46] have been often reported. These logics can apply to the supply chain, and then predict that the economic and environmental SC capabilities influence each other in a positive way. Vachon and Klassen [8] provided supporting evidence that technological integration between the customers and suppliers, a part of the economic

SC capability, to be a significant driver of environmental collaboration, a part of the environmental SC capability.

Second, a few of sustainable SCM studies have hinted that the conventional SCM and social/environmental SCM expertise might covary. Parmigiani *et al.* [47] addressed the relational capabilities, reflecting the ability to align incentives, share information, increase commitment, as well as facilitate collaboration and knowledge transfer, and can be deployed to develop social and environmental capabilities of the supply chain in several ways. For example, highly evolved forms of supplier evaluation enable the firms to create new metrics for social/environmental assessments of its supply chain. Furthermore, collaboration toward long-term goals also reduces incentives for short term opportunistic behavior, such as the covert use of underage labor, short-changing workplace safeguards, using banned substances or improperly disposing of materials, which in turn create social and environmental capabilities of the supply chain.

Collectively, it is believed that one sustainable SC capability can play a foundation for other capabilities to build, and therefore, the sustainable SC capabilities are cumulative ones. This argument leads to the following proposition.

Proposition 1. Economic, environmental, and social supply chain capabilities are cumulative. In other words, there are only significant positive correlations and no negative correlations among economic, environmental, and social SC capabilities.

2.3. Relationship with Supply Chain Performance

There is little empirical support that the pursuit of cumulative SC capabilities leads to supply chain performance. To conjecture about the impact of such capabilities on performance, we firstly reviewed the previous studies that have examined the impacts of each economic, environmental, social SC capabilities on the performance, separately, and then synthesize them for providing a proposition.

First, it is widely believed that the (conventional) SCM capability, which is referred as the economic SC capability of the present study, provides firms with competitive benefits. Enhancing the SCM capability can have significant impact on firm performance in several ways. For example, information sharing among the supply chain partners may reduce demand uncertainty, the levels of inventories, and costs in the process of matching supply with demand in the supply chain [48]. In addition, a seamless supply chain system simplifies the organizational process and then reduces the lead times with suppliers. Social capital theory also supports these positive effects. Structural and relational capitals, usually accumulated through information sharing, collaboration, effective communication, mutual trust, and commitment between the supply chain partners, have been reported to result in improvements in supplier performance, as well as buyer performance along operational dimensions of product design, process design, reduced lead time and improved quality [49].

Second, integrating environmental issues into SCM is also believed to be associated with the manufacturing and firm performance of buyers, as well as suppliers. Improvements in environmental management, such as waste reductions, efficient and effective input use, and control of internal processes, can facilitate total quality management and lean manufacturing practices, because environmental management and lean production are fundamentally parallel to one another [50,51]. A number of studies have provided for this notion by presenting empirical evidence that environmental improvements can enhance delivery performance and reduce the cost of goods, overall costs, as well as improve the net income [52,53]. This synergistic effect applies to the supply chains, and provides explanations about the positive impacts of green SCM on buyers' and suppliers' performance. In particular, environmental collaboration representing advanced proactive environmental orientation can facilitate the formation of idiosyncratic interaction routines between the supply chain partners [8], and thus, render innovations and enhance the accumulation of valuable assets that are tacit, relationship-specific, socially embedded and are not easily replicated by competitors [54]. It should be noted that the social side of sustainable SCM has been relatively little addressed in the literature [17].

Human right issues relating to supplier labor practices, such as child labor, forced labor and illegal work environment, were initially explored, and then other social issues, including diversity and philanthropy to local communities were addressed. Carter and Jennings [55] proposed a comprehensive measure to simultaneously capture diverse social issues in the supply chain, namely purchasing social responsibility (PSR).

Regarding to the relationship between cumulative sustainable SC capabilities and performance, the evidence is quite limited. However, based on the previous studies, which addresses each capability contributing to higher performance, we can expect that the more sustainable SC capabilities a firm owns, the higher performance it can achieve.

Proposition 2. There are direct relationships between cumulative sustainable SC capabilities and supply chain performance.

3. Research Methodology

3.1. Sample

Our unity of analysis is one side of a dyadic relationship between the buyer and the supplier. The sustainable SC capabilities of a supply chain were measured and analyzed from the perspective of suppliers. In particular, this study focused on medium-sized suppliers for two reasons. First, environmental and social SC capabilities in the supply chain are usually more critical in the relationships between the large buying firms and their small- and medium-sized suppliers than those between the large firms. Second, the development of sustainable SC capabilities is initiated mainly by the large firms' effort to their supply chain. In fact, sustainable SC capabilities between a relatively powerful large customer and a smaller supplier typically translate into buyer monitoring and support for the supplier [34]. In addition, we believe that suppliers' perception can better reflect the reality of sustainable SC capabilities than those of the buyers.

The sample consisted of 850 SMEs (defined as firms whose number of employees ranged from 50 to 500) that were listed in the Small and Medium Sized Enterprise Support Program Directory of the Korea Small and Medium Business Administration. First, we contacted each firm by telephone to request its participation in the survey, and for those willing firms, we asked for the appropriate respondents. We targeted a single, well-informed respondent. While the position of respondents varied depending on firm characteristics, such as the CEO or the senior manager in charge of sales, quality assurance, production, planning, or environmental management, these managers were well acquainted with the buyers' requirements and collaborative activities in economic, environmental, and social areas because they dealt with their customers' environmental/social requirements as well as conventional quality, cost, and delivery demands. We collected a total of 248 responses (29.2% response rate). Fifty responses were excluded from further analysis because they were not suppliers (27) or had missing data (23). The final usable sample contained 198 responses (23.3% response rate). Table 1 provides a summary of the respondents.

We assessed non-respondent bias by comparing the responses that were returned before the reminder call with those were returned after the call. For this, 20 items from the survey were randomly selected and conducted a *t*-test to examine any differences in responses between early and late respondents (n_1 = 143, n_2 = 105). The result indicated that there was not difference between the sample and the population at the 95 percent confident interval. We also examined the common method variance by using Harmon's single-factor approach. A single factor will emerge from a factor analysis of all survey items, or one general factor will account for most of the common variance in the data if common method variance exists [56]. A factor analysis (with a sample of 248 respondents) using the eigenvalue-greater-than-one criterion revealed four distinct factors that accounted for 65% of the variance while the first factor captured only 21% of the variance, suggesting that the potential problem of the common method variance was not significant.

Table 1. Summary of responses.

Industry	Machinery and Materials	Electrical and Electronics	Telecommunications	Chemical	Total (Mean)
Sample Size	335	281	134	100	850
Respondents	73	65	22	38	198
Sales (in million USD)	18.6	10.5	19.3	15.8	15.5
No. of Employees	95	64	98	55	77

3.2. Survey

Following previous research, we employed previously validated scales whenever possible. All items, except for the firm size, were measured using a seven-point Likert scale (1 = strongly disagree and 7 = strongly agree). The firm size was measured in terms of the number of employees.

Economic SC capability: We defined the economic SC capability as a supply chain's ability to address the quality, cost, delivery and flexibility issues in the supply chain in an efficient and effective way. This capability is characterized as a set of inter-organizational activities between the supply chain partners, including information sharing and collaborative practices, and consequential mutual trust and commitment. As noted before, this paper focuses on the perspective of suppliers, and thus, measures the perception of suppliers about the activities conducted between them and their major buyer. We developed five items for the economic SC capability based on the literature of SCM [28,35,57]. These items include information sharing, technical assistance, collaborative problem solving, mutual trust, and long-term partnership development.

Environmental SC capability: The definition and measurement of this capability is analogous to those of the social capability. The scale for the environmental dimension was adopted from previous research on green SCM [9,36,50]. This five-item scale also reflected the monitoring and collaboration practices conducted between the supply chain partners (environmental criteria for supplier evaluations, environmental management system implementation, auditing, environmental information sharing, educational and technical assistance, and collaborative product development).

Social SC capability: This capability is defined as a supply chain's ability to manage the social issues in the supply chain and then characterized as the extents of inter-organizational activities between a buyer and its supplier in responding to social issues. Five-item scale reflected the monitoring and collaboration practices conducted between a buyer and its supplier, including social criteria for supplier evaluations, management system certification, auditing, educational and technical assistance for social issue management, and collaborative and precautionary response [2,10,37].

Supplier performance: We measured the supplier's performance by its environmental, social and manufacturing performance. For environmental performance, a perceptual scale consisting of three items was designed. The scale included environmental performance improvements in environmental-friendly products, waste and emissions. For social performance, this study developed a three-item scale, including improvements in the realms of health, safety and human rights of employees and local communities. Previous studies of operations and SCM have reached a general consensus on a list of competitive priorities that can serve primary performance goals for suppliers, including their quality, cost, delivery, and flexibility [35]. We measured manufacturing performance using perceptual measures [20].

3.3. Validity and Reliability

The measurement was tested for its reliability, validity, and unidimensionality. We validated the content validity of the constructs though an extensive literature review before collecting data. We conducted a confirmatory factor analysis (CFA). Table 2 shows the factor loading, composite reliability, average variance extract, and Cronbach's alpha, which provided support for the unidimensionality, convergent validity, and reliability for all constructs. Table 3 shows the correlations between the latent variables. We assessed discriminant validity by examining whether

the average variance extracted for items exceeded the average shared variance (square of off-diagonal correlations) between the two constructs [58]. All constructs satisfied this criterion, indicating sufficient discriminant validity.

Table 2. Constructs' reliability and validity.

Construct	Items	Standardized Loading	AVE	Composite Reliability	Cronbach-Alpha
Sustainable SC capabilities					
Economic SC capability	ESC01	0.72	0.64	0.89	0.92
	ESC02	0.72			
	ESC03	0.79			
	ESC04	0.89			
	ESC05	0.82			
Social SC capability	SSC01	0.87	0.75	0.94	0.94
	SSC02	0.88			
	SSC03	0.91			
	SSC04	0.78			
	SSC05	0.87			
Environmental SC capability	GSC01	0.66	0.6	0.87	0.88
	GSC02	0.78			
	GSC03	0.74			
	GSC04	0.78			
	GSC05	0.78			
Supplier performance					
Environmental performance	GPER01	0.86	0.71	0.84	0.88
	GPER02	0.85			
	GPER03	0.81			
Social performance	SPER01	0.91	0.76	0.91	0.94
	SPER02	0.85			
	SPER03	0.81			
Manufacturing performance	MPER01	0.8	0.63	0.82	0.87
	MPER02	0.61			
	MPER03	0.81			
	MPER04	0.81			

Table 3. Correlation Matrix.

Construct	Mean	S.D.	1	2	3	4	5	6
1. Economic SC capability	5.03	1.16	(0.62)					
2. Environmental SC capability	4.68	1.37	0.58 **	(0.85)				
3. Social SC capability	4.32	1.59	0.62 **	0.66 **	(0.58)			
4. Environmental performance	4.71	1.05	0.55 **	0.51 **	0.54 **	(0.67)		
5. Social performance	4.91	1.11	0.56 **	0.50 **	0.51 **	0.77 **	(0.65)	
6. Manufacturing performance	5.40	0.95	0.56 **	0.45 **	0.43 **	0.60 **	0.66 **	(0.63)

(1) **: $p < 0.01$; (2) The lower half of the matrix shows estimated correlations between latent variables, and figures along the diagonal in brackets indicate the AVE.

3.4. Data Analysis

We used hierarchical regression and cluster analyses to test our propositions. The propositions regarding to cumulativeness and sequences were tested with correlation and multiple regressions by following the approach of Noble [59] and Flynn and Flynn [20]. For example, positive significant coefficients indicate cumulative capabilities, while negative significant correlations represent trade-offs. In addition, stepwise regression and the standardized coefficients were used to determine the order of significant predictor capabilities for each dependent capability. The analysis also provides the variance inflation factors (VIF), indicating the absence of multi-collinearity.

Second, a cluster analysis was carried out to identify the patterns of supply chains to how to accumulate sustainable SC capabilities, and test the relationship between cumulative capabilities and supply chain performance. A hierarchical clustering procedure was applied to draw an adequate

number of clusters (Ward's method). The explanatory power and pseudo F value of this cluster analysis verified that the four clusters were a valid classification. Then, a non-hierarchical clustering method (K-mean method) was implemented to assign the sample to the clusters. In addition, an ANOVA was performed to investigate the differences between the cumulative types in terms of supplier firm size and supplier manufacturing performance.

4. Results

4.1. Cumulative Sustainable SC Capabilities

The results in Table 4 provide support for the first proposition, which predicted cumulative sustainable SC capabilities. All positive and significant pairs of correlations support each capability, enhancing the accumulation of the other capabilities, with no apparent trade-offs. These revealed that the supply chain firms were not trading off an emphasis in the development in social or environmental capabilities for economic capabilities. The results of regression analysis provided an additional support for the development of an emphasis on cumulative sustainable SC capabilities. The results show that there is not a single negative relationship between the three capabilities, economic, social, and environmental capabilities.

Table 4. Relationships between capabilities.

Dependent	Adj-R^2	F	Independent	Coefficient β	T	VIF
Economic SC capability	0.42	66.99 **	Social capability	0.45	6.17 **	1.66
			Environmental capability	0.27	3.78 **	1.66
Social SC capability	0.50	91.21 **	Environmental capability	0.42	6.66 **	1.44
			Economic capability	0.39	6.17 **	1.44
Environmental SC capability	0.44	71.08 **	Social capability	0.47	6.61 **	1.62
			Economic capability	0.26	3.71 **	1.62

**: $p < 0.01$.

As evident from the results of multiple regression analyses (Table 4), the economic and environmental SC capabilities include social SC capability as the most significant predictor, while the social and environmental capabilities include economic capability as the second significant predictor. This implies that the economic capability is a higher level (the lastly accumulated and/or a capability that is more difficult to accumulate), building upon the foundations of the social and environmental capabilities (relatively easily accumulated capabilities), indicating the possible sequences of cumulative capabilities.

4.2. Cumulative Capabilities and Supplier Performance

To assess the impact of cumulative sustainable SC capabilities on supply chain performance, we firstly classified groups of cumulative capabilities and then compared the performance between the groups. The cluster analysis yielded four types of cumulative capabilities. Table 5 summarizes the results of the analysis, including the mean scores for each capability and the number of cased belonging to each group.

Table 5. Cluster analysis and cumulative capabilities.

Sustainable SC Capability	Cluster			
	Laggard	Environmental-Focused	Social-Cautious	All-Round
Economic	3.01	4.31	4.64	5.84
Environmental	2.01	5.34	4.18	5.78
Social	1.63	2.88	4.01	5.82
Number of cases	19 (9%)	34 (16%)	71 (36%)	75 (39%)

The first cluster scored relatively low on all three sustainable capabilities, lagging behind any other clusters in sustainable supply chain capabilities. This was labeled the "laggard". The second cluster shows relatively high and moderate levels in the environmental and economic SC capabilities, respectively. This group's cumulative capabilities primarily involved the environmental and economic SC capabilities. We labeled this cluster the "environmental-focused". The third cluster scored relatively high and moderate on the economic, environmental and social SC capabilities, respectively. This cluster is likely to be more cautious about the social issues in the supply chain than the other two groups of the "laggard" and "environmental-focused". This cluster was labeled the "social-cautious". The last group shows the highest scores in all three capabilities. This cluster represents highly cumulative sustainable SC capabilities, labeled as the "all-round".

Table 6 shows the results of the ANOVA, indicating the differences between the types of cumulative sustainable SC capabilities. First, the firm size of a supplier was found to be associated with cumulative sustainable SC capabilities, even though the extent of the relationship was not quite strong. The suppliers of the "all-round" group were likely to be larger than those of the other groups, but statistical support was not significant. Second, significant differences of supplier environmental, social and manufacturing performance among the clusters were found, providing support for the second proposition. According to the Duncan's test, the average performance of suppliers was not the same across the four clusters. Supplier environmental, social and manufacturing performance of the "all-round" group was significantly higher than that of the other clusters. The "environmental-focused" and the "social-cautious" clusters also showed significantly higher performance than the "laggard" cluster. These results indicate that cumulative sustainable SC capabilities are significantly and positively related to the supply chain performance.

Table 6. ANOVA: Cumulative capabilities and firm performance.

Variables	Laggard (A)	Environmental-Focused (B)	Social-Focused (C)	All-Round (D)	Duncan's Test (*F* Value)
Firm size	136	206	285	367	D = C = B = A (0.54)
Environmental performance	3.28	4.46	4.56	5.28	D > C = B > A (25.07 **)
Social performance	3.71	4.61	4.66	5.54	D > C = B > A (21.45 **)
Manufacturing performance	4.25	5.23	5.24	5.87	D > B = C > A (19.05 **)
Number of cases	16 (9%)	29 (16%)	68 (36%)	72 (39%)	

**: $p < 0.01$.

5. Discussion and Implications

This study provides a more comprehensive definition of the sustainable SC capabilities and identifies a set of three interconnected dimensions of sustainable capabilities: economic, social and environmental capabilities. In addition, the study proposes valid and reliable instruments that are simplified for measuring the sustainable SC capabilities. These constructs, with better definitions and measures, are expected to facilitate future empirical research.

In this research, we explored the cumulative sustainable SC capabilities, indicating the positive and significant relationships between the economic, social, and environmental capabilities. Results provide strong evidence regarding the cumulative capabilities, illustrating that economic, social, and environmental SC capabilities mutually reinforce each other, rather than traded off when they are developed. This is quite consistent with the original cumulative manufacturing capabilities theory [19,59]. This result implies the natural RBV [43], explaining the possibilities of mutual reinforcement between the economic and environmental capabilities, can be extended to the triple bottom line, as well as supply chain contexts. The results of this are also in line with several observations that sustainable supply chain management has been diffused into some of Korean industries. For instance, a national green supply chain initiative was started in 2003, which was originally programed and supported by the Korean government to encourage small- and medium-sized supplier to improve their environmental capabilities by utilizing relationships between the key-players

of large buying firms and their suppliers. Hyundai Motor Company, Samsung SDI, and other large-sized Korean firms have implemented their own green supply chain management practices by actively participating in this national project. Hyundai Motor Company and Samsung SDI introduced their green procurement policy in 2003 and 2004, respectively, by demanding their suppliers to put an environmental management system into place and assure that their products were free of hazardous substances. Along with such an environmental performance monitoring, they also have implemented a supplier-support program by providing their selected major suppliers with environmental education, technical assistance, and environmental information sharing systems. Through these practices, suppliers in the Korean automobile and electronics industries, have improved their environmental capability without compromising economic capability [60], which in turn support the possibility of cumulative capabilities rather than trade-offs.

This study also provides a strong evidence of a relationship between cumulative sustainable SC capabilities and supply chain performance. The cumulative capabilities of the three capabilities (the "all-round" cluster) showed the highest supply chain performance, followed by two other cumulative capabilities, namely the economic/environmental cumulative (the "environmental-focused" cluster) and the middle levels of economic/social/environmental cumulative (the "social-cautious" cluster). This result is very consistent with the previous studies in operations management about the positive relationship between the cumulative capabilities and plant performance [19] and that between the SC capability and firm performance [28], as well as that between the sustainable SCM practices and firm performance [9]. Collectively, this study answers the call for a more comprehensive analysis of sustainable business operations based on all dimensions of the triple bottom line, simultaneously [16], and fills the gap in empirical research on outcomes of sustainable SCM [17,47].

This study provides a better understanding about the sustainable SC capabilities and important guidelines for managers of suppliers and buyers who wish to build a more sustainable supply chain. First, supply chain managers should recognize that cumulative sustainable SC capabilities can increase the supply chain performance. Buyers should integrate sustainability issues into the conventional SCM practices in a steady manner by expecting a balance between the financial performance and nonmonetary performance outcomes, such as quality, buyer–supplier relationship, and social capital. Suppliers should explicitly recognize that enhancing their efforts to comply with social and environmental requirements of their buyers, and make proactive use of support and/or collaboration programs may facilitate the development of sustainable SC capabilities, which in turn, lead to higher manufacturing performance [9,61].

Second, supply chain managers can utilize the measures of this study as powerful tools to build environmental and social SC capabilities. They should design and undertake effective and integrated sustainable SC practices by fully visualizing that the three dimensions of the triple bottom line in the supply chain are closely interrelated. For instance, supply chain partners should introduce environmental and social procurement systems, including the formal monitoring and auditing process with ISO 14001 and/or SA 8000 certificates [10,36]. In addition, information sharing and collaborative activities in response to environmental and social issues need to be facilitated [62]. Such environmental/social monitoring and collaboration practices are not much different from conventional supply chain practices, indicating that supply chain practices to improve sustainable SC capabilities are closely interrelated.

Finally, the results imply that the economic SC capability is the most difficult to build among the three sustainable capabilities because it can build upon the foundation of social and environmental capabilities. Firms, both buyers and suppliers, need to proactively address the social and environmental issues in the supply chain even though the economic capability is the ultimate goal to achieve. Doing so can foster frequent communication, mutual understanding, goal congruence, shared philosophies, and benefit sharing [63,64], which in turn enables the supply chain partners to develop much easily of the economic SC capability.

6. Conclusions and Future Research

This paper proposed an integrated concept of sustainable SC capabilities by combining diverse concepts of capabilities, supply chain management, and the triple bottom line (sustainability). Our findings present a range of issues for managers of buying firms, as well as suppliers attempting to foster social and environmental management capabilities, in addition to the traditional SC capability throughout the supply chain. Evidence of cumulative sustainable SC capabilities and their positive effects on supply chain performance suggests strong possibilities of win-win-win situations and requires firms to develop supply chain strategies toward sustainable development [3]. Overall, the results of this study provide guidance for managers and academics considering how to identify, design and manage the dimensions of sustainability into supply chain management.

By clarifying the limitations of this paper, we suggest directions for future research. First, this study examined sustainable SC capabilities from a supplier perspective. Future research should explore this topic from a dyadic perspective by using data from both sides of the buyer and supplier. In addition, this study relied exclusively on self-reported and subjective measures. The positive effects of cumulative sustainable SC capabilities need to be investigated with objective measures such as financial performance data. Third, this study did not fully consider the radical innovation aspect of sustainable SC capabilities. Sustainability is a fundamentally new way of thinking about SCM requiring radical innovations in terms of practices [12]. Future research should focuses on how to create truly sustainable supply chains being to maintain economic viability, while doing no harm to social or environmental systems. Fourth, this study presented the degree to which the three dimensions of sustainable SC capabilities are correlated varies significantly across firms (e.g., four types of cumulative sustainable SC capabilities). However, the question why firms differ in building sustainable SC capabilities remains unanswered. Intra-organizational factors such as internal process integration, purchasing and supply function capability and organizational learning and inter-organizational factors including the buyer–supplier relationship and dependency as well as contextual factors such as stakeholders' sustainability pressure should be explored in future research. Fifth, the extent and strength of particular relationships may vary across countries, and contextual differences may matter. In particular, future research should address emerging economies that have emerged as one of the factories of the world that are offering a large workforce, in which regulators and consumers do not likely to impose the same extent of environmental and social pressure onto supply chains.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Questionnaire Items Used for This Study

Construct	Item Code	Items
Sustainable Supply Chain Capabilities		
Economic SC capability		
		To what extent do you agree or disagree with each of the following statements (*1 = not at all, 4 = moderately, and 7 = very much*)? *During the last two years, our major customer . . .*
	ESC01	shared relevant and timely information with us.
	ESC02	provided us with technical and managerial assistance.
	ESC03	and our firm solved problems jointly.
	ESC04	and our firm trust each other.
	ESC05	and our firm consider us as a long-term partner.

Construct	Item Code	Items
Social SC capability		
	SSC01	assessed our social performance (e.g., good relationships with local community and employees, no occupational accidents, and legal compliance) a formal procurement process.
	SSC02	conducted audits regarding social issues (e.g., those related to labor, ethics, and community relations) on a regular basis.
	SSC03	provided us with relevant and helpful information on how to comply with its social requirements.
	SSC04	provided us with technical, managerial, and financial assistance to address social issues.
	SSC05	and our firm jointly identified possible social issues to prepare for and respond to them.
Environmental SC capability		
	GSC01	assessed our environmental performance through a formal and green procurement process.
	GSC02	demanded us to implement an environmental management system
	GSC03	conducted environmental audits on a regular basis.
	GSC04	provided us with technical, managerial, and financial assistance to address environmental issues.
	GSC05	and our firm jointly developed environmental-conscious products.
Supplier Performance		
		For each of the items listed below, how does your firm compare with primary competitors? (*1 = far worse than competitors, 4 = about the same as competitors, and 7 = far better than competitors*)
Manufacturing performance		
	MPER01	Product quality
	MPER02	On-time delivery
	MPER03	Production costs
	MPER04	Ability to change output volume
Environmental performance		
	GPER01	Reduced air emissions (e.g., SO_x, NO_x and CO_2)
	GPER02	Reduced waste water and/or solid waste
	GPER03	Decreased consumption of hazardous/toxic materials
Social performance		
	SPER01	Increased employees' health and safety
	SPER02	Improved local community's overall health and safety
	SPER03	Improved awareness and protection of the claims and rights of local community

References

1. Handfield, R.B.; Sroufe, R.; Walton, S. Integrating environmental management and supply chain strategies. *Bus. Strategy Environ.* **2005**, *14*, 1–19. [CrossRef]
2. Chhabara, R. *Ethical Sourcing: The Responsible Chain Gang*; Ethical Corporation: London, UK, 2010; pp. 12–13.
3. Elkington, J. *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*; New Society Publishing: Gabriola Island, BC, Canada, 1998.
4. Bai, C.; Sarkis, J. Integrating sustainability into supplier selection with grey system and rough set methodologies. *Int. J. Prod. Econ.* **2010**, *124*, 252–264. [CrossRef]
5. Kim, M.G.; Woo, C.; Rho, J.J.; Chung, Y. Environmental capabilities of supplies for green supply chain management in construction projects: A case study in Korea. *Sustainability* **2016**, *8*, 82–98. [CrossRef]
6. Lee, S. The effects of green supply chain management on the supplier's performance through social capital accumulation. *Supply Chain Manag. Int. J.* **2015**, *20*, 42–55. [CrossRef]

7. Mari, S.I.; Lee, Y.H.; Memon, M.S. Sustainable and resilient supply chain network design under disruption risks. *Sustainability* **2014**, *6*, 6666–6686. [CrossRef]
8. Vachon, S.; Klassen, R.D. Extending green practices across the supply chain, the impact of upstream and downstream integration. *Int. J. Oper. Prod. Manag.* **2006**, *26*, 795–821.
9. Zhu, Q.; Sarkis, J. Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *J. Oper. Manag.* **2004**, *22*, 265–289. [CrossRef]
10. Klassen, R.D.; Vereecke, A. Social issues in supply chains, capabilities link responsibility, risk (opportunities), and performance. *Int. J. Prod. Econ.* **2012**, *140*, 103–115. [CrossRef]
11. Ageron, B.; Gunasekaran, A.; Spalanzani, A. Sustainable supply management: An empirical study. *Int. J. Prod. Econ.* **2012**, *140*, 168–182. [CrossRef]
12. Pagell, M.; Wu, Z.; Wasserman, M.E. Thinking differently about purchasing portfolios: An assessment of sustainable sourcing. *J. Supply Chain Manag.* **2010**, *46*, 57–73. [CrossRef]
13. Yang, C.-L.; Lin, S.-P.; Chang, Y.-H.; Sheu, C. Mediated effect of environmental management on manufacturing competitiveness, an empirical study. *Int. J. Prod. Econ.* **2010**, *123*, 210–220. [CrossRef]
14. Rao, P.; Holt, D. Do green supply chains lead to competitiveness and economic performance? *Int. J. Oper. Prod. Manag.* **2005**, *25*, 898–916. [CrossRef]
15. Wong, C.W.Y.; Lai, K.-H.; Shang, K.-C.; Lu, C.-S.; Leung, T.K.P. Green operations and the moderating role of environmental management capability of suppliers on manufacturing firm performance. *Int. J. Prod. Econ.* **2012**, *140*, 283–294. [CrossRef]
16. Wu, Z.; Pagell, M. Balancing priorities, decision-making in sustainable supply chain management. *J. Oper. Manag.* **2011**, *29*, 577–590. [CrossRef]
17. Seuring, S.; Müller, M. From a literature review to a conceptual framework for sustainable supply chain management. *J. Clean. Prod.* **2008**, *16*, 1699–1710. [CrossRef]
18. Pagell, M.; Shevchenko, A. Why research in sustainable supply chain management should have no future. *J. Supply Chain Manag.* **2014**, *50*, 44–55. [CrossRef]
19. Ferdows, K.; DeMeyer, A. A lasting improvement in manufacturing performance: In search of a new theory. *J. Oper. Manag.* **1990**, *9*, 168–184. [CrossRef]
20. Flynn, B.G.; Flynn, E.J. An exploratory study of the nature of cumulative capabilities. *J. Oper. Manag.* **2004**, *22*, 439–457. [CrossRef]
21. Barney, J. Firm resources and sustained competitive advantage. *J. Manag.* **1991**, *17*, 99–120. [CrossRef]
22. Wernerfelt, B. A resource-based view of the firm. *Strateg. Manag. J.* **1984**, *5*, 171–180. [CrossRef]
23. Esper, T.L.; Crook, T.R. Supply chain resources: Advancing theoretical foundations and constructs. *J. Supply Chain Manag.* **2014**, *50*, 3–5. [CrossRef]
24. Priem, R.L.; Swink, M. A demand-side perspective on supply chain management. *J. Supply Chain Manag.* **2012**, *48*, 7–13. [CrossRef]
25. Barney, J.B. Purchasing, supply chain management and sustained competitive advantage: The relevance of resource-based theory. *J. Supply Chain Manag.* **2012**, *48*, 3–6. [CrossRef]
26. Hunt, S.D.; Davis, D.F. Grounding supply chain management in resource-advantage theory, in defense of a resource-based view of the firm. *J. Supply Chain Manag.* **2012**, *48*, 14–20. [CrossRef]
27. Nahapiet, J.; Ghoshal, S. Social capital, intellectual, capital, and the organizational advantage. *Acad. Manag. Rev.* **1998**, *23*, 242–266.
28. Wu, F.; Yeniyurt, S.; Kim, D.; Cavusgil, S.T. The impact of information technology on supply chain capabilities and firm performance: A resource-based view. *Ind. Mark. Manag.* **2006**, *35*, 493–504. [CrossRef]
29. Handfield, R.B.; Cousins, P.D.; Lawson, B.; Petersen, K.J. How can supply management really improve performance? A knowledge-based model of alignment capabilities. *J. Supply Chain Manag.* **2015**, *51*, 3–17. [CrossRef]
30. Dobrzykowski, D.D.; Leuschner, R.; Hong, P.C.; Roh, J.J. Examining absorptive capacity in supply chains: Linking responsive strategy and firm performance. *J. Supply Chain Manag.* **2015**, *51*, 3–28. [CrossRef]
31. Crook, T.R.; Esper, T.L. Do resources aid in supply chain functioning and management? Yes, but more (and more precise) research is needed. *J. Supply Chain Manag.* **2014**, *50*, 94–97.

32. Ralston, P.M.; Blackhurst, J.; Cantor, D.E.; Crum, M.R. A Structure–conduct–performance perspective of how strategic supply chain integration affects firm performance. *J. Supply Chain Manag.* **2015**, *51*, 47–64. [CrossRef]
33. Shore, B.; Venkatrachalam, A.R. Evaluating the information sharing capabilities of supply chain partners: A fuzy logic model. *Int. J. Phys. Distrib. Logist. Manag.* **2003**, *33*, 804–824. [CrossRef]
34. Modi, S.B.; Mabert, V.A. Supplier development, improving supplier performance through knowledge transfer. *J. Oper. Manag.* **2007**, *25*, 42–64. [CrossRef]
35. Krause, D.R.; Handfield, R.B.; Tyler, B. The relationships between supplier development, commitment, social capital accumulation and performance improvement. *J. Oper. Manag.* **2007**, *25*, 528–545. [CrossRef]
36. Lee, S.; Klassen, R.D. Drivers and enablers that foster environmental management capabilities in small- and medium-sized suppliers in supply chains. *Prod. Oper. Manag.* **2008**, *17*, 573–586. [CrossRef]
37. Carter, C.R. Purchasing and social responsibility, a replication and extension. *J. Supply Chain Manag.* **2004**, *40*, 4–16. [CrossRef]
38. Hayes, R.H.; Wheelright, S.C. *Restoring Our Competitive Edge, Competing through Manufacturing*; Wiley: New York, NY, USA, 1984.
39. Corbett, L.M.; Whybark, D.C. Searching for the sandcone in the GMRG data. *Int. J. Oper. Prod. Manag.* **2001**, *21*, 965–980. [CrossRef]
40. Amoako-Gyampah, K.; Meredith, J.R. Examining cumulative capabilities in a developing economy. *Int. J. Oper. Prod. Manag.* **2007**, *27*, 928–950. [CrossRef]
41. Boyer, K.K.; Lewis, M. Competitive priorities, investigating the need for tradeoffs in operations strategy. *Prod. Oper. Manag.* **2002**, *11*, 9–20. [CrossRef]
42. Schmenner, R.W.; Swink, M.L. On theory in operations management. *J. Oper. Manag.* **1998**, *17*, 97–113. [CrossRef]
43. Hart, S. A natural-resource-based view of the firm. *Acad. Manag. Rev.* **2005**, *20*, 986–1014.
44. Berchicci, L.; King, A.A. Postcards from the edge, a review of the business and environment literature. *Acad. Manag. Ann.* **2007**, *1*, 513–547. [CrossRef]
45. Pil, F.K.; Rothenberg, S. Environmental performance as a driver of superior quality. *Prod. Oper. Manag.* **2003**, *12*, 404–415. [CrossRef]
46. Ioppolo, G.; Cucurachi, S.; Salomone, R.; Saija, G.; Ciraolo, L. Industrial ecology and environmental lean management: Lights and shadows. *Sustainability* **2014**, *6*, 6362–6376. [CrossRef]
47. Parmigiani, A.; Klassen, R.D.; Russon, M.V. Efficiency meets accountability: Performance implications of supply chain configuration, control, and capabilities. *J. Oper. Manag.* **2011**, *29*, 212–223. [CrossRef]
48. Lee, H.; Padmanabhan, V.; Whang, S. The bullwhip effect in supply chains. *Sloan Manag. Rev.* **1997**, *38*, 93–102. [CrossRef]
49. Kotabe, M.; Martin, X.; Domoto, H. Gaining from vertical partnerships: Knowledge transfer, relationship duration, and supplier performance improvement in the U.S. and Japanese automotive industries. *Strateg. Manag. J.* **2003**, *24*, 293–316. [CrossRef]
50. Curkovic, S.; Sroufe, R.; Landeros, R. Measuring TQEM returns from the application of quality frameworks. *Bus. Strategy Environ.* **2008**, *17*, 93–106. [CrossRef]
51. Corbett, C.J.; Klassen, R.D. Extending the horizons: Environmental excellence as key to improving operations. *Manuf. Serv. Oper. Manag.* **2006**, *8*, 5–22. [CrossRef]
52. King, A.; Lenox, M. Exploring the Locus of Profitable Pollution Reduction. *Manag. Sci.* **2002**, *48*, 289–299. [CrossRef]
53. Melnyk, S.; Sroufe, R.; Calantone, R. Assessing the Impact of environmental management systems on corporate and environmental performance. *J. Oper. Manag.* **2003**, *21*, 329–351. [CrossRef]
54. Paulraj, A. Understanding the relationships between internal resources and capabilities, sustainable supply chain management and organizational sustainability. *J. Supply Chain Manag.* **2011**, *47*, 19–37. [CrossRef]
55. Carter, C.R.; Jennings, M.M. Social responsibility and supply chain relationships. *Trans. Res. E Logist. Transp. Rev.* **2002**, *38*, 37–52. [CrossRef]
56. Podsakoff, P.M.; MacKenzie, S.B.; Lee, J.Y.; Podsakoff, N.P. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J. Appl. Psychol.* **2003**, *88*, 879–903. [CrossRef] [PubMed]

57. Carey, S.; Lawson, B.; Krause, D.R. Social capital configuration, legal bonds and performance in buyer-supplier relationships. *J. Oper. Manag.* **2011**, *29*, 277–288. [CrossRef]
58. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 39–50. [CrossRef]
59. Noble, M.A. Manufacturing strategy, testing the cumulative model in multiple country context. *Decis. Sci.* **1995**, *26*, 693–721. [CrossRef]
60. Nair, A.; Yan, T.; Ro., Y.K.; Oke, A.; Chiles, T.H.; Lee, S. How environmental innovations emerge and proliferate in supply networks: A complex adaptive systems perspective. *J. Supply Chain Manag.* **2016**, *52*, 66–86. [CrossRef]
61. Carter, C.R.; Kale, R.; Grimm, C.M. Environmental purchasing and firm performance: An empirical investigation. *Transp. Res. E* **2000**, *36*, 219–228. [CrossRef]
62. Ioppolo, G.; Cucurachi, S.; Salomone, R.; Saija, G.; Shi, L. Sustainable local development and environmental governance: A strategic planning experience. *Sustainability* **2016**, *8*, 180. [CrossRef]
63. Cao, M.; Zhang, Q. Supply chain collaboration, Impact on collaborative advantage and firm performance. *J. Oper. Manag.* **2011**, *29*, 163–180. [CrossRef]
64. Tuten, T.L.; Urban, D.J. An expanded model of business-to-business partnership foundation and success. *Ind. Mark. Manag.* **2001**, *30*, 149–164. [CrossRef]