Research Article

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Coevolution of environmental sustainability orientation and strategic alliance learning in green supply chain management

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Abstract: The main aim of this paper is to show how green supply chain (SC) environmental sustainability orientation and strategic alliance learning coevolve over time. Our position is that the level of interfirm learning is a determinant of the formations and mastery mechanisms evolving in a green SC. Therefore, this study discusses the environmental sustainability of the learning processes of firms' alliances during the life cycle of the alliances. This is done in order to encourage firms to follow green innovation and green SCs through enhancing their environmental performance and increasing their competitive advantage in the global market. In addition, this study develops a research structure and test hypotheses on the basis of survey data from 342 Taiwanese firms listed on the stock market. The results indicate that green knowledge acquisition plays a prominent role in the performance of firms' alliances, especially when implemented in a green SC management (SCM) context. Moreover, according to one of the main findings, as companies evolve through the different phases of the alliance life cycle, their situation shows high potential for creating knowledge sharing through their exploration capabilities. Finally, when firms focus their internal organizations on learning and environmental requirements, they become better able to expand their learning capacity as well as to build and maintain a sustainable competitive advantage.

Keywords: green supply chain management, alliance knowledge learning, coevolution, alliance performance

1 Introduction

Economic growth that relies on the intensive depletion of natural resources in the long run cannot be thought to be sustainable from either an environmental or economic perspective. In recent years, there has been a global rise in the importance of environmental issues, and environmental consciousness has increased among consumers. Moreover, strict environmental regulations and the popularity of environmentalism have increasingly focused attention on the polluting behaviors of companies, encouraging them to manage their activities' impacts on the environment in order to diminish their reputational risks and prevent extra costs [Pineiro-Chousa et al., 2017]. As a result, it is important for firms to find solutions that can help them reduce environmental burdens associated with their economic activities. In this regard, green innovation is a win–win strategy to overcome the conflict between environmental protection and economic development. Recently, many companies have come to recognize the concept of green supply chain management (SCM), which is also known as supply chain (SC) environmental management. However, although there is an abundance of green SCM literature, relatively little research has concentrated on the relationships among greening the SC, green innovation, environmental sustainability, and the competitive advantage

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in Taiwanese industries [Evangelista et al., 2018]. Taiwan is a major global manufacturer of information products; Taiwanese industries' expenditure of resources cannot be underestimated.

The combination or collection of different business partners for the development of green innovation is often referred to as a technology collaboration portfolio [Calza et al., 2017]. Strategic alliances are voluntary, cooperative interfirm agreements that are intended to promote competitive advantage by allowing partners to share resources and risks, acquire knowledge, and access markets. With efficacious knowledge sharing, the strategic intention of interorganizational cooperation for sustainable competitive advantage is achievable by consolidating the capabilities and relevant organizational resources of all sections [Wang et al., 2018]. Thus, the interactive learning opportunities gained from such alliances help firms to raise their capabilities and develop their resource endowments [Teece, 2018]. Although coevolutionary theory has received increasing attention in the social sciences and in organizational theory, it has seen limited application in the study of green SCM.

This raises the following questions regarding practitioners' knowledge: 1) What is their level of awareness regarding the environmental implications of their activities? 2) Do they operationalize them in their current practices as well as in the planning of future activities? This study uses coevolutionary theory as a lens through which to explore the empirical alignment between business and green SCM strategies. The present study also identifies the mechanisms of coevolution that have continued to be latent in prior research and elucidates how its alliance portfolio coevolves as a consequence of strategic decisions (e.g., downsizing or diversification), which in turn limits the accomplishment of a firm's strategy. This study's scope is therefore extended by providing a contextual account of specific causal linkages between its alliance portfolio and a firm.

2 Literature review and hypotheses

2.1 Environmental sustainability orientation

The resource-based view (RBV), in the context of environmental sustainability, recommends that firms recognize and utilize strategic resources and capacities to create unique and hard to imitate practices, as well as reducing their operations' effect on the natural environment, while simultaneously creating value. In the study of environmentally friendly policies, it was shown that corporate social responsibility actions by firms are more likely to improve their efficiency, resulting in the evolution of a beneficial source of competitive advantage [Amankwah-Amoah et al., 2018], and thus sustainability orientation is a good predictor of entrepreneurial success [Sung and Park, 2018]. The firms have been led by customer expectations and environmental sustainable stresses to strive to offer attractive and better offers to customers continuously. In order to provide services and competitive products, sure strategies that may not be environmentally sustainable are sometimes adopted by firms.

There is more to explore in the research on how firms organize their technology-related strategic alliances [Jiang et al., 2010]. Meanwhile, little attention has been paid to the trade-offs and management mechanisms among alliance firms with different partners from the portfolio-level perspective, especially in the case of emerging markets. In this paper, the main emphasis has therefore been on understanding the strategies and concept of alliance knowledge and environmental sustainability orientation learning in its influence and green SCM on sustainability of the society and environment.

2.2 Dynamics of alliance learning mechanisms in green SCM

Alliance provides a context in which vicarious learning is facilitated and encouraged. In order to survive selection pressures and remain competitive, firms must find and exploit new external information. In this regard, firms scan the environment for new ideas and knowledge, and when a promising idea is found, they transfer the idea from the external environment to the internal one, so that it will be commercially exploited. In the alliance learning process, partners undertake intentional efforts to learn, cumulate, and leverage practical alliance management knowledge [Kale and Singh, 2007]. Alliances arguably provide a context in which vicarious learning is facilitated and boosted. Indeed, it has been proposed that it is their knowledge-sharing characteristics that enable their existence [Zosh et al., 2018]. All the aforementioned

researchers recognize that collaboration with partners enables learning by providing partners for access to new knowledge that resides outside a single firm's boundaries and by collaboratively that leverages existing knowledge. This study thus aims at developing a better understanding of the different learning mechanisms that affect the management of collaborative green technology portfolios.

This study suggests that green knowledge acquisition and sharing with customers in the green SC is the first step in understanding value, and green knowledge acquisition and sharing with suppliers in the SC offers insights and also boosts the efficiency and effectiveness of delivery and value creation. Therefore, alliance green knowledge acquisition and sharing is conceptualized as a joint activity in which two firms strive to create more value together than they would create individually or with other partners. It is treated as a multidimensional construct with multiple facets, including green relationship learning (GRL), joint sense making (JSM), and green knowledge integration (KI) [Cheung, 2005; Chen and Chang, 2013]. Thus, green knowledge acquisition and sharing in an alliance is conceptualized as a joint action in which interfirms strive to produce more value jointly than they would have created either individually or with other members in the green SCM. Furthermore, it is treated as a multidimensional construct with multiple structures, including GRL, JSM, and green KI [Tan, 2017].

2.3 Coevolution theory

The coevolutionary viewpoint is emerging as a considerable organizational framework for investigating outcomes and organizational behavior, especially as a joint function of selection pressures and managerial achievement imposed by the environment. Although researchers have studied the reasons behind the formation of such alliances, questions regarding whether they always move from one stage to the next and what factors can destroy the alliance process remained unanswered. Coevolutionary thinking considers organizations' embeddedness in an historical and complex sociocultural situation, where the forces of change and interactions meet and reverberate. More specifically, in regard to coevolution, movement should be apparent in at least one of the three evolutionary procedures influenced by those mutual causal mechanisms between the two populations (i.e., fluctuation, selection, and retention). The evolution of a firm's strategic alliances and networks is arguably a coevolutionary adaptation to the concurrent choice of individuals, dyads, and groups. More specifically, the evolution of alliances is examined by this study with an emphasis on the simultaneous and changing relationships between alliance learning and institutional processes. Diverse scenarios could therefore unfold, depending on how the strategic alliance shifts from the initial conditions to the evolved circumstances. Thus, focusing on evolutionary forces is the key to understanding how alliances evolve from one stage to another.

The major rationale of the interorganizational knowledge governance perspective is the achievement of organizational learning, knowledge acquisition, and knowledge creation and accumulation through structural arrangement of the interorganizational knowledge flow. Drawing on the green SCM literature review, firms transfer knowledge through their supplier chain and support the notion that environmental learning occurs within a firm's SC [Jackson, 2004]. Therefore, although researchers have studied the reasons behind the formation of alliances, whether or not an alliance always moves from one stage to the next or what factors destroy the alliance process are not yet clear because the alliance evolutionary force is the key to understanding how alliances evolve from one stage to another.

3 Methodology

3.1 Conceptual framework

Figure 1 shows the entire conceptual framework and delineates the proposed relationships among green SCM strategic orientation and alliance institutional processes. As such, based on this research model, interorganizational knowledge governance's major rationale is the achievement of organizational learning, knowledge acquisition, and knowledge creation and accumulation by interorganizational knowledge flow's structural arrangements.

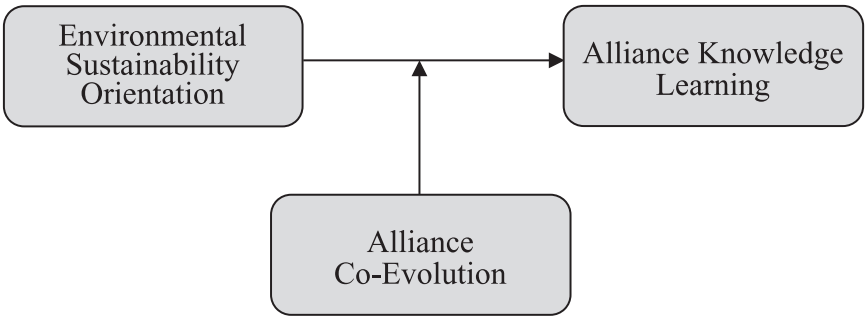

Figure 1. Research Framework

3.2 Data collection

Data collection occurred over a 5-month period from January 2018 to May 2018. All of the potential respondents for the main test were selected from a database acquired from the Taiwan stock exchange (854 TSE companies) and the over-the-counter (969 OTC firms) market. For these selected companies, this research required the respondents to be engaged in SCM with Asian partners (domestic, Hong Kong, mainland China, and other Asian countries). More specifically, the focus was on logistics, manufacturing, and marketing managers at the vice-presidential or directorial levels. In total, three reminder e-mails were sent at evenly distributed time intervals. The result of this procedure was that there were 741 unique visitors to the survey website (39.5% of qualified potential respondents actually accessed the survey), after which 368 submitted their finished responses (49.7% of the 741 visitors accessing the website or 25.8% of the 1,814 aimed respondents). The remaining 47.6% of the potential respondents dropped out quickly or within the first few pages of the survey (Table 1).

Table 1. Characteristics of the Firms

Description	Frequency	%	Description	Frequency	%
Type of Industry			**Established**		
Electronics	138	40.35	Less than 5 years	2	0.58
Industrial products	96	28.07	6–10 years	76	22.22
Chemicals/plastics	24	7.02	11–15 years	115	33.63
Pharmaceutical	47	13.74	More than 15 years	149	43.57
Others	37	10.82	**Total Employees**		
Annual Sales			Less than 500	65	19.01
Less than 50 million	35	10.24	501–1,000	138	40.35
51–200 million	84	24.56	1,001–2,000	84	24.56
201–1 billion	89	26.02	More than 2,000	55	16.08
More than 1 billion	134	39.18			
Times for Alliance with Current Partner			**Partners' Country of Origin**		
Newly established	5	1.46	Taiwan	193	56.44
1–3 times	128	37.43	Asia	96	28.07
4–6 times	96	28.07	American	31	9.06
More than 6 times	113	33.04	European	22	6.43

Information on the sampled firms in regard to their experience of managing green SC strategic alliances is summarized in Table 2. These results indicate that the majority of the survey participants had more than 5 years of experience managing green SC strategic alliances (more than 50%). Only 6.15% firms had newly established alliances with their current partners, while approximately 70% had engaged in alliances more than four times. As expected, the length of the alliances with the current partners varied: less than 1 year (15.79%); less than 3 years (14.33%); less than 6 years (21.93%); and more than 6 years (47.95%).

Approximately 28.36% of the companies had a dedicated division to manage their green SC strategic alliances, while 26.02% included a mixed division. In addition, 15.50% of the firms perceived their

company's green alliance to be in its initial stage, 27.19% viewed it as ongoing, 54.09% indicated that it was in the mature stage, and 3.22% viewed their green alliance as dissolved.

Table 2. Characteristics of the Firms Managing Green SC

Description	Frequency	%	Description	Frequency	%
Length of Alliance			**Frequency of Alliance**		
Less than 1 year	54	15.79	Newly established	21	6.15
1–3 years	49	14.33	1–3 times	81	23.68
4–6 years	75	21.93	4–6 times	152	44.44
7–10 years	84	24.56	More than 6 times	88	25.73
More than 10 years	80	23.39	**Benefit from the Alliance**		
Form of Alliance Management			Our company	75	21.93
A dedicated division	97	28.36	Our partner	64	18.71
A mixed division	89	26.02	Both	203	59.36
No special division	156	45.62	**Who initiated this Green Alliance?**		
			Our company	107	31.29
Stage of the Green Alliance			Our partner	57	16.67
Initial stage	53	15.50	Both	178	52.04
Ongoing stage	93	27.19	**Importance of the Alliance**		
Mature stage	185	54.09	R&D alliance	84	24.56
Dissolved stage	11	3.22	Production alliance	154	45.03
Initial stage	53	15.50	Distribution alliance	104	30.41

Abbreviations: R&D, research and development; SC, supply chain.

4 Empirical study

4.1 Hypotheses testing

Thus, the second-order factor was employed by this study to test the full model using structural equation modeling (SEM). The structural model results, as shown in Figure 2, indicate that the chi-squared value of 157.73, with 95 degrees of freedom, is acceptable at a 0.05 significance level. Besides, the goodness-of-fit index (GFI) is 0.945, the adjusted GFI (AGFI) is 0.946, and the root mean square error of approximation (RMSEA) is 0.040. A good fit is indicated by these fit indices for this model. Since the goodness of fit suggests further implications, it is significant to further identify the significance and magnitude of the model's structural path coefficients.

The path from green SCM to alliance knowledge acquisition sharing was significant ($p < 0.001$) in the hypothesized direction and strong (0.243). Thus, the hypothesis that green SCM has a positive effect on alliance knowledge acquisition and sharing was supported. Moreover, as shown in Figure 2, alliance knowledge learning is positively influenced by GRL, JSM, and KI among green SC partners. In fact, the higher the levels of GRL, KI, and JSM in green SC partners, the higher the level of alliance knowledge learning.

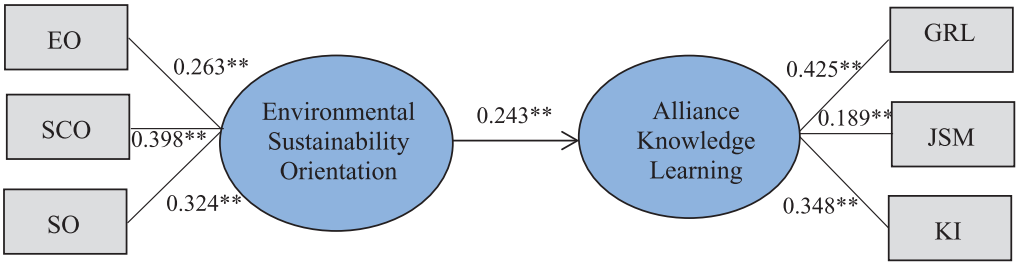

Figure 2. Structural Model Tested

Notes: 1. χ^2 (df) = 157.73 (95); p < .05; GFI (RMR) = .945 (.042); CFI (RMSEA) = .943 (.040).

2. EO = Environmental Orientation; SCO = Supply Chain Orientation; SO = Sustainability Orientation; GRL = Green Relationship Learning; JSM = Joint Sense-Making; and KI = Knowledge Integration.

4.2 Model testing with moderators

This section shows that the sampled firms have the experience to manage the strategic alliances of green SCM among the research variables and discusses the effects of the alliances' learning processes on overall success. The regression was performed applying a hierarchical two-step approach. The regression models' overall fit is summarized in Table 3.

Table 3. Regression Model Fit

Model	*R*	R^2	Adjusted R^2	SE Est.	Change Statistics				
					$\triangle R^2$	*F* change	*df* 1	*df* 2	Sig. *F* change
1	0.472	0.223	0.235	2.143	0.225	8.274	8	334	0.000
2	0.534	0.285	0.240	2.086	0.069	2.433	24	320	0.072

Abbreviation: SE, standard error.

Overall, the research model explains 53.4% (adjusted $R^2 = 0.240$) of the variance in green SCM, the dependent variable. The main effects of alliance knowledge learning and alliance performance account for 22.3% (adjusted $R^2 = 0.235$) of the explained variance, while the moderating variables include: length of alliance, form of alliance management, the number of times alliances were formed, benefits from alliance, and the stage of green alliance. Regression analysis was used to evaluate the impact of independent variables on alliance performance, associated with the adoption of green SCM practices in China and Taiwan.

A total of 342 responses were analyzed. Based on the analysis, Table 4 summarizes the emergence of a significant model (F (6,335) = 22.651, $p < 0.001$) with the adjusted R^2 being 0.097. The significant variable includes alliance knowledge learning ($\beta = 0.245$, $p = 0.000$) on alliance performance. For the moderator variables, important beta path coefficients were shown statistically. Length of alliance, forms of alliance management, number of times alliances were formed, and benefits from alliance did not exhibit significant interactions with alliance knowledge learning. However, the stage of green alliance exhibited a positive interaction effect, along with alliance knowledge learning on alliance performance.

4.3 Coevolution of alliance knowledge learning

This section presents the linear relationship results among the research variables, specifically the effects of the developmental stages of green alliance and alliance knowledge learning processes on alliance performance, and the effects of institutional processes on alliance success. Table 5 summarizes the multiple regression results and indicates that the following stages of green alliance have significant effects on green knowledge learning (M1 in the table): the initial stage ($\beta = 0.420$, $p < 0.001$); the ongoing stage ($\beta = 0.275$, $p < 0.001$); the mature stage ($\beta = 0.296$, $p < 0.001$); and the dissolution stage ($\beta = 0.289$, $p < 0.001$). JSM also indicates that the four developmental stages of green alliance have significant effects (M2 in the table): the initial stage ($\beta = 0.449$, $p < 0.001$); the ongoing stage ($\beta = 0.354$, $p < 0.001$); the mature stage ($\beta = 0.320$, $p < 0.001$); and the dissolution stage ($\beta = 0.201$, $p < 0.001$). Furthermore, there are significant effects of the developmental stages of green alliance on alliance KI (M3 in the table): the initial stage ($\beta = 0.541$, $p < 0.001$); the ongoing stage ($\beta = 0.471$, $p < 0.001$); the mature stage ($\beta = 0.306$, $p < 0.001$); and the dissolution stage ($\beta = 0.253$, $p < 0.001$).

The regression results indicate that the development in the initial stage of green alliance ($\beta = 0.406$, $p < 0.001$), the ongoing stage ($\beta = 0.363$, $p < 0.001$), the mature stage ($\beta = 0.273$, $p < 0.001$), and the dissolution stage ($\beta = 0.192$, $p < 0.001$) has significant effects on relationship value (M4 in the table). Finally, perceived SC performance is significantly influenced by the initial stage ($\beta = 0.583$, $p < 0.001$), the ongoing stage ($\beta = 0.439$, $p < 0.001$), the mature stage ($\beta = 0.290$, $p < 0.001$), and the dissolution stage ($\beta = 0.204$, $p < 0.001$; M5 in the table).

Table 4. Model Testing with Moderators for the Treatment

Regression Model					
Model	***R***	***R*²**	**Adjusted *R*²**		**Standard Error of the Estimate**
1	0.314[a]	0.099	0.097		0.778
ANOVA					
Model		**Sum of Squares**	***df***	**Mean Square**	***F*-value**	**Significance**
1	Total	87.564	6	14.594	22.651	0.000[a]
Factors effecting Green SCM Practices					
Alliance Performance		**Unstandardized Coefficients**		**Standardized Coefficients**	***T*-statistics**	**Significance**
		B	**Standard error**	β		
(Constant)		3.012	0.138		12.435	0.000
AKL		0.353	0.047	0.245	7.043	0.000
LA		0.078	0.051	0.034	1.324	0.274
FMA		0.063	0.028	0.095	1.647	0.259
TA		0.093	0.042	0.102	1.951	0.122
BFA		0.021	0.017	0.050	0.061	0.961
SGA		0.121	0.069	0.142	5.121	0.000

Notes: [a]Predictors: (constant), AKL. [b]Dependent variable: AP.
Abbreviations: AKL, alliance knowledge learning; ANOVA, analysis of variance; AP, alliance performance; BFA, benefit from alliance; FMA, form of manage alliance; LA, length of alliance; SCM, supply chain management; SGA, stage of green alliance; TA, times alliance.

Table 5. Regression Results of the Effects of Strategic Alliance Competence

Independent Variables	**Dependent Variables**				
	Alliance Learning Process			**Alliance Performance**	
	GRL	**JSM**	**KI**	**RV**	**PSCP**
	M1	**M2**	**M3**	**M4**	**M5**
Control Variables					
LA	0.025	0.006	0.011	0.042	0.032
FMA	−0.023	−0.010	−0.069	0.069	0.046
TA	0.028	0.031	0.004	0.041	0.020
BFA	0.075	0.038	0.129⁺	0.047	0.038
Developmental Stages of Green Alliance					
Initial stage	0.420***	0.449***	0.541***	0.406***	0.583***
Ongoing stage	0.275***	0.354***	0.471***	0.363***	0.439***
Mature stage	0.296***	0.320***	0.306***	0.273***	0.290***
Dissolution stage	0.289***	0.201***	0.253***	0.192***	0.204***
R^2	0.532	0.479	0.500	0.498	0.600
Adjusted R^2	0.540	0.482	0.509	0.469	0.569
F	50.978	37.707	45.575	43.732	69.509
p	0.000	0.000	0.000	0.001	0.000

Notes: ***$p < 0.001$ level; ** $p < 0.01$ level; *$p < 0.05$ level.
Abbreviations: BFA, benefit from alliance; FMA, form of manage alliance; GRL, green relationship learning; JSM, joint sense making; KI, knowledge integration; LA, length of alliance; TA, times alliance.

The abovementioned results (Table 5) indicate a statistically significant *F*-value in the developmental stages of green alliances affecting the alliance knowledge learning process and alliance performance. An investigation of the related coefficients in the four stages of developing green alliances appears to indicate that the factors were related to the knowledge learning process. Most respondents in the initial and ongoing stages exhibited significantly higher related coefficients than in the other stages. Remarkably, all of the groups displayed a relatively greater willingness to engage in alliance knowledge learning processes and to contribute to alliance performance. The interaction's beginning is marked by an evolutionary phase between partners. The ongoing and initial stages involve extensive scanning of the potential alliance environment, including government policies, societal culture, competition and markets, and to some extent, the potential partner's corporate culture. As the alliances mature, the initial partner motivations and conditions alter, making it imperative to reevaluate and readjust learning priorities.

5 Conclusion

5.1 Discussion of the findings

Important theoretical contributions are provided by our findings. First, the main aim of this paper is to show that green SC environmental sustainability orientation and strategic alliance learning coevolve over time. Our stance is that the level of interfirm learning is a determinant of the structures and control mechanisms evolving in a green SC. Therefore, this study discusses the environmental sustainability of the learning processes of firms' alliances during the life cycle of the alliances, in order to encourage firms to apply green innovation and green SCs, enhance their environmental performance, and increase their competitive advantage in the global market. However, because interfirm learning cannot be immediately generated or destroyed, partner firms should balance the inevitable trade-offs among GRL, JSM, and KI. As Kirchoff [2011] suggested, by guiding such products and implementing environmentally friendly policies, firms are more likely to enhance their efficiency, because there are several avenues firms could take with their supplier management.

Furthermore, the results of testing the study hypothesis show that a green SC partner's learning capability appears to play an important role in raising knowledge that it shares with its supporting firms. A green SC is considered to be a learning process, a corporate culture, and an organizational belief system incorporating environmental responsibility, apprehension, and management [Kirchoff, 2011]. Shared interorganizational knowledge enhances the SCs' competitive advantage as a whole. Thus, the influence of alliance knowledge sharing and learning on environmental performance is significant because meeting the standards of green directives has already become the common consensus among firms in green SCM. This perspective is discussed herein as a multidimensional construct with multiple aspects, including information sharing, JSM, and KI. JSM refers to the extent and degree of information sharing and GRL as well as the integration of knowledge into a firm's memory [Russo and Cesarani, 2017]. Hence, the development of knowledge sharing in green SC relationships will lead to beneficial performance outcomes, as identified in the present study. Therefore, the hypothesized relationship and the empirical findings in this study support interfirm knowledge sharing and green SCM as antecedents to higher alliance performance in the green SC.

Lastly, the findings also suggest that alliance performance has a positive effect on perceived SC performance. The pursuit of collaborative values may be hindered by overemphasis on alliance performance since it prevents the partners from developing mutual commitment to the relationship. Furthermore, shared alliance knowledge elucidates how interfirm knowledge sharing improves relationship value and perceived SC performance as a whole. This strategic perspective regarding the coevolution of interorganizational relationships implies that firms can coevolve by leveraging such relationships and obtaining knowledge resources and assets. Moreover, reciprocal relationships allow alliance performances to increase, not only in regard to virtual profit but also to invisible value. This study provides a practical application of

coevolutionary theory. Using this theory, it has been demonstrated that how a relationship between environmental sustainability orientation and alliance green knowledge learning can develop over time. Furthermore, it showed that the interaction of a number of variables will impact the ability of firms' managers to develop such relationships. Interfirm knowledge shared between suppliers and customers, therefore, is the first step in understanding value, and it ought to raise the efficiency and effectiveness of delivery and value creation.

5.2 Managerial implications

The first implication for managers is the model for green SCM innovation strategy, especially in regard to how it provides insights into managing interfaces with multiple stakeholders as well as highlights its effects on green SCM innovation strategies, processes, and outcomes. The entire model can be of assistance to managers hoping to develop products that improve both firm performance and ecological preservation, especially since it identifies factors that positively relate to alliance performance and factors that do not have such relations. This study not only illustrates that both external environmental orientations and internal SCs exert a significant and positive influence on alliance performance and green SCM, but more importantly, how green SCM is practiced [Vural, 2015]. SC managers and strategists can use the results to evaluate their current levels of green SCM practices in their intra- and interfirm SCs. The present study also recommends that successful green SCM practices need to be upheld by economic culture and an underlying environmental corporate culture [Liu and Chang, 2017] in environmental orientation firms, sustainability orientation firms, and SC orientation firms. Realizing how to measure and evaluate the integration of green SCM practices into firm campaigns could be worthwhile in the expanding and increasingly competitive global business surroundings. Moreover, this study provides an improved conceptual framework for SC managers for assessing their capabilities and current green SC initiatives, pointing out that firms apply green SCM practices to address multiple dimensions related to firm performance, and green practices' potential benefits as evidence of level of understanding on the part of SC managers.

The second implication is the alliance knowledge [Kale and Singh, 2007] composed of articulation, codification, sharing, and internalization. Hence, beneficial alliance performance outcomes will result from the development of knowledge shared in SC relationships, as identified in this study. The positive impact of knowledge shared on SC performance was also discovered by Caridi et al. [2015], who emphasized that knowledge sharing ascertains SC activities' implementation. Whalen and Bowen [2017] similarly studied knowledge's effect sharing on SC performance and advised that the role of knowledge shared on the effectiveness of the SC is very important. When partners have specified knowledge and skills the focal firm lacks, a learning process is crucial to obtain these resources.

Finally, a promising alternative embracing the complexities and capturing alignment's messy nature in practice is provided by coevolutionary theory. In particular, the feedback loops intrinsic with this viewpoint can either improve alignment or further entrench an isolationist context. In the alliance partner selection phase and awareness, alliance partners unilaterally learn by diverse mechanisms. There is a conscious effort to absorb as much explicit knowledge as possible regarding potential partners, especially in areas such as products, services and technologies, skills, and management practices. The outset of interaction is marked by a phase of evolution between partners. Broad scanning of the potential alliance environment is involved during this initial stage, including social culture, government policies, markets and competition, and to some extent, the potential partner's collective culture. As the alliances mature, the initial motivations and conditions of partners shift, making it imperative to reevaluate and readjust learning priorities. It is this dynamic, synergistic aspect determining the successful maturing, that is, whether it grows to partnership and excellent levels of cooperative collaboration. As the alliance succeeds in removing various barriers to cooperation, alliance knowledge learning mechanisms provide methods to ensure gradual reciprocal learning. As alliances mature, this integrative model is also reinforced by this study by examining several processes that might make learning easier.

5.3 Research limitations and future research directions

To begin, this study deals with Taiwanese focal firms only. As such, the findings might not apply to firms and markets in other areas and at different stages of development. Future researchers may wish to attempt to test these hypotheses in similar markets, particularly those transitional economies of Asian neighbors. Another limitation is the generalizability of single research study results. The study was limited to one dyadic link in the SC to minimize extraneous variation. Future studies should test other different tiers in the SC or perhaps should even test relationships involving more entities within the SC.

References

Amankwah-Amoah, J, Danso, A., Adomako, S. (2018), Entrepreneurial orientation, environmental sustainability and new venture performance: Does stakeholder integration matter? Business Strategy and the Environment, retrieved from http://hdl.handle.net/2086/16278

Calza, F., Parmentola, A., Tutore, I. (2017), Types of green innovations: ways of implementation in a non-green industry, *Sustainability*, Vol. 9, No. 8, 1301.

Caridi, M., Moretton, A., Perego, A., Tumino, A. (2015), The benefits of supply chain visibility: a value assessment model, *International Journal of Production Economics*, Vol. 151, pp. 1–19.

Chen, Y. S., Chang, C. H. (2013), Utilize structural equation modeling (SEM) to explore the influence of corporate environmental ethics: the mediation effect of green human capital, *Quality & Quantity*, Vol. 47, No. 1, pp. 79–95.

Cheung, M. (2005), Inter-firm knowledge sharing and its effect on relationship value: a global supply chain perspective. A Dissertation Presented for the Doctor of Philosophy Degree. The University of Tennessee.

Closs, D. J., Speier, C., Meacham, N. (2011), Sustainability to support end-to-end value chains: the role of supply chain management, *Journal of the Academy of Marketing Science*, Vol. 39, No. 1, pp. 101–116.

Huber, G. (1991). Organizational learning: the contributing processes and literature, *Organization Science*, Vol. 2, No. 1, pp. 88–115.

Jackson, G. (2004). Contested boundaries: ambiguity and creativity in the evolution of German co-determination, in: W. Streeck, K. Thelen, eds. *Beyond continuity: institutional change in advanced political economies*, Oxford University Press, Oxford, pp. 229–254.

Kale, P., Singh, H. (2007). Building firm capabilities through learning: the role of the alliance learning process in alliance capability and firm-level alliance success, *Strategic Management Journal*, Vol. 28, pp. 981–1000.

Kirchoff, J. F. (2011). A resource-based perspective on green supply chain management and firm performance. PhD Dissertationa, University of Tennessee, retrieved from http://trace.tennessee.edu/utk_graddiss/1046.2011.

Liu, S., Chang, Y. T. (2017), Manufacturers' closed-loop orientation for green supply chain management, *Sustainability*, Vol. 9, p. 222.

Min, S., Mentzer, J. T., Ladd, R. T. (2007), A market orientation in supply chain management, *Journal of the Academy of Marketing Science*, Vol. 35, No. 4, pp. 507–522.

Russo, M., Cesarani, M. (2017), Strategic alliance success factors: a literature review on alliance lifecycle, *International Journal of Business Administration*, Vol. 8, No. 3, pp. 1–9.

Sung, C. S., Park, J. Y. (2018), Sustainability orientation and entrepreneurship orientation: Is there a tradeoff relationship between them? Sustainability, Vol. 10, p. 379.

Tan, S. Y. (2017), Towards a Framework for Realizing Actionable Insight from Complex Data. Submitted in fulfillment of the requirements for the degree of Doctor of Philosophy, School of Electrical Engineering and Computer Science, Science and Engineering Faculty, Queensland University of Technology.

Teece, D. J. (2018), Business models and dynamic capabilities, *Long Range Planning*, Vol. 51, No. 1, pp. 40–49.

Wang, H., Han, P., Liu, W. (2018), How to improve sustainable competitive advantage from the distributor and the supplier networks: evidence from the paper-making industry in China, *Sustainability*, 10, doi:10.3390/su10062038

Whalen, E., Bowen, J. T. (2017), Engaging the customer: the impacts of online travel community engagement on brand identification and behavioral intentions, *Travel and Tourism Research Association: Advancing Tourism Research Globally*, 15.

Zosh, J., Hirsh-Pasek, K., Hopkins, Emily J., Jensen, H., Liu, C., Neale, D., Solis, S. L., Whitebread, D. (2018), Accessing the inaccessible: redefining play as a spectrum, *Frontiers in Psychology*, Vol. 9, 1124.