"Innovation Diffusion With the Supply Chain: The Chinese Apparel Firms in Shenzen"

AUTHORS	Christopher Gan ⓘD https://orcid.org/0000-0002-5618-1651
	Mike Clemes
	Tzu-Hui Kao
	Vivian Xin

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
0	0	0

INNOVATION DIFFUSION WITH THE SUPPLY CHAIN: THE CHINESE APPAREL FIRMS IN SHENZEN

Christopher Gan[*], Mike Clemes[**], Tzu-Hui Kao[***], Vivian Xin[****]

Abstract

Supply chain management directly affects corporate performance. Today's supply chain management which involves developing and implementing a networked, flexible supply chain that integrates all partners – manufacturers, retailers, suppliers, and carriers – into a seamless unit is the crucial step in meeting ongoing customer demand and maintaining a competitive advantage. However, effective supply chain integration can not be achieved unless the different components involved in the processes are coordinated.

Globalisation has forced companies to innovate to be competitive and carry out a holistic, fully integrated approach to their supply chain designs. By doing so, the management sectors of supply chain integration can replace conventional, functional, silo-limited thinking with the pursuit of flexibility and effectiveness. This research addresses a gap in the literature between innovation diffusion and supply chain integration. The study examines how organisations expand their efforts on supply chain integration and how they can improve their innovation efforts during the integration process.

Companies that manufacture for designer labels and other apparel lines in Shenzhen, China were surveyed to examine the inter-relationship between their supply chain integration performance, their perception of the two governance mechanisms, and their innovation diffusion processes. The results showed that supply chain integration has a positive relationship with innovation diffusion and supply chain integration governance mechanisms do impact innovation diffusion processes.

Key words: supply chain integration, innovation diffusion, supply chain governance mechanisms.

1. Introduction

There has been increased interest in supply chain management with innovation seen as the critical path in achieving competitive advantage over the past several years (Spekman, Spear, and Kamaiff, 2002; Van de Ven, 1986; Porter, 1985). A number of authors in the supply chain management area have argued for the necessity of creating new ways of doing business to survive in a highly competitive environment (Corso and Pavesi, 2000; Bolwijn and Kumpe, 1990) as traditional mechanisms for organisations' business growth erode (Capon and Glazer, 1987). New and innovative business designs must match business competitive environments. Some organisations have already explored this idea by focusing on innovation (Santos, Doz, and Williamson, 2004).

Previous researchers have combined supply chain integration and innovation together either by studying an organisation's integration as a source of innovation (Marshall, 2004; Teece, Pisano and Shuen, 1997), or by identifying the innovation generation process within the supply chain (Sivadas and Dwyer, 2000; Dodgson and Rothwell, 1994). However, the literature on a detailed analysis on the processes of innovation diffusion within the supply chain context is sparse.

An organisation could strengthen its competences through innovation (Danneels, 2002). Thus, the diffusion of innovation is believed to be a key factor to achieve an overall improvement of the entire supply chain (Teece, 1980). However, the trend of integrating organisations' supply chain activities has encouraged organisations to compete through their supply chains, rather than through

[*] Lincoln University, New Zealand.
[**] Lincoln University, New Zealand.
[***] Lincoln University, New Zealand.
[****] Export Division, Shenzen, China.

individual organisational effects (Giannakis and Croom, 2004; Lummus and Vokurka, 1999; Lambert, Cooper, and Pagh, 1998). Therefore, there is a demand for organisations to extend their innovative efforts over a broader range, that offers greater value for supply chain competitiveness (Marshall, 2004).

This research addresses a gap in the literature between innovation diffusion and supply chain integration and examines how organisations expand their efforts on supply chain integration and how to improve their innovation efforts during the integration process. The rest of this paper is organized as follows. Section 2 provides an overview of the relevant literature and addresses the research questions of this study. Section 3 describes the conceptual research model, research methodology, and the hypotheses. Section 4 discusses the empirical results. Section 5 offers a discussion and conclusions.

2. Literature Review

The term supply chain integration represents the synthesis of all processes and activities in the complete manufacturing and distribution cycle – this includes everything from product design, materials and component ordering, manufacturing and assembly, and warehousing and distribution, until the finished product reaches the end customers (Svensson, 2003; Morgan and Monczka, 2003; Croxton, Garcia-Dastugue, Lambert, and Rogers, 2001). This complex process implies that supply chain organisations need to re-evaluate the totality of everything they do if they want to remain competitive (Fawcett and Magnan, 2001). New and innovative business designs must also be created to match the new business model (Porter and VanDerLinde, 1995).

Furthermore, since supply chain integration involves more than one organisation's benefits and endeavours, this new form of business operation deserves certain protection to prevent organisations' supply chain integration efforts from being subjected to numerous supply chain hazards (for example, the opportunistic behaviour) (Williamson, 1999). The two common behavioural supply chain theories, the resource based theory and the transaction cost theory, suggest that relational governance and formal contract governance may be two effective complementary mechanisms to achieve the supply chain governance purpose (Lummus *et al.*, 2003; Amit and Schoemaker, 1993; Williamson, 1999).

The innovation literature suggests that innovation can bring new business opportunities to organisations and lead to breakthroughs in new business models (Florida and Goodnight, 2005; Afuah, 2003). However, within the innovation diffusion environment (for example, the supply chain setting), there are always certain embedded situational or environmental factors that impact the innovation diffusion processes (Rogers, 2003). Being aware of these factors and knowing how to use them to impact the diffusion processes are the key issues addressed in this research. This research applies the features of the innovation diffusion processes into the supply chain setting and studies the inter-relationship between supply chain integration, innovation diffusion, and the two supply chain governance mechanisms.

2.1. Resource Based Theory and the Relational Governance

Resource based theory emphasises value maximisation through the possession of a particular valuable resource (Barney, 2001). According to resource based theory, organisations' resources are not limited to only tangible assets, the enduring inter-firm relationships are also regarded as valuable intangible resources that generate long-term values for organisations' supply chain management (Olavarrieta and Ellinger, 1997; Amit and Schoemaker, 1993).

Since no organisation can be described as completely self-sufficient regarding its resource possession along the supply chain (Ettlie and Sethuraman, 2002; Olavarrieta and Ellinger, 1997), members operating on the same supply chain should be considered as a collection of complementary resources and capabilities (Fawcett and Magnan, 2002; Skjoett-Larsen, 1999). Therefore, from the resource based view, developing relationships to accompany the mutual exchanges of complementary resources is a necessity (Lambert *et al.*, 1998).

The inter-firm relationship that is derived from organisations' repeated exchange processes will continuously help to generate more benefits in the future (Cadilhon and Fearne, 2005). These benefits are deeply embedded in the norms nurtured by the resource based relationship. Trust, mutual business goals, and commitment are all examples of the promoted norms (Wilson, 1995). Organisations need to obey these norms so that they can meet each other's performance expectation, which represents quality collaboration (Skjoett-Larsen, 1999). Also, these norms can work as a benchmark for organisations to make mutual adjustment and bring the sense of fairness to their joint efforts, which improves organisations' operation flexibility by enhancing their problem solving capability (Poppo and Zenger, 2002; Lambert *et al.*, 1998).

Resource based theory binds supply chain organisations together by highlighting the importance of the exchanges of complementary resources (Heide and John, 1992; Dwyer *et al.*, 1987). Through the repeated exchange processes, organisations solidify their inter-firm relationships, for which the developed cooperation norms are the core (Olavarrieta and Ellinger, 1997). The relationships in turn become a governance mechanism of organisations' supply chain integration in terms of their impacts on organisations' pursuit of the supply chain collaboration and operation flexibility (Barney, 2001).

2.2. Transaction Cost Theory and the Formal Contract Governance

Transaction cost theory is *a blend of institutional economics, organisational theory, and contract law* (Heide and John, 1988, p. 20). Transaction cost theory distinguishes two types of transaction governance: market and hierarchies (Williamson, 1975). Market governance is efficient when transactions are simple and easy to manage (Williamson, 1999, 1975). In this case, the transactions do not require specialised asset investment. Even if non-compliance happens, it does not cost the involved parties too much to contract with alternative partners (Heide, 1994).

Unfortunately, the preceding scenario is not often the case in today's business world. Currently, the complexity of transactions increases as the involved parties are making more idiosyncratic investments that cannot be transplanted easily for other transactional purposes (Bensaou and Anderson, 1999; Klein *et al.*, 1990). In this situation, the owner firm of the idiosyncratic investments may want some particular protection; when the complicated unforeseeable outcomes are perceived by managers as significant contracting hazards, they would prefer hierarchies as the methods to vertically integrate their transactions (Mayer and Argyres, 2004; Poppo and Zenger, 2002; Williamson, 1975). The more a firm has invested in the specialised assets, the more a firm will attempt to evaluate the various future contingencies, which in turn lead to their preference on complex contracts to protect their idiosyncratic investments (Klein *et al.*, 1990).

It is necessary to note that *"transaction cost economics ascribes foresight rather than myopia to human actors"* (Williamson, 1999, p. 1089). The theories *"do not presume that all players act in an opportunistic way, but the problem is that some players sometimes behave in an opportunistic way"* (Skjoett-Larsen, 1999, p. 42). So what transaction cost theory does is to encourage organisations to *"look ahead, perceive hazards, and factor these back into the contractual relation"* (Williamson, 1996, p. 9). Opportunism still has its possibility to occur, therefore organisations' demands on formal contract governance can not be ideally omitted from the discussion (Williamson, 1993).

These perspectives from transaction cost theory suggest that organisations deserve governance for their transactional investments and formal contracts are often their final choices because they represent organisations' forethoughts for the future to a certain extent (Lummus *et al.*, 2003; Williamson, 1999). Without the foresight, organisations will be too vulnerable to achieve flexibility and responsiveness (Tadelis, 2002).

2.3. The Complementarities between the Two Governance Mechanisms

Dwyer *et al.* (1987) have emphasised the importance of a transactional/relational continuum to study channel partnership. The authors advocate that transactional exchanges are at one end of the continuum that are characterised by discrete buyer-seller exchanges of a product for money with no anticipation of future exchanges (Dwyer *et al.*, 1987). At the other end of the continuum are

relational exchanges, which are aimed at achieving the collective benefits of all partners' through mutual adjustment (Dwyer *et al.*, 1987).

The relational governance, on the one hand, has its own embedded shortcoming while safeguarding the supply chain integration – it does not stop organisations from acting opportunistically (Poppo and Zenger, 2002; Skjoett-Larsen, 1999). Even though it develops operation norms among organisations, the optimal operation for one organisation may be far away from optimal for another organisation (Mayer and Argyres, 2004). By adopting formal contracts, organisations can *"narrow the domain and severity of risks to which an exchange is exposed and thereby encourage cooperation and trust"* (Poppo and Zenger, 2002; p. 708). In these cases, the formal contracts play a complementary role for relational governance by clearly stating the can-do and can-not-do (Williamson, 1975).

On the other hand, however, the formal contract governance has its disadvantage as well as writing complex contracts is costly (Heide, 1994). Furthermore, formal contracts may have a side-effect of discriminating the trust between parties as they are based on the guess of other parties' opportunistic behaviour in the future (Mayer and Argyres, 2004). Purely depending on the efficacy of the formal contracts will be a less-optimal choice; relational governance needs to be introduced as complementary (Poppo and Zenger, 2002; Dwyer *et al.*, 1987).

3. Research Model and Hypotheses

This research applies innovation diffusion processes into the supply chain setting and studies the different relationships that emerge during this process. The preceding discussion outlined the major variables used in this research. These variables include supply chain integration (SCI), innovation diffusion (ID), relational governance (RE), and formal contract governance (CON). The objectives of research include ascertaining whether there is a certain type of relationship between innovation diffusion and an organisation's performance on supply chain integration and identifying and examining the effectiveness of the two supply chain governance mechanisms within the innovation diffusion processes (see Figure 1).

Fig. 1. The Conceptual Research Model
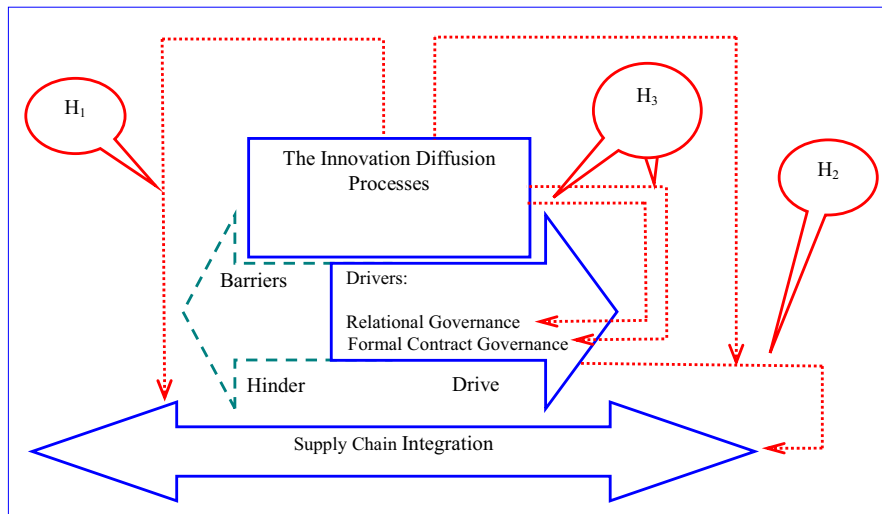
Figure 1 shows the two governance mechanisms that safeguard organisations supply chain efforts and drive the supply chain operation forward along the right track (Mayer and Argyres, 2004). The governance mechanisms are considered as the drivers for the supply chain integration (Lummus *et al.*, 2003). However, there are some barriers, which may hinder organisations' supply chain efforts

in the real business world (McCullen and, Towill, 2002). This study focuses on the two governance mechanisms that safeguard organisations supply chain efforts.

Innovation has been regarded as one of the main multipliers for firms' business growth (Christensen et al., 2002), which reflects how firms conduct their business creatively and whether they are able to turn their creativity into financial results. However, innovation alone is insufficient for an organisation to survive. Giannakis and Croom (2004) argue that firms need to compete through supply chains rather than through the individual company. There is a demand for firms to extend their innovative efforts to a broader range that offers greater value for the entire supply chain competitiveness (Marshall, 2004). The broader an innovation can be diffused, the better the overall supply chain can perform (Rogers, 2003; McAdam and McCormack, 2001). Thus innovation diffusion processes and supply chain integration are closely related and the following relationship is hypothesised:

> *Hypothesis 1: The innovation diffusion processes within the supply chain context*
>
> *are related to supply chain integration.*

Research on supply chain integration suggests that both supply chain relationships and the inter-firm formal contract can act as effective mechanisms for supply chain integration (Mayer and Argyres, 2004; Williamson, 2002). These studies were conducted in the absence of innovation diffusion. However, innovation diffusion has shown to be a multiplier for firms' business growth. This study proposes that the processes of innovation diffusion will not hinder the effectiveness of the two supply chain governance mechanisms (the relationship governance and the formal contract governance). The following relationship is hypothesised:

> *Hypothesis 2: The two supply chain governance mechanisms (the relationship*
> *governance and the formal contract governance) are related to the supply chain*
> *integration while innovation diffusion processes are taking place.*

When the innovation diffusion processes are taking place within a supply chain context, they are likely to be influenced by some supply chain related situational factors (see Roy et al., 2004; Sivadas and Dwyer, 2000). The two supply chain governance mechanisms can be included into these situational factors due to their embedded positions within the supply chain activities (Whinston, 2003; Kleindorfer and Wu, 2003). The following relationship is hypothesised:

> *Hypothesis 3: Supply chain governance mechanisms are related to the supply*
> *chain innovation diffusion processes.*

4. Research Methodology and Empirical Results

The apparel industry is becoming prominent as one of the most globalised industries in the world (Lord and McIntyre, 2003; Yen, 2002). On the supply side, the apparel industry *"is a supply driven commodity chain led by a combination of retailers, contractors, subcontractors, merchandisers, buyers, and suppliers; each plays an important role in a network of supply chains…"* (Yen, 2002, p. 43). On the demand side, the apparel industry suffers from great volatility; the material sourcing and the clothing design are always driven by fashion elements, which can be described as highly whimsical (Stratton and Warburton, 2003). This implies that within the supply network of the apparel industry, both the interconnection and collaboration between the supply chain members, and the innovative supply chain operation methods are especially critical (Thomassey, Happiette and Castelain, 2005).

Companies that manufacture for designer labels including other apparel lines in Shenzhen, China were surveyed to examine the inter-relationship between their supply chain integration performance, their perception of the two governance mechanisms, and their innovation diffusion processes. This includes manufacturing companies that were established by investors from Hong Kong, Macao, and Taiwan, which confront greater supply chain challenges since their products are often sold overseas and their supply chains tend to cut across regional and national boundaries (Yen,

2002). Consequently, supply chain integration and supply chain collaboration are of great importance to the companies.

4.1. Questionnaire and Sample Size

A personal self administrated questionnaire was considered as the most appropriate data collection method for this research as it enables the researcher to clarify ambiguous questions immediately and helps provide a high response rate. A pilot study to pre-test the questionnaire was administered to 18 respondents. The pilot group was comprised of English-speaking and Chinese-speaking respondents at Lincoln University. The pilot study was conducted to ensure that the survey questions were understood by the respondents and there was no ambiguity in the translation of the questions from English to Chinese. The survey was conducted in China in Chinese and the back-translation method was applied to maintain the consistency of the survey instrument. A 5-point Likert scale was used to measure how strongly the respondents agreed or disagreed with statements pertaining to the measurements of the research variables.

This research obtained the index of Shenzhen apparel manufacturing companies from the statistical department of GuangDong State Council. There are 1527 clothing manufacturers located in Shenzhen and 492 of these companies were established by investors from Hong Kong, Macao, and Taiwan. The sample was drawn from the entire 1527 clothing manufacturers. The representatives of 66 firms agreed to take part in the survey and completed the questionnaire.

4.2. Empirical Analysis

4.2.1. Descriptive Statistics of the Respondents

Table 1 presents the descriptive statistics of the respondents. In terms of the respondents demographic characteristics, the 66 respondents that were surveyed are directors of the marketing departments of their companies, where 42.42% have corporate-wide responsibilities, and 57.58% are in charge of business within their own marketing departments or divisions. The education levels for the sample respondents include bachelor degree (40.91) and diploma (30.3%).

Table 1

Descriptive Statistics of Respondents and Companies

	Scales	Frequency	%	Mean	Regroup the Scales	Frequency	%	Mean
Sex	Male	49	74.24	1.26	Male	49	74.24	1.26
	Female	17	25.76		Female	17	25.76	
Age	<25	8	12.12	2.39	<25	8	12.12	2.32
	25-35	29	43.94		25-35	29	43.94	
	36-45	25	37.88		>36	29	43.94	
	46-55	3	4.55					
	56-65	1	1.52					
Responsibility	Cor_wide	28	42.42	1.58	Cor_wide	28	42.42	1.58
	Div_wide	38	57.58		Div_wide	38	57.58	
Education	High_Sch	2	3.03	2.89	Diploma and Lower	22	33.33	1.92
	Diploma	20	30.30		Bachelor	27	40.91	
	Bachelor	27	40.91		Postgrad	17	25.76	
	Postgrad	17	25.76					

Table 1 (continued)

	Scales	Frequency	%	Mean	Regroup the Scales	Frequency	%	Mean
Supply Chain Experience	3-4	52	78.79	3.33	> 3 years	66	100.00	3.00
	5-6	9	13.64					
	7-8	2	3.03					
	9+	3	4.55					
Length of Relationship	<1	1	1.52	3.24		13	19.70	2.17
	1-2	12	18.18			29	43.94	
	3-4	29	43.94			24	36.36	
	5-6	20	30.30					
	7-8	2	3.03					
	9+	2	3.03					
Firm Size	<100	28	42.42	1.70	<100	28	42.42	1.70
	101-200	30	45.45		101-200	30	45.45	
	201-300	8	12.12		201-300	8	12.12	
Firm Age	<1	1	1.52	3.85	<2 years	3	4.55	2.55
	1-2	2	3.03		3-4 years	24	36.36	
	3-4	24	36.36		5+	39	59.09	
	5-6	22	33.33					
	7-8	13	19.70					
	9+	4	6.06					
Concept Age	<1	4	6.06	2.88	<2 years	21	31.82	1.89
	1-2	17	25.76		3-4 years	31	46.97	
	3-4	31	46.97		5+	14	21.21	
	5-6	12	18.18					
	7-8	1	1.52					
	9+	1	1.52					

In terms of the supply chain experience, 78.79% of the respondents have less than 3-4 years of supply chain working experience. Only 11.21% of the respondents have more than 4 years of supply chain working experience.

In terms of the company's demographic characteristics, almost all of the surveyed companies (99%) have maintained more than 2 years of supply chain relationships with their biggest suppliers, in particular, companies maintaining 3 to 4 years of relationship were highest group (43.94%), and 5 to 6 years of relationship were second highest group (30.30%). Firm size was estimated by the number of full-time employees, where 45.45% of the surveyed companies have between 101 to 200 employees, and 42.42% have less than 100 employees. Approximately 59% of the companies have been in business for more than 4 years, and 46.97% have implemented the concept of supply chain management for 3 to 4 years. However, no more than 3.04% of the companies have implemented the supply chain concept for over 7 years.

4.2.2. Reliability Test of the Construct Measurements – Entire Sample

The reliability tests of the construct measurements for the entire sample size are shown in Table 2. This research adopts a Cronbach's Coefficient Alpha of 0.60 as the cut-off point, which indicates satisfactory internal consistency reliability in exploratory research (Miller, 1995).

Table 2

Reliability Test of the Construct Measurements

Factors	Construct Measures	Cronbach's α [1/]
Supply Chain Integration	Q10. Your company and the other supply chain partners have a collective vision.	0.688
	Q13. Your company teams with suppliers.	
	Q14. Your company teams with customers.	
	Q15. The supply chain manager maintains performance measurement.	
	Q16. Your company's supply chain undertakes regular performance re-evaluation.	
Innovation Diffusion	Q17. Your company invests aggressively in supply chain innovations.	0.611
	Q18. Your company communicates with partners about the usefulness of innovations.	
	Q19. Your company recognises the importance of learning.	
	Q20. Your company communicates with partners about the existing problems.	
	Q21. Your company communicates with partners about innovative solutions for existing problems.	
Supply Chain Relationship	Q22. You trust your supply chain partners.	0.658
	Q23. You commit to your supply chain relationship.	
	Q24. You cooperate with your supply chain partners.	
	Q25. You share mutual goals with your supply chain partners.	
	Q26. You are satisfied with your supply chain partners' performance.	
The Governance of Formal Contract	Q27. Geographical proximity requires the governance of formal contracts.	0.691
	Q28. Assets specificity requires the governance of formal contracts.	
	Q29. Human factor specificity requires the governance of formal contracts.	

All of the constructs have a Cronbach's Coefficient Alpha greater than 0.60, therefore, the items are reliable for measuring supply chain integration, innovation diffusion, supply chain relationship, and governance of formal contract. A summated scale is formed by combining the average scores of the items.

4.2.3. Mean Test of Company's Demographic Factors

One-way ANOVA test is used to test the difference of mean for supply chain integration, and innovation diffusion based on the company's demographic factors. The results are presented in Tables 3 and 4.

Table 3

Mean Test between Supply Chain Integration and Demographic Variables

Demographic Factors	Groups of Answers	N	Mean	Test Statistics	Sig	
Length of Relationship	<2	13	3.877	0.086	0.918	
	3-4	29	3.938			
	>5	24	3.958			
Firm size	<100	28	3.750	5.898	0.004	***
	101-200	30	3.960			
	201-300	8	4.475			
Firm Age	<2	3	4.467	2.603	0.078	*
	3-4	24	4.075			
	>5	39	3.805			
Concept Age	<2	47	3.762	3.274	0.044	**
	3-4	48	3.983			
	>5	25	3.784			

*** Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.

Table 4

Mean Test between Innovation Diffusion and Demographic Variables

Demographic Factors	Groups of Answers	N	Mean	Test Statistics	Sig
Length of Relationship	<2	13	3.923	1.933	0.153
	3-4	29	3.966		
	>5	24	3.683		
Firm size	<100	28	3.721	2.008	0.143
	101-200	30	3.907		
	201-300	8	4.125		
Firm Age	<2	3	4.067	1.279	0.282
	3-4	24	3.925		
	>5	39	3.795		
Concept Age	<2	47	3.745	0.651	0.525
	3-4	48	3.990		
	>5	25	3.840		

*** Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.

Table 3 shows that the t-tests are significant for firm size, firm age, and the concept age, indicating that the supply chain integration is different depending on the firm's size, number of year established, and number of year implementing supply chain concept. Table 4 shows no significant factors are found in innovation diffusion, indicating that innovation diffusion process does not differ based on the company's demographic factors.

The factors that yielded significant mean differences were further investigated for their effects on supply chain integration. Dummy variables are developed for firm size, firm age, and concept age as follows.

- ♦ SIZE01 = 1 if the firm has less than 100 full-time employees, else 0
- ♦ SIZE02 = 1 if the firm has 101-200 full-time employees, else 0
- ♦ SIZE03 = 1 if the firm has 201-300 full time employees, else 0
- ♦ FAGE01 = 1 if the firm has established for less than 2 years, else 0

- ♦ FAGE02 = 1 if the firm has established for 3 to 4 years, else 0
- ♦ FAGE03 = 1 if the firm has established for more than 5 years, else 0
- ♦ CAGE01 = 1 if the firm implemented the concept of supply chain management for less than 2 years, else 0
- ♦ CAGE02 =1 if the firm implemented the concept of supply chain management for 3 to 4 years, else 0
- ♦ CAGE03 = 1 if the firm implemented the concept of supply chain management for more than 5 years, else 0

These dummy variables are included in Models 1 and 2.

The following regression models are estimated:

Model 1

Supply Chain Integration = Innovation Diffusion + SIZE01 + SIZE02 + FAGE01 + FAGE02 + CAGE01 + CAGE02 + ε

Where ε is the error term.

Model 2

Supply Chain Integration = Innovation Diffusion + Supply Chain Relationship + Governance of Formal Contract + SIZE01 + SIZE02 + FAGE01 + FAGE02 + + CAGE01 + CAGE02 + ε

Where ε is the error term.

Model 3

Innovation Diffusion = Supply Chain Relationship + Governance of Formal Contract + ε

Where ε is the error term.

4.2.4. Regression Analysis

Hypothesis 1 tests the relationship between supply chain integration and innovation diffusion (Model 1). The t-test is significant for innovation diffusion (β=0.291, $p < 0.05$), therefore, Hypothesis 1 is supported. In addition, the t-tests for the dummy variables SIZE01, SIZE02, FAGE01 are also significant, therefore, firm size and firm age also have impact on supply chain integration, and the concept age does not have significant impact (see Table 5).

Table 5

Regression Analysis Results

Model 1	Unstandardized Coefficients		Standardized Beta Coefficients	t	Sig.	
	B	Std. Error				
(Constant)	3.096	0.522		5.936	0.000	
Innovation Diffusion	0.303	0.117	0.291	2.594	0.012	**
SIZE01	-0.480	0.215	-0.421	-2.235	0.029	**
SIZE02	-0.434	0.211	-0.383	-2.060	0.044	**
FAGE01	0.608	0.310	0.224	1.957	0.055	*
FAGE02	0.194	0.143	0.166	1.362	0.179	
CAGE01	-0.139	0.179	-0.115	-0.776	0.441	
CAGE02	0.039	0.171	0.034	0.227	0.821	
Dependent Variable: Supply Chain Integration						
F= 3.939***	Adjusted R^2 = 0.240					

*** Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.

Table 5 (continued)

Model 2	Unstandardized Coefficients		Standardized Beta Coeffi-cients	t	Sig.	
	B	Std. Error				
(Constant)	1.216	0.525		2.316	0.024	
Innovation Diffusion	0.074	0.101	0.071	0.736	0.465	
Supply Chain Relationship	0.454	0.120	0.443	3.791	0.000	***
Governance of Formal Con-tract	0.214	0.088	0.263	2.431	0.018	**
SIZE01	-0.196	0.178	-0.172	-1.099	0.276	
SIZE02	-0.364	0.169	-0.322	-2.153	0.036	**
FAGE01	0.533	0.249	0.197	2.140	0.037	
FAGE02	0.096	0.115	0.082	0.834	0.408	
CAGE01	-0.053	0.144	-0.044	-0.369	0.714	
CAGE02	0.069	0.137	0.061	0.504	0.616	
Dependent Variable: Supply Chain Integration						
F= 8.676***	Adjusted R^2 = 0.515					

*** Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.

Model 3	Unstandardized Coefficients		Standardized Beta Coeffi-cients	t	Sig.	
	B	Std. Error				
(Constant)	2.108	0.455		4.638	0.000	
Supply Chain Relationship	0.297	0.135	0.301	2.198	0.032	
Governance of Formal Contract	0.151	0.107	0.193	1.406	0.165	
Dependent Variable: Innovation Diffusion						
F= 7.552***	Adjusted R^2 = 0.168					

*** Significant at 1% level.
** Significant at 5% level.
* Significant at 10% level.

Hypothesis 2 tests the relationship between supply chain integration and innovation diffusion, supply chain relationship, and governance of formal contract (Model 2). The t-tests are significant for supply chain relationship (β=0.443, $p < 0.01$) and governance of formal contract (β=0.263, $p < 0.05$). However, the t-test for innovation diffusion (β=0.071, $p > 0.10$) is not significant, therefore, Hypothesis 2 is partially supported. In addition, the t-tests for the dummy variables SIZE02, FAGE01 are significant, therefore, firm size and firm age have impact on supply chain integration, and the concept age does not have any significant impact (see Table 5).

Hypothesis 3 tests the relationship between innovation diffusion, supply chain relationship, and governance of formal contract (Model 3). The t-tests are significant for supply chain relationship (β=0.301, $p < 0.05$), but not significant for governance of formal contract, therefore Hypothesis 3 is also partially supported. The results for the regression analysis performed on the three models are presented in Table 5.

5. Discussions and Conclusions

The findings of hypothesis 1 imply that innovation diffusion and supply chain integration are positively related. These findings are consistent with those in the previous literature (see (Vashishta, 2005; Florida and Goodnight, 2005; Hamdouch and Samuelides, 2001; Quinn, 2000). According to Watson (2005) findings, innovation diffusion improves the performance of the corporations that join the diffusion processes by strengthening their abilities to make new things happen.

However, the findings of Hypothesis 2 indicate that when supply chain relationship and governance of formal contract are considered, these two mechanisms have more explanatory power on supply chain integration, and innovation diffusion becomes not significant in explaining supply chain integration.

This finding may be due to two reasons. Firstly, the previous discussion about innovation suggested that innovation behaviour in origination has been attributed to dissimilar situational factors such as institutional arrangement, entrepreneurial behaviours, and organisational learning (Montalvo, 2004). Once an organisation has maintained a certain degree of innovativeness, or has already initiated an innovation, further efforts can be refined on the situational factors to continue the sustainability of innovation (Garcia and Calantone, 2001). The situational factors are important, especially when organisations desire to spread their innovation efforts and accelerate the innovation diffusion within the supply chain setting. They can then implement changes and derive new generations of innovations (Montalvo, 2004; Rogers, 2003). Therefore, when the relationship between supply chain integration and innovation diffusion is found to be insignificant with the inclusion of the two governance mechanisms, it does not necessarily mean that innovation diffusion is no longer important. The relationship between these two variables was statistically verified by the results for Hypothesis 1. The hidden rational for the lost relationship could be that after the firms have stayed in the business for some time and gained some supply chain experiences, they may have implemented their first generation of innovation but currently shift their efforts to sustain their innovation endeavours by focusing on the important situational factors – the two governance mechanisms identified in this research.

Secondly, the previous discussion of the literature also suggested that innovation diffusion can be expensive and risky (Afuah, 2003). Innovation adopters are active decision-makers rather than passive units (Windsor, 1995). Therefore, when companies have stayed in the business long enough to nurture their stabilised supply chain relationship and formulate reliable contracts with their partners, they may not choose to take more risks on costly innovations to achieve their supply chain integration.

In addition to the hypothesized results, the inclusions of the dummy variables firm size and firm age have an impact on supply chain integration. Specifically, the larger the firm size, the better supply chain integration setting the firm has, which means when firms have more than 200 employees they have better supply chain integration setting, followed by firm size 100-200 employees and firm size less than 100 employees. However, when supply chain relationship and governance of formal contract is considered, firm size less than 100 employees have slightly better supply chain integration setting than firm size 100-200 employees (see Joo and Kim, 2004; Eder and Igbaria, 2001). In terms of the firm's age, the younger the firm, the better supply chain integration setting.

The findings of Hypothesis 3 suggest that the companies considered supply chain relationship as more important than the governance of formal contracts. This is consistent with the literature (for example, see Williamson, 1975). Firms find that their relationship with partners is less-expensive to maintain when compared to writing up formal contracts, which are usually associated with numerous legal costs. Further, when it comes to the inter-firm process like innovation diffusion (which is more associated with an active, decision-making, relationship) it is probably more suitable to deal with conflicts generated by the different thoughts of management (Dwyer *et al.*, 1987). These findings suggest that firms prefer to use supply chain relationship to govern the innovation diffusion processes rather than the formal contract governance.

6. Limitations and Future Research

This study has important limitations in terms of generalising its findings. First, due to the unstable market demand that is driven by whimsical fashion trends, apparel manufacturers may perceive higher risks than manufacturers in other industries. This may lead to their favouring legal binding contracts that are believed by the contractors to have the effect of narrowing the domain and severity of risks. However, this may not be the case for other industries in other sectors. For example, the notion of the formal contract governance may not be able to be generalised to those industries that have comparatively stable demand and high-volume production. Future research may consider applying the proposed research model to different industries to achieve a broader understanding of the relationships analysed in this study.

Second, the economic and institutional environment in which this study was conducted is still evolving. China's economic development has been remarkable during the past decade. This may give rise to firms' preference for formal contracts as inter-firm trust can only emerge with successful cooperation and the growth of profits. These growth prospects need some time to take place. In addition, the concept of supply chain management is new in China, and it has not been studied indepth when compared to the Western countries. The limitation of the understanding on this particular issue may lead to biased answers to research questions regarding supply chain management. Future research may be able to overcome this limitation by surveying companies that have longer supply chain experiences in order to obtain more reliable responses.

Third, both supply chain integration and innovation diffusion are time-consuming processes. The dynamics embedded within the processes has not been completely analysed by this cross-sectional study. However, in order to fully understand the dynamics, future research may consider changing the research time horizon and obtaining longitudinal data.

Fourth, this research emphasises the innovation diffusion processes rather than any particular type of innovation. As a result, the study does not distinguish the different diffusion processes according to the different innovation taxonomies. In fact, the innovation diffusion processes do vary depending on what type of innovation is to be diffused. Certainly, a more detailed and clearly categorised innovation typology should improve model specification, and the reliability and validity of an empirical study. Therefore, future research may be enhanced by removing this inability to distinguish the innovation types.

Finally, this study was conducted in China, the language bias and the cultural factors that may arise naturally are additional limitations. Future research should be conducted in different countries so that the findings can be more suitably generalised and cross-cultural comparisons can be made.

References

1. Amit R., P.J. Schoemaker. Strategic Assets and Organisational Rent // Strategic Management Journal, 1993. – 14(1). – pp. 33-46.
2. Afuah A. Innovation Management: Strategies, Implementation and Profits. – New York: Oxford, 2003.
3. Barney J.B. Is the Resource-Based "View" a Useful Perspective for Strategic Management Research? Yes. // The Academy of Management Review, 2001. – 26 (1). – pp. 41-56.
4. Bensaou M., E. Anderson. Buyer-Supplier Relations in Industrial Markets: When do Buyers Risk Making Idiosyncratic Investments? // Organisation Science, 1999. – 10 (4). – pp. 460-481.
5. Bolwijn P.T., T. Kumpe. Manufacturing in the 1990s – Productivity, Flexibility, Innovation. // Long Range Planning, 1990. – No. 23. – pp. 44-57.
6. Cadilhon J., A.P. Fearne. Lessons in Collaboration: a Case Study from Vietnam. // Supply Chain Management Review, 2005. – 9 (4). – pp. 11-12.
7. Capon N., R. Glazer. Marketing and Technology: A Strategic Coalignment. // Journal of Marketing, 1987. – No. 51. – pp. 1-14.

8. Corso M., S. Pavesi. How Management can Foster Continuous Product Innovation. // Integrated Manufacturing Systems, 2000. – 11 (3). – pp. 199-211.
9. Croxton K.L., S.J. Garcia-Dastugue, D.M. Lambert, D.S. Rogers. The Supply Chain Management Processes. // International Journal of Logistics Management, 2001. – 12(2). – pp. 13-36.
10. Danneels E. The Dynamics of Product Innovation and Firm Competences. // Strategic Management Journal, 2002. – 32 (12). – pp. 1095-1121.
11. Dodgson M., R. Rothwell. The Handbook of Industrial Innovation. – UK: Edward Elgar, 1994
12. Dwyer F.R., P.H. Schurr, S. Oh. Developing Buyer-Seller Relationships. // Journal of Marketing, 1987. – 51 (2). – pp. 11-27.
13. Dyer J.H. Effective Interfirm Collaboration: How Firms Minimise Transaction Cost and Maximise Transaction Value. // Strategic Management Journal, 1997. – 18 (7). – pp. 535-556.
14. Ettlie J.E., K. Sethuraman, K. Locus of Supply and Global Manufacturing. // International Journal of Operations & Production Management, 2002. – 22 (3). – pp. 349-370.
15. Fawcett S. E., G.M. Magnan. Achieving World-Class Supply Chain Alignment: Benefits, Barriers, and Bridges. // Available at: http://www.capsresearch.org/. 2001.
16. Fawcett S.E., G.M. Magnan. The Rhetoric and Reality of Supply Chain Integration. // International Journal of Physical Distribution and Logistics Management, 200. – No. 32. – pp. 339-361.
17. Florida R., J. Goodnight. Managing for Creativity. // Harvard Business Review., 2005. – 83 (7). – pp. 125-131.
18. Garcia R., R. Calantone. A Critical Look at Technological Innovation and Innovativeness Terminology: A Literature Review. // The Journal of Product Innovation Management, 2001. – No. 19. – pp. 110-132.
19. Giannakis M.G., S.R. Croom. Toward the Development of a Supply Chain Management Paradigm: A Conceptual Framework. // Journal of Supply Chain Management, 2004. – 40 (2). – pp. 27-37.
20. Handfield R.B., M.D. Pagell. An Analysis of the Diffusion of Flexible Manufacturing Systems. // International Journal of Production Economics, 1995. – No. 39. – pp. 243-253.
21. Heide J.B. Interorganisational Governance in Marketing Channels. // Journal of Marketing, 1994. – No. 58. – pp. 71-85.
22. Heide J.B., G. John. Do Norms Matter in Marketing Relationships? // Journal of Marketing, 1992. – No. 56. – pp. 32-44.
23. Heide J.B., G. John. The Role of Dependence Balancing in Safeguarding Transaction-Specific Assets in Conventional Channels. // Journal of Marketing, 1998. – 52 (1). – pp. 20-35.
24. Klein S., G.L. Frazier, V.J. Roth. A Transaction Cost Analysis of Channel Integration in International Markets. // Journal of Marketing Research, 1990. – No. 27. – pp. 196-208.
25. Lambert D.M., M.C. Cooper, J.D. Pagh. Supply Chain Management: Implementation Issues and Research Opportunities. // International Journal of Logistics Management, 1998. – 9 (2). – pp. 1-19.
26. Lord R.A., J.E. McIntyre. Leverage, Imports, Profitability, Exchange Rates, and Capital Investment: A Panel Data Study of the Textile and Apparel Industries 1974-1987. // International Review of Financial Analysis, 2003. – No. 12. – pp. 287-310.
27. Lummus R.R., R.J. Vokurka. Defining Supply Chain Management: A Historical Perspective and Practical Guidelines. // Industrial Management and Data System, 1999. – 99 (1). – pp. 11-24.
28. Lummus R.R., L.K. Duclos, R.J. Vokurka. Supply Chain Flexibility: Building a New Model. // Global Journal of Flexible Systems Management, 2003. – 4 (4). – pp. 1-13.
29. McCullen P., D. Towill. Diagnosis and Reduction of Bullwhip in Supply Chains. // Supply Chain Management, 2002. – 7 (3/4). – pp. 164-179.
30. Marshall C. The Dynamic Nature of Innovation Partnering: a Longitudinal Study of Collaborative Interorganisational Relationships. // European Journal of Innovation Management, 2004. – 7 (2). – pp. 128-140.
31. Mayer K.J., N.S. Argyres. Learning to Contract: Evidence from the Personal Computer Industry. // Organisation Science, 2004. – 15 (4). – pp. 394-410.
32. Miller M.B. Coefficient Alpha: A Basic Introduction from the Perspectives of Classical Test Theory and Structural Equation Modelling. // Structural Equation Modelling, 1995. – 2 (3). – pp. 255-273.

33. Montalvo C. What Triggers Change and Innovation? // Technovation, 2004. – XX. – pp. 1-12.
34. Morgan J.P., R.M. Monczka. Why Supply Chains must be Strategic. // Purchasing, 2003. – 132 (7). – pp. 42-45.
35. Olavarrieta S., E.E. Alexander. Resource-Based Theory and Strategic Logistics Research. // International Journal of Physical Distribution and Logistics Management, 1997. – 9/10. – pp. 559-587.
36. Poppo L., T. Zenger. Do Formal Contracts and Relational Governance Function as Substitutes or Complements? // Strategic Management Journal, 2002. – No. 23. – pp. 707-725.
37. Porter M.E. Competitive Advantage: Creating and Sustaining Superior Performance. – New York: The Free Press, 1985.
38. Porter M.E., C. VanDerLinde. Green and Competitive: Ending the Stalemate. // Harvard Business Review, 1995. – 73 (September-October). – pp. 120-134.
39. Rae-Smith J.B., A.E. Ellinger. Insight from the Introduction of an Online Logistics Service System. // Supply Chain Management, 2002. – 7 (1). – pp. 5-11.
40. Rogers, E.M. The Diffusion of Innovation (5th ed).- New York: Free Press, 2003.
41. Santos J., Y. Doz, P. Williamson. Is Your Innovation Process Global? // MIT Sloan Management Review, 2004. – 45 (4). – pp. 31-37.
42. Sivadas E., F.R. Dwyer. An Examination of Organisational Factors Influencing New Product Success in Internal and Alliance-Based Processes. // Journal of Marketing, 2000. – 64 (January). – pp. 31-49.
43. Skjoett-Larsen T. (1999). Supply Chain Management: A New Challenge for Researchers and Managers in Logistics. // International Journal of Logistics Management, 1999. – 10 (2). – pp. 41-53.
44. Spekman R.E., J. Spear, J. Kamauff. Supply Chain Competency: Learning as a Key Component. // Supply Chain Management, 2002. – 7 (1). – pp. 41-55.
45. Stratton R., R.D.H. Warburton. The Strategic Integration of Agile and Lean Supply. // International Journal of Production Economics, 2003. – No. 85. – pp. 183-198.
46. Svensson G. Holistic and Cross-Disciplinary Deficiencies in the Theory Generation of Supply Chain Management. // Supply Chain Management, 2003. – 8 (3/4). – pp. 303-316.
47. Tadelis S. Complexity, Flexibility, and the Make-or-Buy Decision. // The American Economic Review, 2002. – 92 (2). – pp. 433-437.
48. Teece D.J. The Diffusion of an Administrative Innovation. // Management Science, 1980. – 26 (5). – pp. 464-470.
49. Teece D.J., G. Pisano, A. Shuen. Dynamic Capabilities and Strategic Management. // Strategic Management Journal, 1997. – 18 (7). – pp. 509-533.
50. Thomassey S., M. Happiette, J.M. Castelain. A Global Forecasting Support System Adapted to Textile Distribution. // International Journal of Production Economics, 2005. – No. 96. – pp. 81-95.
51. Van de Ven A.H. Central Problems in the Management of Innovation. // Management Science, 1986. – No. 32. – pp. 590-607.
52. Whinston M.D. On the Transaction Cost Determinants of Vertical Integration. // Journal of Law Economics and Organisation, 2003. – 19 (1). – pp. 1-23.
53. Williamson O.E. Strategy Research: Governance and Competence Perspective. // Strategic Management Journal, 1999. – 20 (12). – pp. 1087-1108.
54. Williamson O.E. The Mechanisms of Governance. – New York: Oxford University Press, 1996.
55. Williamson O.E. Markets and Hierarchies, Analysis and Antitrust Implications. – New York: the Free Press, 1975.
56. Windsor R.D. Marketing under Conditions of Chaos: Percolation Metaphors and Models. // Journal of Business Research, 1995. – 34 (2). – pp. 181-189.
57. Yen, B.P.C. Electronic Commerce Front-End in Apparel Supply Chain. // Computers and Industrial Engineering, 2002. – No. 42. – pp. 471-480.