Developing a Reference Framework for Measuring the Supply Chain Capability

Hsin-Lu Chang[1]
Department of MIS, National Chengchi University, Taiwan
hchang@mis.nccu.edu.tw

Chia-ying Hsuan[2]
Department of MIS, National Chengchi University, Taiwan

Huai-Chia Weng[3]
Department of MIS, National Chengchi University, Taiwan

Abstract

This research aims to develop a framework for measuring the supply chain capability. The literature review and company interviews allow us to propose four capabilities and relative measurements. A field survey is then conducted in the Taiwan PC industry to assess the measurements. To ensure the measurements are valid, we apply two-step measurement assessments: the factor analysis and initial reliability are first conducted and then followed by item-total correlation, optimal reliability coefficients, convergent validity, and discriminant validity. The resulting model is an 18-item and three-dimension construct. The three dimensions are: (1) reducing transaction related risk, (2) promoting good relationship, and (3) managing environment change. The confirmatory factor analysis then suggests us to arrange the three dimensions in two groups. The first group includes the first dimension, indicating the firm capability, and the second group includes the other two, expressing the inter-firm capability. The contribution is multi-folded. Validated supply chain capability measures can help managers better gauge the characteristics of the collaborations. IT researchers can build upon the model developed in this study through further examination of the factors that are discovered.

Keyword: Supply chain capability, Inter-organizational systems, Information technology, Supply chain management

1. Introduction

Supplier-customer relationships have undergone radical changes in recent years because the business environment has changed (e.g., volatility in demand, curtailment of product life cycle, changing of information technology, and so forth). Facing this situation, new organizational forms such as the extended or agile enterprise emerge to allow for a tighter link among strategic partners - customers, suppliers, or other third party service providers - that decide to dovetail their capabilities to provide a seamless and electronically enabled closed loop of unimpeded business processes. Corporate supply chains become more network-connected and involve more business partners. Since this kind of supply chain collaboration involves more business partners than traditional inter-firm coordination, the issue such as how to develop good supply chain capabilities to handle the increasing complexity and dynamism is becoming more important than ever.

According to resource-based theory, firm resources and capabilities are the source of sustained competitive advantage [3, 12]. Thus, to make the supply chain collaboration successful, it is important to offer an integrated view of what capabilities a supply chain should obtain in terms of transaction handling capabilities, relationship capabilities, IT capabilities, and so on. Those capabilities may cause the firms to gain more competitive advantages and benefits. We believe that a systematic investigation of these influences could offer significant insights for firms to manage their supply chain network. Thus, this paper seeks to contribute to the literature on supply chain studies through (1) the development and formalization of a framework of supply chain capabilities within the supply chain network; and (2) the operationalization and test of the framework through primary field data obtained in industrial supply chains.

2. Literature Review

Some researchers have recognized the significance of supply chain capabilities. Riggins and Mukhopadhyay (1994) assert that companies with good supply chain capabilities can increase the interdependent benefits [21]. Dyer and Singh (1998) emphasize the impact of relational rents on inter-firm collaboration, the benefits that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance [11]. Angeles and Nath (2000) find that focal firms prefer to partner with suppliers that have good capabilities to handle supply chain problems including channel inventory management, manufacturing planning and scheduling, demand forecasting, and distribution and transportation planning [1]. Further, Craighead and Shaw in 2003 argue that supply chain performance is dependent on multiple capabilities: supply chain partners capabilities, manufacturing firm capabilities, information technology capabilities, and operational capabilities [9]. These capabilities, along with final customer's desire, create and accumulate the value of the supply chain.

Although researchers use different concepts and theories to investigate supply chain capabilities, we derive four levels of supply chain capability according to the resource-based view: technology level, transaction level, relationship level, and environment level. We discuss each accordingly.

Technology Level. The basic resource-based theory examines the link between a firm's internal characteristics and performance. It suggests that firm's IT resources such as IT investment and IT staffs enable a firm to implement successful IT strategies. Some scholars also recognize that firm's IT capability not only affect firm's internal performance but also the performance of supply chain. Bensaou and Venkatraman (1995) propose that the greater the multiplicity of channels and the frequency of information exchanges, the greater the information processing capabilities of the dyad [5]. They assert the information processing capabilities of a relationship will increase with greater intensity and scope of the use of the technology between the two firms. In similarly, Riggins and Mukhopadhyay (1994) suggest that the great volume of business communications for which the firm uses EDI and the high degree to which the firm becomes immersed in EDI of doing business as the efficient ways to maintain partner relationship [21].

Transaction Level. Clemons and Row (1992) propose three major sources of transaction risk: transaction-specific capital, asymmetries in information, and loss of resources control, and suggest create firm's capability that better control these resources can resolve these transaction risks [7]. For the transaction-specific capital, Clemons and Row (1992) suggest that the characteristics of software used, such as reusability, modularity, replicability of know-how, coupled with open standards, IT support for conversion and transaction, and intuitive interfaces that reduce the costs of training or re-training can reduce this risk substantially [7]. On the other hand, information asymmetries, the second source of transaction risk, mostly possibly occur in cases of performance measure ambiguity. Kumar and van Dissel (1996) refer that the performance measure ambiguity may be reduced by using information technology to generate and collect monitoring information that would otherwise be too expensive to collect manually [17]. The third transaction risk, loss of resource control, occurs when resources are transferred as part of the relationship and these resources cannot be returned or controlled in the event of the termination of the relationship [7]. Information know-how is the most possible resource that may be lost of control, since firms are very difficult to control the access and subsequent utilization of such resources. Previous literature also shows that such resource contention and conflict can be much reduced while conducting pre-established concurrency control and security mechanisms beforehand. Besides, the control of such resource is better placed in the hands of a neutral third party such as a trade association, exchange, government agency, or a joint venture company [17].

Environment Level. Facing the increasing complex and dynamic environment, some RBV studies find that the successful market players have the capability of timely responsiveness and rapid and flexible product innovation, coupled with the management capability to effectively coordinate and redeploy internal and external competences [26]. They define the ability to achieve new forms of competitive advantage as “dynamic capabilities”. The focal point is to hold the timing and then to adapt, integrate, and reconfigure internal and external resource to response the rapid technological change and changing business environment. Such capabilities can be mainly divided into two groups based on their focused problems. One is to handle information uncertainties and the other is to task uncertainties. In order to handle information uncertainty, Clemons and Row (1993) suggest related technologies and systems to gather information surrounding dynamic supply chain environment, for example, a system to help firms gather dynamic information to forecast the customers’ needs [8]. Besides, open and frequent communications between firms and firms’ partners is also a way to handle the information uncertainty risk [1]. Task uncertainty arises due to the specific set of tasks carried out by the organizational agent responsible for the interorganizational relationship. In this work, the task uncertainty refers to the uncertainty of selling/buying activities because our research focuses on selling and buying activities of the supply chain. Bensaou and Venkatraman (1995) suggest that setting up the clearly known way, established practices and procedures employees follow, as well as detail and clear job descriptions are the ways and means to handle the uncertainty of selling/buying activities [5].

Relationship Level. Besides the dynamic view, some scholars extend the RBV to relational view while arguing that a firm’s critical resources may extend beyond firm boundaries, and the benefits often linked to the relational network that the firm is embedded [15]. Applying the relational view to the supply chain context, firms that have capabilities to maintain good relationships with trading partners can reduce transaction costs, negotiation costs, and uncertainty about the opportunistic behavior, thereby having a positive effect on performance. These capabilities include long-term relationship, reputation, investment both sides, complementarity of technology, business practice, goal, and culture, as well as regulations to handle the management dependency [10, 11, 13, 17]. We summarize them into three categories: trust, complementarity, and management dependency and describe them in the following paragraphs respectively.

Based on Dwyer, Schurr, and Oh (1987), trust is defined as “the belief that a party’s word or promise is reliable and the party will fulfill his/her obligations in an exchange relationship” [10]. Lewis and Weigert (1985) recognize the significance of trust in uncertain/risky environment and refer that persons involved in a risky course of action can act competently and dutifully while they trust with each other [19]. Therefore, trust is an important concept in understanding expectations for cooperation and planning in a relational contract.

Dyer and Singh (1998) define complementary resource endowments as distinctive resource of alliance partners that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner [11]. Similarly, Bensaou (1997) argue that compatibility in goals and technological capabilities reduce the uncertainty about the partner’s inclination and potential intentions for opportunistic behavior and therefore invite cooperation [4]. Further, cultural differences between two organizations are also likely to exacerbate the transaction risks by increasing the risk of different interpretations of the transaction contract [17].

Management dependency is another important factor to handle the fairness of supply chain relationship. According to Hart and Saunders (1998), relative dependence in a dyadic relationship between customer and supplier is a determinant of power [13]. Often the powerful partners provide software free of charge, long term incentive, risk sharing, education seminar, and cost subsidy to less power company who otherwise may not be able to justify the investment [21, 27].

In summary, firm’s supply chain capabilities result from different perspectives of internal or external firm resources and shared by relational network partners. These resources and capabilities may result in special competitive advantages or benefits in supply chain collaboration.

3. Research Framework

According to our previous discussion, we argue that an enterprise with good supply chain capability should be able to handle the supply chain collaboration more successfully. These views are synthesized into the following definition and are characterized by Figure 1:

Supply chain capability is a company-owned ability to well operate company's supply chain networks, which can efficiently aid the companies to handle the collaborative activities with their trading partners. The scope of considering the supply chain capability is from the basic technology level to the environment level, which include how to improve the transaction efficiency, how to reduce the transaction risk, how to promote a good relationship, and how to resolve the uncertainty in the dynamic environment.

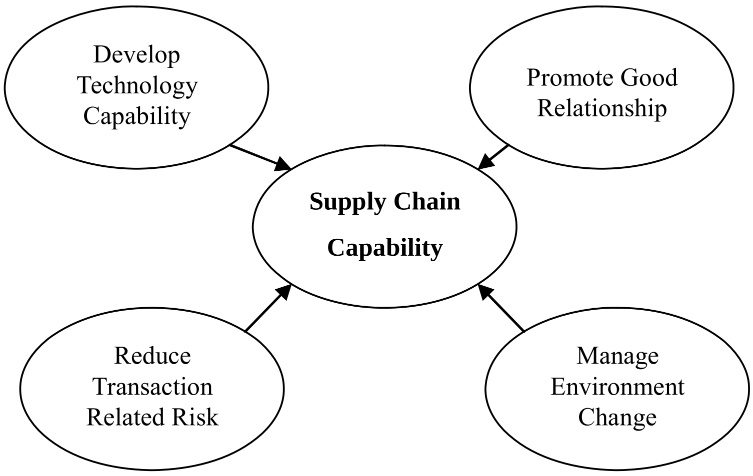

Figure 1. Research Framework for the Development of Supply Chain Capability Construct

4. Research Methodology

The content analysis results in an initial pool of 26 items with at least 4 items in each dimension. Table 1 shows the measures for each dimension, operationalized using the items provided in the referenced studies. Each item is presented on a seven-point Likert scale.

In preparation for large-scale data collection, the resulting questionnaire was pilot-tested by six executives that are directly responsible of IOS collaborations during fall 2004. These six executives come from three different types of firms in Taiwan PC industry: the component supplier, the service provider, and the manufacturer. The findings of pilot-test are consistent with our model.

Table 1. Item Measures for Supply Chain Capability Construct

Factors	Items	Measures of Develop Technology Capability (TC)
IOS usage and integration	TC1	Percentages of transaction by IOS links [5, 22]
	TC2	Number of partners that are connected by IOS links [5]
	TC3	Degree of IOS integration with each process [5, 22]
	TC4	Degree of IOS integration with current enterprise systems [5, 22]
	TC5	
Information technology	TC6	Degree of technology investment in IOS [22]
	TC7	Establishment of IT infrastructure [5, 14]

infrastructure	TC8	Establishment of applications to support tasks [5]
Factors	**Items**	**Measures of Reduce Transaction Related Risk (TR)**
Reducing transaction-specific capital	TR1	Successful implementation experience [7]
	TR2	Modularity and replicability of know-how [7]
	TR3	Following the industrial standard [7]
Managing information asymmetries	TR4	Pre-established security mechanisms [17]
Managing loss of resource control		
Factors	**Items**	**Measures of Promote Good Relationship (GR)**
Trust	GR1	Existed undergoing supply chain collaboration projects [4]
	GR2	Establishment of clear norms for business behavior [4, 11]
	GR3	Sharing confidential or proprietary information [1, 11, 25]
	GR4	Open and frequent communications [1]
Complementarity	GR5	Similar IT infrastructure [16, 17]
	GR6	Compatible company culture [11]
	GR7	Similar decision processes to handle transactions [17]
	GR8	Providing similar support of cooperative firms by top management [1, 4]
Management dependency	GR9	Technology support or cost premiums [22, 27]
	GR10	Education seminars or system implementation expertise [21]
Factors	**Items**	**Measures of Manage Environment Change (EC)**
Manage information uncertainty	EC1	Related technologies and systems to help gather information [8]
	EC2	Explicit regulations to measure trading performance [17]
	EC3	Sending the timely, accurate, and complete information [1]
Manage uncertainty of selling/buying activities	EC4	Clearly known practices and procedures in doing inter-firm tasks [5]

After pilot test, we conduct a general survey in Taiwan PC industry to validate our proposed framework. Data were collected using a questionnaire instrument. We coordinated with six Taiwan PC firms, three of which have participated in our pilot-test. For each firm, a purchasing and/or engineering senior manager at the central division was first asked to select a set of suppliers under his or her responsibility. Then for each of the selected suppliers these senior managers helped identify the purchasing agent and/or engineer to whom we could send the questionnaire. The total data set constitutes a representative sample of n = 352. Among all returned questionnaires, 55 were found to be complete and usable; this represented a response rate of 15.625 percent.

5. Empirical Assessment of Construct Measurement

Once the data is collected, the verification of this model is conducted through a series of statistical techniques. From a theoretical standpoint, the measurement properties of a construct can be evaluated using a variety of techniques, including internal and external validity, theoretical meaningfulness, internal consistency of operationalization, convergent validity, discriminant validity, and nomological validity. From an operational standpoint, however, the following minimal subset is considered important: unidimensionality and convergent validity, reliability, and discriminant validity [6, 24]. The statistical assessments follow the outline given in Figure 2 and the rationale of this outline is described as follows.

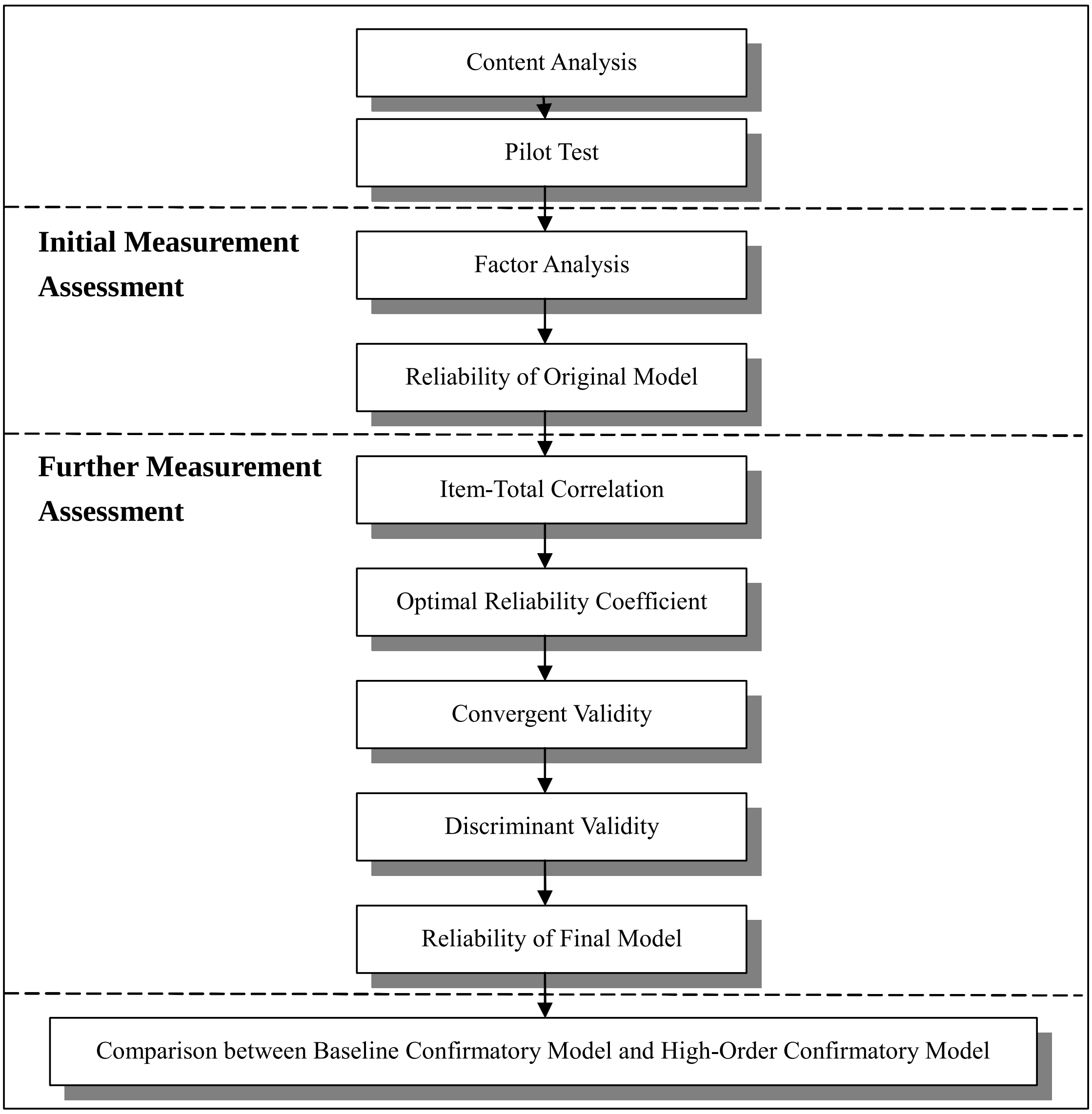

Figure 2. Outline of Statistical Assessments

5.1 Initial Measurement Assessment

The completeness issue is first investigated. Items in this study were selected based on a broad review of literature which satisfies the content validity. The pilot test was done with six executives that are directly responsible of IOS collaborations. Such methodology assures that the model is complete. We then conduct the factor analysis to identify underlying constructs from a large number of interrelated variables. The result is a solution with four factors, each with eigenvalues greater than 1.0. Two items (TC3 and TC4) are excluded from the original model as their factor loadings are less than 0.4 (0.35 recommended by Churchill (1979)), and three items (TC6, TC7, and TC8) that measure the information technology infrastructure are removed to Factor2, resulting in a 24-item model. According to the results of the factor analysis, we point out that the Factor1 measures the technology capability which related the IOSs, the Factor2 presents the technological and managerial capabilities to reduce the transaction related risk, the Factors3 contributes the abilities to promote the good supply chain relationships, and the Factor4 expresses the capabilities to handle the uncertainties of the environment change. The initial reliability is assessed by Cronbach's α coefficient for each of the dimensions determined from the factor analysis. The alpha coefficient for each factor is above 0.8 except TC (Table2), indicating an acceptable reliability [18].

Table 2. Measurement Properties of Proposed Model

Factors	Measures of Model Fit
Overall Model	Independence Model X^2 (276) = 4.994
	Factor Reliability = 0.940
Technology Capability (TC)	Independence Model X^2 (3) = 2.967
	Factor Reliability = 0.473
Capability to Reduce Transaction-Related Risk (TR)	Independence Model X^2 (21) = 15.260
	Factor Reliability = 0.818
Capability to Promote Good Relationship (GR)	Independence Model X^2 (45) = 10.036
	Factor Reliability = 0.838
Capability to Manage Environment Change (EC)	Independence Model X^2 (6) = 15.588
	Factor Reliability = 0.842

5.2 Further Measurement Assessment

To further improve reliability, item-total correlation and optimal reliability coefficients are suggested for use [20]. Under these two procedures, no items are dropped from the model, and therefore the model is still a 24-item model.

Then, the construct validity of each item is examined to ensure that the items included in the model measure the construct. To establish the construct validity of a measure, the literature suggests that the analysis must determine convergent validity and discriminant validity [13, 20]. A multi-trait/multi-method (MTMM) is used for convergent and discriminant validity of the model. The smallest within-dimension correlations for TC, TR, GR, and EC are 0.21, 0.38, 0.43, and 0.51. These correlations are significantly higher than zero and indicate convergent validity [20].

To establish discriminant validity, the relationship between measures from different dimensions should be very low. Using the MTMM approach, discriminant validity for each item is tested by counting the number of times each inter-correlation more highly with an item of a different variable than with items of its parent dimension [20]. It is notable that all items of TC are dropped, eliminating the dimension from the model, and one item (TR2) of transaction level and two items (GR4 and GR7) of relationship level are excluded from the model. After above procedures, six items are dropped from the 24-item model, making it an 18-item model.

After a series of measurement assessment, Table 3 shows the reliability coefficient values for the final model. The reliability of two factors, TR and GR, is increased and the factor, EC, without adjusted items is leveling off. All the items in the factor TC are dropped because they violate the discriminant validity. In summary, the adjusted model with an overall reliability of 0.943 represents good instrument validity. The summary of statistical assessment is shown in Figure 3.

Table 3. Measurement Properties of Final Model

Factors	Measures of Model Fit
Overall Model	Independence Model X^2 (153) = 6.070
	Factor Reliability =0.943
Capability to Reduce Transaction-Related Risk (TR)	Independence Model X^2 (15) = 17.310
	Factor Reliability = 0.907
Capability to Promote Good Relationship (GR)	Independence Model X^2 (28) = 10.870
	Factor Reliability = 0.920
Capability to Manage Environment Change (EC)	Independence Model X^2 (6) = 15.588
	Factor Reliability = 0.842

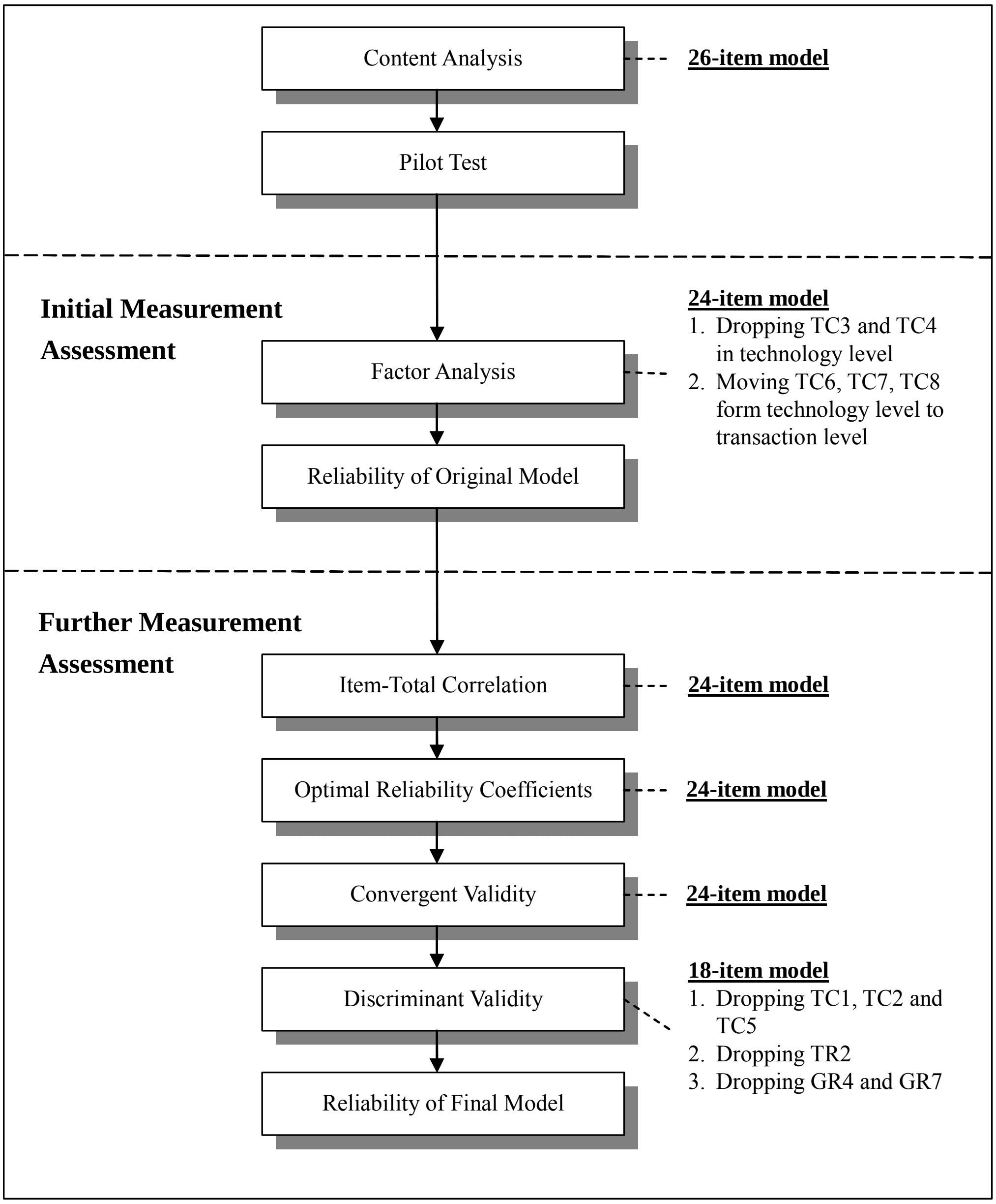

Figure 3. Summary of Statistical Assessments

5.3 Evaluating a Covariation Model of Supply Chain Capability

The further verification of this model is through the use of confirmatory factor analysis. According to Segars and Grover (1998) [23], the analytical framework of confirmatory factor analysis provides an appropriate means of assessing the efficacy of measurement among scale items and the consistency of a pre-specified structural equation model with its associated network of theoretical concepts. The EQS for Windows program (Version 6.0) is utilized as the analytical tool for estimating the measurement and structural equation models developed in this study.

The 18-item model, derived from last section, forms the baseline confirmatory model for the supply chain capability construct. The baseline model suggests that transaction, relationship, as well as environment are independent in their prediction of supply chain capability (Figure 4). Table 4 reports the goodness-of-fit summary for the baseline model. The X^2 divided by its degrees of freedom is 1.99, which is conforming to the recommended 2 [24]. The goodness-of-fit (GFI) for the baseline model is 0.834, which is below the recommended 0.9 [24]. However, it is not out of line with other exploratory studies developing measures for complex organizational phenomena. The root mean square residual (RMSR) is 0.089, which is below the recommended 0.1 [24], providing further evidence of a good fit for this model. The reliability is above the cutoff of 0.8 that is good for exploratory studies. Overall, the fit indicators seem to suggest that each criterion is capturing a significant amount of variation in the latent dimensions of the supply chain capability construct.

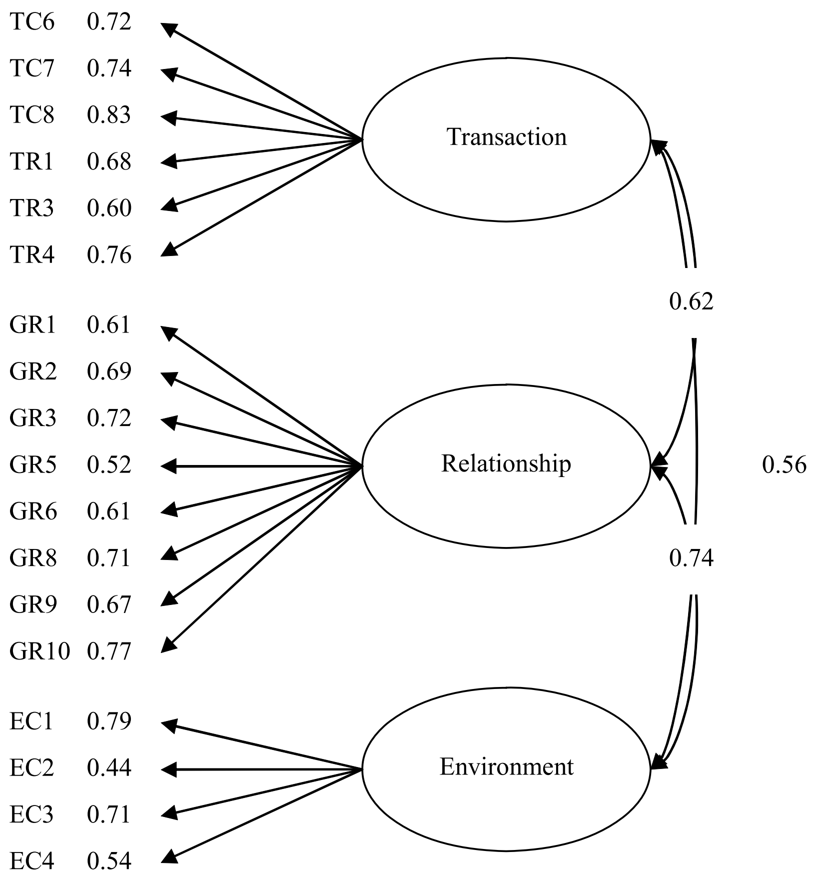

Figure 4. Baseline Confirmatory Model for Supply Chain Capability Construct

Table 4. Model Fit Indices for Baseline Model

Number of Latent Variable	3
Total Number of Items	18
X^2/degrees of freedom	262.674/132=1.99
p-value	0.000001
Goodness of Fit	0.834
Root Mean Square Residual	0.089
Factor Reliability	0.943

The comparative methodology contrasts a baseline model with a model featuring a second-order model.

The second-order model was iteratively modified to improve its fitness. Table 5 shows the model fit indices for the alternative model and the structure is shown in Figure 5. Overall, the fit indices for the second-order model are satisfactory based on the criteria of X^2/ degrees of freedom (df), GFI, RMSR, and reliability.

Table 5. Model Fit Indices for Second-Order Confirmatory Model

Number of Latent Variable	5
Total Number of Items	18
X^2/degrees of freedom	262.674/129=2.04
p-value	0.000001
Goodness of Fit	0.834
Root Mean Square Residual	0.089
Factor Reliability	0.943

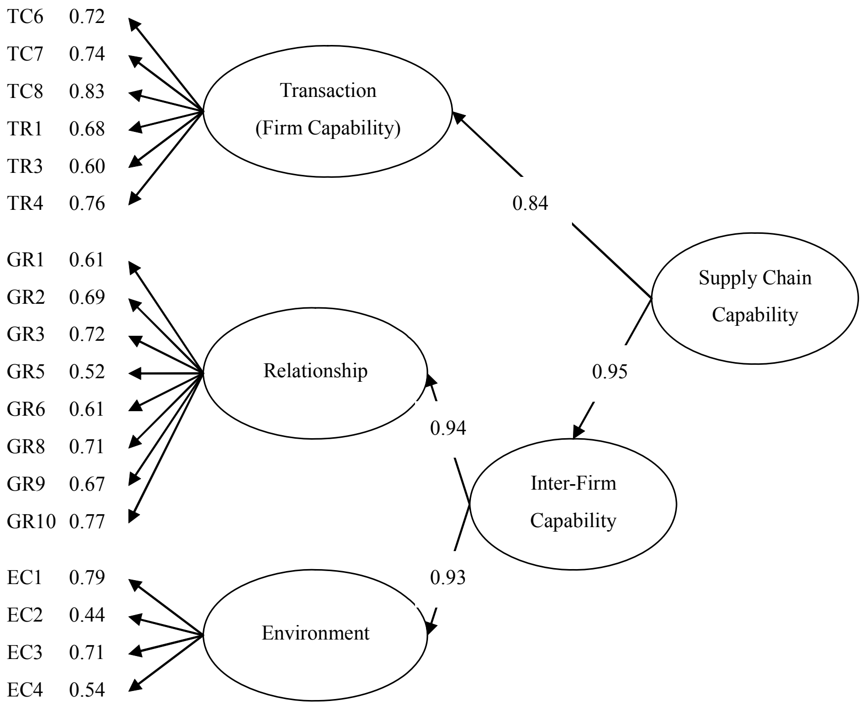

Figure 5. Second-Order Confirmatory Model for Supply Chain Capability Construct

It has been suggested that the efficacy of second-order model be assessed through examination of the target (T) coefficient (T = X^2 (baseline model)/ X^2 (alternative model)) (Segars and Grover 1998). The coefficient has a lower bound of 1.0 if the higher-order model is sufficiently captures the factor in the model. As shown in Table 5, the coefficient between the baseline model and second-order model is 0.98. The value suggests that the addition of the second-order model does increase chi-square. Therefore, the second-order model is a truer representation of the model structure and that the second-order model can be accepted over the baseline model.

6. Discussion

6.1 Items of the Construct

It is notable that all items of TC were either dropped or moved, eliminating the dimension from the construct. The possible reason is that technology capability is not a performance differentiator for both suppliers and original equipment manufacturers (OEMs) in Taiwan PC industry. Most of the suppliers in Taiwan PC industry are small and medium-sized enterprises (SMEs); therefore the trading means of the interorganizational collaboration may greatly depend on the requests of their customers. The customers choose the suppliers with a long-term relationship so that the quality, cost, and the price of the offerings are trustworthy, rather than choose those simply having better technology abilities. Thus, from the SMEs' perspective; suppliers do not consider the technology capability as a major ability for supply chain collaboration. On the other hand, from the perspective of OEMs, they are big and powerful in the Taiwan PC market. Due to the government support and similar customer pool, most of them have developed high but similar technology capability to conduct the inter-firm coordination. Technology capability can not generate competitive advantage for them.

The statistical analysis also suggests us to move the items that measure the IT investment to the transaction level, indicating that the investment of IT infrastructure is an important factor to reduce transaction related risks. This change represents that the firms' IT infrastructure can not directly influence the supply chain capability by itself, but it indirectly affect by reducing the transaction risks. This finding is basically consistent with previous IT research [2, 7, 8, 17]. For example, Kumar and van Dissel (1996) propose a framework that considers the IT as a supporting role in reducing transaction costs and transaction risks. In order to reduce the transaction risks such as overgrazing of the common, fouling or contaminating, and poaching the commons, Kumar and van Dissel (1996) suggest that IT may be used effectively as the village constable to guard against these risks [17]. According to the results of Clemons and Row (1992), IT is both creating the opportunity for cooperation and providing the monitoring capability to reduce the transaction risk associated with cooperation [7]. Their research shows that the IT increases the amount or timeliness of information transferred across firm boundaries as well as reduces the information asymmetries which result in transaction risks. Therefore, instead of being treated as an independent supply chain capability, IT should be viewed as one of the transaction enablers.

In summary, our research points out the IT capability is not a significant supply chain capability for good supply chain collaboration. This result is contrast with most of past related studies as they treat technology as one of the important factor for inter-firm collaboration. Though this finding may need further justification in the future, it reflects the fact that more and more companies view IT as a foundation for inter-firm transaction, but not a weapon for creating competitive advantage. In our interview, most companies agree that technology is not a major concern while considering supply chain collaboration, other factors like trust or the power of partners play more important role.

6.2 Structure of the Construct

Another interesting aspect of this study is the discovery of a second-order confirmatory model. The three dimensions are modeled as baseline latent variables, determined by two second-order latent variables. The first label presents the firm capability which can effectively help company handle the transaction related risk with the technical and managerial abilities. The second label expresses the inter-firm capabilities that include the abilities to promote good supply chain relationship and capacity to handle the uncertainties in the dynamic environment. The dimensions of our final model are described as follows.

Firm capability: The dimension consists of a transaction level describing abilities of reducing transaction risks: degree of technology investment in IOS (TC6), establishment of IT infrastructure (TC7), establishment of applications to support tasks (TC8), successful implementation experience (TR1), following the industrial standard (TR3), and pre-established security mechanisms (TR4). The first three items are from the technical perspective to reduce the transaction risks and the other three items are from the managerial perspective to prevent the transaction risks.

Inter-firm capability: the dimension includes two levels – (1) promote good relationships and (2) manage environment change. The relationship level measures how to well maintain the supply chain relationships with trading partners, including the items of existed undergoing supply chain collaboration projects (GR1), establishment of clear norms for business behavior (GR2), sharing confidential or proprietary information (GR3), similar IT infrastructure (GR5), compatible company culture (GR6), providing similar support of cooperative firms by top management (GR8), technology support or cost premiums (GR9), and education seminars or system implementation expertise (GR10). The environment level comprises of the capabilities of handling the environment uncertainties: related technologies and systems to help gather information (EC1), explicit regulations to measure trading performance (EC2), sending the timely, accurate, and complete information (EC3), and clearly known practices and procedures in doing inter-firm tasks (EC4).

Thus, to understand firms' supply chain capability, this study suggests the companies have to consider two dimensions: firm capability and inter-firm capability. The firm capability presents the abilities to reduce the transaction related risks, and the inter-firm capability indicates the abilities to handle the relationships and environment issues. It is interesting to notice that past research seldom considers the ability to handle environment uncertainty as an important supply chain capability. However our study indicates that such capability becomes more and more important in the current e-business environment where customer requests frequently change, product obsoletes quickly, and customization becomes a norm

7. Conclusion

Many organizations are reengineering their business processes in order to take full advantage of supply chain collaboration. Our study seeks to uncover the key company-owning capability that can contribute to the supply chain collaboration. The proposed framework measures the supply chain capability in four levels: (1) the technology capability in terms of IOS usage and integration as well as information technology infrastructure, (2) the transaction risk resolution capability, (3) the capability to maintain good relationships, and (4) the capability to reduce uncertainties of external environment.

To pretest the applicability of this model, we conduct interviews with three companies in Taiwan PC industry. The findings are consistent with our model. To further test the model, we conduct a general survey with main Taiwanese PC firms during spring 2005. After a series of measurement assessment, the supply chain capability construct is adjusted as a second-order model. The model consists of two groups of items. The first group captures the firm capability for resolving the transaction risk. The other group presents the inter-firm capabilities for promoting good relationship and managing the environment uncertainties with trading partners.

As any empirical investigation, weaknesses in our methodology and data are present [18]. First, the number of observations upon which the analyses are performed is in the barely acceptable range. Although we have cited evidence that our sample size is minimally adequate, we recognize that other researchers might take exception to our small size. Second, the survey data utilized in this study are collected from firms in the Taiwan PC industry. Although the utilized sampling frame has been widely-used in similar studies and contains organizations which likely participate in the activity of interest, no claim of externally validity for this study's findings can be made. Instead, these findings can only be generalized to the population of firms within the sampling frame.

However, at the very least, the components of supply chain capability and the measurement instrument developed in this study provide a good starting point for further investigations of the supply chain capability construct. Validated supply chain capability measures can help managers better gauge the characteristics of the collaborations. IT researchers can build upon the model developed in this study through further examination of the factors that are discovered. Further research can be conducted by the cross-industry or cross-country survey in the future to verify these results.

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