

AN INVESTIGATION OF SUPPLY CHAIN RESPONSIVENESS IN THE THAI TEXTILE INDUSTRY

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Abstract

The purpose of this paper is to appraise the determinants of supply chain responsiveness with regards to demand uncertainties in the Thai textile industry. The Thai textile industry is the second largest industry contributing to the GDP of the country. In this study, the authors will test five important factors (e.g., buyer behavior, operational accuracy, lead time, organizational culture, and collaboration) that are considered to be important in managing responsiveness in a textile supply chain. It is critical for the Thai textile industry to establish a coherent supply chain strategy to meet buyers' expectations as buyers play a vital role in designing textile logistics channels.

Accuracy of the process was found to be the most important determinant to responsiveness. Organizational culture also plays a critical role in shaping the capability of firms to be responsive. Decentralization and empowerment within the firm offer flexibility to the employees to make decision, and ultimately to enhance responsiveness to customers' demand. Finally, it is also important for the industry to collaborate to enable the efficient flow of information between the upstream and downstream supply chain. The use of Electronic Data Interchange (EDI) can help the firms within the textile supply chain in accessing real time data.

Keywords: Thailand, Responsiveness, Textile, Information System, Buyer Behavior.

Introduction

The management of efficient supply chains is difficult, usually it is because of an inability to predict end customer demand. Therefore, the first step in devising an effective supply chain strategy is to consider the nature of end customer demand. It is also important for firms to identify the root causes of demand uncertainty (Lee and Billington, 1995). As an example, demand uncertainty can take the form of unforeseen demand variability, which in turn creates problems in planning, scheduling, and control that will impact the delivery performance (Fisher et al. 1997).

At the simplest level, uncertainty in a supply chain can be viewed as the reliability of a series of sequential and parallel tasks. This uncertainty is related to the number of echelons or to the horizontal dimension of the supply chain (Lambert *et al.*, 1998). It is recognised that uncertainty will increase with the number of echelons or levels (Beamon, 1999). The Thai textile supply chain is taken as an illustrative example to examine variables that have an impact on Thai textile supply chain responsiveness. These variables are buyer behavior, operational accuracy, lead-time, organizational culture, and collaboration.

Literature Review

In order to understand the concept of demand responsiveness, a certain number of factors need to be understood. Based on the literature, the following conceptual framework has been derived, where five variables are found to have impact on demand responsiveness.

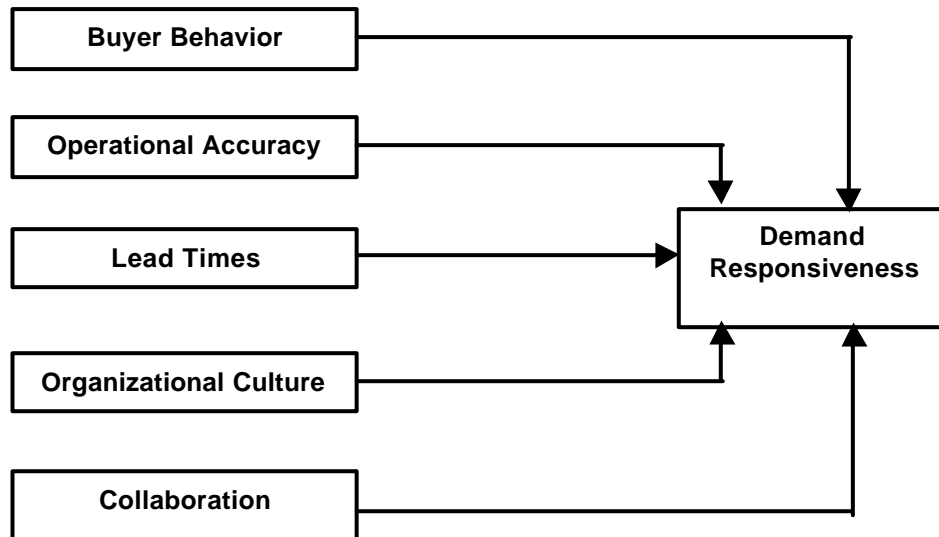


Figure 1: Factors Affecting Demand Responsiveness

Dependent Variable: Demand Responsiveness

Market demand is the foundation upon which company strategy is built. However, a limited number of organizations have undertaken a deep, sophisticated analysis of demand – and even fewer have acted on its strategic potential (Mentzer, 1993). Understanding market demand requires an understanding of customers in minute detail and using that knowledge to respond to their needs as quickly as possible. It is simply not enough to react to demand; supply chains must be able to anticipate.

The key paradigm is real-time responsiveness and flexibility, as competitors improve their operations and the Internet drives ever-higher expectations, especially in the B2B marketplace (Towill, 1997). Demand-driven organizations are highly integrated. These organisations operate with partners in a state of high flexibility and responsiveness to ever changing market conditions and customer requests (Lowson et al. 1999). Traditional supply chain searched for efficiencies in production and logistics, and it was based primarily on a planner's view of an optimized supply chain environment (Sterman, 2002). Today, the supply chain becomes truly demand-driven, with a more contemporary concept of 'demand chain' emerging. This 'demand chain' focuses on revenue creation and cost minimization through a more precise demand analysis and management process that is marked by the following five characteristics (Fisher et al. 1997):

- Real-time access to inventory levels, shipping, lead times and prices, available through synchronized demand analysis
- Visibility to actual customer order information and other point-of-sale data
- Capability to manage demand for multiple, complex SKU hierarchies
- Visibility into future projections and historical demand patterns
- Collaboration capabilities with trading partners and other chain members

Independent Variables

1. Buyer Behavior

Buyer behavior is defined as, the study of individuals, groups, or organizations and the processes they use to select, secure, use, and dispose of products, services, experiences, or ideas to satisfy needs and the impacts that these processes have on the buyer and society (Rosenberg and Stern 1970). Although it is not necessary to memorize this definition, it brings up some useful points:

- Behavior occurs either for the individual, or in the context of a group (e.g., friends influence what kinds of clothes a person wears) or an organization (people on the job make decisions as to which products the firm should use).
- Buyer Behavior involves the use and disposal of products as well as the study of how they are purchased. Product use is often of great interest to the marketing people; because this may influence how a product is best positioned or how increased consumption can be encouraged.
- A number of environmental problems result from product disposal (e.g., motor oil being sent into sewage systems to save the recycling fee, or garbage piling up at landfills) this is also an area of interest.
- Buyer Behavior involves services and ideas as well as tangible products.

The understanding of buyer behavior helps firms to improve their marketing strategies by understanding issues such as:

- How buyers think, feel, reason, and select between different alternatives (e.g., brands, products);
- How the buyer is influenced by his or her environment (e.g., culture, family, signs, media);
- The behavior of buyers while shopping or making other decisions;
- The limitations in buyers' knowledge or related information for processing that may influence decisions and/or marketing outcome;
- How buyer motivation and decision strategies differ between products and services; and
- How marketers can adapt and improve their marketing campaigns and marketing strategies to more effectively reach buyers.

An understanding of these issues will help in the adaptation of the best supply chain strategies to implement by taking the buyer into consideration (Lowson *et al.*, 1999).

2. Operational Accuracy

Performance measurement, which is done in the form of benchmarking, is currently relatively in vogue (Lowson *et al.* 1999). Successful companies rely upon performance measurement, which reflect not only internal, but also external activities. The latest developments in performance measurement include new pipeline method where suppliers and retailers evaluate each other and the total business they are in. What is particularly innovative is the new form of added value assessment (AVA) that is beginning to emerge (Tyndall *et al.* 1999). This concept theoretically brings together the stakeholders in a given supply chain as equal partners. The successful supply chain member must excel in activities such as:

Quality and reliability:

- Adherence to quality procedures
- Limited quality failure level (internal and external)
- Level of customer/Buyer input through Quality Function Deployment (QFD)
- Quality performance
- Accuracy of interpretation of customer needs and requirements
- Customer satisfaction with product life-cycle and new product introduction

Distribution:

- Flow-through distribution
- Shipping cycle time
- Floor ready units
- Direct to store delivery
- Shipping accuracy
- Inventory accuracy

3. Lead Time

Lead-time is defined as, 'the total time that elapses between an order's placement and its receipt. It includes the time required for order transmittal, order processing, order preparation, and transit' (Fisher et al. 1997). There are two types of inventory at every stage in the supply chain: cycle stock and safety stock. Cycle stock is the material needed to cover average demand during the inventory lead-time period. Safety stock is the material kept 'just in case' to cover the variability in demand and in lead-time itself during the inventory lead-time period.

4. Organizational Culture

The culture of an organisation will both contribute to strategic direction and greatly influence its implementation (Lowson et al. 1999). The organisation's culture should be aligned to the desired strategic response. Organisation culture is a deeper level of basic assumptions and beliefs that are shared by members, that operate unconsciously and is defined in a basic taken-for-granted perception of how the organisation view itself and its environment. The culture is rooted in organisational group, and individual experience over time.

The successful use of Quick Response (QR) strategies and operations will rely totally upon the cultural adaptation of the firm and its mutual network. The main element are as followed (Lowson et al. 1999):

- **Structure.** A vast array of organizational structures exists. The simple structure, the traditional functional structure, the multi-divisional structure, holding company structures, process or horizontal structures. Work groups and indeed whole organizations will form synergistic facilities dedicated to customer groupings or particular product processes. These will be highly flexible and able to dissolve and reconvene as demand flows change.
- **Externality.** The ethos and philosophy of the QR organization is externally focused. Traditional boundaries are fleeting. Networks, alliances, and working groups form and disband in-line with demand. This new constitution requires a change in thinking and approach.
- **Information.** In a similar manner, information must be comprehended as inter organizational. It is the culture of the web and the complete dependence on other firm in symbiotic relationships that must be instilled.
- **Knowledge.** With information comes knowledge and knowledge sharing at the point of need and use through a networked pattern of communication. A board knowledge development, access, retrieval, sharing and use must be encouraged for the flexibility needed in the QR organization.
- **Control systems and leadership styles.** The traditional command and control hierarchy of large bureaucratic systems has dissolved into a decentralized process of efficiency and economic control. The QR approach takes this a step further by placing an emphasis upon open network co-ordination, cross-functional, and cross-organizational processes and external systems integration. Leader styles must reflect the need for an outward focus and recognition of the degree to which the new environment shapes and influences all activity.
- **Management.** The management of the organization reflects the various requirements of the various market served. The primary task of the management of the enterprise as a whole is relating the total system to its environment and network through the regulation of boundary interchanges, rather than internal regulation. Management that takes the environment as given and concentrates on organizing internally in the most efficient way is pursuing a dangerous course.
- **Total Quality Management.** TQM is both a set of guiding principles that represent the foundation of a continuously improving organization. TQM is the application of quantitative and human resources to improve the material services supplied to an organization, all the processes within the organization, and the degree to which the needs of the customer are met. TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach focused on continuous improvement. TQM has particular relevance and importance to materials flow within logistics (Stock and Lambert 2001). The TQM approach stresses long-term benefits resulting from continuous improvement to systems, programs, products, and people. Improvement most often results from a combination of small innovations. A structured, disciplined, operating method is used to maximize customer services level.

5. Collaboration

A collaborative supply chain simply means that two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation (Rosenberg and Stern, 1970). Many researchers have proposed equivalent definitions to the collaborative supply chain. Lambert, et al., (1998) suggested a particular degree of relationship among chain members as a means to share risks and rewards that result in higher business performance than would be achieved by the firms individually. Bowersox (1997) discussed that logistics alliances offer opportunities to dramatically improve customer service and at the same time lower distribution and storage operating costs. Anderson and Narus (1990) defined a collaborative supply chain as the cooperation among independent but related firms to share resources and capabilities to meet their customer's most extraordinary needs.

Although collaboration is based on a mutual objective, it is a self-interested process in which firms will participate only if it contributes to their own survival. Each member seeks to achieve individual benefits such as eliminating redundant functions, reducing transactions, achieving lower inventory, increasing responsiveness. Nevertheless, the focus of a mutual objective should be on the outcome and experience of joint offers to end customers. By sharing their resources and capabilities, members can exploit profit-making opportunities that they cannot create alone.

A collaborative supply chain is commonly differentiated in terms of its structure (i.e., vertical, horizontal, and lateral) (Stank et al. 1999). Vertical collaboration occurs when two or more organizations such as the manufacturer, the distributor, the carrier, and the retailer share their responsibilities, resources, and performance information to serve relatively similar end customers. Several examples are Vendor Managed Inventory (VMI), Efficient Customer Response (ECR), and Collaborative, Forecasting and Replenishment (CPFR). Horizontal collaboration occurs when two or more unrelated or competing organizations cooperate to share their private information or resources such as joint distribution centers. A lateral collaboration aims to gain more flexibility by combining and sharing capabilities in both vertical and horizontal manners. Integrated logistics, and multimodal transport are examples of lateral collaborations that attempt to synchronize shippers and carriers of multienterprises in an effective transportation network (Stank et al. 1999). Other types of collaborations are based on formality, supply chain related alliances, and resource pooling (Stank et al. 1999).

Research Methodology

For this study primary data has been collected through structured survey questionnaires. A total of 245 samples were collected randomly from a total population of 671 textile manufacturers in Thailand. A mail survey was carried out followed by series of telephone reminders. Most of the responses were received by fax. The sample is considered acceptable as a representative of the textile manufacturers in Thailand. The survey instrument was developed based on a previous study by Griffis (2001).

Hypothesis Statement

The hypothesized relations can be addressed as followed:

- **H1o:** There is no relationship between buyer behavior and demand responsiveness.
- **H1a:** There is a relationship between buyer behavior and demand responsiveness.
- **H2o:** There is no relationship between operational accuracy and demand responsiveness.
- **H2a:** There is a relationship between operational accuracy and demand responsiveness.
- **H3o:** There is no relationship between lead-time and demand responsiveness.
- **H3a:** There is a relationship between lead-time and demand responsiveness.
- **H4o:** There is no relationship between organizational culture and demand responsiveness.
- **H4a:** There is a relationship between organizational culture and demand responsiveness.
- **H5o:** There is no relationship between collaboration and demand responsiveness.
- **H5a:** There is a relationship between collaboration and demand responsiveness.

Data Analysis

Reliability Analysis

Alpha is an index of the reliability of each variable in which the alpha value more than 0.7 will be considered as measures are reliable (Nunnally 1978). In this study, Cronbach alpha of all the constructs are: Buyer Behavior = .8128, Operational Accuracy = .8683, Lead times = .8632, Organizational Culture = .8338, Collaboration = .7858, and Demand Responsiveness = .8496; which justifies that the constructs have satisfactorily met the reliability criteria.

Inferential Analysis – Hypothesis Testing

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.975 ^a	.950	.949	.14190	1.926

a. Predictors: (Constant), Buyer Behavior, Operational Accuracy, Lead time, Org Cul, Collaborate

b. Dependent Variable: DEMAND

Table 1: Multiple Regressions

Table 2: ANOVA

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.100	.065		1.540	.125	.228	.028		
	Buyer Behavior	.265	.042	.260	6.286	.000	.182	.348	.122	8.178
	Operational Accuracy	.176	.040	.178	4.409	.000	.097	.254	.128	7.837
	Lead Time	.251	.040	.265	6.205	.000	.171	.330	.114	8.774
	Org Cul	.132	.035	.125	3.801	.000	.063	.200	.194	5.166
	Collaborate	.200	.038	.195	5.270	.000	.125	.275	.153	6.550

a. Dependent Variable: DEMAND

Table 3: Coefficients

Regression Equation:

$$Y = 0.1 + 0.265 * X_1 + 0.176 * X_2 + 0.251 * X_3 + 0.132 * X_4 + 0.2 * X_5$$

Analysis and Discussions

The Variance explained (R^2) by the model is a very good indicator of the fitness of the data for the model. In this study the adjusted R^2 is 0.949 or it can be interpreted, as the amount of variance explained by the regression model is 94.9%, which is a very good for this type of research. The result from the regression analysis in the above table indicates that, model is extremely well fitted to the data.

Bagozzi (1994) described that, 'better the coefficient of determination close to 1 the better the model is fit to the data'. Beside that, there is no problem of multicollinearity with the model. That is, the VIF (collinearity index) suggests that there is limited multi-collinearity (association between the explanatory variables) between predictor variables. As suggested by Marquardt (1970), a maximum VIF greater than 10 is thought to signal harmful collinearity, which was not in this case. Also, the limited existence of multi-collinearity is confirmed by another indicator as suggested by Bagozzi (1994), if the correlation coefficient between two explanatory variables is larger than the correlation coefficient between them and the criterion variable. This can be verified from the correlation matrix hereunder (table 4)

Table 4: Summary of correlations between variables

		Correlations					
		Buyer Behavior	Operational Accuracy	Lead Time	Org Cul	Collaborate	Demand Responsive
Buyer Behavior	Pearson Correlation	1	.889**	.897**	.849**	.907**	.939**
	Sig. (2-tailed)	.	.000	.000	.000	.000	.000
	N	245	245	245	245	245	245
Operational Accuracy	Pearson Correlation	.889**	1	.915**	.871**	.859**	.928**
	Sig. (2-tailed)	.000	.	.000	.000	.000	.000
	N	245	245	245	245	245	245
Lead Time	Pearson Correlation	.897**	.915**	1	.875**	.878**	.942**
	Sig. (2-tailed)	.000	.000	.	.000	.000	.000
	N	245	245	245	245	245	245
Org Cul	Pearson Correlation	.849**	.871**	.875**	1	.834**	.895**
	Sig. (2-tailed)	.000	.000	.000	.	.000	.000
	N	245	245	245	245	245	245
Collaborate	Pearson Correlation	.907**	.859**	.878**	.834**	1	.921**
	Sig. (2-tailed)	.000	.000	.000	.000	.	.000
	N	245	245	245	245	245	245
Demand Responsive	Pearson Correlation	.939**	.928**	.942**	.895**	.921**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.
	N	245	245	245	245	245	245

** . Correlation is significant at the 0.01 level (2-tailed).

Based on the above discussion of the result from the regression analysis, it can be suggested that, out of five hypothesized relations, all five have been found to have significant relationship with demand responsiveness. The result of this study shows that, all the hypothesized relations of 'buyer behavior', 'operational accuracy', 'lead time', 'organizational culture' and 'collaboration' have been substantiated. This implies that 'buyer behavior'; 'operational accuracy', 'lead time', 'organizational culture' and 'collaboration' are positively and significantly important determinants of demand responsiveness in the Thai textile industry.

Hence, it can be deduced that to increase demand responsiveness and to improve the effectiveness of Thai textile supply chain these 5 determinants will need to be improved in order to create or maintain a high level of responsiveness to demand uncertainty.

Conclusion

In this study, five potentially important variables were tested to understand the issues of demand uncertainty. It was discovered that in the Thai textile supply chain, accuracy of the process during the order cycle is the most important factor that must cope with demand fluctuation in the textile market.

Therefore, the emphasis for Thai textile firms must be on the accuracy of such processes (i.e., order processing, order transmittal, shipment, and inventory control). The other factors that Thai textile companies must prioritised are a better understanding of buyer behavior, lead-time, organization culture and how to implement collaboration within the supply chain.

In term of buyer behavior, the Thai textile firms must conform to buyers' specifications. These firms should be able to predict the buyers' behaviour in terms of purchasing and understand how they evaluate quality. The firms should also reduce lead-time through the provisions of improved business processes that are responsive to buyers' need. A rethink of organisation culture is needed, where information sharing in the organization and the decentralization of decision making can help employees to handle buyers' request more rapidly. Last but not the least, in terms of collaboration, the Thai textile firms should integrate their information system with their supplier and customer by using EDI system to improve the effective of their logistics strategy, however this is still a costly solution for the majority of firms.

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