Establishing Customer Service and Logistics Management Relationship under Uncertainty

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Few studies have investigated how customer service plays its role in logistics management. Despite numerous in-depth researches in supply chain management, the relationship between customer service and logistics management has received little attention. As both activities are practically human-oriented activities, they are inherently difficult to be mutually supportive, particularly in the presence of uncertainty. This study will investigate how they are associated so as to elevate their operational efficiency and quality, thereby reaching higher business achievement. Our proposed approach encompasses three investigative stages. First, we identify the primary factors in logistics activities that affect customer service quality and efficiency. This is accomplished through a set of preliminary survey on small, medium, and large firms. Next, a conceptual model is established based on those factors to serve as a framework for empirical hypothesis of uncertainty relationship. We employ exploratory factor analysis, One-Way ANOVA, and principal component analysis to examine the correlation among relevant influential factors. Lastly, we conduct a case study to reaffirm the validity of the model. Our findings reveal that only firm size has no effect on customer service performance. The rest of the hypothesized factors mostly show that both activities have direct positive associations, especially to the financial performance, with a few exceptions on internal uncertainty factors such as executive support, IT use and skills. The benefits will certainly be conducive toward improving customer service performance in support for more efficient logistics management leading to the success of business as a whole. We plan to incorporate stochastic process into the proposed model to accommodate and assess the risk involved.

Keywords: *Customer Service, Logistics Management, Relationship Uncertainty, Customer Service Performance*

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1. Introduction

Business competitive pressure forces firms to explore all possible processes or methods to gaining sustainable competitive advantage that enhances both customer's satisfaction and firm's performance (Korpela et al., 1998; Collins et al., 2001; Cheung et al., 2003). This is because customer service is an effective instrument to increase number of customers, sales, profit, shareholders' wealth, and market value through partner relationships and customer loyalty (Collins et al., 2001; Wiles, 2007). Lambert (1992) explained that firm should understand final customer's requirements. With the help of new technology, customer value can be enhanced considerably (Renko and Ficko, 2010). Many firms applied enterprise resource planning (ERP) and information systems (IS) to manage and monitor logistics management so as to satisfy the above customer's requirements while making their operation cost effectiveness (Tilokavichai and Sophatsathit, 2011; Celebi et al., 2008; Ngai et al., 2008; Narasimhan and Kim et al., 2001; Cheung et al., 2003). Integration of IS and strategic partnerships also plays an important role to achieve the desired service level (Su and Yang, 2010). As the systems do not operate in stand-alone environment, the unavoidable uncertainties will have an influence on customer service performance (Fink et al., 2008). Some forms of strategic partnership must be incorporated to devise an integrated IS supporting desired service level. One of such partnerships is logistics management. The basis of logistics management considers a balance among customer service level, total logistics costs, and total benefits to the firms. To accomplish the above objectives, the compelling questions addressed in this study are as follows: (1) what are the influential factors on customer service performance? (2) what are the barriers to successful customer service performance? (3) what are the uncertainties that impact on customer service performance? and (4) how does the customer service performance impact to financial performance?

The organization of this paper is as follows. Section 2 provides some influential prior works to this study. Section 3 describes the research methodology and model. Data analysis and findings are elucidated in Section 4. Section 5 demonstrates a case study of customer service support in a retail household business, along with the result interpretations and discussions. Section 6 concludes with a few thoughts and potential future work.

2. Literature Review
We shall look into a few relevant prior works in the sections that follow.

2.1 Customer service
Customer service plays an important role in firms. Many firms are aware of growing customer requirements and adopt sets of standards to evaluate their service for customer's satisfaction (Kisperska-Moron, 2005). Korpela et al. (1998) explained that companies should establish a customer service strategy and focus on designing an efficient logistics system to better serve customer's requirements and sustain competitive advantage. Steven et al. (2012) examined the linkages between customer service, customer's satisfaction, and profitability. They found that customer's satisfaction affected competitive markets. Wouters (2004) addressed four customer service strategic options, namely, integration, adaptation, logistical precision, and standard service level by determining the customer needs accurately and exceeding the needs. The customer service in logistics had a direct impact on a firm's market share, total logistics costs, and profitability (Collins et al., 2001; Bottani and Rizzi, 2006). Berne et al. (2001) explored the variety-seeking negative effect of customer retention that helped lessen the impact of the management efforts and improve service quality and customer's satisfaction. Wiles (2007) examined the shareholder value created by customer service discipline of the retailer

which is affected by the heuristics and clues used to judge the likelihood of service delivery.

2.2 Uncertainty in Customer Service

Ramanathan (2010) explored risk characteristics of products that affected the relationships between logistics performance and customer loyalty such as risks in terms of price and ambiguity of products. The important elements in customer service consisted of order completeness, order accuracy, and stocking levels. Collins et al. (2001) summarized uncertainty variables as follows: order cycle time, consistency and reliability of delivery, inventory availability of delivery, order-sized constraints, delivery time, claim procedure, post-sale support for the product, and order status information. Of particular interest is lead time which has direct effects on customer service level and stock-out costs. One remedy is the use of ERP and IS to support logistics management that satisfies customer's requirements (Tilokavichai and Sophatsathit, 2011; Vickery et al. 2008). Gupta et al. (2000) applied stochastic programming methodology to trade-off between customer demand satisfaction and production costs. Yucesan and De Groote (2000) assessed customer service in an uncertainty environment. Schmitt (2011) developed a multi-echelon model where disruptions could occur at any stage. Chowdhury and Miles (2006) studied customer induced uncertainty in predicting organization design. They found that service firms and manufacturing firms had the same level of customer induced uncertainty.

2.3 Customer Service Performance

Vickery et al. (2008) found positive direct relationships between information technology and customer service performance that affected financial performance. Table 1 shows customer service factors considered in this study.

Table 1. Summary of customer service factors.

Service factors	Description	Related
Lead time	Time period starts from customer's order to receive product (order cycle time).	Bottani and Rizzi, 2006; Collins et al., 2001
Flexibility	Capability to change order in terms of due date and quantity when required.	Bottani and Rizzi, 2006; Collins et al., 2001
Accuracy	Right quantity, right product, right price in order delivered that mandates accurate invoices to be provided.	Bottani and Rizzi, 2006; Collins et al., 2001; Salema et al., 2007; Hsiao et al., 2010
Reliability	Capability to deliver customer's order within due date.	Bottani and Rizzi, 2006; Collins et al., 2001; Yu and Li, 2000; Pishvaee et al., 2009
Fill rate	The percentage of product available upon customer request.	Bottani and Rizzi, 2006; Collins et al., 2001
Frequency	Number of deliveries achieved in a given period of time.	Bottani and Rizzi, 2006; Collins et al., 2001
Organization accessibility	Customers can contact firm to submit questions or complaints.	Bottani and Rizzi, 2006
Complaints management	Solve problems or errors in service process to meet the quality standards.	Bottani and Rizzi, 2006

3. Proposed Model and Methodology

We have established a research framework and hypotheses on various factors affecting customer service performance shown in Figure 1, where *Ha* denotes uncertainties in customer service having an effect on customer service performance; *Hb* denotes the barriers factors having an effect on the customer service performance; *Hc* denotes logistics activity performance having an effect on customer service performance; *Hd* denotes firm sizes having an effect on customer service performance; *He* denotes customer service performance having an effect on financial performance. The enclosed details in each factor are depicted in Figure 1. Logistics activity performance consists of order processing, demand forecasting and planning, inventory management, warehouse

management, reverse logistics, purchasing and procurement, packaging, and transportation. Barriers consist of employee skills, employee turnover, executive support, difficult to use IT systems, communication with vendors and customers. Firm sizes consist of small, medium, and large firms. Uncertainties in customer service consist of product quality, product quantity, packaging quality, vendor's lead time, transportation schedule, number of vehicles in transportation, damage product, IT systems, number of orders, product price, sale order cancellation, customer's demand, returned product, and natural disaster. Customer service performance consists of customer's satisfaction index, number of new customers, average delivery time, product return rate, average stock days, damage value per sales, customer service cost per sales, number of complaints, average response time from sale order, and average waiting time. Financial performance is measured with growth rate.

We also conducted an empirical study to investigate the relationships between customer service performance and logistics management of firms in Thailand. The objectives are five folds: (1) to analyze current status of customer service performance, (2) to assess the capacity of uncertainty management in customer service, (3) to identify how logistics activity performance and barriers that influence customer service performance, (4) to find the relationship between firm size and customer service performance, and (5) to find the relationship between customer service performance and financial performance.
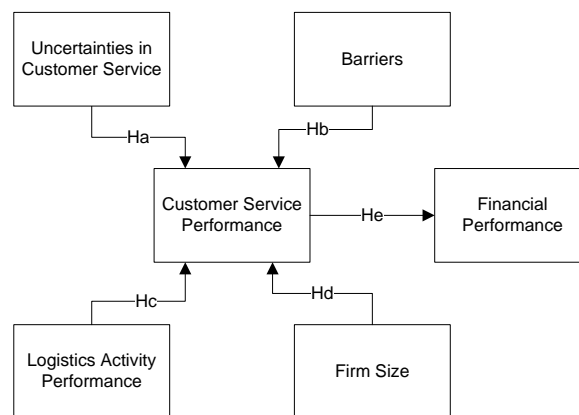

Figure 1. Research framework of customer service performance.

We created a survey questionnaire consisting of five topics, namely, (1) performance in logistics activities including customer service performance, (2) barriers in logistics management, (3) ability to handle uncertainty in customer service activities, (4) use of customer service performance indicators, and (5) financial performance in firms. The questionnaire used a 5-point Likert scale having 1 being "Strongly disagree" and 5 being "Strongly agree" to distinguish the variations in feedback. Pilot tests on practitioners in customer service were carried out during the development of the questionnaire. From the preliminary 500 questionnaire, 166 respondents had involved in customer service. Table 2 summarizes company's profile of the respondents who involve in customer service function. Customer service performance indicators are shown in Table 3.

Table 2. Profile of respondent companies (166 total).

Variable	Category	N	Rate (%)
Firm size	Small	41	41
	Medium	36	21.7
	Large	62	37.3
Operation (Yrs)	<1 Yrs	2	1.2
	1-3 Yrs	15	9
	4-6 Yrs	22	13.3
	7-9 Yrs	15	9
	>= 10 Yrs	112	67.5
Number of Employees	< 50	68	41
	51 – 200	36	21.7
	201 – 350	11	6.6
	> 350	51	30.7
Revenue (Baht)	< 30,000,000	48	28.9
	30,000,001 – 50,000,000	24	14.5
	50,000,001 – 100,000,000	20	12
	100,000,001 - 200,000,000	5	3
	> 200,000,001	69	41.6
Growth Rate (%)	< 3%	9	5.4
	3-5 %	55	33.1
	6-7 %	32	19.3
	8-9 %	15	9
	10-11 %	27	16.3
	12-13 %	6	3.6
	14- 15 %	6	3.6
	> 15%	16	9.6
Trend of Sales	Decrease	21	12.7
	Equal	10	6.0
	Increase	135	81.3

Table 3. Customer service performance indicators in firms.

Customer service performance indicators	Adopted		Not Adopted	
	Frequency	%	Frequency	%
1.Customer's satisfaction index	141	84.9	25	15.1
2.Number of new customers	137	82.5	29	17.5
3.Average delivery time	139	81.9	30	18.1
4.Product return rate	121	72.9	45	27.1
5.Average stock days	117	70.5	49	29.5
6.Damage value per sales	116	69.9	50	30.1
7.Customer service cost per sales	113	68.1	53	31.9
8.Number of complaints	113	68.1	53	31.9
9.Average response time from sale order	111	66.9	55	33.1
10.Average waiting time	92	55.4	74	44.6

The results of adoption from 141 firms or 84.9 % use customer's satisfaction index most because they would like to keep the customers. The second highest indicator is number of new customers (representing sales volume) being selected by 137 firms or 82.5 %.

4. Data Analysis and Findings

We employed exploratory factor analysis (EFA) to examine the underlying dimensions in order to reduce uncertainty variables in customer service. We also applied principal component analysis (PCA) to extract the factors loading and varimax rotation method to classify the variables into relevant factor grouping. In which case, the eigenvalue of any factor should be greater than one (Hair et al., 1998). In addition, the Kaiser-Meyer-Olkin (KMO) measure was applied to detect any prerequisite of a good factor analysis setting the minimum acceptable value at 0.5 (Kaiser, 1974). Items were validated by factor

validation having factor loading exceeding 0.4 (Nunnally, 1967). In the meantime, factor reliability was measured by Cronbach's alpha to ensure the internal consistency of multi-item scales to be no less than 0.6 (Nunnally, 1967). Table 4 shows the results of EFA grouping and validation.

Table 4.Results of exploratory factor analysis of uncertainty for items in customer service.

Factor	Internal uncertainty	External uncertainty
Cronbach's α = 0.892 KMO = 0.848	Product quality Product quantity Packaging quality Vendor's lead time Delivery lead time Transport schedule Number of vehicles in transportation Damage product IT systems	Number of order Product price Sale order cancellation Customer's demand Returned product Natural disaster
% variance	29.950	25.201
Eigenvalue	4.492	3.780

Notice that uncertainty items in customer service were classified by internal and external uncertainties. Internal uncertainty consists of product quality, product quantity, packaging quality, vendor's lead time, delivery lead time, transport scheduling, number of vehicles in transportation, damage product, and IT systems. External uncertainty encompasses number of orders, product price, sale order cancellation, customer's demand, returned product, and natural disaster. The total variance percentage of both internal and external uncertainties is 55.151. This implies that they account for over half the performance data variations.

Setting Pearson correlation coefficient at 0.05 significant level, we found that customer service performance did have association with logistics activity, uncertainties, barriers, and growth rate. This is summarized in Table 5. The one-way analysis of variance (One-Way ANOVA) and least significant difference (LSD) for multiple comparisons factors yielded different comparative results in each group-pair.

Table 5. Summary of customer service performance association.

Association			Results
Customer service performance	Logistics activity performance	Order processing	Associated (+)
		Purchasing and procurement	Associated (+)
		Transportation	Associated (+)
		Warehouse management	Associated (+)
		Inventory management	Associated (+)
		Demand forecasting	Associated (+)
		Packaging	Associated (+)
		Reverse logistics	Associated (+)
	Uncertainty factors	Internal uncertainty factors	Associated (-)
		External uncertainty factors	No associated
	Financial Performance	Growth rate	Associated (+)
	Barriers	IT systems difficult to use	Associated (-)
		Executive support	Associated (-)
		Employee skills	Associated (-)

One noteworthy finding was that firm size played no role in customer service performance. Note also that customer service performance has positive associated with all logistics activity performance and financial performance. The interpretation is straightforward. If customer service performance improves, financial performance will increase. On the contrary, it has negative association with barriers and internal uncertainty factor. This is a forewarning sign to responsible parties as they affect customer service performance directly. Case in point, if the employees lack the necessary skills or the IT systems are difficult to use, service performance will drop. This shortfall can be remedied by executive support (barrier) through training programs, customized IT systems for support operations. The good news, however, is that the level of customer service performance depends solely on each firm's own policy and administration. No external uncertainties can influence it. Therefore, firm should improve logistics activity performance, eradicate barriers, and mange internal uncertainty to improving customer service performance.

5. Case Study

The case study was taken from a 30-year old retail business in household products which will be referred to by GGG company for identity confidentiality purpose. Based on our literature review, some predominant logistics activity support tools implemented by the company are listed in Table 6.

Table 6: Logistics activity support tools of GGG Co., Ltd.

Year	Tools to support customer service	Description
2001	-Oracle ERP, Intranet	-Use ERP and Intranet
2002	-Product knowledge base -Business intelligence system (Client-server)	-Manage product data -BI : analyze data
2003	-Vendor online (Online purchasing)	-Reduce time for purchasing
2004	-VMI (Replenishment, Min-Max)	-Available products
2005	-www.GGG.com, -Product library (Kiosk), -BI (Web based)	-WWW -customers can search product data by themselves -BI : easy to use
2006	-Distribution center (DC)	-Distribute products to branches
2007	-Customer's satisfaction measurement (Smile project), -Delivery system (Trips and Routing)	-Improve service -On time delivery
2008	-GPS system (Track delivery system), -Member system (Reward/redeem point)	-Track delivery -Customer loyalty
2010	-Call centre, -SAP ERP, -BI (Web based) and dashboard	-Customer support -Use SAP ERP -Easy to use and more features
2011	-Updated sales order system	-Reduction in order cycle time

Figure 2 shows annual cost of goods sold (COGS) and inventory cost. In 2006, GGG set up a distribution center (DC) to distribute products to branches. Turnover ratio computed from COGS divided by inventory cost increased which meant that the firm could reduce inventory cost while increase sales. Thus, DC could support customer's requirements and increase satisfaction.
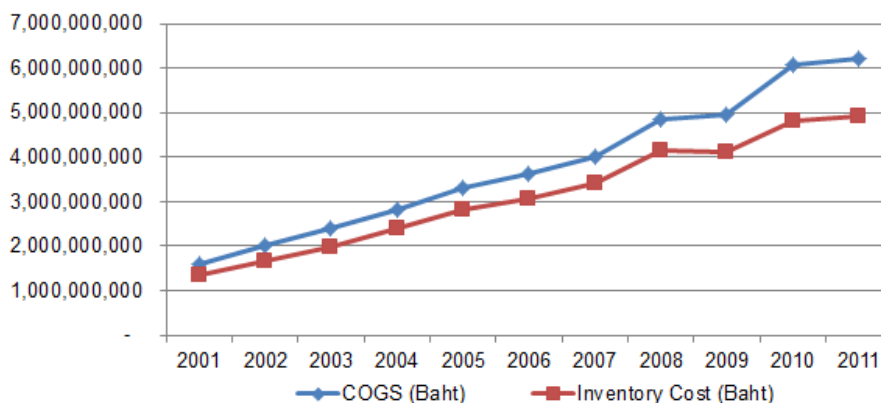

Figure 2: Graph of annual cost of goods sold and inventory cost (Baht).
($1 = B31)

Figure 3 shows the number of customers steadily increases as customer service improves. In 2007, GGG developed a delivery system to improve delivery time. In 2008, they established a member system to retain customer loyalty through promotion campaigns. In 2010, they set up a call center to better serve the customers. Moreover, SAP ERP and BI were introduced in operations and supported decision making. In 2011, a sales order update system was set up to reduce order cycle time. All these efforts accompanying by proper supporting tools help increase sales volume, reduce inventory costs, increase new

customers, and maintain customer's loyalty. This fact is obviously visualized in Figure 3. As a consequence, variation in logistics factors affects or relates directly to customer service performance that must be planned and administered properly.
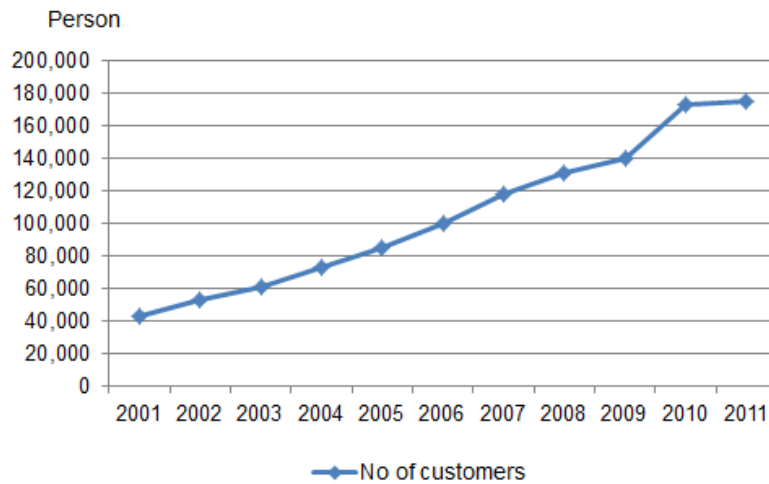

Figure 3: Graph of number of customers.

6. Conclusion

In this paper, we have investigated items that influent customer service performance. As customer service can bring about performance and financial gains for firms, special attention must be paid in planning and operation. Analysis of the model framework and hypotheses furnishes some in-depth considerations of customer service and logistics management relationships. From our findings, logistics activity directly affects customer service performance in various unpredictable manners. Most influential factors came from internal uncertainty items that were positioning at negatively associated with customer service performance, while external uncertainty items played no role in the association. The intriguing twist is the firm size which is not related by any means. This is because every firm concentrates and concerns about customer's satisfaction. Therefore, all firms try to attain competitive advantage from customer loyalty as customer service performance has a direct relationship on gaining financial performance. Complication as the uncertainty has bring about, we plan to incorporate stochastic process into the proposed model to accommodate and assess the risk involved, the effect, and higher performance of customer service level.

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References

Berne, C., Mugica, J. M. & Jesus Yague, M 2001, 'The effect of variety-seeking on customer retention in services', *Journal of Retailing and Consumer Services,* vol. 8, no. 6**,** pp. 335-345.

Bottani, E. & Rizzi, A 2006, 'Strategic management of logistics service: A fuzzy QFD approach', *International Journal of Production Economics,* vol. 103, no. 2, pp. 585-599.

Celebi, D., Bayraktar, D. & Bingol, L 2010, 'Analytical Network Process for logistics management: A case study in a small electronic appliances manufacturer', *Computers & Industrial Engineering,* vol. 58, no. 3, pp. 432-441.

Cheung, C. F., Lee, W. B., Wang, W. M., Chu, K. F. & To, S 2003. 'A Multi-perspective knowledge-based system for customer service management', *Expert Systems with Applications,* vol. 24, no.4, pp. 457-470.

Chowdhury, S. & Miles, G 2006, 'Customer-induced uncertainty in predicting organizational design: Empirical evidence challenging the service versus manufacturing dichotomy', *Journal of Business Research,* vol. 59**,** no.1, pp. 121-129.

Collins, A., henchion M., & O'Reilly P 2001, 'Logistics customer service: performance of Irish food exporters', *International Journal of Retail & Distribution Management*, vol. 29, no. 1, pp. 6-15.

Fink, R. C., James, W. L. & Hatten, K. J 2008, 'Duration and relational choices: Time based effects of customer performance and environmental uncertainty on relational choice', *Industrial Marketing Management,* vol. 37, no. 4**,** pp. 367-379.

Hair, J.F., Anderson, R.E., Tatham, R.L., Black, W.C 1998. Multivariate Data Analysis. Prentice-Hall, Englewood Cliffs, NJ.

Hsiao, H. I., Kemp, R. G. M., Van Der Vorst, J. G. A. J. & Omta, S. W. F 2010, 'A classification of logistic outsourcing levels and their impact on service performance: Evidence from the food processing industry', *International Journal of Production Economics,* vol. 124, no. 1, pp. 75-86.

Gupta, A., Maranas, C. D. & Mcdonald, C. M 2000, 'Mid-term supply chain planning under demand uncertainty: customer demand satisfaction and inventory management', *Computers & Chemical Engineering,* vol. 24, no. 12**,** pp. 2613-2621.

Kaiser, H.F. 1974. An index of factorial simplicity. Psychometrika 39, pp. 31–36.

Kisperska-Moron, D 2005, 'Logistics customer service levels in Poland: Changes between 1993 and 2001', *International Journal of Production Economics,* vol. 93–94**,** pp. 121-128.

Korpela, J., Tuominen, M. & Valoaho, M 1998, 'An analytic hierarchy process-based approach to the strategic management of logistic service: An empirical study in the mechanical forest industry', *International Journal of Production Economics,* vol. 56–57**,** pp. 303-318.

Lambert D.M 1992, 'Developing a Customer-focused Logistics Strategy', *International Journal of Physical Distribution & Logistics Management,* vol. 22, No. 6, pp. 12-19.

Ngai, E. W. T., Lai, K.-H. & Cheng, T. C. E 2008, 'Logistics information systems: The Hong Kong experience', *International Journal of Production Economics,* vol. 113**,** no. 1, pp. 223-234.

Narasimhan, R., & Kim, S. W 2001. 'Information system utilization strategy for supply chain integration', *Journal of Business Logistics*, vol. 22, pp. 51−75.

Nunnally, J.C. 1967. Psychometric Theory. McGraw-Hill, N.Y.

Pishvaee, M. S., Jolai, F. & Razmi, J 2009, 'A stochastic optimization model for integrated forward/reverse logistics network design', *Journal of Manufacturing Systems,* vol. 28**,** no. 4, pp. 107-114.

Renko, S. & Ficko, D 2010, 'New logistics technologies in improving customer value in retailing service', *Journal of Retailing and Consumer Services,* vol. 17, no. 3, pp. 216-223.

Salema, M. I. G., Barbosa-Povoa, A. P. & Novais, A. Q 2007, 'An optimization model for the design of a capacitated multi-product reverse logistics network with uncertainty', *European Journal of Operational Research,* vol. 179, no. 3 , pp. 1063-1077.

Schmitt, A. J 2011, 'Strategies for customer service level protection under multi-echelon supply chain disruption risk', *Transportation Research Part B: Methodological,* vol. 45, no. 8, pp. 1266-1283.

Steven, A. B., Dong, Y. & Dresner, M 2012, 'Linkages between customer service, customer satisfaction and performance in the airline industry: Investigation of non-linearities and moderating effects', *Transportation Research Part E: Logistics and Transportation Review,* vol. 48**,** no. 4, pp. 743-754.

Su, Y.-F. & Yang, C 2010, 'A structural equation model for analyzing the impact of ERP on SCM', *Expert Systems with Applications,* vol. 37, no. 1, pp. 456-469.

Tilokavichai, V. & Sophatsathit, P 2011. 'An Organization-W ide Analysis of ERP and Information Systems Interrelationship for Logistics Support', *Journal of System and Management Sciences*, vol. 1, no. 1, 59-68.

Wiles, M. A 2007, 'The effect of customer service on retailers' shareholder wealth: The role of availability and reputation cues', *Journal of Retailing,* vol. 83, no. 1**,** pp. 19-31.

Wouters, J. P. M 2004, 'Customer service strategy options: A multiple case study in a B2B setting', *Industrial Marketing Management,* vol. 33**,** no. 7, pp. 583-592.

Yu, C.-S. & Li, H.-L 2000, 'A robust optimization model for stochastic logistic problems', *International Journal of Production Economics,* vol. 64, no. 1-3, pp. 385-397.

Yucesan, E. & De Groote, X. 2000, 'Lead times, order release mechanisms, and customer service', *European Journal of Operational Research,* vol. 120, no. 1**,** pp. 118-130.