RECONFIGURING TRANSPORTATION FROM SHENZHEN TO BANGKOK

Nithiwit Apaiwong*
Assumption University of Thailand

Abstract

In this case study, the focus Bangkok company imports electrical products from China via a Singapore hub and then distributes them to end customers in Thailand. The company wants to reduce the heavy transportation cost and order lead time of this shipping route. Quantitative methodology was used to process data. A route optimization procedure identified the potential savings, while short interviews with supply chain managers were used to understand attitudes. The findings indicate that dispensing with the Singapore hub would halve the lead time to seven days and reduce costs by 61%. This proposed route also has the potential for a faster and less expensive supply chain to improve customer satisfaction. There are some potential disadvantages, such as the possible need to re-establish the consolidation hub if the current strategy of supplier clusters is abandoned.

บทคัดย่อ

บทความนี้เป็นกรณีศึกษาของบริษัทนำเข้าเครื่องใช้ไฟฟ้าจากประเทศจีน ผ่านศูนย์ที่ประเทศสิงคโปร์ เพื่อกระจายต่อให้ผู้บริโภคในประเทศไทย บริษัทต้องการลดค่าขนส่งและระยะเวลาในการสั่งซื้อจากเส้นทางนี้ โดยใช้วิธีวิจัยเชิงคุณภาพโดยการสัมภาษณ์ผู้จัดการโซ่อุปทาน และวิธีการหาเส้นทางที่เหมาะสมที่สุดบ่งชี้ว่าสามารถประหยัดต้นทุนได้ ผลการศึกษาแสดงให้เห็นว่า การกระจายสินค้าจากศูนย์ที่สิงคโปร์จะใช้เวลา 7 วัน และลดต้นทุนได้ 61 เปอร์เซ็น เส้นทางที่เสนอนี้เป็นเส้นทางที่เร็วและถูกที่สามารถสร้างความพึงพอใจให้ลูกค้าได้ แต่วิธีนี้ก็ยังมีข้อเสีย หากว่ากลยุทธ์ที่ใช้อยู่ในการรวมกลุ่มซัพพลายเออร์ถูกเมินเฉย ก็อาจมีความเป็นไปได้ที่จะต้องจัดตั้งศูนย์รวบรวมสินค้าขึ้นมาใหม่

INTRODUCTION

The focus company, which is a Thai subsidiary of an American company, provides software and hardware for data centers, telecommunications networks, and business operations. Its products are manufactured in China, shipped to a consolidation hub in Singapore,

---

*Mr. Apaiwong MSc researched this issue as a requirement of his postgraduate supply chain course. This is a condensed version of his research report. Email: wongsakorn55@hotmail.com and transported to the shipment center in Thailand (where the company's Head Office is). The goods are then dispatched, based on existing orders, to South Korea, Malaysia, Indonesia, Philippines, Pakistan, and Australia. This case study will focus on the export system from Singapore to Bangkok. This route worked well when the volume of Thai business was small. However, with dramatic growth the cost of transportation has greatly increased.

The focus company considers logistics and transportation to be a key success factor, yet is not achieving full efficiency because of its continued practice of using a consolidation hub at Singapore in mid-route. Excessive transportation costs and lead time, related to the storage and distribution of goods, prohibits the firm to respond effectively to customers' needs and to attain cost-competitive advantage. Currently, ABC spends an average of USD 2,580 per container, or USD 346.37 per ton, to move inventory from Shenzhen to Singapore (the intermediate distribution point) to the final destinations in Bangkok. This route has an average lead time of 12 to 14 days, which is high, particularly for a small firm that does not have the inventory reserves to pad changes in demand. Preliminary analysis suggests that eliminating the stop in Singapore and shipping directly between Shenzhen and Bangkok, could reduce this lead time. However, a consequence would be the need to make a capital investment for an alternative consolidation facility, and to redesign the delivery process. The company would expect to make substantial cost reductions, to the freight cost and the shipping costs.

REVIEW OF RELEVANT LITERATURE

One of the key issues in current research is the use of consolidation hubs. A classical problem in logistics is that where there are multiple points of origin such as suppliers and destinations, the use of a direct connection can be difficult and expensive (McWilliams, Stanfield, & Geiger, 2005). This is why consolidation hubs are used, as centralized receiving and distribution points which collect materials from several different points of manufacture, repackage these, and redistribute them to further distribution points (McWilliams et al., 2005). This can improve supply chain efficiency by reducing the amount of low-volume point-to-point shipping, and can also increase the lead time required to fill those orders which are not based on goals of reducing cost and shipping time. This is commonly used with marine logistics - shipping goods via container ship from one oceangoing port to another (Creazza, Dallari, & Melacini, 2010). However, according to Creazza et al. (2010), this is not necessarily the most efficient approach to marine logistics, especially when shipments between well-defined endpoints are large enough to justify direct shipping.

Supply chain reconfiguration is the process of changing the distribution patterns for goods and information between different end points such as suppliers, consolidation hubs, and end distribution points (Christopher, 2005). Reconfiguration is important because it can help reduce transportation lead time and costs (Christopher, 2005). A Danish manufacturer gradually eliminated regional distribution centers in Europe in the 1990s, by changing to direct distribution from its Danish production centre to its customers (Lemoine & Skjott-Larsen, 2004).

Causes of Delay and High Cost of Transportation and Consolidation Hub

There are many things that can cause delay during transportation, including within the consolidation hub. One is the inappropriate location of facilities, such as suppliers, consolidation hubs, or other distribution points (Melo, Nickel, & Saldanha-da-Gama, 2009). Another is transportation disruptions which can occur for many reasons, such as driver strikes, unavailability of transport, weather, or accidents. Wilson (2007) analyzed the negative effects of transportation disruptions at particular points along the supply chain to determine which were most serious. He found that disruption in the supply chain link between the supplier of finished goods and the distribution warehouse, was most likely to cause cost increases or stock-out, which implies that the longer the link between these two points is, the more chance for disruption and increased cost.

The third potential problem is stock loss or shrinkage caused by inaccurate recordkeeping or theft (Niederman, et al, 2007). This can be due to inadequate or inaccurate information flows between buyers and suppliers (Christopher, 2005). In consolidation hubs it can also occur because of unshipped or misdirected products that are not delivered to the correct location. Regardless of cause, this imposes a cost since it can involve stock loss or write-off. One way to combat this problem is by using radio frequency ID (RFID) chips, which can automatically track products along their shipping route and while in the warehouse (Niederman et al., 2007).

The last problem is repositioning empty containers at distribution points in order to maximize availability of containers or packages and reduce lead time associated with the lack of equipment (Erera et al., 2009). The more complex a supply chain becomes, the more it is necessary to predict future demand from each origin point and to return an appropriate number of containers to this point.

An Effective Model of Logistic Networks

Supply chain reconfiguration refers to the redesign of supply chain processes, supplier strategies, and logistic approaches in order to maximize the firm's benefit (Chandra & Grabis, 2007). Supply chain reconfiguration typically focuses on organizational needs like improved lead time, increased flexibility, increased supply, or reduced cost, in order to help it gain efficiency and expand its operational strategic possibilities (Chandra & Grabis, 2007). In this case, the logistical reconfiguration is the focus which refers to the reconfiguration of the logistic processes in order to reduce cost and lead time.

A case study of Danfoss Drives, a Danish company in Jutland, shows how a firm can benefit from supply chain reconfiguration to reduce cost and lead time (Lemoine & Skjott-Larsen, 2004). The firm used 150 suppliers, and had many international production facilities. The company closed down warehouses and consolidation hubs and opted for direct distribution for its products, as a means of saving warehousing costs. Direct distribution, along with just-in-time or low inventory holdings, has been used successfully by a number of firms as a means of reducing warehousing and logistics costs (Smart, 2008).

RESEARCH METHODOLOGY

This research is based on both quantitative and qualitative methodologies.
The data required for this research consists of the company's current transportation procedure, the volume and value of products delivered from Singapore to Bangkok, the lead time for delivery from Shenzhen to Bangkok and from Singapore to Bangkok, current vessel schedules, and freight cost for each leg of the journey.

Current Transportation Data

The current transportation process begins in the firm's factories in Shenzhen, China, where goods are produced based on orders from the Thai company. These goods are then dispatched to Singapore, where they are unloaded and consolidated in the company's shipping hub. The goods are then delivered to the firm's port facility in Bangkok. At the port, the shipment is unpacked and arranged based on customer orders, and then prepared for delivery to customers in containerized ocean shipping to various locations around the Asia Pacific region. This transportation process is relatively straightforward.

Data for past delivered volumes is useful for understanding the scope of the firm's logistic problem. The recent full-year figures available for 2011 are monthly and annually. They include the number of containers, tons, and transportation costs.

Schedules were obtained for shipping between Shenzhen, Singapore, and Bangkok The current route has a total lead time of 14 days. Going directly between Shenzhen and Bangkok could reduce this total lead time to 7 days, although thus, this would require the establishment of consolidation facilities in Shenzhen. Freight cost data is cost per shipment for each route.

Data Analysis on the Results of Reconfiguration

All the data will be used to map the whole transportation process. The lead time and cost of all activities will be considered in order to identify the possible cause of the problem.

Unnecessary or non-productive activities will be identified. This data analysis will then be used along with contextual and other information found within the company records and documents. Then, a new transportation route will be proposed.

Possible Transportation Route Changes

By cutting out the consolidation hub in Singapore and shipping directly between Shenzhen and Bangkok, the firm could improve shipping costs and lead time. Previous analysis of pre-collected data has shown that this is possible. In the new process, production continues at suppliers in Shenzhen, and products are then shipped to Bangkok rather than to Singapore. In Bangkok, the products are unloaded, distributed, and repackaged for shipment via sea to customers around the Asia Pacific. The key change is that the products will arrive directly from Shenzhen. There would be no need for the Singapore warehouse.

However, this does not mean that it is the only way in which the transportation processes could be improved. For example, the firm could move to a direct distribution model, shipping its products straight from the suppliers to the retail locations (Lemoine& Skjott-Larsen, 2004). This change would need a shift from containerized shipping to smaller courier shipments (Lemoine& Skjott-Larsen, 2004). This approach was used by Danfoss to reduce the cost of warehousing, and has been used by a number of other companies (Smart, 2008). However, analysis would need to be done to determine whether the use of direct shipping would be appropriate, given the clustered nature of its suppliers in Shenzhen and its distribution points in Bangkok. However, it could be an advantage given that shipping volume varies throughout the year, and higher costs during some points of the year suggest that the firm is not fully utilising its shipping containers. These issues need to be fully analysed in order to arrive at a robust conclusion.

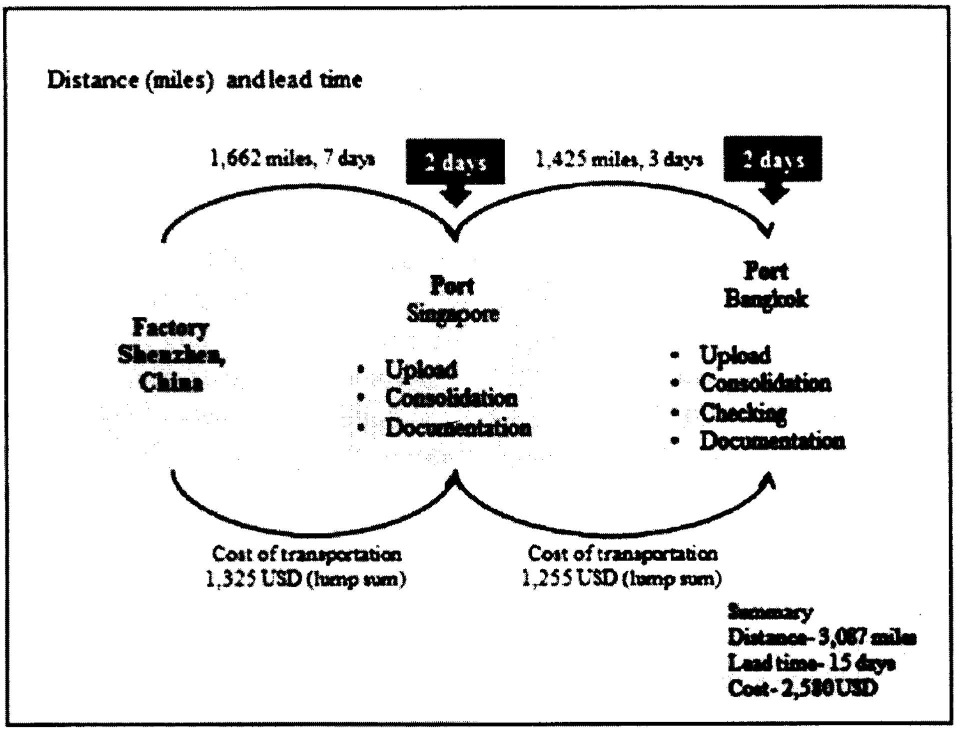
PRESENTATION AND DISCUSSION OF RESULTS

The Current Transportation Process and Responsibility of the Firm

The current transportation process and sites are summarized in Figure 1. This shows two legs. The first leg from Shenzhen to Singapore takes 7 days with a travel distance of 1,662 miles. In Singapore, each container undergoes unloading, consolidation, and documentation (including customs and other documentation). This takes approximately 2 days to complete. These 2 days include a day for custom and another day for sorting, repacking and doing documentation for the items that will be delivered to Thailand. The second leg is both shorter and considerably faster, taking 3 days with a travel distance of 1,425 miles. At Bangkok, each container undergoes unloading, consolidation, checking, and documentation before goods are released for road transportation to retail destinations. This also takes 2 days. The lead time required for each shipment from Shenzhen to

Thailand is 14 days, with containers traveling on average 3,087 miles. The lead time includes two days for import processing and documentation. The total cost of transportation is USD 2,580.

Figure 1: Summary of the Current Freight Transportation



Source: Author, from company data

Responsibilities and Charges

In the first leg, warehouse storage, warehouse labour, and export packing are currently assigned to those Chinese factories from which goods are dispatched. The firm's Singapore hub takes responsibility for loading charges, inland freight, terminal charges, forwarding fees, loading on the vessel, ocean/freight costs, charges on arrival at Singapore, and customs duty.

In the second leg, in Singapore the firm is responsible for warehouse storage, warehouse labour, and export packing. Once in Bangkok, all other charges, loading charges and customs clearance are handled by the firm. The current arrangement is likely to result in duplicate charges in some categories compared to a direct journey. All this clearly suggests that there is room for improvement in efficiency of the shipping charges in other areas rather than the simple per-container liner charges that are calculated as variable cost savings.

Warehouse cost

With the restructuring of the route, only the China factory warehouse costs would remain, since the products would be packed for exporting directly to Bangkok. This will result in cost savings of approximately half the current cost.

In the warehouse cost structure for the current process in China in 2011 and 2012, the main costs for 2011 were handling in and out, while in 2012 the container stuffing and un-stuffing costs dominated. In 2011, the percentage of cost structure devoted to each task was as follows: storage (4.91%), handling in and out (51.7%), and stuffing and un-stuffing (43.38%). In 2012, the percentage cost structure was as follows: storage (3.84%), handling in and out (40.46%), and stuffing and un-stuffing (55.69%). This suggests that in 2012, compared to 2011, containers were not leaving the Shenzhen warehouses as full as previously. This indicates that shipments from China could use some improved efficiency. Although this is not the main concern of this research project, it does affect overall cost efficiency, and the firm should investigate.

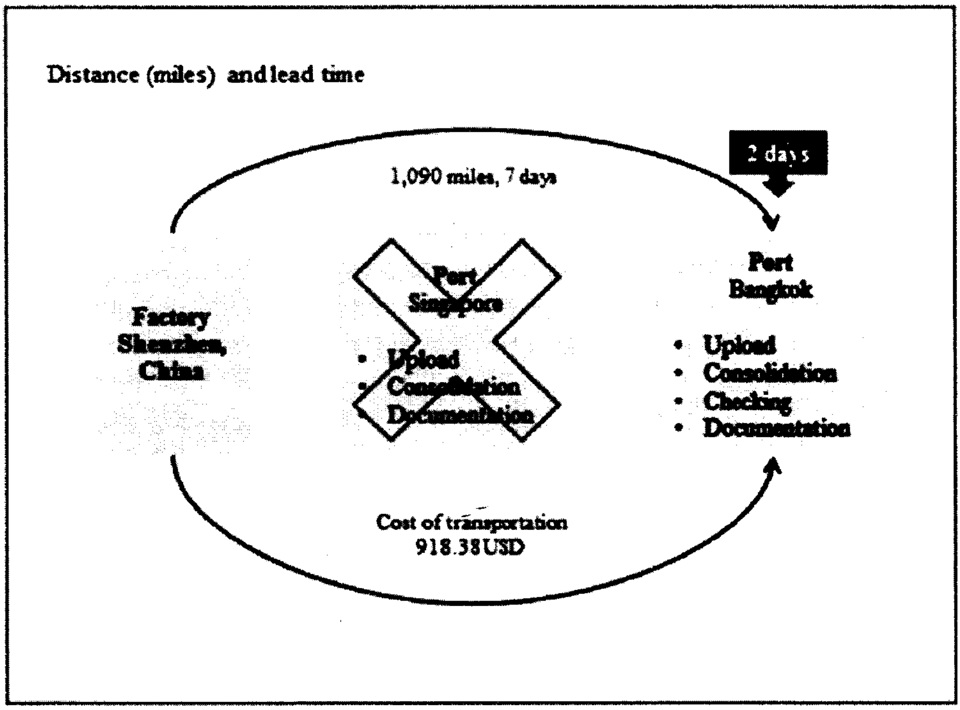
As production occurs in China and initial shipment must occur from this point, the costs in Shenzhen are not avoidable. Again handling in and out and stuffing and un-stuffing are the major costs in Singapore, while storage costs are relatively unimportant. In 2011, the cost structure was: storage (1.01%), handling in and out (55.22%), and stuffing and un-stuffing (43.77%). In 2012, this cost structure shifted to the following report: storage (0.87%), handling in and out (43.10%), and stuffing and un-stuffing (56.03%). This approximately mirrors the cost structure of the Chinese warehousing operations, though even less is devoted to warehousing. The same inefficiency observation mentioned above applies here, and it appears that warehouse and shipping operations are not more efficient in Singapore than in China.

Comparison of costs indicates that the storage cost is considerably less expensive in Singapore than in China (USD 0.17 compared to USD 0.76). However, the handling in and out was somewhat more expensive (USD 8.47 compared to USD 8.00). Container stuffing and un-stuffing costs are the same. This is a relevant consideration because the storage costs are a relatively small part of the cost equation in both Singapore and Shenzhen (less than 5%), while handling in and out and stuffing and un-stuffing are the most important. Thus, increased costs in handling in and out in Singapore are likely to negatively impact the firm's cost structure more than the reduction in cost associated with storage gains them.

In summary, this analysis has shown that warehouse operations in both China and Singapore double the cost for warehouse and shipping preparation. If the firm were receiving goods from multiple locations at Singapore, this could be a worthwhile cost, but as there are no other major supplier points, it is difficult to see any advantages for the shipments from

Shenzhen being routed through Singapore in terms of warehouse cost management.

Figure 2: New Proposed Route



Source: Author, from company data

Figure 2 shows the new proposed direct route. This reduces the total travelling distance to 1,090 miles and the lead time to 6-8 days, including only one day in Bangkok for documentation and consolidation. There are saving of 1,997 miles on average, along with seven day saving of lead time. The cost is reduced to USD 918.38, representing a saving of USD 1,661.62. This is not a significant per-mile saving since the cost of transportation is still USD0.84 per mile, but for a container there are substantial savings.

This new route is beneficial because it eliminates one of the most significant causes of slow shipping, an inappropriately placed facility (Creazza, et al, 2010; McWilliams et al., 2005; Melo, et al., 2009). While consolidation hubs have advantages for companies receiving goods from multiple dispersed locations, this is not the case with this firm, which has consolidated its manufacturing in Shenzhen. Given this situation, there is no reason to retain the Singapore consolidation hub, especially as the consolidation and preparation for distribution to the end points of the supply chain can be done just as easily in Bangkok. The seven-day reduction in lead time will help the company to deal with unexpected supply chain disruptions (Wilson, 2007). It will also reduce the possibility of inaccurate and poor recordkeeping, or theft since the goods will pass through a single port (Niederman, et al., 2007).

Figure 3: Working Process Flow for the New Route

Source: Author, from company data

Figure 3 shows the working process to export shipments from China to Bangkok. The Supply Chain Manager at the China Office (SCMC) can assign one staff from his team to take care of this new proposed routing. First, the China factory sends an invoice and packing list to Thailand for checking confirmation including shipping instruction for the factory. A freight forwarder is informed to arrange this shipment and send a pre-alert to Thailand. Once the shipment has arrived at the Bangkok port, the customs clearance process begins. Then the shipment is released and transported to the Bangkok warehouse.

The shipping process will begin at the manufacturers in Shenzhen, where sorting and palletizing will be done. The factory export departments are are already equipped to handle this level of logistics management. This will eliminate the sorting stage in Singapore, and reduce opportunities for loss, theft, or human errors.

Goods will move from their manufacturing site to the inventory management location of the exporting firm. After the goods arrive at the factory sorting department from the manufacturing floor, an export department employee will handle the sorting, palletizing, and records management. This work will be done within two days, the current lead time. The loaded containers will then be shipped directly to the Bangkok docks for dispatching to the existing warehouse, and then they will be processed as usual from the existing workflow.

Warehouse costs are relatively low. In the new route, warehouse costs will be just under half the current cost. This is a relatively minor cost advantage, compared to the anticipated USD 89,727 savings in 2013, but it adds approximately 10% to the total cost savings realized by the firm.

Besides the warehouse cost, there are sorting cost and transportation cost that will be reducedl. The total sorting cost in China in 2012 was USD 9,370.58. However, if the current route had been replaced by the new route in 2012, The firm would save USD 4,883.26 in 2012. The firm could save another USD 83,080.5 for transportation in 2012.

The final issue is the lead time associated with the new process. The new lead time for the project will be approximately nine days, including product sorting and transportation time as well as custom clearance. This includes two days maximum for product sorting, five days for shipping based on the ocean liner schedule from Shenzhen to Bangkok ports, and the maximum of two days custom clearance in Bangkok. For the custom clearance from Bangkok, the products will then be released to the warehouse in Bangkok and immediately prepared for delivering to the end distribution points. This is a substantial improvement over the existing model.

Advantages and Disadvantages of the New Route

The proposed new route has both advantages and disadvantages. The analysis above shows that the substantial advantages of the suggested supply chain reconfiguration are substantial. The disadvantages are much less important, as now discussed..

The main disadvantage that the SCMC interviewee thought of was that staff would need to be retrained in order to account for the new requirements. Another possible disadvantage is the increasing risk from transportation disruption if one of the two port operations is disrupted (Wilson, 2007). Currently, the company retains the flexibility to ship directly from Shenzhen to Bangkok if Singapore's operations were disrupted, but it may be more difficult to reroute shipments through Singapore if the firm gives up its consolidation hub there. Also, if the firm begins to use more than one supplier, the direct shipment could again become more expensive. The general trend is moving toward fewer, more consolidated suppliers or clustered suppliers (Craighead, et al, 2007), but some companies find a significant competitive advantage in using a wide range of suppliers (Lemoine & Skjött-Larsen, 2004). If this focus firm changes its sourcing strategy, it is unlikely that direct shipment will remain the most efficient; this is ultimately why companies use consolidation hubs in the first place, despite the increased cost and lead time (McWilliams et al., 2005). Thus, if the company does change its sourcing strategy, it will need to reconsider its transportation routes once again. This is also the case if the company decides to engage in direct to consumer shipping (Seifert, et al., 2006). It is also possible that the company could have contractual constraints on its ability to eliminate the Singapore consolidation hub. This would need to be determined by the company's legal team.

In summary, introducing the new route can create both advantages and disadvantages as summarized in Table 1.

Table 1: Advantages and Disadvantages of the New Route

Advantages	Disadvantages
Reduce lead time	Increase cost of retraining staff for new route
Save logistics cost	Increase risk of transportation disruption
Eliminate unnecessary node of transportation	Increase risk of using new supplier

Source: Author

The Difference between Current and New Transportation Route

The main difference between the current and new transportation route in practice is that rather than routing from Shenzhen to Singapore, through a consolidation hub in Singapore, and then to Bangkok, the route will go directly from the docks in Shenzhen (after the aggregation of goods from various suppliers in Shenzhen) to Bangkok for sorting and distribution into the retail network. This will result in a significant cost and time savings over the current route, with a reduction of about a week in lead time and per-container shipping costs of USD 1,641.62. This analysis has not taken into account any one-time or fixed cost changes associated with the route, such as elimination of leases on consolidation hub premises or changing the conditions of shipping manufacturers. This would need to be calculated on a case-by-case basis from the firm's actual contractual arrangements, which were not available to the researcher at the present time. However, based on this analysis, the new route would result in substantial cost and time advantages compared to the old route. By reducing the handling steps, it would also reduce the opportunity for human errors, shipment loss, or theft, which can further impact the overall shipping costs for goods.

CONCLUSION

In summary, the elimination of the Singapore stop on the route has numerous effects. These effects include reduced per-container shipment costs, reduced warehouse costs, and potentially reduced handling costs associated with the shipment. It also has the effect of reducing the lead time by as much as a week, which could significantly improve the firm's ability to respond to changes in demand, reduce the chance of stock outs, and so on. Finally, it has the effect of reducing the number of opportunities for human error, shipment loss, and theft. In general, there are strong advantages to adopting the direct route from Shenzhen to Bangkok rather than continuing to ship through Singapore.

The most important long-term implication is that the company should reassess its current supply chain and logistic processes and engage in a supply chain reconfiguration process. This analysis has provided one possible option for realizing significant improvements in lead time and cost for its existing supply strategy. However, it is possible that the company could obtain even better results through exploration of longer-term strategies such as relocating production to Thailand or other approaches. The fact that the company still uses the Singapore consolidation hub, despite the lack of need to do so, indicates that it is not reassessing its supply chain management strategy. This should be part of the routine strategic scanning and reassessment process, which should result in continuing efficiency improvements and adjustments as the company adjusts its supplier strategy.

REFERENCES

Attaran, M. (2007). RFID: an enable of supply chain operations. *An International Journal, 12(3), 249-257.*

Chandra, C., &Grabis, J. (2007). *Supply Chain Reconfiguration: Concepts, Solutions, and Applications.* London: Springer.

Christopher, M. (2005). *Logistics and supply chain management.* London: Pearson.

Coyle, J. C., Langley, J., Gibson, B., Novack, R. A., & Bardi, E. J. (2008). *Supply chain management: A logistics perspective.* London: Cengage.

Craighead, C. W., Blackhurst, J., Rungtusanatham, M. J., & Handfield, R. B. (2007). The severity of supply chain disruptions: Design characteristics and mitigation capabilities. *Decision Sciences,* 38 (1), 131-156.

Creazza, A., Dallari, F., & Melacini, M. (2010). Evaluating logistics network configurations for a global supply chain. *Supply Chain Management: An International Journal,* 15 (2), 154-164.

Erera, A. L., Morales, J. C., & Savelsbergh, M. (2009). Robust optimization for empty repositioning problems. *Operations Research,* 57 (2), 468-483.

Laporte, G. (1992). The Vehicle Routing Problem: An overview of exact and approximate algorithms. *European Journal of Operational Research.* 59, 345-358.

Lemoine, O. W., & Skjott-Larsen, T. (2004). Reconfiguration of supply chains and implications for transport: A Danish study. *International Journal of Physical Distribution & Logistics Management,* 34 (10), 793-810.

McWilliams, D. L., Stanfield, P. M., & Geiger, C. D. (2005). The parcel hub scheduling problem: A simulation-based solution approach. *Computers and Industrial Engineering,* 49 (3), 393-412.

Melo, M. T., Nickel, S., & Saldanha-da-Gama, F. (2009). Facility location and supply chain management - A review. *European Journal of Operational Research,* 196 (2), 401-412.

Niederman, F., Mathieu, R. G., Morley, R., & Kwon, I. (2007). *Examining RFID applications in supply chain management. Communications of the ACM,* 50 (7), 92-101.

Rodrigue, J.,& Notteboom, T. (2013a). *The Geography of Transport System.* In Hofstra University. Retrieved January 16, 2013, from http://people.hofstra.edu/geotrans/eng

Seifert, R. W., Thonemann, U. W., & Sieke, M. A. (2006). Integrating direct and indirect sales channels under decentralized decision-making. *International Journal of Production Economics,* 103 (1), 209-229.

Sekaran, U. (2003). *Research methods for business: A skill building approach.* New York: John Wiley & Sons, Inc.

Sinha, A. (2009). *Supply chain management.* Delhi: Global India Publications.

Smart, A. (2008). eBusiness and supply chain integration. *Journal of Enterprise Information Management,* 21 (3), 227-246.

Wilson, M. C. (2007). The impact of transportation disruptions on supply chain performance. *Transportation Research Part E: Logistics and Transportation Review,* 43 (4), 295-320.