

Selecting Suppliers in the Automotive Industry: Comparing International Logistics Costs

Selecting Suppliers
in the
Automotive
Industry

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Abstract

Maquiladoras operations along the Mexico-US border are an oft-studied example of a lean supply chain strategy that allows US manufacturers to benefit from lower labour costs in Mexico while being able to supply to assembly plants in the industrial US Midwest, with a minimum of safety stock.

This study examines an alternative strategy of the subsidiary of a North American automotive parts producer, which purchases raw and semi-finished materials from approved North American automotive 2nd tier suppliers, manages the shipment of the materials to a plant in Thailand where the semi-finished materials are converted in a labour-intensive process into higher-value sub-assemblies. These sub-assemblies are then shipped back to the US for installation into automobiles at an assembly plant in the Detroit area.

The additional logistics costs of using Thailand as a production base are overcome by demonstrable quality advantages and lower wages, as compared to competitors performing similar operations in Mexican maquiladoras.

This case study illustrates that international logistics management strategies must also incorporate product characteristics in addition to customer requirements for meeting optimum logistical performance.

Keywords: International logistics, Thailand, Maquiladoras (Mexico), Automotive industry, Supplier selection, Global supply chain.

1. Introduction

Supply chain management integrates suppliers, manufacturers and distribution centres to get the right products to the right place at the right time and in the right condition (Christopher and Towill, 2001). As the management of supply chains improve, the promise of integrated global supply chains begins to be realized, where raw materials are harvested at their sources, manufacturing is performed in the locations providing highest processing

value-added, and products are sold in the markets offering highest prices—regardless of the geographical locations of the various members in the supply chain.

A number of theories have been investigated to determine how management could devise efficient and effective global supply chain strategies. As discussed in the literature review section, agile supply chains strategies are implemented when customer responsiveness is the most important goal. Lean strategies, in contrast, attempt to secure competitive advantage by eliminating all waste from the supply chain. Further refinements have included combining the key advantages of both lean and agile into a hybrid strategy known as “leagile” (Naylor *et al.*, 1999). Despite these developments, many supply chains fail to meet their performance objectives (Fisher 1997). Moreover, as illustrated in the following case study, some firms have been able to successfully compete by selecting opposite strategies to that proposed by lean or agile supply chain theorists.

In this study, part of the global supply chain of a US automotive seat supplier is examined. This global supply chain sourced raw materials from approved vendors in the US, transported them over a 28-day transit time to a cut-and-sew operation in the North East of Thailand, returned completed leather seat covers to the US over another 28-day period, and delivered them to a seat assembly plant, which ultimately fed into a just-in-time (JIT) auto assembly plant in Detroit, USA. Despite substantially increasing the supply chain cycle time to over twelve weeks (including a two-week holding of safety stock in both the US and Thailand), this supply chain had a competitive advantage over similar operations in maquiladoras firms located on the US-Mexico border which had only a three-day transit time to the seat assembly plant.

Maquiladoras were originally formed in 1964 when the US cancelled a program that admitted Mexican workers into the US to provide labour in agriculture. Mexico initiated the Border Industrialization Program (BIP) in order to replace the lost economic value of the exported labour, providing incentives for US factories located across the US border to move to the Mexican border to take advantage of lower labour costs. Mexico gained directly from the close proximity of its rich neighbour, and the large US consumer market (Fullerton and Barraza de Anda, 2003).

Maquiladoras import 90% or more of the raw materials or components that they process. These companies assemble components into finished or semi-finished goods, and then re-export them back to the US, mostly to the industrial Midwest states (Fullerton and Barraza de Anda, 2003).

The formation of (North American Free Trade Agreement) NAFTA was expected to spur additional growth in maquiladoras, and indeed the number has increased rapidly since 1994, when the agreement went into effect. However, while NAFTA was blamed relocating US jobs to Mexico, the

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strongest economic force for the rapid growth of maquiladoras was the devaluation of the local Mexican currency at the end of 1994, effectively cutting labour costs in dollar terms by more than 40% (Gruben 2001). Maquiladoras have been incorporated into the "lean" paradigms of automobile suppliers to provide labour cost savings, while maintaining proximity to auto assembly plants based in the US Mid-West.

The cost competitive advantage in this automotive supply chain was achieved through a supplier in Thailand that produced leather seat covers at a higher quality level (with a direct economic benefit of higher yields), and a lower labour cost, compared to maquiladoras operations in Mexico. These benefits helped offset the additional costs of safety stock, freight between the US and Asia, and the potential obsolete inventory due to a longer supply chain.

As supply chain strategies continue to be developed and refined, characteristics of the product itself (size vs. cost) as well as the value of the labour input (quality and efficiency vs. cost) need to be incorporated into global supply chain design and management decision-making framework in order to permit optimum performance.

2. Background

One of the main motivations for a firm to look at suppliers outside of its home country is to secure competitive advantage through lower costs and/or higher quality products. This might be in the form of unit price reductions from items produced in low-wage markets (Trent & Monczka, 2003) or to source products that are not available locally (Mansfield 2003). As an example, a significant industry relying on procurement from international sources is the US clothing industry, where apparel and footwear are produced in low-wage areas of the world including Asia, and/or South and Central America. The global aspects of these supply chains include only the final link: the product may be entirely produced in the low-cost region, and shipped to distribution centres or directly to retailers in the markets of North America or Europe. (Cho & Kang, 2001).

A strategy that attempts to leverage advantages of global suppliers is "agile" supply chains. Industries that rely on agile supply chains require the flexibility to meet rapidly changing customer expectations, or to stay ahead of changing technologies, which may quickly become obsolete. Examples of products in these industries include the semi-conductors or computers industry, where innovation drives customer demand, and where service response is the primary driver (Christopher & Towill, 2001). Supply chains systems for semi-conductors and computers may link manufacturers and subcontractors in multiple locations in Asia or Europe, to customers in the US. (Brown & Petrakian, 2000; Bhatnagar & Viswanathan, 2000)

Under a different paradigm, "lean" supply chains tries to stabilise the supply of raw materials and manufacturers' components, while eliminating waste in the supply chain. In "lean" supply chains, the primary driver for the system is cost, and every effort is made to shorten transit times and eliminate in-process inventory or safety stock (Womack & Jones, 1990). The automobile industry, initially in Japan, then followed by the US, has focused on developing "lean" systems, categorizing suppliers based on strategic importance, and requiring key firms to make regular deliveries as often as every two hours (Levy 1997). Suppliers seeking lower labour costs might locate to the Mexican side of the US-Mexican border, in so-called maquiladoras operations, within 2-3 days shipping time to the major assembly plants in the US Midwest, but a more distant global source would not be considered if management's goal is to create a lean supply chain (Levy, 1997).

It has also been observed that the advantages of lean and agile strategies are not mutually exclusive. Hybrid or "leagile" strategies include using lean methods for high volume lines, while maintaining agility for more specialized products; implanting lean concepts through part of the supply chain, up to a de-coupling point (Naylor *et al.*, 1999), after which agile processes are applied; or using lean methods in situations where demand is demonstrably stable, and agile principles for more unpredictable aspects operations (Christopher and Towill, 2001).

Another approach to determining the appropriate supply chain strategies is based not on the customers requirements (responsiveness vs. low-cost), but on the type of product. Using this method, responsive supply chains would be applied for innovative products with unpredictable demand, while functional products, which are maturing in their life-cycle, would benefit more from an efficient supply chain, which minimise waste (Fisher, 1997).

The case study presented here illustrates a deliberate competitive strategy that involved selecting an eight-week transit time over a one-week transit time, with increased safety stock of four weeks, in order to utilise a more geographically distant supplier (i.e. in Thailand instead of Mexico for the American firm) offering better quality at lower cost. These actions seem contradictory with the prevailing body of knowledge pertaining to lean and agile supply chains that dominate the literature today. As such, this case study can be considered an appropriate part of the iterative process in understanding the theory of globally integrated supply chain management (Eisenhardt 1989).

The Case Study

In most modern automobile assembly operations, the process is limited to forming body panels and welding vehicles frames, while all other components, including engines, seats, instrument panels, and the various other

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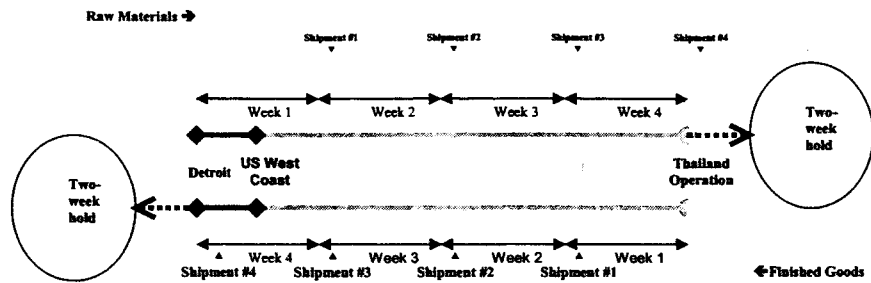
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Figure 1: Pipeline of weekly shipments between Thailand and the US



Source: The Authors

electrical, mechanical, and decorative items are supplied from external sources, and are bolted on the vehicle as it moves down the production line.

One of the most expensive and complicated subassemblies supplied to the automobile is the seat (Torrance, 1998). Seats are supplied in a wide variety of colours, materials, and options (such as heaters, air bags, or memories) for any given vehicle model. To be able to respond to the range of permutations that are required by automakers, seat manufacturers have set up seat assembly operations that mirror the automobile assembly plant that they feed. The operations are usually located within a transport time of 30 minutes or less, and are tied to the auto plant via electronic data interchange (EDI). The same job order that triggers the production of the automobile also triggers the assembly of the seat. During the approximately two hours that the vehicle travels from the welding shop to final assembly, the seat must be built and sent in proper sequence directly to the location at the auto assembly plant to be installed in the correct automobile, matched by colour and options (Shufelt, 1999).

Similar to the auto plant, the seat operation performs little manufacturing, except the forming of seat frames. All other components, such as moulded foam, electromechanical parts, and seat covers are delivered in batches and used on an as-needed basis. As a second-tier supplier (supplying the first-tier seat plant) the operation in Thailand was of a type referred to in the automobile industry as a "cut and sew" or "trim" operation (Stampfle, 2001). In this process, cloth, foam, leather, vinyl and other soft materials were cut and sewn together to form one component of an automobile seat, which was the seat cover.

Raw materials had to be produced by approved suppliers, who were primarily located in the greater Detroit area, or states adjoining Michigan. The one exception was the leather supplier, which produced and shipped from Omaha, Nebraska, a centre of beef production and source for raw hides. All materials were shipped in full containers, packed at the respective suppliers' location, with the exception of a small number of items, such as thread and fasteners. Overland transportation in the US averaged 3-5 days from the Midwest to a west coast port, and sea shipments to Thailand took approximately 24 days, with the entire transit time averaging four weeks in one direction. The supply chain system was set up so that deliveries were made every week (see Figure 1). At any one time, therefore, there was always a shipment that was about to arrive in Thailand, two in transit between Asia and North America, and one just leaving suppliers in the US. Finished seat covers flowed back to the seat assembly plant in the Detroit area in a similar pipeline, also within a four-week timeframe.

Safety stock was maintained in both Thailand (in the form of raw materials) and the US (in the form of completed seat covers awaiting assembly) as a contingency against a delayed shipment, and was strictly controlled to two weeks' supply. This stock level was determined based on the strategic assumption that a problem in transit could occur which might delay any one shipment, but not two consecutive shipments. Therefore, two weeks supply of inventory would be enough to maintain production, until the next shipment arrived the following week.

Table 1: Comparison of cost components for one leather seat cover (Mexico vs. Thailand)		
Cost per seat cover, complete set (US\$)	Mexico	Thailand
Labour	88	15
Leather	199	185
Other materials	67	67
Packaging	2	6
Outbound logistics	4	21
Inbound logistics	2	8
Cost of inventory	-	3
Obsolescence allowance	-	9
Total Costs	362	314
Source: The Authors		

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The key competitive advantage for the Thailand operation was the processing of leather. Leather is a natural product varying in grain and appearance, and contains many imperfections that cannot be used in the seat covers. Each hide had to be inspected for imperfections before patterns for the various pieces would be sewn together into the complete seat cover, thus avoiding the imperfections. The leather cutting process is time consuming, and requires considerable judgment and skill by the leather cutters. The leather cutters in the Thailand operation had many years' experience and were heavily relied upon for their expertise.

The Thailand plant achieved an average yield of 70%, or about 5% better than the best suppliers from Mexico, giving the Thailand plant a US\$14 cost advantage per seat cover over its competitors from better utilisation of leather. At the same time, lower wages gave the Thailand plant an additional US\$73 cost advantage, contributing to an overall advantage of US\$87 per seat cover. Meanwhile, additional freight, inventory, an obsolescence allowance, and more durable packaging, offset the cost advantage by US\$39, for a net positive contribution of around US\$48 per seat cover (see table 1 for a complete breakdown of the logistics costs involved).

The difference in production cost seems to be the main driver for the selection of the Thai supplier however cost cannot be considered as the only selection factor as other variables need to be included in the decision making process of selecting suppliers. It is a combination of various factors that will contribute to supplier selection but it is perceived that cost is usually the first factor considered in any decision:

Conclusions

The supply chain literature focuses on how customer requirements and market demand determine supply chain strategies that are responsive (agile) or efficient (lean), or a combination of both ("leagile"). However, the case study presented here suggests that market-driven factors alone may not be sufficient to determine the optimum supply chain strategy.

Product characteristics also have considerable influence over transportation options, and therefore supply chain strategies. For example, the size of the product with respect to its value influences whether air freight or sea freight is the most viable option, which in turn affects the supply chain strategy.

The expertise, efficiency and cost of labour as a resource in the supply chain must be considered when supply chain strategies are being determined. A labour advantage in one location relative to another—better skills or lower wages—may offset additional transportation costs, so that a supply

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chain that uses a more distant labour source could offer advantages over one closer to the customer market as illustrated in the case study hereover.

As the study of supply chain management seeks to find a way to integrate strategies to provide greatest value, it must consider the deployment of all resources that affect customer value.

References

Bhatnagar, I
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References

Bhatnagar, R. & Viswanathan S. (2000) "Re-engineering global supply chains alliances between manufacturing firms and global logistics services providers.", *International Journal of Physical Distribution & Logistics Management*, 30.1: pp.13-34.

Brown, A.O., Hau L.L & Petrakian, R. (2000) "Xilinx improves its semiconductor supply chain using product and process postponement." *Interfaces* 30.4: pp.65-80.

Cho, J. & Kang, J. (2001) "Benefits and challenges of global sourcing: Perceptions of US apparel retail firms." *International Marketing Review* 18.5: pp.542-561.

Christopher, M & Towill D (2001) "An integrated model for the design of agile supply chains." *International Journal of Physical Distribution & Logistics Management*, 31.4: pp.235-246.

Eisehardt, K (1989) "Building Theories from Case Study Research." *Academy of Management Review*, 14.4: pp.532-550.

Fisher, M.L. (1997) "What is the right supply chain for your product?" *Harvard Business Review*, 75.2(1997): pp.105-116.

Fullerton, T. M. Jr., & Barraza de Anda M. P. (2003) "Maquiladora Prospects in a Global Environment." *Texas Business Review*, Oct 2003, pp. 1-5.

Gruben, W.C. (2001) "Was NAFTA behind Mexico's High Maquiladora Growth?", *Economic Financial Review*, Third Quarter: pp.11-21.

Mansfield, B. (2003) "Spatializing globalization: A 'geography of quality' in the seafood industry.", *Economic Geography*, 79.1: pp.1-16.

Naylor, J.B., Naim, M.M. and Berry, D. (1999). "Leagility: Integrating the Lean and Agile Manufacturing Paradigms in the Total Supply Chain", *International Journal of Production Economics*, 62 (1,2).

Trent, R.J. & Monczka, M. R. (2003), "International purchasing and global sourcing - what are the differences?" *Journal of Supply Chain Management*, 39.4: pp.26-37.

Womack, J.P., Jones, D.T. and Roos, D. (1990), *The Machine That Changed the World*, Macmillan, New York, NY.