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Supply Chain Dynamics in Asia

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Abstract

Supply chain management in Asia is a relatively new topic but is a key challenge for all Asia-based manufacturers and traders trying to integrate into the “global market.” The purpose of this paper is to describe key supply chain issues faced in Asia. Many of these issues are related to the importance of a properly managed supply chain in enhancing firms’ competitiveness, as well as supply chain security issues that force Asian firms to comply with numerous regulatory requirements. The critical role played by Asia-based logistics providers in facilitating supply chain integration is further explored. Logistics providers must be able to design effective and efficient supply chains in order to meet clients’ needs. A case study is then presented to illustrate how supply chain dynamics affects supplier selection.

JEL Classification: L14

Contents

1. INTRODUCTION

The development of logistics services and communication technologies has revolutionized supply chain management and has created a "global" market. Shippers and consignees require efficient logistics services that can move their goods to the right place, at the right time, in the right condition, and at the right price (Grant et al. 2006). It is, therefore, of great importance that linkages within and between Asian countries be strengthened to facilitate trade and integrate supply chains for better access to the global market.

The purpose of this paper is first to introduce a number of key supply chain issues that impact the operations of manufacturers and traders in Asia and the rest of the world. The second objective is to illustrate the key role played by Asia-based logistics providers in managing dynamics that occur within any given supply chain. The last section of the paper describes a case study that illustrates how supply chain decisions are made and how a particular Asian manufacturer was able to integrate itself into the global supply chain of a major car manufacturer located in the United States (US).

World markets have become increasingly "globalized." To a large extent, this reflects the fact that the majority of, if not all, countries are adjusting to the strong trade liberalization pressures observable around the world. This pressure stems from international trade agreements, including the North American Free Trade Agreement (NAFTA) and the General Agreement on Trade in Services under the auspices of the World Trade Organization. There is also the development of trading blocs like the European Union (EU), Association of Southeast Asian Nations (ASEAN), and the Asia-Pacific Economic Cooperation (APEC). These trade policy initiatives have a common objective: to open up new trading opportunities by facilitating and enhancing international trade.

Global economic integration relies upon efficient global supply chains, but integration can only succeed if there is cooperation among trading nations. Certain countries, especially in some regions of Asia, are served by relatively few logistics service providers, under less than favorable operating conditions, and where risks are higher. For these countries, this situation results in a failure to develop their international trade potential, higher prices for imports, lower foreign exchange earnings from exports, restricted investment and employment and, thus, in limited economic growth. The logistics costs associated with the distribution of any product can account for a high proportion of its sale price (Banomyong, Cook, and Kent 2008). There is therefore, potentially, considerable scope for efficiency gains that will reduce costs, which in turn will be reflected in the price of a given product. This reduction cannot be implemented without local manufacturers and traders being in complete control of their respective supply chains.

Supply chain management is an integrative approach for planning and controlling the material flow from suppliers to end users (Carter and Ferrin 1995). It is used as a technique to create and maintain a firm's competitive advantage. The management of supply chains is important in ensuring that customers' demands are met, as well as in preventing excess in stocks that may lead to high holding costs or losses through obsolescence. One of the goals of supply chain management is to meet customer service objectives while simultaneously minimizing transport, inventory, and other associated costs (Cooper, Lambert, and Pagh 1997).

The integration of supply chains in Asia can provide a foundation for further economic cooperation and development. For some countries in Asia, inadequate transport infrastructure and high logistics service costs have constrained supply chain development and integration. Major infrastructure investments are already being undertaken in many Asian countries and more are planned (Asian Development Bank [ADB] 2007). Physical connectivity between neighboring countries will be significantly improved on the completion of these infrastructure investments. The improving infrastructure, coupled with expanded

cross-border cooperation among Asian countries, will accelerate the process of integrating the Asian supply chain with the rest of the world and the global market.

2. KEY SUPPLY CHAIN ISSUES IN ASIA

Supply chains are not just confined within national borders or markets. In an international supply chain, many state agencies and, in particular, customs agencies play a very important role in the efficiency and efficacy of the supply chain. There is also a heavy reliance on specialized logistics service providers, such as freight forwarders or customs brokers, that can facilitate the flows of goods across borders or even develop logistics systems for their clients. The biggest difference between domestic and international supply chains is the environment in which the chains operate.

The key role of a supply chain is to assist in the production, consumption, and distribution of goods and services. This means that goods must be produced and delivered to the market (or customer) in the right quantity, of the required quality (i.e., without defect), and at a competitive price. Integrated and seamless logistics systems can play an important role in facilitating global supply chain processes (Byrne and Markham 1991).

It is therefore important that the movement of goods can be done by combining several modes of transport from one point or port of origin, via one or more interface points, to a final point or port where one carrier or many carriers can organize the whole transport process. Integrated transport is an efficient transport system that provides physical door-to-door operations within the environment of a simple, streamlined documentation process with a single liability system. The objective of integrated transport is to provide a service that is completely reliable and predictable, and that fully meets the needs of the customer (Andersson and Hasson 1998).

However, the efficient operation of transport modes and nodal points is dependent on reduced barriers, fewer institutions, and a simplified legal regime in order to effectively implement integrated logistics operations. As trade is not possible without transport, support for integrated transport will facilitate national and international trade by ensuring an uninterrupted and smooth flow of cargo and by giving better control over the supply chain to manufacturers and traders.

2.1 Managing the Supply Chain for Enhanced Competitiveness

Asian countries are recognized for the high quality and low cost of their products. The competitiveness of internationally traded products is greatly influenced by various factors that add to the overall logistics cost within supply chains (Banomyong 2004). These factors need to be taken into account when considering Asian supply chains in order to sustain competitiveness. The main factors are:

The cost associated with the physical transfer of goods is an essential piece of information in the negotiation of an international trade transaction. To maintain a product's competitiveness, the seller must make sure that his cost is as low as possible. However, in any particular supply chain, this cost is made up of a number of cost elements corresponding to services that enable physical linkages between supply chain members. These elements cannot always be clearly quantified beforehand.

Some cost elements (i.e., direct costs) are directly related to the logistics service provided. In general, they are based on published tariffs that reflect the local market conditions, the quality of the service, and the management capacity of the service provider. These considerations depend on the state of the local infrastructure and equipment, and on the local infrastructure and/or equipment maintenance policy to provide reasonable transport services.

Other cost elements (i.e., indirect costs) are a consequence of the service provided. They build up as financial costs resulting from poor operations (e.g., low speed, unexpected delays), as additional costs (e.g., increased insurance premiums), or as "consequential costs" (e.g., sales opportunities lost because goods are not readily available). They reflect the efficiency of the service, the level of risk involved, and the capacity of the service providers to cope with administrative and operational problems.

Transit time is an important element as goods in transit cost money (Tyworth and Zeng 1998). Any reduction in transit time therefore reduces the overall cost of the delivered goods. Transit times can be improved by increasing transport speed while cargo is moving on any particular transport mode or by reducing idle time while cargo is waiting at some interface point for its next movement. A lack of proper coordination of transport operations or excessive administrative and documentary requirements can neutralize any effort or investment in increasing commercial speed.

To reduce the financial cost of their inventories, producers favor arrangements that supply the required input goods "just in time" (JIT), that is, within a short time of the item's anticipated use in production or sale (Christopher 1998). Under these conditions, time reliability is very important. Industries with tight schedule operations (i.e., JIT supply chains) cannot afford delays in delivery (Banomyong, Nair, and Beresford 1999).

Safety of goods is equally important. Any loss or damage—because of theft, mishandling, poor quality packaging, or physical damage caused by accident—will result in goods not being available at the expected time and place, or in the expected condition. The financial consequences of such non-availability, in addition to the cost of loss or damage, are similar to the time reliability consequences mentioned above.

Uncertainties related to issues such as schedules, breakages, loss, pilferage, and rules and regulations are faced by traders and may disadvantage exporters and importers.

Security measures are necessary to guarantee the protection of global supply chains against acts of terrorism or other unexpected threats. Beyond the loss of human life and material destruction, a terrorist attack will disrupt the flow of goods within a global supply chain.

The above-mentioned considerations indicate that trading opportunities can benefit from better-organized supply chain services. To increase the competitiveness of existing supply chains, sellers and buyers must adapt their commercial practices to meet customers' supply chain requirements, and governments must provide logistics service providers with institutional, regulatory, and operational environments that can stimulate and guarantee the level of service needed for the efficient movement and storage of goods, services, and information.

Logistical activities have traditionally been among the largest costs in global supply chains. However, the most significant advances in modern logistics have not been in cost reduction, but in improved processes to move goods and materials between nations in a timely and seamless manner (Sinha and Babu 1998). Distance is critical in global supply chains, as international marketers require systems designed to handle the challenges of distance in a manner that is timely and transparent to customers (Sharma, Sahay, and Sachan 2004).

Distance in global supply chains equates to transportation speed and dependency. As a general rule, the longer the average distance of transport, the greater is the total cost of transportation. This increased transportation cost results from firms seeking to maintain flexibility while reducing or avoiding extensive inventory commitment. Improved flexibility and lower average inventories translate into an increased number of small shipments moving under positively controlled logistical operations. The distances involved and the specialized nature of international requirements have created a dependence by supply chain members on third-party providers, such as logistics service providers, capable of providing a broad range of value-added services to assure logistical continuity and supply chain integration.

A supply chain approach must encompass not only the economic, commercial, and operational aspects of the international movement of goods, but also all issues related to the facilitation of trade and the responsibility for the goods while in transit (Childerhouse et al. 2008).

To take into account all interests involved in the development of a supply chain, especially in Asia, the relationships between traders, services providers, and governments must be clearly identified and proper coordination in the implementation of security measures must be established. The development of supply chains will also create a need for properly regulated logistics providers. This can result in an increased level of competitiveness for all key supply chain stakeholders.

Asian traders and manufacturers can expect the following economic and financial benefits from integrating their supply chains:

- Reduced transit time, increased time reliability, and increased security of cargo, particularly at interface points.
- Reduced transport costs (resulting from the use of modern transport-related technologies, such as ocean going containers and electronic data interchange [EDI]).
- Closer commercial relationships with services providers.
- Greater awareness and understanding of supply chain and logistics related issues influencing their trade.

Asia-based service providers can expect the following benefits:

- Increased importance of international logistics service providers and supply chain solution developers. This will be particularly useful in the development of relationships with and for recognition by governmental agencies.
- Commercial incentives to adopt new technologies, such as the internet, EDI, and radio frequency identification.
- Opportunities to further refine their marketing strategies; for example, for logistics service providers can concentrate their activities in niche operations to serve specific commodities on specific trade routes.

Asian governments will, in theory, benefit from better-integrated supply chains, as they offer an opportunity to update trade and transport related administrative procedures and regulations. An efficient and effective national supply chain will facilitate commerce with other trading partners.

2.2 Supply Chain Security

Supply chain security can be perceived as being inconsistent with the objective of facilitating international trade (Dulbecco and Laporte 2003). However, security has now become very much a part of the mainstream supply chain paradigm and can also become a trade facilitation driver.

If all firms involved in a particular supply chain were to optimize their logistical systems independently of other firms in that chain, the management of product flow across the whole chain or pipeline would likely be suboptimal. Attempts to overcome this problem have resulted in the creation of supply chain management. Supply chain management extends the principles of logistics management to customers and suppliers, crossing geographical and organizational boundaries (Banomyong et al. 2005).

Supply chain management leads to stricter requirements on the level of service related to frequency, reliability, lead time, information provision, risk of damage to cargo, security of cargo, complexity of administrative procedures, and the number of smaller consignments.

The security of the supply chain, like the efficiency of the chain, concerns both the physical flow of goods and the flow of information from origin to customer (Banomyong 2005). In a supply chain, there is no benefit if certain links or stakeholders are operating efficiently while others are not. It is the total performance of the supply chain from origin to final consumption that is relevant. Each link in the supply chain is dependent on the previous link in order to achieve continuity, synchronization, and enhanced final customer service level. The security issue is directly related to the performance measurement of any supply chain. This means that all security conditions must be met and guaranteed in order for goods to move unhindered within supply chains.

The supply chain in Asia has experienced important changes during the last 25 years and several ports in the region have come to specialize in the concentration of transshipment activities. Oceangoing containers ensure flexibility of shipments. Several Asian ports are dedicated to this technology and are, as a consequence, consolidating their status as supply chain hub centers. Economic growth and development have restructured the nature and pattern of supply chains, introducing new demands within the main trading regions in Asia.

Hub centers thus require a specialized, high-capacity transshipment infrastructure. However, infrastructure is not the only dimension in nodal restructuring. Supply chain development also requires the integration of value-added services and transshipment functions at key nodal links. These key nodal links will not only further supply chain integration, but will also support the efficient distribution of manufacturers' and traders' goods and services. The security of these hub centers as nodal links in the supply chain is of critical importance.

The world has become a system of linkages in which individual nodal links are connected in intricate patterns of dependency in hub-feeder relationships, as well as in end-to-end connections that reflect the increasing trade dependencies among regions. This trade dependency is derived within a broader competitive regional environment, with the development of supply chains underlining the need for efficiency as well as security. These conditions have had, and will continue to have, an impact on the management strategies of supply chain nodes around the world (Robinson 1998).

Security has now become, along with reliability, time compression, and cost reduction, one of the necessary preconditions for high-performance supply chain management capable of guaranteeing high economic performance. The quest to achieve global supply chain efficiency and efficacy is currently leading toward the development of techniques that allow a wide variety of unforeseen events to be overcome through the use of prevention measures. This is made even more evident by the JIT paradigm and door-to-door service, which require a high level of security, low inventory levels, and efficient movements between several points of origin and destinations.

However, security comes at a cost. Supply chain security leads to an increase in logistics costs and exerts a relatively negative pressure on economic growth, especially for the Asian countries involved. Even though the cost of security is universal, much of the burden has been shifted to Asian countries by the main importing countries in the West (such as the US), whose security programs have been targeted at Asian exporters (Banomyong 2005).

The short-term effect of an increase in supply chain security is relatively negative, but the medium- to long-term impact is likely to be beneficial to certified and recognized operators. This permits the creation of dedicated secure supply chains, where supply chain processes are considered to be more efficient and controlled. More security could, therefore, mean greater trade facilitation and possible expansion (e.g., as a supply chain becomes more secure, goods that are physically moved within the system benefit from greater ease of access to importing countries).

It must also not be forgotten that the cost of delays and procedures linked to the trade of goods is estimated to be between 5% and 13% of the value of goods traded (Banomyong, Cook, and Kent 2008). Security issues, if not dealt with properly, can also become a major cause of delays. Table 1 describes the main players involved in the security of the global supply chain.

Table 1: Players involved in the Security of the Supply Chain

Governments	Customs have a duty to protect the national economy and society, in addition to focusing on goods control at the border.
Traders	A reliable, secure, and efficient supply chain will, in theory, contribute to global trade expansion.
Ports	Port security will represent a critical variable in terms of competitiveness.
Service providers	Key players in terms of security, as they move goods and information.
Insurance providers	Increased security will lead to a reduction in insurance premium fees.

Source: Adapted from Dulbecco and Laporte (2003).

Stakeholders are diverse, with often-conflicting objectives, but it is in the interest of all parties to improve the reliability of global supply chains by increasing security in order to avoid disruption of the system. It is important to guarantee the protection of global supply chains and their capacity to serve international markets. If a nodal link is considered secure, it is likely to benefit from increased goods traffic. However, only a uniform level of security in all supply chain nodal links will reduce the risk of disruption to global supply chains, as a supply chain is only as strong as its weakest link (Banomyong and Sopadang 2009). It is not enough to have a number of selected secure supply chain nodes if other nodes within the supply chain are not held to the same standard.

Box 1: Secure Supply Chains:

The People's Republic of China (PRC)-Europe Smart and Safe Trade Lanes

The EU concluded an agreement on Customs Cooperation and Mutual Administrative Assistance in Customs Matters with the PRC that entered into force on 1 April 2005. On 19 September 2006, the European Commission and the PRC agreed to launch a pilot project on smart and secure trade lanes, with particular emphasis on sea containers. The agreement aims to improve cooperation on supply chain security and to work toward mutual recognition and reciprocity of security measures. The pilot project initially involves the ports of Rotterdam (Netherlands), Felixstowe (United Kingdom), and Shenzhen (PRC).

As of 19 November 2007, the customs administrations of the United Kingdom, Netherlands, and PRC exchange electronic information on sea containers leaving their territory through Rotterdam, Felixstowe, and Shenzhen. This is an important step in European customs cooperation with the PRC and paves the way for reciprocity and mutual recognition of security measures. This initiative took place within the EU framework for the secure and smart trade lanes pilot project.

Both sides agreed to exchange experience and develop best practices in order to better understand and prepare the implementation of the World Customs Organization Framework of Standards to Secure and Facilitate Global Trade. They also agreed to pursue the objectives of reciprocity and mutual recognition of measures for security and facilitation to be implemented between the General Administration of Customs of the PRC and the customs authorities of the EU.

In summary, the smart and secure trade lane pilot project will allow:

- The testing of end-to-end supply chains from the point of packing containers, through the entire container journey, to the point of final destination;
- Agreement on and testing of criteria for economic operators to be granted authorized economic operator (AEO) status;
- Agreement on and testing of data requirements for preloading security clearance for "door to door" supply chains;
- The definition of and agreement on minimum risk rule set (profiles) and minimum control standards for customs clearance;
- The testing and evaluating of information technology and technical solutions that enhance security and control systems while facilitating legitimate trade; and
- Comparison of equivalent AEO legislation in order to prepare the ground for mutual AEO recognition between the EU and the PRC.

The evaluation of the first phase of the pilot project was launched in spring 2009 and should be finalized by the end of the year.

Source: Adapted from European Commission. Security Cooperation with Third Countries. http://ec.europa.eu/taxation_customs/customs/policy_issues/customs_security/cooperation_3thcountries/index_en.htm (accessed 31 December 2009).

In order for traders and manufacturers to integrate into efficient and effective global supply chains, security related activities must be completely synchronized in their requirements relating to global supply chain management. Security initiatives are now considered key logistical activities, but are also very problematic, especially in an international context where the institutional framework is confusing. If a security activity fails, it will have an impact on the competitiveness of global supply chains. This is a challenge that Asian countries must overcome.

3. THE ROLE OF LOGISTICS PROVIDERS IN HANDLING SUPPLY CHAIN DYNAMICS

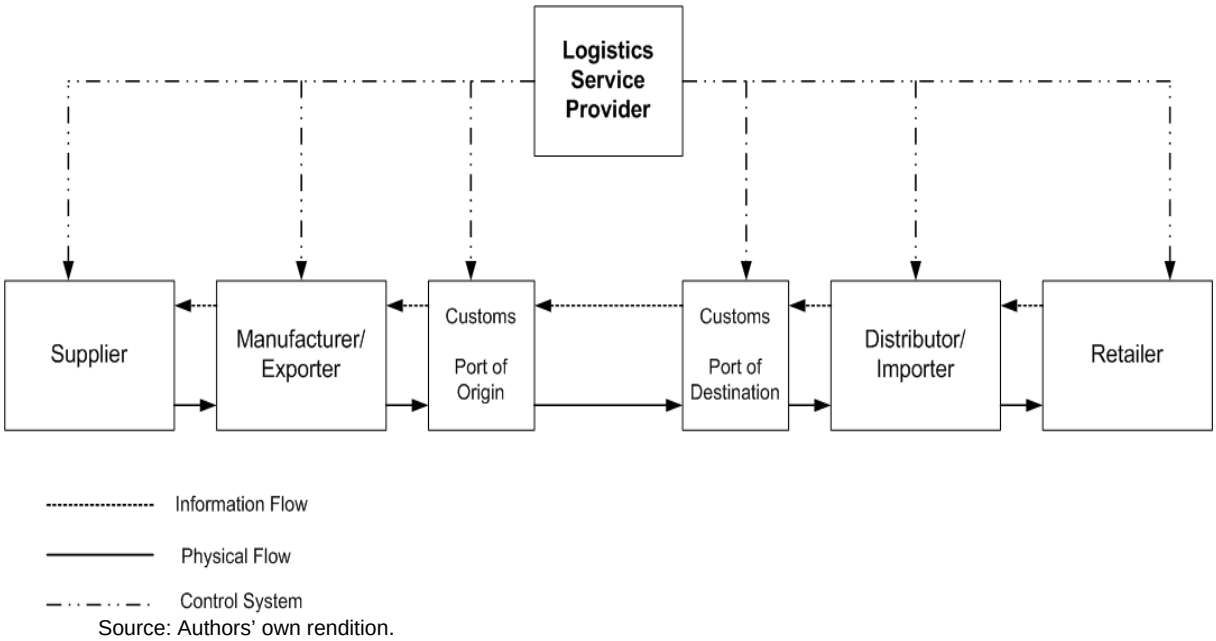
Supply chain objectives are rarely fully met because of the individual behavior of decision makers in firms along the supply chain, as their behavior is neither optimal nor rational (Parnaby 1979). Due to the dynamic nature of the supply chain, amplifications and fluctuations occur from suppliers all the way down the chain (Sterman 1989). What is needed is a robust control system that is flexible enough to counteract any disturbances along the supply chain.

Logistics and supply chain management are seen as the fields in which logistics providers, by virtue of their particular expertise, are able to offer the most added value to transactions in the freight trade. Freight forwarders, as “logistics service facilitators,” play an important role in supply chain management, as an increasing number of firms outsource their logistics function (United Nations Economic and Social Commission for Asia and the Pacific [UNESCAP] 2002). These third party logistics providers are now becoming more involved in the design, management, and control of firms’ supply chains. Asia-based regional logistics providers are the best equipped to manage supply chains in Asia as they are familiar with the context in which they operate.

The selection of a logistics provider is critical to supply chain competitiveness (Hensher and Chow 1999). Third party logistics plays a pivotal role in the design and provision of an integrated supply chain that responds to the client’s needs. In order to help their customers, logistics providers need to behave more like partners of their clients. Not only do logistics providers have to arrange for the transport of cargo and facilitate its clearance through

customs, they also need to manage their clients' order processing. This means that logistics providers are involved not only in lowering their clients' costs by reducing waste in ordering operations, but also in integrating their clients' supply chains. The aim is to make the partnerships so tight and seamless that the logistical services provided become part of the clients' own businesses. Figure 1 illustrates how logistics service providers control a global supply chain.

Figure 1: Role Played by Logistics Service Provider in Global Supply Chain



Source: Authors' own rendition.

The task of a logistics provider is to facilitate trade to the extent that the trader needs only to produce and sell the goods (or to order the goods, in the case of imports). Once this has been done the logistics provider can take over and provide every subsequent function from factory gate to final delivery. As the distance between the manufacturer (i.e., the exporter) and the distributor or retailer is often quite considerable (and vice-versa for imports), problems relating to both material and information flows are common.

Suppliers have to respond as quickly as possible to various situations within a specified time frame. If the supplier cannot do so, the multinational enterprise (MNE), as the focal firm in the supply chain, will probably choose another supplier. This creates a number of problems for manufacturers, as they not only have to manufacture goods on time, but they also need to deliver them on time (Bruisma, Gorter, and Nijkamp 2000). The problem of delivering goods on time becomes very crucial when MNEs use JIT management techniques.

The logistics provider's main role is to manage the supply chain such that goods arrive on time; however, because of limited resources and various operational constraints, logistics providers are not always able to deliver, rendering their clients less competitive.

3.1 The Logistics Provider's Role in a Regional Supply Chain

Supply chain routing alternatives between Thailand and Viet Nam will now be presented and compared. The purpose of this subsection is to illustrate some of the issues logistics providers have to deal with when managing their clients' supply chains in the context of Southeast Asia. A total of three supply chain alternatives are described in Table 2 and illustrated in Figure 2. Exporters and importers are not interested in routing decisions. Their sole focus is on having their goods delivered as per the agreed upon service level and cost. It is the duty of the logistics provider to find the optimal solution that balances the client's

cost and time requirements. A contextual scanning is needed in order to find the most suitable option for a client's supply chain.

Table 2: Routing Alternatives between Thailand and Viet Nam

Route	Thailand	Mode	Viet Nam
1	Bangkok/Laem Chabang	Road vs. Sea	Hanoi
2	Bangkok/Laem Chabang	Road vs. Sea	Danang
3	Bangkok/Laem Chabang	Road vs. Sea	Ho Chi Minh

Source: Compiled from industry sources.

Figure 2: Supply Chain Routing Alternatives between Thailand and Viet Nam

Source: Authors' own rendition.

There is currently no direct maritime link between Bangkok and Hanoi. Freight containers being transported by sea must therefore be transshipped at Ho Chi Minh port, increasing transit time and cost. Sea transport costs (including transshipment) represent about 30% of total transport costs, but more than 70% of transit time. Trucking costs represent around 15% of total transport costs. It is interesting to note that administrative formalities can comprise up to 36% of the total cost of transportation between Bangkok and Hanoi via the maritime route. Also, while the total cost of transport by road is 30% higher than the maritime option, it is also 80% faster.

For a shipment traveling by land between Bangkok and Hanoi, transport has the highest activity ratio: more than 68% of total costs and 73% of total time for the whole journey. If no

transloading is conducted at the border, it is possible to reduce transport costs by over 300 US dollars (US$) per twenty-foot equivalent unit.[1] Transloading does not need to be done at the Lao People's Democratic Republic (Lao PDR)-Viet Nam border.

A number of fees are levied by various related authorities in the transit of goods between Thailand and Viet Nam. This creates a problem for the land route as there is empirical evidence that the land route is likely to be selected by traders who are handling higher value and more-time-sensitive commodities. These add-on fees defeat the purpose of physically and institutionally connecting Thailand and Viet Nam via Lao PDR to facilitate trade.

The actual physical transportation of goods is not a problem in and of itself. The difficulty lies in border crossings, despite the existence of the Greater Mekong Subregion Cross Border Transport Agreement, whose objective is to reduce border crossing time to not more than 30 minutes per border.

Cost is not the sole factor taken into account in routing selection; transit time is another key component. The land route can link Bangkok to Hanoi in just over two days, while the sea route takes more than 14 days due to transshipment. Even if a direct maritime link between Bangkok and Hanoi existed, the journey would take at least five days to complete.

The current maritime linkage is a reflection of the relatively low volume of direct trade between Thailand and Viet Nam's northern region. If the volume of trade were higher, there would surely be direct links between the countries. The existing maritime linkage is not competitive given the time dimension and is probably only suitable for cargo that is non-time sensitive.

3.2 Designing Supply Chains: The Role of Logistics Providers

In Asia, supply chain control processes, including production scheduling, shipment of product, and inventory maintenance, are frequently decentralized and remote from each other. The processes usually operate independently of one another and in serial order. Slow feedback from the marketplace causes scheduled production to over or under manufacture in relation to the actual demand. Another issue in the region is the relatively high cost of logistics—the result of inadequate physical facilities and cumbersome administrative barriers, coupled with a legal framework not adapted to modern international business practices (Banomyong, Cook, and Kent 2008).

Specialized middlemen, such as logistics service providers, perform critical, value-enhancing functions that benefit all the players along the supply chain and increase the supply chain's competitiveness. One of the ways Asia-based logistics providers can support the integration of supply chains for their clients and their network is by designing and developing effective supply chains and integrating multiple service suppliers into a seamless distribution system.

Limited resources and operational constraints are not unique to logistics provider operations in Asia. In each region or country in the world, various resource limitations and operational constraints exist. It is the duty of Asia-based logistics providers to make the best use of their resources within the existing physical constraints and the limited institutional framework prevalent in many Asian countries (Banomyong and Beresford 2001).

The logistics provider sees its function in the supply chain as that of a distributor. Its main role is to move goods from one end of the supply chain to the other within the constraints imposed by both clients and the commercial environment. "Customer panic" occurs when a client is faced with a difficult situation in the supply chain—usually a stockout—and is unable to rectify the situation. When a break in the supply chain occurs or is going to occur, there is a very strong risk that the whole supply chain will be immobilized, generally for a longer

[1] On 11 June 2009, Thailand, Lao PDR, and Viet Nam held a ceremony to officially mark the implementation of a trilateral exchange of traffic rights, but the procedures are still being implemented.

period that it took the break to occur (Hong-Minh, Disney, and Naim 2000). An analogy may be drawn between this type of situation and a traffic jam along a motorway. Typically, it can take up to three times longer for a traffic jam to clear than it takes one to build up.

The increased interest in managing supply chain dynamics in recent years has led to a number of research activities that have tried to verify the predicted demand amplification and information distortion. So far, most of these studies have focused on retail networks and distribution chains, neglecting the complexity introduced by product conversion in supply chains.

According to Hines, Holweg, and Sulliwan (2000), the factors affecting supply chain complexity are:

- A lack of interaction of information and material flow, causing, for example, short or late deliveries, which force firms to reschedule production.
- Interaction of whole value streams, competing, for example, for capacity at bottleneck points.
- Multiple routing of parts or products through the supply chain.
- Dynamic demand and supply patterns of particular parts or products.
- The average numbers of parts bought from each first tier company, which can range from 50 to 600 parts.
- Ordering policies and customer prioritization, which distorts demand and supply chain flows.
- Product conversion and value added within each manufacturing level of the supply chain.
- New product introduction and product retirement, which creates further instability.

Due to the complexity involved, a new system dynamics framework is necessary to gain a more comprehensive view of supply chain reality. Supply chain management in many Asian countries, such as Thailand, is still in its early stages. This is particularly true for local small and medium enterprises (SMEs) and family-owned businesses. Supply chain management practices have been widely implemented between multinational firms operating in Asian countries, but these practices have not yet reached the small- and medium-sized local suppliers (Wong and Boon-itt 2008). Supply chain performance for most local firms in Asia is weak, but has great potential for improvement because most business owners do not yet have a grasp of supply chain issues. During a supply chain assessment of many local firms, it was discovered that existing assessment tools, such as the Supply Chain Operation Reference model or the Enkawa Supply Chain Logistics Scorecard, were considered to be too complicated and too difficult to use, especially for SMEs (Banomyong 2008). This shows that many SMEs in the region are not in control of their supply chains and are subject to the influence of the focal supply chain firm, which is usually an MNE.

When members in the supply chain are rendered nonoperational, costs increase significantly and major penalties are incurred. In such situations, the players involved must find someone who is able to solve the problem of immobilization in the supply chain.

This is where logistics providers become invaluable as, through their network of overseas agents, they can monitor manufacturers throughout Asia, giving them complete control over their clients' supply chains. Some logistics providers may even act as a buffer to potential problems, creating an emergency network so that goods will arrive on time. The purpose of such an "emergency channel" is to minimize the impact of interruptions along supply chains (Jennings, Beresford, and Banomyong 2000).

The only prerequisite for a logistics provider to be able to activate an emergency channel is that the provider, or a member of the provider's network, must be physically in possession of

the goods. In such cases, a solution is feasible and can be worked out at the most reasonable cost to the client. If the goods are not in a logistics provider's (or the provider's agent's) possession, however, it is almost impossible to find a solution.

The logistics provider's role is not only to organize the supply chain, but also to service it. As such, the logistics provider can be described as the "engineer" or "architect" of the supply chain. The duty of the logistics provider is not only to forecast customers' requirements, but also to provide value-added services that will contribute to the enhancement of customers' competitiveness. However, forecasting customers' requirements is not an exact science and the logistics provider must also be able to respond rapidly to unforeseen events or requests involved in the provision of logistics services to clients.

The logistics provider cannot operate successfully in isolation, but has to rely on his agency network, subcontractors, and clients. A close partnership has to be formed between the service provider and the client. This partnership, in turn, will facilitate the creation of more realistic supply chain designs and operational processes. It is the duty of the logistics provider to be aware of all the options available and to design supply chains flexible enough to cope with unforeseen events.

Today, logistics providers are faced with the daunting challenge of balancing cost minimization with clients' almost infinitely variable requirements. The outsourcing of logistics functions and JIT management techniques have forced logistics providers to design more-dynamic and more-efficient supply chains within various operational constraints. However, it is the physical aspects of the supply chain that will ultimately shape supply chain dynamics.

The successful development of basic infrastructure and the adaptation of local commercial practices to international standards through the removal of all unnecessary trade barriers are preconditions to the integration of supply chains in Asia and the rest of the world.

The challenges for logistics providers in Asia include identifying essential transport infrastructure and networks, as well as determining how to achieve and maintain an active and competitive role in providing logistics services through the integration of global supply chains.

Logistics providers located in developed Asia provide extensive logistical and supply chain management services. These services go beyond transport and distribution, catering to the needs of exporters and importers by managing all transport requirements from the point of origin of raw materials, through the manufacturing process, to delivery to the final consumer. In contrast, logistics providers in Asia's developing economies are faced with many physical and non-physical barriers to providing full door-to-door transport and other logistical services, such as inadequate banking practices, documentation, and insurance.

Logistics and supply chain management, as a discipline, is not fully developed in many parts of Asia. The main functions of logistics—purchasing, production, distribution, warehousing, inventory, and information—are available in the region, but the emphasis is generally on transportation or distribution issues. The majority of logistics providers in Asia are not currently capable of offering a higher level of value-added logistics services.

4. INVOLVEMENT OF ASIAN SMES IN GLOBAL AND REGIONAL SUPPLY CHAINS: A CASE STUDY

Supply chain management integrates suppliers, manufacturers, and distribution centers to get the right products to the right place at the right time and in the proper condition (Christopher and Towill 2001). As the management of supply chains improves, the potential of integrated global supply chains is starting to be realized. Eventually, raw materials will be harvested at the source, manufacturing will be performed in the locations providing the

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

A number of theories have been tested to determine how firms could devise efficient and effective global supply chain strategies (Naylor, Naim, and Berry 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 employing strategies that oppose those recommended for lean and agile supply chain design.

In this case 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 period to a cut-and-sew operation in the Northeast of Thailand, returned the completed leather seat covers to the US over another 28-day period, and delivered them to a seat assembly plant that ultimately fed into a JIT auto assembly plant in Detroit, Michigan. Despite substantially increasing the supply chain cycle time to over 12 weeks (including a two-week holding of safety stock in both the US and Thailand), the supply chain had a competitive advantage over similar operations in maquiladoras located near the US-Mexico border that 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 labor in agriculture. Mexico initiated the Border Industrialization Program in order to replace the lost economic value of the exported labor, providing an incentive for American factories located in the US to move to Mexico to take advantage of lower labor costs. These maquiladoras enabled Mexico to accelerate its economic growth through the provision of cheap labor located in border areas (Fullerton and Barraza de Anda 2003).

Maquiladoras import at least 90% of the raw materials for 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). NAFTA was expected to spur additional growth in maquiladoras, and the number has indeed increased rapidly since 1994, when the agreement went into effect. However, while NAFTA was blamed for relocating US jobs to Mexico, the primary economic force behind the rapid growth of maquiladoras was the devaluation of the peso at the end of 1994, which effectively cut labor costs (in US dollar terms) by more than 40% (Gruben 2001). Maquiladoras have been incorporated into the “lean” paradigms of automobile suppliers to provide labor cost savings while maintaining proximity to auto assembly plants based in the US Midwest.

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

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

One of the main motivations for a firm to look at suppliers outside of its home country is to secure a competitive advantage through lower costs and/or higher quality products. This might be in the form of unit price reductions for items produced in low-wage markets (Trent and Monczka 2003) or of a source of products not available locally (Mansfield 2003). As an example, a significant industry relying on procurement from international sources is the US clothing industry, in which apparel and footwear are produced in low-wage regions including

Asia and South and Central America. The global aspects of these supply chains include only the final link: the product may be produced entirely in the low-cost region and then shipped to distribution centers or directly to retailers in North America or Europe (Cho and Kang 2001).

"Agile" supply chains attempt to leverage the advantages of global suppliers. Industries that rely on agile supply chains require the flexibility to meet rapidly changing customer expectations, or to stay ahead of changing technologies that may quickly become obsolete. Examples of products in these industries include semiconductors and computers, for which innovation drives customer demand and responsiveness is a primary requirement (Christopher and Towill 2001). Supply chain systems for semiconductors and computers may link manufacturers and subcontractors in multiple locations in Asia or Europe to customers in the US (Brown, Hau, and Petrakian 2000; Bhatnagar and Viswanathan 2000).

Under a different paradigm, "lean" supply chains seek to stabilize the supply of raw materials and manufactured components, while eliminating waste in the supply chain. In lean supply chains, the primary driver of the system is cost. As a result, every effort is made to shorten transit times and eliminate in-process inventory or safety stock (Womack, Jones, and Roos 1990). The automobile industry, first in Japan and now also in 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. Suppliers might relocate to Mexico to reduce labor costs while remaining within two to three days shipping time from major assembly plants in the US Midwest. More distant global sources would not be considered if the management's goal is to create a lean supply chain.

It has also been observed that the advantages of lean and agile strategies are not mutually exclusive. Hybrid or "leagile" strategies use lean methods for high volume lines, while maintaining agility for more specialized products. These strategies make use of lean concepts up to a decoupling point in the supply chain (Naylor, Naim, and Berry 1999; Banomyong, Veerakachen, and Supatn 2008), after which agile processes are applied. Alternatively, they use lean methods in situations where demand is demonstrably stable and agile principles for the more unpredictable aspects of operations (Christopher and Towill 2001).

Another approach to determining the appropriate supply chain strategy is based not on customer requirements (e.g., responsiveness vs. low cost), but on the type of product. Using this method, agile supply chains would be used for innovative products with unpredictable demand, while functional products, with their mature life cycles, would benefit more from lean supply chains that minimize waste (Fisher 1997).

The case study presented below illustrates a deliberate, competitive supply chain strategy that involved accepting an eight-week transit time over a one-week transit time, plus an increased safety stock of four weeks, in order to utilize a more distant supplier (i.e., in Thailand instead of Mexico) offering better quality at a lower cost. This decision seems to go against the prevailing body of knowledge pertaining to lean and agile supply chains that dominates 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).

4.1 The Case Study

In most modern automobile assembly operations, the assembly process is limited to forming body panels and welding vehicles frames. All other components—engines, seats, instrument panels, and other electrical, mechanical, and decorative items—are supplied from external sources and then bolted onto the vehicle as it moves down the production line.

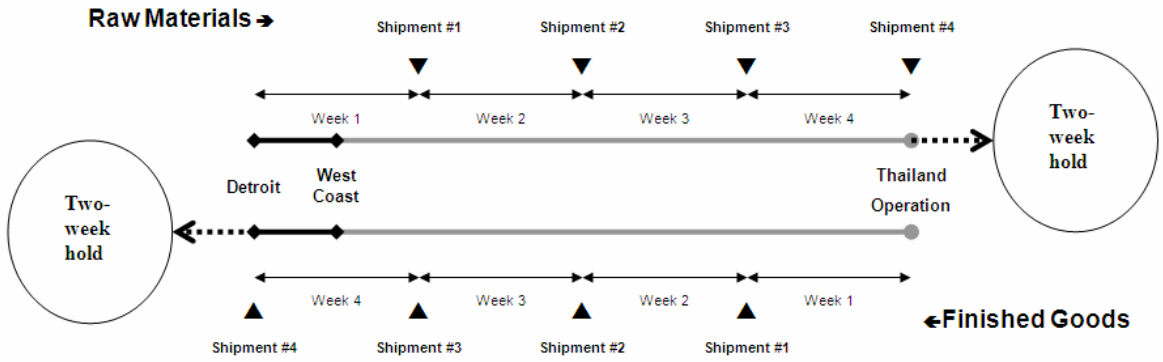
One of the most expensive and complicated subassemblies supplied to the automobile is the seat. Seats are supplied in a wide variety of colors and materials, and many other options

(e.g., heaters and air bags) are available for any given vehicle model. To be able to respond to the range of permutations that are required by automakers, seat manufacturers have assembly operations that mirror the automobile assembly plants that they supply. Their operations are usually located within 30 minutes of the automobile assembly plant and are tied to the plant via EDI. The same job order that triggers the production of the automobile triggers the assembly of the seat. During the two hours it takes the vehicle to travel from welding shop to final assembly, the seat must be built with all the required options and sent directly to the correct location at the auto assembly plant to be installed in proper sequence in the correct automobile.

Similar to the auto plant, the seat-making operation performs little manufacturing other than forming the seat frames. All other components, such as molded 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. This refers to the process of cutting and sewing together cloth, foam, leather, vinyl, and other soft materials to form one component of an automobile seat; in this case, the seat cover.

Raw materials had to be produced by approved suppliers, who were primarily located in the greater Detroit area, or in the states adjoining Michigan. The one exception was the leather supplier, which produced and shipped its components from Omaha, Nebraska, a center of beef production and a source of raw hides. All materials were shipped in full containers and packed at the respective suppliers' locations, with the exception of a small number of items, such as thread and fasteners. Overland transportation in the US averaged three to five 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 3). At any one time, therefore, there was one shipment that was about to arrive in Thailand, two shipments in transit between Asia and North America, and one shipment 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.

Figure 3: Pipeline of Weekly Shipments between Thailand and the US



Source: Adapted from Rubesch and Banomyong (2005).

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 that 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.

The key competitive advantage for the Thailand operation was in the processing of leather. Leather is a natural product varying in grain and appearance, and contains many

imperfections that cannot be used in seat covers. Each hide had to be inspected for imperfections before patterns for the various pieces could be cut in order to avoid 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 Thai plant achieved an average yield of 70%, or about 5% better than the best suppliers from Mexico, giving the Thai plant a US$14 cost advantage per seat cover over its competitors as a result of better utilization of leather. At the same time, lower wages gave the Thai 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 US$48 per seat cover (see Table 3 for a complete breakdown of the logistics costs involved).

Table 3: Comparison of Cost Components for One Leather Seat Cover (Mexico vs. Thailand)

Cost per seat cover, complete set (US$)	Mexico	Thailand
Labor	88	15
Leather	199	185
Other materials	67	67
Packaging	2	6
Outbound logistics	4	21
Inbound logistics	2	8
Cost of inventory	Not Applicable	3
Obsolescence allowance	Not Applicable	9
Total Costs	**362**	**314**

US$ = United States dollar.

Source: Adapted from Rubesch and Banomyong (2005).

The difference in production cost seems to be the main driver behind the selection of the Thai supplier; however, cost cannot be the only factor as other variables need to be included in the decision-making process of selecting suppliers. Production cost needs to be understood within the total cost framework. It is this total cost approach that illustrated the cost competitiveness of the Thai plant.

4.2 Case Study Summary

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

Product characteristics have considerable influence over transportation options and, therefore, over 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 supply chain strategy.

The expertise, efficiency, and cost of labor as a resource in the supply chain must be considered when supply chain strategies are being determined. A labor advantage in one location relative to another—e.g., better skills or lower wages—may offset additional transportation costs so that a supply chain that uses a more distant labor source could offer advantages over one that employs labor closer to the customer market, as illustrated in the case study above.

5. CONCLUSIONS

The purpose of this paper was to describe a number of key supply chain issues and the key role that can be played by logistics providers within an Asian context. A case study was provided to illustrate actual supply chain dynamics and how an Asian firm might integrate into global supply chains.

Supply chain management in Asia still remains a challenge for all involved stakeholders. Asian manufacturers and traders need to be in better control of their supply chains, while most local providers are still struggling to provide value-added logistics services. Infrastructure and institutional arrangements are improving, but not quickly enough to enable successful supply chain management. Supply chain management must consider the deployment of all resources that affect customer value.

Asian policymakers need to be aware of the importance of supply chain management and of how the integration of national supply chains into regional and global supply chains can contribute to sustainable trade growth with key trading partners.

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