

Configuration of International Supply Networks and their Operational Implications: Evidences from Manufacturing Companies in Indonesia

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Abstract

In this paper, we attempt to investigate how the value chain is configured in several international supply networks and identify the implications that supply network configuration decisions bring to the operation of the network. The aspects of configuration investigated here including allocation of value chain activities including: research and development, procurement, manufacturing, distribution, sales and marketing and demand management and geographical span among suppliers, manufacturers and markets.

Results from empirical study involving six manufacturing companies in Indonesia belonging to international supply networks show that one of the main value activities handled by the companies in Indonesia is, not surprisingly, manufacturing activities. In all cases research and development activities are centralised and handled directly by corporate headquarters. Most cases are characterised by supply network flexibility where capacity can be switched from one subsidiary to another. There is only one case (shoe manufacturer), where the network is structured based on process while the rest of the networks are structured based on products.

Looking at the geographical span of the supply networks, all the case companies use a European supply base to a great degree while the manufacturing process are conducted in Indonesia to serve regional or global markets. In most cases, this practice not only adds complexity to the global network, but also puts additional lead-time in the global pipeline, which makes the supply network less responsive to any changes happening in the business environment.

Introduction

In today's manufacturing world more and more companies are developing their network of operations across different countries (Ferdows, 1989; Levy, 1997; Meijboom, 1999). Managing an international supply network is certainly not an easy task. There are at least two important issues inherent in managing an international supply network. The first issue is how to configure the value chain activities across the international network of factories. The second issue is determining ways to manage the value chain activities in order to meet demand and achieve advantages from the global network.

Several authors have highlighted that understanding the configuration, which describe the key members of the chain, main processes and contributions among these members, relationship types and integration elements acting on these processes, is necessary to understand and analyse a supply chain or network (Stewart, 1997; Lambert et. al., 1998; Fine et al, 2002). In an international context, the importance of configuration becomes even more significant. As much as a good supply chain structure can provide the overall chain with competitive advantage, it can also be the limiting factor. Developing international supply chains may increase firms' business complexity and expose them to greater risk and vulnerability (Houlihan, 1987). Prater et al (2001) asserted that firms' international supply chains frequently limit performance in many attributes associated with agility. They argued that it may be hard to adjust the structure or geographical set-up of a supply chain to react to changes in the manufacturing or political environment if the firm has plants in more than one continent. At the same time, configuration decisions affect, to an extent, the way the supply chain is or should be operated and managed. The organisation and management of a supply chain consisting of units scattered in different countries would not be the same as managing a domestic supply chain.

While a lot of authors have investigated the issue of configuration of international manufacturing networks, most of the work has aimed at understanding the drivers and characteristics or building typologies of global/international manufacturing network. Little works has explicitly looked at the impacts of configuration on the operations or management of the international network. In this paper, we attempt to address this gap. We look at how various international supply networks configure their value activities and the geographical span of such networks and use these findings to identify the implications that the configuration might have on the operation of the supply network.

The paper is organised as follow. Several fundamental works on configuration or structure of a supply chain or network and a work on international supply chain will be presented in the following sections. In the fourth section, a brief overview of the research methodology is provided followed by descriptions of case companies in section five. Analysis of the configurations of the case companies and their implications to the operation of the supply networks are provided in section six and section seven respectively. A brief concluding remark is provided in the final section.

Value Chain Configuration

Several authors have highlighted the importance of configuration or structure as part of supply chain management. Understanding and redesigning a certain value chain begins with a map, one that identifies the organisations involved, the capabilities they bring to the value proposition, and the technological contribution each makes to the company's products and services (Fine et al, 2002).

The value chain concept in investigating the source of competitive advantage was first introduced by Porter (1986). He suggested that "every firm is a collection of discrete activities performed to do business that occur within the scope of the firm". Companies that operate internationally must decide how to spread the value chain activities across different countries and at the same time determine how those activities should be linked to one another. According to Porter, the distinctive issues in international - as opposed to domestic - strategy can be structured around two dimensions: *configuration and co-ordination* of companies operating internationally. Configuration of a firm's worldwide activities is concerned with where and in how many places in the world each activity in the value chain is conducted. Configuration ranges from *concentrated* - that is performing all the value chain activities in one location to serve the world - to *dispersed*, which means performing various activities in the value chain in different countries. Co-ordination on the other hand is defined as the

manner in which the activities performed in different countries are linked and integrated. It ranges from *none*, which implies full autonomy for each plant, to *highly co-ordinated* where the plants are tightly linked to one another.

Since introduced by Porter (1986) there has been a great body of literature dedicated to study the configuration and co-ordination dimensions. One of the most common themes addressed in international operations literature is classification of internationally operating companies based on the configuration and co-ordination dimensions. Ferdows (1989) attempted to map subsidiaries of multinational companies based on the primary strategic reasons for establishing the plants and the level of technical activities assigned to the plant. Ferdows identified six strategic roles of a plant in international networks, offshore, outpost, server, source, lead and contributor. Roth (1992) on the other hand tried to determine the basic configuration and co-ordination 'archetypes' for 126 US medium-sized companies by identifying whether a certain part of the value chain – such as manufacturing, sales, marketing, product and process innovation, etc - was performed in a single country or in multiple countries. For activities performed in multiple countries respondents also had to indicate whether the activities were co-ordinated globally, regionally, or managed locally.

Work on International Supply Chain

While the works referred to previously contributed to a clearer understanding on the drivers and several key issues on international manufacturing configuration, none of these works look in more detail on the operational implications of employing different international network configurations. Levy (1995) is one among a few studies that relates configuration and more operational issues in managing international supply chain. His study is based on the international value chain of CCT, a personal computer manufacturer that has three manufacturing sites in California, Ireland and Singapore. He developed a simulation model to investigate the impact of disruptions - related to demand fluctuation, production problems and supplier dependability - on two measures of the supply chain performance i.e. demand fulfilment and inventory level. Four simulation models describing different CCT's supply chain configurations, combining the use of responsive or slow vendors to supply assembly production held in Singapore or US to serve the US market, were developed. Based on these models, the costs and lead times of each supply chain configuration were investigated. Results from the simulation suggested that demand instability raises the proportion of unfulfilled demand for each configuration, however it has bigger impact on configurations with longer lead-time (Singapore). Interestingly, while the literature tend to point to unstable production and technology rather than demand as factors that hinder international sourcing, Levy's study found that production disruption has a very little impact on the supply chain.

Levy (1997) continued his work in CCT by examining the implementation of lean production in their international value chain. His study indicated that lean production - which entails JIT delivery, low inventories and close co-ordination with suppliers and customers - is indeed difficult and expensive to implement in an international supply chain. He argued that in CCT supply chain, long distances create longer lead times and consequently increases the amount of inventories in the supply chain, which makes just-in-time delivery impossible. He also found that distance impairs communication and forces forecast to be made further into the future with consequent reduced in forecast accuracy. However, Levy (1997) suggested that *Design for Manufacture* and *reduction of defect levels* - two key elements of lean production - can facilitate globalisation by stabilising the supply chain.

Research Methodology

In order to understand how real international supply networks configure their activities, an empirical study has been conducted involving six manufacturing companies in Indonesia that belong to international supply networks. Four of the case companies are respectively part of multinational networks producing shoes, consumer food, heat exchangers, and chemical, while the other two companies are part of a global networks producing light bulbs. A semi-structured questionnaire was developed in order to guide a face-to-face interviews with representatives from each company. The questionnaire covered general information about the case companies, value chain activities (research and development, procurement, manufacturing, distribution, sales and marketing and demand management), locations of suppliers, subsidiaries /manufacturing units or other organisations involved in the supply network as well as the market. Supporting information is obtained from the companies' documents or publications. Findings from the empirical study are described in the following section.

Empirical Findings

EI - Shoe Manufacturer

The shoe manufacturer is one of the production units of an international group producing high quality leather shoes headquartered in Denmark. The international group has four other *production units* located in Denmark, Portugal, Slovakia and Thailand and three *wholly owned subsidiaries* in Finland, Sweden and USA. The production unit in Indonesia specializes in producing shoe uppers for the group, while the finishing processes i.e. adding shoe uppers with soles to make finished shoes are held in other facilities of the group. Production unit in Indonesia satisfies approximately 40% to 50% of shoe upper demand in the group.

In the production of shoes, the main materials required are rawhides (procured locally as well as imported) that are processed into semi-finished and finished leather. Other materials required for production including reinforcement, yarn and accessories. A great amount of the materials (70-80%) are obtained from suppliers in Europe. Procurement of raw material takes 8 weeks from placement of order until materials are ready to be shipped and 5 weeks for sea shipment.

The group produces various types of shoes including casual, outdoor, men's, ladies', kid's to semi-sports shoes for two selling seasons i.e. spring-summer and autumn-winter. Design and product development processes are conducted by headquarters but with a strong involvement from the subsidiary in Indonesia in order to transform the design into good and comfortable shoe uppers. Before starting actual production for the next season, the subsidiary in Indonesia is required to make samples of production. The marketing team in headquarters will screen the samples to decide (forecast) the volume and style of production. Based on the sales forecast, headquarters will allocate production orders among its network of subsidiaries and licensees. The production of shoe uppers itself generally involves significant manual work. When the shoe uppers are completed, they are shipped by sea to another group's facilities for subsequent processing according to the allocation set by headquarters. Finished shoes are distributed via the group's Distribution Center and Sales Agents.

MALI - Light Bulb Manufacturer I

The first light bulb manufacturer is a *wholly owned subsidiary* of a Japanese Multinational Company producing various electrical products ranging from consumer, industrial to component products. The unit in Indonesia is one among three companies in the group that produce light bulbs, while the two others subsidiaries are located in Japan and China. Each of these subsidiaries produced different types of light bulbs. MALI products are mainly sold to worldwide markets and only 10% are sold locally (Indonesia market).

Product development activities are conducted by its headquarter in Japan. Sales and marketing activities are handled by *National Sales Agent* located in Jakarta, Indonesia under the control of *Regional Sales Office* in Singapore. Sales agents and regional offices send sales forecast of its respective region to headquarter in Japan. The headquarters will determine the aggregate production requirement and send four months rolling production requirement to the subsidiary in Indonesia. Production of the light bulbs requires some machining operations (such as the glass furnace, bulb blowing, capsule production) with high-tech equipment as well as manual works (assembly). In addition to the glass globe, production of light bulbs requires other components such as semiconductors. A great amount of materials required for production are imported from suppliers worldwide (Holland, Poland, Japan, etc) which on average require three months to procure. Finished products are packed according to each market destination and its distribution is handled by the group's sales office in Singapore.

PRE - Light Bulb Manufacturer II

PRE is the second light bulb manufacturer involved in this study. PRE is part of a multinational network headquartered in The Netherlands. The group has a lot of subsidiaries all over the world, which are divided into several regions. PRE is one of the subsidiaries operating in Asia Pacific Region. Within this region, the group has several manufacturing units - called *supply centres* - located in Indonesia (PRE), Thailand, and China. Each supply center has core products that they produce for the region, however some product variants are made in every supply centre. All product design and development activities are conducted in corporate headquarters in The Netherlands. However, each supply centre has the authority to develop the products according to local/regional needs. In light bulb case, the product proliferates into a great number of product variants due to different electrical specification (voltage and wattage) required by different countries.

Sales and marketing activities in each country is managed by the group's *Commercial Organisation (National Lighting Organisation)*. The demand management of Asia Pacific Region is handled by *regional office* in Hong Kong. Regional office tries to ensure balanced load across supply centres in its region. It has the authority to re-route capacity when there is overload in one of the supply centre to another supply centre that has a spare capacity. A small number of components used in production are bought from a *Sister Company* located close to PRE's factory. However, the majority of the components have to be brought from European supplier(s). Lead times to procure imported materials are 6 weeks to 12 weeks, comprising of factory lead-time, transportation via sea and clearance time.

NI - Consumer Foods

NI is a wholly owned subsidiary of a multinational company producing various food products ranging from beverages, confectioneries, and instant milks headquartered in Switzerland. Research and development activities are held in the *Corporate Innovation Centre* in Switzerland. This centre continuously ‘innovates and renovates’ their products formulas. They provide a basic formula that each subsidiary has to customise according to local market preferences. The food supply network is scattered worldwide with the establishment of their subsidiaries in almost every country in the world. In South East Asia and Pacific region, the group has subsidiary in Malaysia, Philippines, Thailand, and Australia. Each of these subsidiaries has its core product(s) or brands to produce. NI is the main producer of condensed milk in Asia Pacific Region. For this type of product, NI not only satisfies Indonesian market but also other countries in South East Asia.

In order to manage demand for their core products as well as other products produced in sister company, each subsidiary has several *supply planners* working in a *national office* in each country. NI's supply planners are based in Jakarta, Indonesia. Each supply planner handles several products or brands. Supply planners handling NI's core products will receive sales forecasts from local distributors and demand requirement from supply planners in importing countries. Supply planners will determine weekly production plan and send it to NI to be executed. The national office also has supply planners in charge of importing the group's products produced by another subsidiaries in different countries.

Main materials required for NI production is skimmed milk and sugar. Procurement activity for skimmed milk is conducted through corporate headquarters in order to gain economies of scale and quantity discount. This forces NI to place their order of skimmed milk up to three months in advance to allow for transportation, which on average takes 1 month for sea shipment from Europe.

GI - Heat Exchanger

The next company is a joint venture between a German group and local entrepreneur that is involved in the business of developing and manufacturing heat exchanger units and heat exchanger systems. The group has other subsidiaries located in Germany, Hungary, Russia and Switzerland. Product design and development activities are handled by headquarters in Germany. To ensure standard quality of material as well as achieving economies of scale, procurement of material is held by headquarters. Tactical and strategic issues such as investment decisions made by the subsidiary in Indonesia, have to be consulted with parent companies in German. Other than this, the subsidiary in Indonesia performs most of their day-to-day activities with not a lot of involvement from headquarters.

The company in Indonesia manufactures product based on customer order. Customers mainly come from neighboring countries such as Thailand, Malaysia and Singapore. They are usually contractors in charge of developing or installing cooling systems in food manufacturing, office or public facilities. The company only produces some parts of the entire cooling system. Sometimes the customer comes with specific needs, so the company has to customise its standard products according to the customer order. In this business, the company not only sells a product but also services to satisfy the customer. Therefore, the company also offers assistance in finding tailor-made solutions for the customers and offers 18 months customer service guarantee.

ISI - Chemicals Manufacturer

The last company discussed in this paper is a wholly owned subsidiary of a multinational group that produces different types of chemicals. The group has three operational sites producing silica located in the UK, Brazil and Indonesia. The UK manufacturing operations are located in Southampton, which also acts as the corporate headquarters and R&D center. Production in this site is targeted to serve the European, Middle East and Africa markets. The production site in Brazil aims to serve North and

South America markets. For the Asia Pacific region, the group has *regional offices* located in Singapore, *sales offices* in Tokyo (Japan), Melbourne (Australia), Hong Kong and Shanghai (China) and Jakarta (Indonesia), and *production site* in East Java, Indonesia. The regional office in Singapore is in charge of co-ordination of sales and development of the group's business in the region. The sales offices spread in four countries in Asia Pacific becomes the focal points for the group to understand their customer specific needs - which may vary across the countries - and offer a better solution for them.

The production site in Indonesia produces two main products: *abrasive components (AC)* and *thickener components (TC)* used in toothpaste manufacturer. The company's products are sold to local customer (50%) as well as another Asia Pacific countries. A majority of local demand comes from UI, a Multinational Company producing personal care products, that is located close to the ISI's factory in East Java, Indonesia. Foreign customers come from Vietnam, The Philippines, Thailand, New Zealand and occasionally also come from Middle East and South Africa.

Product development activities are concentrated in R & D centres in UK, with a lot of inputs from regional offices. Main materials used by ISI are glass - which is mainly imported from Malaysia and Europe. The company and UI as their major customer established a long-term contract, where UI provides ISI with a yearly forecast of their material requirements. This is considered by ISI as a yearly production plan that is broken down into monthly plans. On a weekly basis the customer will send a confirmation order.

Analysis on Configuration Aspects

Findings from the six companies described in the previous section are summarised in table 1. Most companies involved in this study are part of European Multinational Company's network, except for MALI, the first light bulb manufacturer, which is owned by Japanese Multinational Company. In general, it was found that one of the main value activities handled by the subsidiaries in Indonesia is manufacturing activities. These companies are also in charge of controlling the quality of the products according to standard set up by their parent companies. None of the six companies are found to develop their own product. Research and development activities are centralised and conducted directly by the corporate headquarters.

Regional Subsidiaries

Distinct differences are found in the implementation of customer-related activities (demand management, customer service, sales and marketing and distribution activities) and procurement activities. Two companies that produce intermediary (industrial) products i.e. GI (heat exchangers) and ISI (chemicals) handle all the customer-related activities. On the other hand, the other four companies that produce customer products are not in charge of any of those activities. This finding supports a proposition by DuBois et al (1993) who suggested that companies producing intermediary (industrial) products where close contact with customer is necessary to accommodate their specific needs will put greater emphasis on market responsiveness. These two subsidiaries act as the sole subsidiary of their respective networks in the Asia Pacific region. However, they maintain co-ordination with their head office. Subsidiaries reported the knowledge that they found in serving the customers in the region and share it with subsidiaries serving different regions. In some cases, the headquarters also re-allocates demand that can not be satisfied by subsidiaries in different region.

Table 1. Summary of Findings

Characteristics	Shoes (EI)	Light Bulb I (MALI)	Light Bulb II (PRE)	Consumer Foods (NI)	Heat Exchangers (GI)	Chemicals (ISI)
Main product	Shoe uppers	Light bulbs	Light bulbs	Instant & Condensated milk	Heat Exchanger	Abrasive & thickener chemicals
International Engagement	Joint Venture With Multinational Company (<i>Headquarters in Denmark</i>)	Wholly Owned Subsidiary of Multinational Company (<i>Headquarters in Japan</i>)	Joint Venture with Multinational Company (<i>Headquarters in Holland</i>)	Wholly owned subsidiary of Multinational Company (<i>Headquarters in Switzerland</i>)	Joint Venture with Multinational Company (<i>Headquarters in Germany</i>)	Wholly owned subsidiary of Multinational Company (<i>Headquarters in UK</i>)
Market	Global	Global	Regional (Asia Pacific)	Regional (Asia Pacific)	Regional (Asia Pacific)	Regional (Asia Pacific)
Other subsidiaries	Thailand, Slovakia, Portugal & Denmark	Japan & China	Thailand & China	Malaysia, Philippines, Thailand & Australia	Germany (2), Hungary, Russia, and Switzerland	United Kingdom & Brazil
Supply base	- Europe - Own Tannery Facility	- Worldwide - Sister Company	- Worldwide - Sister Company	Worldwide	Europe	Malaysia & Europe
Types of production	Supply Chain: Make to Stock Subsidiary: Make to forecast	Supply Chain: Make to Stock Subsidiary: Make to forecast	Supply Chain: Make to Stock Subsidiary: Make to forecast	Supply Chain: Make to stock Subsidiary: Make to forecast	Make to Order	Supply Chain: Make to stock Subsidiary: Make to forecast
Value Chain Activities Conducted in Indonesia						
Product Development	NO	NO	NO	NO	NO	NO
Demand Management	NO (Handled by Headquarters)	NO (Handled by Headquarters)	NO (Handled by Regional Office in Hong Kong)	NO (Handled by Planner in National Office in Jakarta)	YES (Co-ordination with headquarters)	YES (Co-ordination with Regional office in Singapore)
Customer Service	NO	NO	NO	NO	YES	YES
Procurement	YES	YES	YES	NO	NO	YES
Production	YES (Semi- finished)	YES	YES	YES	YES	YES
Quality Control	YES	YES	YES	YES	YES	YES
Distribution	NO	NO	NO	NO	YES	YES
Sales and Marketing	NO (Handled by Sales agents & Headquarters)	NO (Handled by Sales Agents in the group)	NO (Handled by Commercial Organisation in the group)	NO (Handled by National Office in Jakarta)	YES	YES

Regionalisation of Demand and Network Flexibility

Another important finding is the fact that most Multinational Company appears to build 'clusters' of subsidiaries within the Asia Pacific Region. In the food manufacturer case, the group has several other subsidiaries in the region. Each subsidiary has core products/brands and they are in charge of the manufacture of core products to satisfy regional demand. Sometimes they have to make some adjustment to the core products in order to satisfy different country preferences (especially in terms of packaging). In the food supply network, a great extent of exporting and importing of finished products across subsidiaries in the region was found.

Similar evidence was also found in two of the light bulbs manufacturer (MALI and PRE). Both networks also have other subsidiaries in the Asia Pacific region and each subsidiary mainly handles a certain type of products. However, unlike the food supply network where each subsidiary has distinct product and process competencies, the product and process technology in the light bulb manufacturer in general is quite similar. Thus, there are certain products in the two light bulb manufacturer networks that can be produced in several manufacturing units. This allows the two networks to switch production of a certain product to another subsidiary when there is a problem such as shutting down of factories, strikes, capacity shortage, etc in one of their subsidiary. These two networks have regional organisations that monitor and attempts to manage/consolidate demand and ensure balance capacity load across subsidiaries in the respective regions.

Centralised Procurement

An interesting finding was discovered in the procurement activities. While all companies appear to use foreign supply base to a great extent they have different procurement policies. Most of the case companies have the authority to procure the materials directly, except for GI (heat exchanger) and NI (instant & condensated milk). In these two companies, procurement of main materials is held centrally by their respective head offices. In NI case, the procurement of skimmed milk is handled directly by its head office in Switzerland. Similarly, GI's head office in Germany handles the procurement of major materials such as plates, motor or fan for the heat exchanger manufacturing. This practice is partly driven by the fact that the standard quality of materials required for production can only be satisfied by European suppliers. Another driver for centralised purchasing is to gain economy of scale and quantity discount.

Process Based Supply Network - Shoe Manufacturer

In this study, the shoe supply network is found to be a special case. While the rest of the supply networks investigated in this study show a product based structure, where each subsidiary produce certain types of product, EI supply network is structured based on processes. EI only conduct one stage of the manufacturing process i.e. producing shoe uppers and the finishing operations are conducted in different manufacturing units within the group. In addition, the shoe manufacturer is the only case where the products are entirely sold in foreign market.

Discussion: Operational Implications of Supply Network Configuration

In addition to how the value chain activities are allocated across different elements in the supply network, in this paper we also look at the geographical span of the supply network i.e. the location of suppliers of main materials, manufacturing units or subsidiaries and the market. Information on supply base and average lead-time to procure materials of each case companies are summarised in table 2.

**Table 2. Supply Base and Average Procurement Lead-time
Of the Six Case Companies**

Characteristics	Shoes (EI)	Light Bulb I (MALI)	Light Bulb II (PRE)	Heat Exchangers (GI)	Consumer Foods (NI)	Chemicals (ISI)
Foreign Supply Base	Europe	Japan & Europe	Europe	Europe	Europe & Australia	Malaysia & Europe
Contact with suppliers	Direct	Direct	Direct	Head office	Head office	Direct
Average Lead time from foreign supply base	12 – 13 weeks	8 - 12 weeks	6 – 12 weeks	8 – 12 weeks	12 weeks	6 – 12 weeks

Synchronization in Process-Based Supply Network

Based on the previous description and information shown in table 2, the shoe supply network appears to span globally with a very complex flow of materials and information across the element in the supply network. As highlighted previously, the materials (rawhides, reinforcement, accessories, etc) for production mainly come from Europe. These materials are sent to manufacturing units in Indonesia and being processed into shoe uppers. The shoe uppers are shipped into other subsidiaries such as Thailand, Slovakia, Portugal and Denmark to be finished. The end products are sent back to head office and distributed to sales agents all over the world. In this complex supply network a synchronized operation is necessary to ensure a smooth flow of materials through the stages of the supply chain.

Long Lead Time vs. Responsiveness

In addition to this, the fact that the shoe manufacturer produces seasonal products with a short product life cycle means the availability of the right products at the right time in the retailers' shelf is essential. In the apparel business, it is very difficult to predict which product variants (SKU) are going to sell. Therefore several authors (Fisher, 1998) have proposed what is called 'Accurate Response' program suggesting apparel supply chain to produce just a small samples of product (SKU), launch it to the market and adjust production based on early market signal. However, in EI case, with such a long lead-time in their global pipeline it is difficult for the EI supply network to adjust their production once materials have been committed.

Although not as great as the challenges facing the shoe supply network, the rest of the case companies also face similar problems. MALI (light bulb I) for example, obtains a great amount of materials from European suppliers with average lead-times of 12 weeks. Although MALI produces light bulbs that have a more standard demand compared to shoes, MALI and PRE also have to order their materials 6 – 12 weeks in advance to ensure smooth running of the operations. Therefore, the two companies admitted that they have slow moving goods in their warehouse as they cannot adjust or amend order of materials that have already being placed based on sales forecast made far ahead the actual production. Similarly, GI that manufactures heat exchangers according to customer order or specification has to wait for materials procured by its head office. Problem occurs when the materials (components) are late or the customer needs to change the specification while the materials have already being ordered.

The above discussion highlighted some of the problems that might be driven by the supply network configuration. One of the main orientations for the companies to develop its manufacturing unit in Indonesia appears to be the low labour cost that the country offers. However, without considering other factors such as the availability of capable supply base close to the manufacturing unit, these advantages might be written off by costs that occur due to express expedition of materials or late items, co-

ordinating complex network, customer cancellation due to late deliveries, etc. For the companies highlighted in this paper, it might be difficult to change or re-configure their supply network. Nevertheless, all the case companies admitted that they are gradually trying to develop regional or local suppliers closer to their manufacturing unit in order to cut off some of the lead-time in their pipeline. At the same time, these issues are among several operational considerations that have to be considered for those companies wishing to design an international supply network.

Concluding Remarks

In this paper, we investigate how six companies that belong to international supply networks configure its value chain activities. In general, it was found that the main activities handled by the subsidiaries in Indonesia are labour-intensive manufacturing operations. This is partly driven by the low labour costs in Indonesia. None of the case companies has the ability to develop their own product, and research and development activities are centralised in corporate headquarters. Distinct differences are found in the implementation of demand management, customer service, procurement, sales and marketing and distribution activities that appears to be affected by the characteristics of product produced by the networks. Two companies that produce intermediary/industrial products are actively involved in customer related activities (demand management, customer service, distribution and sales and marketing), while the four companies producing consumer goods are not involved in these activities. Interestingly, three Multinational Companies in the study (the two light bulbs and food) appears to build 'clusters' of subsidiaries within the Asia Pacific Region. These three supply networks have several subsidiaries located in different countries in the Asia Pacific Region. Relationships among subsidiaries within these networks can be in the form of export and import of finished products. In addition, it also gave the networks flexibility to switch demand to other subsidiaries within the region when there are problems in one subsidiary. The shoe supply network is a special case as it is structured based on processes.

Based on the analysis on geographical span among the suppliers, manufacturing unit and the market it was found that the shoe supply network faces the greatest challenges as it has to perfectly synchronize its supply chain to ensure smooth flow of product/information across subsequent stages in the supply chain. Interestingly, it was found that due to several reasons such as maintaining standard quality or achieving economy of scale, all the case companies procure a great amount of their materials from European suppliers to feed the manufacturing units in Indonesia. This not only adds more complexity over the supply network but also may hinder the network responsiveness to change. This appears to be one important factor that Multinational Company wishing to expand its operation to the Far East needs to consider carefully in configuring its supply network.

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