

## Chapter 14

# Manufacturing of Automotive Components in Mexico: Perspectives from Three Firms

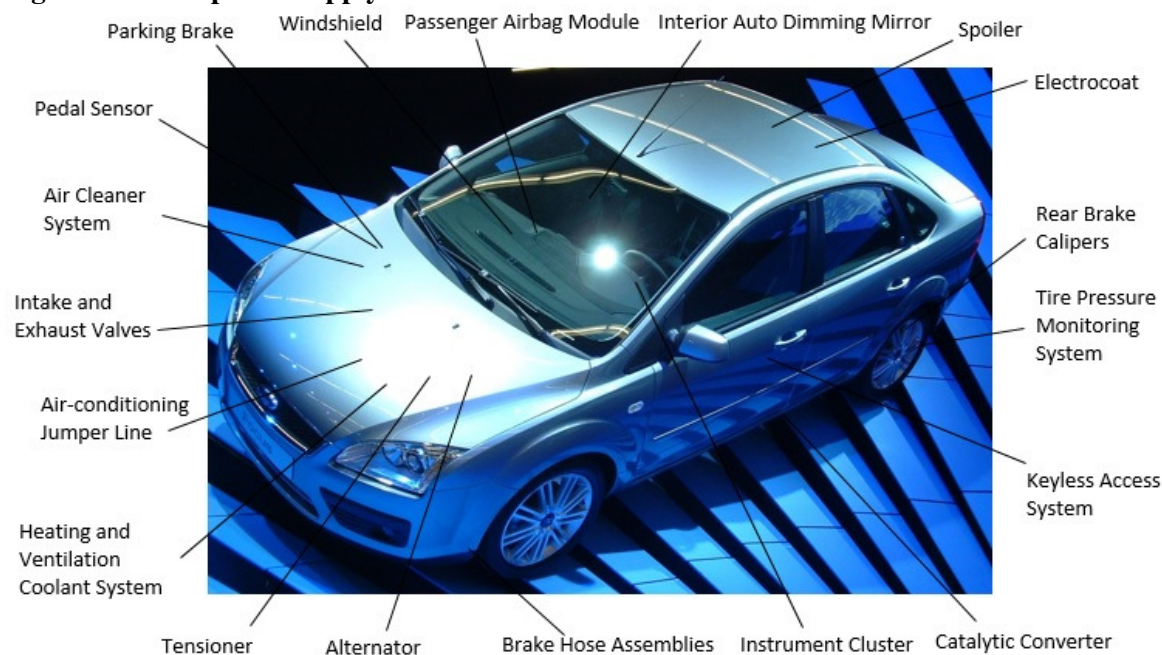
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### 14.1. Industry Overview

Mexico is now the fourth largest car exporter and occupies the 8<sup>th</sup> position in the world as a car producer (PwC Mexico, 2014). Because car manufacturing requires efficient supply chains, the automotive parts and components industry has followed its growth, making Mexico the fifth largest producer as of 2012, behind China, Japan, USA and Germany (ProMexico, 2013). The automotive industry's contribution to manufacturing GDP of Mexico has increased from 9.4 percent in 1989 to 19.8 percent in 2011 and it provides employment to 13.4 percent of total industrial labour in 2010 (AMIA, 2014). Investments by automotive and auto parts manufacturers together made up 20.8 percent of inward FDI received by Mexico in 2012 (AMIA, 2014).

Despite the fact that a car brand and model are often associated with the final assemblers, manufacturing a car actually involves many suppliers of different tiers from around the world. Figure 14.1 gives an illustration of this complexity, showing the number of suppliers that it takes to produce a car. It should be noted that the list provided in the figure is non-exhaustive and there are parts such as music players and antennas whose suppliers are not identified in the figure. In turn, these suppliers have their own global value chains for producing and supplying parts and components to Mazda or the car manufacturer. The three case study firms in this paper are examples of tier 1 or 2 parts suppliers for the car industry.

**Figure 14.1. Simplified supply chain of a car**



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## 14.2. Background Information on the Three Firms<sup>2</sup>

The three firms indicated in this report are Japanese manufacturers of various automotive parts that are based in Bajío, a region in North Central Mexico which includes parts of the states of Guanajuato, Queretaro, Aguascalientes and Jalisco. Information about these firms, henceforth referred to as firms A, B and C, are described below<sup>3</sup>.

### *Firm A (Chassis parts manufacturer)*

Firm A is a designer and manufacturer of chassis parts, which are vital for vehicle safety and stability. In some instances, the firm is viewed as a tier 1 supplier because its products are directly supplied to automotive manufacturers. In other cases, it is viewed as a tier 2 supplier because the firm sells its products to tier 1 suppliers, which then incorporate them into their products before selling them to automotive manufacturers. It is headquartered in Hiroshima, Japan and has a wholly-owned subsidiary in Guanajuato.

It provides a fully-integrated production starting from material molding all the way to machining process and assembly. Its involvement in chassis parts started with knuckle components but has since expanded its range of chassis products to parts such as hub support, bush bracket, hanger bracket, arms and joint shaft (see Figure 14.2). Today, the firm manufactures parts that the automotive manufacturers used to produce by themselves, a show of their confidence and trust on Firm A. Some of the firm's major customers include Mazda, Ford, Mitsubishi and Aston Martin.

**Figure 14.2. Examples of chassis parts produced by firm A**



Source: Courtesy of the firm.

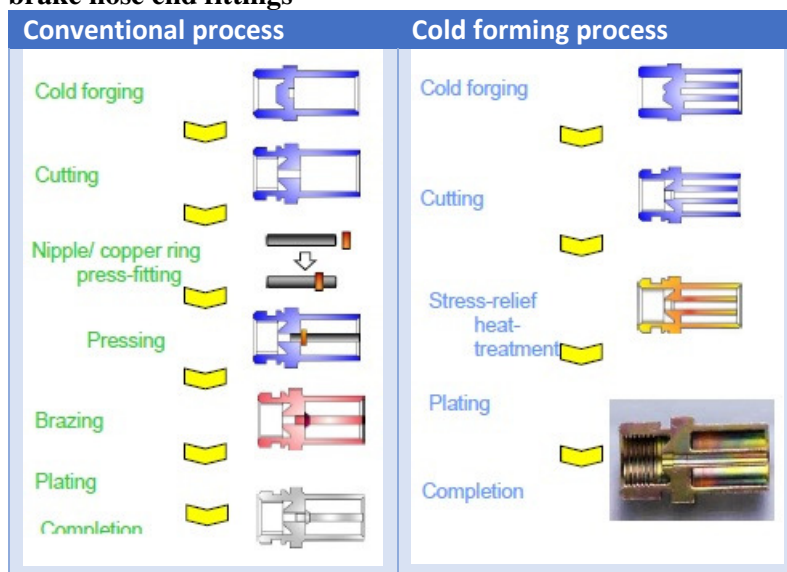
<sup>2</sup> All information about the firms in this case study are from their corporate websites and interviews.

<sup>3</sup> In this paper, firm A, B, and C are used interchangeably to refer to either the parent firm or their respective subsidiaries in Mexico.

**Firm B (Brake hose end fittings manufacturer)**

Firm B is a manufacturer of brake hose end fittings and supplies them to automotive suppliers worldwide which, in turn, supplies the finished products to major vehicle manufacturers. In this regard, the firm is a tier 2 supplier of the automotive industry. The firm also manufactures stud bolts and supplies them directly to automotive manufacturers as a tier 1 supplier. It is headquartered in Tokyo, Japan and has wholly-owned subsidiaries in Thailand in addition to Guanajuato. Its Mexican subsidiary is involved in supplying to the North American, South American and European markets. The firm started with production of stud bolts, which it continues to supply directly to automotive manufacturers. However, unlike the earlier years where stud bolts made up the bulk of its sales, it now contributes only about 30 percent of firm’s total sales. Since 1964, the firm’s technology has centred around cold forming process which allows most products to be manufactured in one integrated procedure. This is in contrast to conventional process where final products are usually composed of 2 or more parts that have to be combined together by pressing, for instance (see Figure 14.3). In addition, this technology enables the manufacture of high-precision, high-quality near-net-shapes that were previously impossible to produce using conventional technology. The use of cold forming process, therefore, cuts the number of production steps and leads to speed enhancement as well as cost optimization. Firm B’s experience in cold forming process has allowed it to adapt the technology for the manufacture of other products such as air bag parts. The plan is to use the technology to continue diversifying the range of products that the firm manufactures.

**Figure 14.3. Comparison of conventional and cold forming process for the manufacturing of brake hose end fittings**



Source: Courtesy of the firm

Specifically on brake hose end fittings, which now make up about 70 percent of firm’s sales, the firm produces many different versions of it, among them female type, male type, banjo type, block type and variant type (see Figure 14.4). After they are assembled to both sides of a rubber hose, the hose would be installed on the brake caliper. These brake calipers are subsequently installed on all the wheels and play an important role in braking.

**Figure 14.4. Different brake hose end fittings manufactured by firm B**



Source: Courtesy of the firm

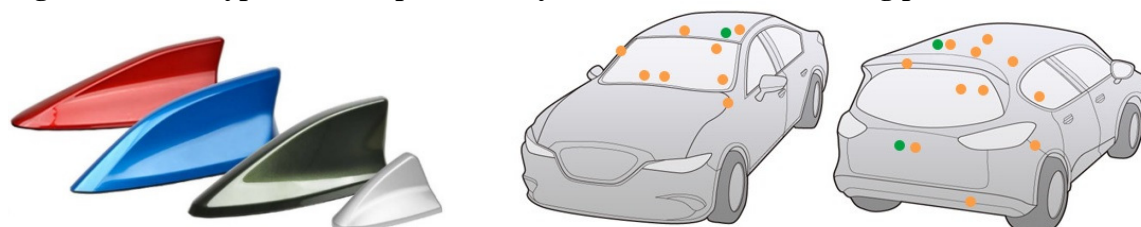
### *Firm C (Antenna manufacturer)*

Firm C is a specialized supplier of automotive antenna which serves almost all major vehicle manufacturers and automotive suppliers worldwide either as a tier 1 or tier 2 supplier. It is headquartered in Japan and has wholly-owned subsidiaries in 9 economies around the world focusing on functions such as research and development (R&D), sales, and manufacturing. Its Mexican subsidiary is located in Queretaro and was established 27 years ago in 1988. As an indication of its global footprint, more than two-thirds of Firm C's consolidated net sales in 2014 were made outside Japan and covered Asia, Europe, North and South America.

The firm has been producing antennas since its founding and has expanded the type of antennas that it manufactures over the years. Among the different types of antenna that the firm currently manufactures and supplies are fin type/low profile antenna (LPA), rod type antenna, screen type antenna, film type antenna, in-dash type antenna, in-spoiler type antenna, and other integrated/hidden type antenna.

These antennas serve different functions and can be mounted in different parts of a car depending on its type. The fin type antennas (see Figure 14.5), for instance, supports all kinds of radio application such as analog AM & FM, digital audio broadcasting (DAB) as well as satellite broadcasting. They can also be used in telematics application such as global positioning system (GPS). On the other hand, the on-dash type antennas can be used for dedicated short range communication (DSRC) and support technologies such as electronic toll collection (ETC). The firm indicated that it continues to develop new antennas in response to diversifying needs. Indeed, its engineers work closely with engineers of automotive companies to develop antennas that suit their needs.

**Figure 14.5. Fin type antennas produced by firm C and their mounting positions**



Note: Possible mounting positions of fin type antennas are shown by green dots.

Source: Courtesy of the firm

In addition to antennas, Firm C also supplies products and peripheral technologies associated with automotive antennas such as cable routing in cars, coaxial cables, CCA (copper clad aluminium) cables, STP (shielded twisted pair) cables, connectors assembly, amplifiers, and noise filters.

### 14.3. Description of the Value Chain

This case study will focus on the three firms' Mexican subsidiaries, which were established in different years and for various reasons. The subsidiaries of firms A and B are relatively younger, having been established in 2013 and 2012 respectively. In contrast, firm C's subsidiary was set up in 1988.

All the subsidiaries were established with the objective of accessing markets in North and South America, the immediate one being Mexico itself. Indeed, many of their client firms are located in the same Bajio region where they are based. However, there exist other more idiosyncratic reasons for the establishment of these subsidiaries. Firm A, for example, wanted to leverage on the low production cost provided by Mexico while Firm B shared that its Mexican subsidiary was also established with the purpose of experimenting with new production methods which are relatively more challenging to apply in its Japan HQ and Thai subsidiary due to the presence of well-established procedures that have stood the test of time.

The product of focus and dimension of the value chain covered by this study differ between firms and are summarized in Table 14.1 below. This is to be expected considering that these firms, as indicated in the earlier section, produce very different parts and components despite all of them being in the automotive industry. Furthermore, in the interest of accuracy and capturing more recent and relevant information, while the dimension of value chain for firms A and B begins with their subsidiary's establishment stage and ends with the provision of after-sales parts/services to the client firms, that for firm C begins with pre-manufacturing stage.

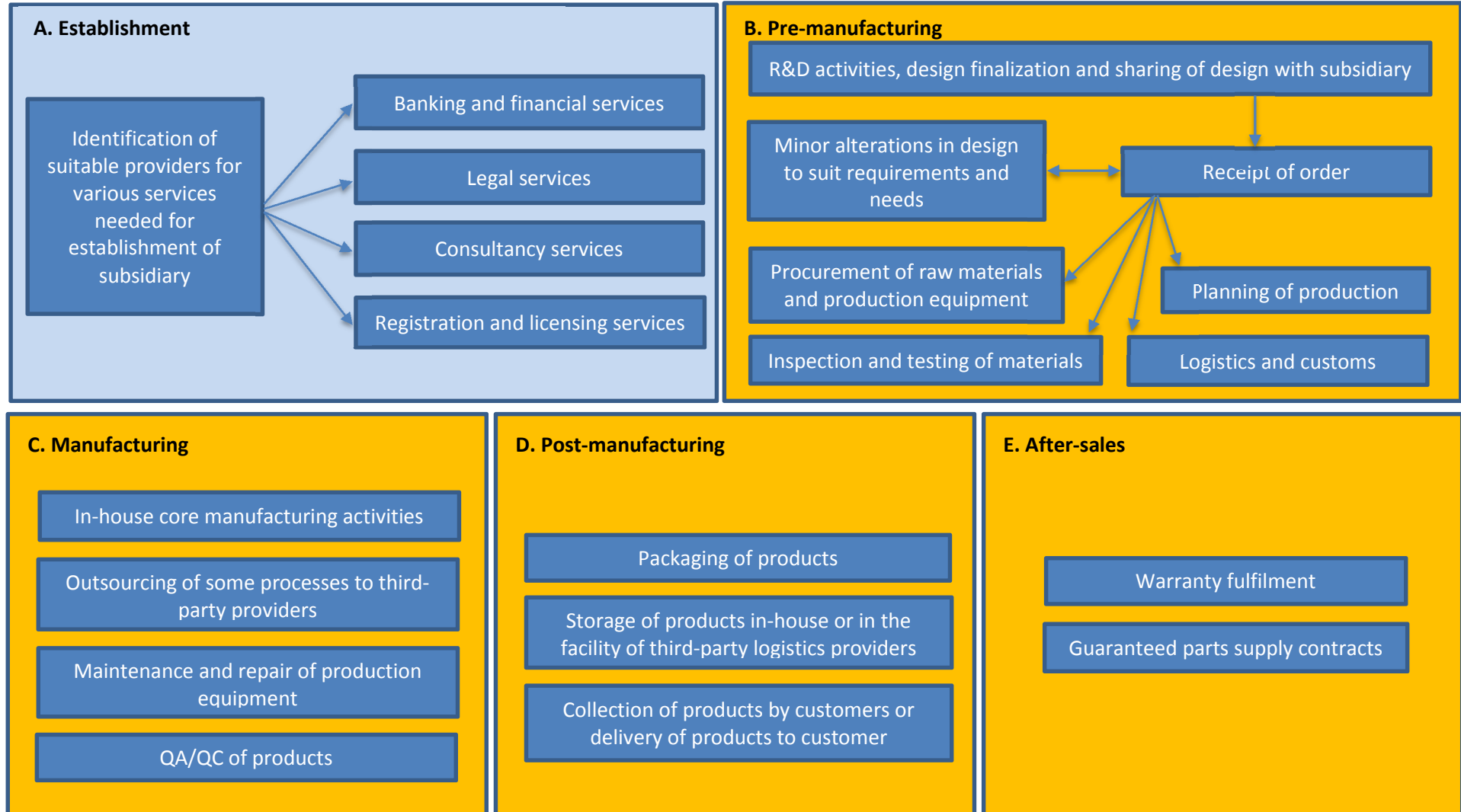
**Table 14.1. Product of focus and dimension of value chain by firm**

	Product of focus	Dimension of value chain covered				
		Establishment	Pre-manufacturing	Manufacturing	Post-manufacturing	After-sales
Firm A	Part of suspension systems of car (i.e knuckle, hub support and bush bracket)	✓	✓	✓	✓	✓
Firm B	Brake hose end fittings	✓	✓	✓	✓	✓
Firm C	Fin type/low profile antenna (LPA)		✓	✓	✓	✓

Source: APEC Policy Support Unit

Figure 14.6 gives a general representation of some of the important steps involved at each phase of the value chain. It should be noted, however, that each firm may not necessarily undertake all the steps listed.

**Figure 14.6. Dimension of the value chain covered by the case study**



Note: Establishment stage is only applicable to firms A and B. Source: Compilation by APEC Policy Support Unit based on firm interviews.

### ***Establishment***

Firms A and B utilized several services activities during the establishment stage of their Mexican subsidiary including company registration, business consultancy and legal services. Firm A fully outsourced these activities while firm B either fully or partially outsourced them to third-party providers for various reasons such as efficiency (outsourced firms are more familiar with local rules and regulations); or economies of scale (e.g. banking and financial services); or legally mandated (e.g. licensing from the government).

The establishment phase of firm C is not covered in this report as its subsidiary was set up 27 years ago and what the firm experienced at that time would perhaps no longer reflect the current situation faced by newly established firms or subsidiaries.

### ***Pre-manufacturing: design and materials sourcing***

#### **Firm A (Chassis parts manufacturer)**

Firm A's pre-manufacturing stage begins when the lead automotive manufacturer invites the participation of the firm's engineers in the design of a new car model approximately 3 years before its launch into the market. Firm A indicated that out of the 10-man design team led by the car manufacturer, 3 people would usually come from them. These engineers are based at the premise of the automotive manufacturer and would provide their expertise on chassis parts and components that the firm will eventually produce and supply to the manufacturer. As long as the design has not been finalized, firm A's engineers would have a free hand on the design and specifications of parts such as hub support and knuckle. However, once the design has been finalized, it would become the property of the lead automotive manufacturer and only it has the rights to modify the design. As a supplier, firm has to abide by the agreed design and specifications.

All finalized designs are shared by the automotive manufacturer through its supplier portal. Regular access to the portal is critical for all suppliers including firm A because it is only from the portal that the firm would be able to foresee the weekly demand for its parts and components and hence respond accordingly. Sometimes, when demand is extraordinarily high, firm A's Mexican subsidiary seeks the support of its manufacturing facilities in Japan in order to meet the demand of its client firms.

Changes to the designs, if any, could also be seen via the portal. Minor changes are usually handled by firm A's subsidiary but for cases beyond the capability of the local team (for example, design change that necessitates an installation of new production line) it has to request for assistance from its Japan headquarters which, besides approving the production, may also send the appropriate number of staffs who can temporarily help out.

Raw materials are sourced from either Japan or Korea and they come in processed form of iron and steel. Firm A disclosed that it would prefer to source raw materials locally but, so far, has not been able to identify local suppliers who can produce the same high quality materials. Upon arrival, its in-house staffs test the raw materials but, at times, their suppliers send their own staffs to test the materials on-site. For materials imported from Japan, its headquarters may also be involved in the testing activities.

#### **Firm B (Brake hose end fittings manufacturer)**

In contrast to firm A whose involvement starts from the pre-launch of the new car model, the pre-manufacturing stage of firm B's Mexican subsidiary usually begins when its customers place orders for brake hose end fittings with the firm. Due to the firm's reputation and long-term relationships with existing manufacturers, orders are placed directly with them without need to participate in competitive

biddings. Unlike firm A where its engineers have a role in product designs, firm B's customers usually specify the product designs.

Upon receipt of the customer's order, staff at its Mexican subsidiary shares the product designs and specifications with firm's R&D department in Japan. There are currently no such departments in its two subsidiaries in Thailand and Mexico although firm B has plans to establish an R&D department in Mexico in the future. The role of the R&D department is to design moulds which are then used in the production stage. For products that are entirely new, the R&D department is also involved in the design of production machinery as well as production line. Even though the product design is provided by the customer, firm B's R&D department can make design suggestions if they affect the manufacturing process. Communications between customer and R&D department are mediated by firm B's Mexican subsidiary. However, customer at times also liaises directly with firm's R&D department in Japan, for instance when the customer also has its design team in Japan. Once the mould design has been finalized and the moulds produced, they are sent to firm's Mexican subsidiary for installation in the production machinery. Besides installation, firm B's engineers at its Mexican subsidiary are also involved in process improvements.

Depending on the type of material inputs, sourcing and procurement are handled by firm B's in-house staffs, its HQ or third-party trading companies. The steel used for production is currently imported from Japan. Firm B has tried to source steel locally in Mexico but found that its quality does not meet the firm's requirements. The logistics of getting material inputs into the facility is fully outsourced to third-party providers and include services such as customs clearance, loading, and transport. Composition and purity testing of these inputs are performed in-house but may also be outsourced to its affiliates or third-party providers if the firm does not have in-house equipment.

In preparation for the manufacturing stage, firm B trains many of its local production staff such as machine operators in its facility in Japan for 6 months. In addition, to ensure that processes in the new facility start off correctly, firm B now has 5 Japanese staff on site to provide expertise and training on activities such as plant management, cold forming process technology, plating technology and QA/QC procedures. Specifically for training pertaining to external certification, external trainers come to provide training to firm's staffs.

Customers require that firm's manufacturing facility has the necessary certifications to produce parts and components. To this end, firm B has completed CQI-11 Plating System Assessment program, which was developed by the Automotive Industry Action Group (AIAG) to ensure adherence to plating procedures and systems<sup>4</sup>. This has then led to the firm passing the Nissan ASES (Alliance Supplier Evaluation Standard), which is designed by Nissan to evaluate if a firm qualifies to become a suitable supplier<sup>5</sup>. At the moment, the firm is in the process of obtaining ISO/TS16949 certification which defines the quality management system requirements for the design and development, production and, when relevant, installation and service of automotive-related products<sup>6</sup>.

### Firm C (Antenna manufacturer)

The pre-manufacturing stage of firm C's Mexican subsidiary begins when its customers place direct orders for antennas with the firm. In some cases, it could also involve the customers requesting for quotations from the firm or submissions of bid in response to call by customers. However, prior to describing this part of the value chain in greater detail, it is worth taking a few steps back to understand the processes that happen before this stage.

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<sup>4</sup> More details about CQI-11 Plating System Assessment can be obtained at: <http://cqi-support.de/en/cqi-standards/cqi-11>.

<sup>5</sup> More details about Nissan ASES can be obtained at: [http://www.nissan-global.com/EN/QUALITY/PRODUCTS/GLOBAL\\_SP/GUARANTEE/](http://www.nissan-global.com/EN/QUALITY/PRODUCTS/GLOBAL_SP/GUARANTEE/).

<sup>6</sup> More details about ISO/TS16949 can be obtained at: [http://www.iso.org/iso/catalogue\\_detail?csnumber=52844](http://www.iso.org/iso/catalogue_detail?csnumber=52844).



Firm C's actual involvement in the manufacturing process of an automotive antenna begins much earlier through R&D activities carried out by its engineers based in the United States, United Kingdom and Japan. The activities carried out by these engineers could generally be divided into two parts: 1) internal research and 2) working with their counterparts in the client firms. As antenna experts, they constantly carry out internal research and collaboration to improve existing antenna technology.

More significantly, firm C's engineers also work with their counterparts in the automotive companies to develop antennas that meet their requirements. In fact, depending on the travel distance between the firm and their customers' premises, firm C's engineers, like firm A, could be based in their customers' facility as guest/resident engineers. The fin-type antenna is a good example of an antenna that was conceived through the close collaboration between firm's engineers and that of its customers. Considering that firm C's engineers work with different customers, there is a need to maintain secrecy and ensure that proprietary information of one customer is not shared unintentionally with another customer. Firm C signs Non-Disclosure Agreement (NDA) with each customer to protect such confidential information.

Once the antenna design has been finalized, its drawings and schematics would be passed to firm's manufacturing facility where mass production engineers prepare for large scale production of the antenna. Although not formally part of the design team, it is possible for mass production engineers to provide feedback to firm's HQ and obtain its approval to manufacture a specific type of antenna that is adapted to local context after conducting field test and obtaining the nod of its customers. Due to the present infrastructure in Mexico, this revised design would still be able to perform its function well but at the same time, could be produced at a lower cost than the original version. Usually, its customers appreciate the revised, usually lower-cost, design adapted to the local context.

Firm C's Mexican subsidiary has its own procurement department. This department generally handles the sourcing and procurement of material inputs, which can come from either small or large firms, domestic firms or multinationals. However, firm C also has affiliates in other economies and if the suppliers for certain inputs happen to be based in the same economy where its affiliates are (for example, Japan), then it may ask its affiliate to procure on behalf of the Mexican subsidiary. Firm's supplies come from different parts of the world including Japan; Malaysia; the United States; and Europe. The logistics of getting material inputs into the facility is fully outsourced to third-party providers, which provides bundled services which include customs clearance, loading and transport. Composition and purity testing of these inputs are performed in-house although they may be outsourced to its affiliates or third-party providers if the firm does not have the requisite in-house equipment.

### ***Manufacturing process***

#### **Firm A (Chassis parts manufacturer)**

Except for basic machining and fabrication activities which are usually bundled with the steel materials as well as painting work which it outsources to a local firm, all manufacturing activities including forging and thermal treatment are performed in-house. Similar to sourcing of raw materials, firm indicated that it would have outsourced certain activities to local providers but at the moment, it has not been able to identify qualified providers. Maintenance and repair services of machineries are carried out by firm A's own staffs but are also outsourced to third-parties such as equipment providers if they could not be maintained and repaired internally.

Once manufacturing has been completed, products are tested to ensure that they are in good, working conditions. While these are usually conducted in-house, some customers also prefer to test the products themselves.

### Firm B (Brake hose end fittings manufacturer)

The production process of brake hose end fittings by firm B involves three main procedures; namely, cold forming process, machining, and plating. Cold forming process is the firm's mainstay technology and therefore fully conducted in-house. The firm also carries out machining and plating in-house but in certain cases, may outsource the activities. For instance, they are sometimes carried out by the customers if they order non-finished products from the firm. In other words, firm's role in the manufacturing process is only at the cold forming process stage. Heat treatment, if needed, is outsourced to its partners because of lack of in-house equipment.

Firm B initially planned to outsource plating activities in Mexico. However, it found local plating activities to be limited, expensive and do not meet quality requirements. Therefore, it decided to undertake in-house plating activities for its own products as well as offer the services to other customers.

Firm B's philosophy that quality must be 100 percent perfect and the fact that it manufactures brake hose end fittings, which play an important role in ensuring the safety of automobiles and their users, means that it is necessary for the firm to develop rigorous QA/QC procedures. Firm wants that all products (i.e 100 percent) are automatically inspected by machines followed by manual inspection. The largest share of its direct labour is, in fact, involved in the manual inspection. Furthermore, randomly sampled products are inspected using higher-end equipment.

### Firm C (Antenna manufacturer)

As with firms A and B, firm C outsources certain non-proprietary steps such as fabrication and basic machining, usually to the suppliers of its material inputs. Thus, many of the firm's material inputs are already in processed form when they enter its facility. Otherwise, all final products are manufactured in-house. Maintenance and repair services of factory equipment are carried out by firm's in-house staff or outsourced to third-parties such as equipment providers if they could not be performed internally.

Products are tested and certified upon completion of manufacturing. These are usually conducted in-house although some customers may require them to be done by its certified third-party testers.

### *Post-manufacturing*

Post-manufacturing, in this case study, refers to packaging, handling and transport of products to customers. Firm A do the packaging services in-house. Third-party logistics provider are then engaged to transport the products to the customers, which are mostly based domestically.

Firms B and C, likewise, undertake the packaging services in-house but are also sometimes provided by third-party logistics providers or done by the customers themselves. If done by third-party logistics providers, packaging is bundled with other services like customs clearance, loading, and transport. Products are then stored either in the firm's facility or leased warehouse within the industrial park before being transported to its customers.

For firm C products sold domestically, they are usually sold ex-works and transport services are provided by its customers via milk-run system, where customers come to collect the products themselves from firm C's facilities.

### After-sales services

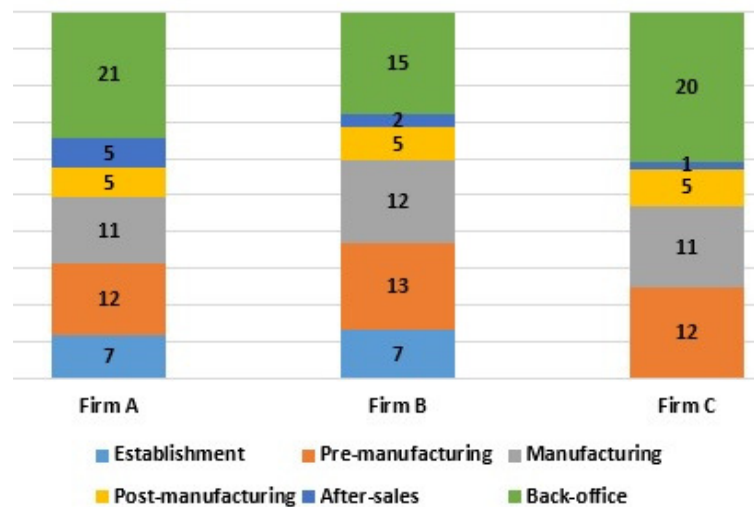
The exact provision of after-sales services by each firm varies but, in general, it consists of: 1) Guaranteeing that replacement parts will be available for a specified number of years (ranging between 10 and 20 years) after mass production has been completed; It should be noted that besides automotive manufacturers, replacement parts may also be sought by car dealers and repair shop; 2) Replacing parts during the warranty period via the automotive manufacturers in case of any defects in its products; and 3) Standing ready to send its engineers to the automotive manufacturers' facilities to resolve any technical issues<sup>7</sup>.

## 14.4. Services along the Value Chain

### Services identification and value contribution

The total number of services identified in each firm's value chain differs and varies between 49 to 61 services (see Figure 14.7). These services are categorized according to the various stages within the chain: i) services during establishment, ii) pre-manufacturing services, iii) services during manufacturing, iv) post-manufacturing services, v) after-sales services, and vi) back-office services. It is worth noting in the comparison across the three firms though that the exact dimension of the value chain differs, i.e. Firm C has no establishment phase while the other two have.

**Figure 14.7. Breakdown of number of services by stage and examples of key services**



Stage	Examples of key services
Establishment	<ul style="list-style-type: none"> <li>Company registration and licensing services</li> <li>Business consultant services</li> </ul>
Pre-manufacturing	<ul style="list-style-type: none"> <li>Engineering services</li> <li>Design services</li> <li>Procurement services</li> </ul>
Manufacturing	<ul style="list-style-type: none"> <li>Production management services</li> <li>QA/QC services</li> </ul>
Post-manufacturing	<ul style="list-style-type: none"> <li>Packaging services</li> <li>Transport/logistics services</li> </ul>

<sup>7</sup> The last one applies only to firm A.

After-sales	<ul style="list-style-type: none"> <li>• Inventory management services</li> </ul>
Back-office	<ul style="list-style-type: none"> <li>• Headquarter services</li> <li>• Financial services</li> <li>• Legal services</li> </ul>

Source: Compiled by APEC Policy Support Unit

Although information on which are the high value-added services inputs is not available, it could be surmised that engineering services are among the critical ones across all three firms. The role of engineering services in the firms' core activities such as those pertaining to R&D (both development and utilization) and quality assurance and control is invaluable. They work closely with their counterparts from R&D departments (in the parent firm) and/or client firms to design components that would become an integral part of the final car model. Thereafter, they need to adapt proprietary technology to produce these components at the right specifications and quality. Often, these may include designing new machinery and re-configuring production lines in addition to good production planning. Engineering services would also be needed to establish the proper QA/QC procedures to ensure that supplied components are of the highest standards.

The importance of services to the case study firms can also be inferred from the share of employees devoted to service activities. Firm A shared that approximately a third of its on-site employees are involved in the provision of services such as plant management, procurement services, production planning, etc. The remaining two-thirds are operators who are directly involved in the manufacturing process on the production floor. In the case of firms B and C, the share of services employees is approximately 42 and 20 percent, respectively. Given that some of the staffs categorized as manufacturing employees could also be involved in activities such as testing and QA/QC, the share of employees involved in services provision in these firms could well be higher than this estimate.

Where it is possible to obtain information on costs, they provide another perspective through which the relevance of services to firm is clearly exhibited. Firm B, for instance, noted that direct manufacturing cost which includes cost of raw materials, machines and direct labour made up only about half of firm's total operational cost. This indicates that the cost of everything else (back office, logistics, etc) which are mostly services in nature made up the other half.

In contrast, services made up only approximately 15 percent of firm C's total cost, which is relatively low compared to other case study firms which disclosed estimates of its cost structure. Several reasons could explain this observation. First, firm C has a large direct labour cost. With 80 percent of its employees directly involved in manufacturing on the production floor, the share of services significantly shrink. Second, firm C has minimal expenditure on services generally because: A) the cost of logistics are usually covered by its suppliers in the case of material inputs and by its customers in the case of finished products; B) the firm does not need to send its engineers to provide after-sales services; and C) it does not have to undertake much advertising and marketing because of its B2B business model. Third, the share of services does not include the value-added that are embedded in material inputs purchased by firm C which comes in processed form and therefore already contains a significant amount of services value added which are not considered in this study.

Looking ahead, the share of services in each firm's value chain is expected to remain significant because of various reasons. First, one of the primary reasons for the establishment of these subsidiaries is to allow the firms (and ultimately its client automotive firms) to access the NAFTA market at preferential rates. To achieve this, there must be sufficient transformation of imported inputs and/or regional value content<sup>8</sup> and value addition through services is one option to do so. Second, while significant share of their raw materials are currently imported, firms generally have plans to source more from local

<sup>8</sup> More information on NAFTA Rules of Origin can be obtained at: [http://tcc.export.gov/Trade\\_Agreements/All\\_Trade\\_Agreements/NAFTA\\_Annex\\_401\\_5.asp#P39\\_3158](http://tcc.export.gov/Trade_Agreements/All_Trade_Agreements/NAFTA_Annex_401_5.asp#P39_3158). Rules pertaining to firm's products can be found in Section XVII, Chapter 87.

suppliers. The savings from sourcing materials locally could reduce the cost of raw materials on one end and, concurrently, increase the share of services on the other end. In addition, some of the raw materials obtained by firms are already in processed form. As such, sourcing them locally means that services associated with the processing activities will also be captured locally. Last but not least, firms B and C have plans to undertake R&D activities in the near future. In addition, firm B is currently expanding its facility and when construction is ready, the expanded facility is expected to host a section that will focus on new processes where engineering services are likely to be intensely used.

### ***Outsourcing, Bundling and Other Aspects of Services Supply***

Further disaggregating the services identified in these value chains and classifying them into whether they are provided in-house or outsourced showed that each firm has different mix of in-house and outsourced services (see Table 14.2 and Appendix A)<sup>9</sup>.

**Table 14.2. Number of in-house and outsourced services by firm**

	Firm A	Firm B	Firm C
<b>In-house</b>	26	19	25
<b>Partially outsourced</b>	7	32	19
<b>Fully outsourced</b>	72	40	44

Note: Services are defined as follows: 1) in-house if it is provided by the case study firm itself or its affiliates; 2) fully outsourced if it is provided fully by third-party providers; and 3) partially outsourced if it is provided partially by the firm its affiliates and partially by third-party providers.

Source: *Compiled by APEC Policy Support Unit.*

Services provided entirely in-house are generally those that are considered firms' core activities such as R&D, production management, head office and QA/QC services<sup>10</sup>. All firms indicated that these services are conducted in-house because they involve proprietary technology and/or critical to ensure that the products meet the highest standards of quality required by the client firms.

Firm B further added that it initially tried to outsource plating activities. However, it found that the cost was very high and the quality of plating was not up to the standards required by the firm. Firm decided to undertake its own plating activities and, at the same time, provides plating services to other manufacturers.

Other reasons for keeping certain services in-house, according to firm C, include the use of common IT portal and sales reporting template across subsidiaries.

On outsourced services, firm A is unique (when compared to firms B and C) in that it fully outsources majority of its non-core activities to third-party providers which include numerous business processes such as accounting and human resources. While it is not surprising to observe the outsourcing of these activities, it is not often that one finds firms that fully instead of partially outsource them (see Box 1 for some of the motivations behind these decisions). Firm A disclosed that two staff members from its third-party provider of human resources management are based on-site as though it were its own HR

<sup>9</sup> Some of the reasons for firms to outsource services include: i) government services, such as visa and immigration services as well as company registration and licensing services ; ii) required by laws and regulations, such as external auditing services by third party providers; iii) lack of expertise or specialization in-house to provide certain services, such as legal services and medical services; iv) need access to the best services, such as maintenance and repair services for some equipment; v) lack of feasibility to supply service in-house, such as banking services and utilities services; vi) economies of scale, such as transport/logistics services; vii) need for strong relationships with government agencies, such as customs clearance services; and viii) network economies, such as security services.

<sup>10</sup> The only reason where QA/QC is outsourced is the lack of expertise/equipment and this may be the case if the equipment is rarely used and capital expenditure on it is deemed unnecessary by firm.

department. Confidentiality agreements are signed between the firm and its third-party providers to prevent leakage of corporate information (e.g. salaries it offers) considering that these providers also service other firms.

Due to the nature of outsourced services in general and the extent through which they are outsourced, many of these services are bundled. For instance, one of the third-party providers actually handles activities ranging from company registration and obtaining the necessary government licensing to recruitment and legal matters. Another example where bundling is observed is in the supply of raw materials to the firm. When they are delivered to the firm, these raw materials are already in processed form in that the suppliers have performed basic machining and fabrication works on them. In addition, transport/logistics provider rarely provides only point-to-point transportation services but also customs clearance, freight insurance and even loading and unloading of materials inputs.

**Box 14.1. Third-party providers of non-core activities**

Operating in a foreign economy is a challenge for many firms because it requires extensive knowledge of that economy’s regulations in different areas such as company registration, customs and labour. Often, the amount of resources allocated to understanding them are so massive that the firm decides either not to set up in the economy or if it has set up, to revise its timeline from establishment to operation. Realizing these opportunities, many third-party providers are now offering services whereby they will handle the non-core but necessary functions of the firm while leaving the firm to focus on core activities such as production and quality control. Among the possible benefits of this arrangement is increased efficiency and productivity of foreign firms’ operations.

One provider of these services in Mexico is the North American Production Sharing, Inc. (NAPS). It has serviced more than 100 firms including one case study firm in this report since its establishment in 1991. As can be seen in Table 14.3 below, the range of services provided by NAPS is very broad and can be tailored to suit the needs of individual client firm. At the same time, these services allow its client firms to focus on improving efficiency in its production and operations.

**Table 14.3. Sample functions provided by NAPS**

Area	Activities
Pre-establishment support	<ul style="list-style-type: none"> <li>• Site selection</li> <li>• Organizational structure</li> </ul>
Human resources	<ul style="list-style-type: none"> <li>• Personnel recruitment</li> <li>• Supervision</li> </ul>
Accounting	<ul style="list-style-type: none"> <li>• Tax compliance</li> <li>• Payroll processing</li> </ul>
Customs	<ul style="list-style-type: none"> <li>• Regulatory compliance</li> <li>• Shipping</li> </ul>
Environmental	<ul style="list-style-type: none"> <li>• Certifications</li> <li>• Audits</li> </ul>

**14.5. Policies Affecting the Value Chain**

A critical component of this study is the analysis of how policies influence the value chain and identify areas of improvements in the process. The firms identified a number of policy issues in different areas including human capital and labour mobility.

### *Constant revisions of tax laws and regulations*

In an effort to minimize tax evasion and at the same time boost tax revenues, the Mexican Government has been revising its tax laws and regulations, with the last reform being signed by the President in December 2013 and changes generally effective 1 January 2014. Firm B has been trying to comply with these revisions but indicated that the constant revisions have made it challenging for its staff to understand and follow because time and effort are required to comply with the laws and regulations. There were instances when firm B thought that it has complied with everything only to find that the laws and regulations have been revised yet again.

An example of a recently instituted regulation is the one pertaining to the requirement to maintain electronic accounting records and submission of general ledger to the tax authorities on a monthly basis. In addition, digital invoices of transactions must be issued by all taxpayers including the firm (Deloitte, 2015 and EY, 2014). Although it has good intent, the government appeared to have been unprepared for the wealth of information that they received. Overwhelmed with data, the government is trying to change the regulations again.

### *Recent changes to IMMEX*

The increased level of competition at the global markets motivated the Mexican Government to publish the Decree for the Promotion of the Manufacturing, Maquila and Export Services Industry (IMMEX Decree) in November 2006. One of the main objectives of the Decree is to increase the competitiveness of its export sector by simplifying the compliance regime and reducing firms' operational costs. Among the defining characteristics of the IMMEX Program is one that allows maquiladoras to temporarily import material inputs, machinery and equipment without paying the general import tax, value added tax (VAT) and in some cases, countervailing duties, as long as these inputs are intended for use in the production, transformation and repair of goods for exports<sup>11</sup>. Firms only need to pay tax if the finished products are sold domestically in Mexico.

The 2013/2014 tax reform, however, has included a revision of the IMMEX Program. Specifically, the VAT and excise tax exemptions on the temporary import of goods have been abolished. This means that VAT rate of 16 percent have to be paid upfront at point of entry. The maquiladora then needs to obtain certification from the Mexican tax authorities. If it is certified, the VAT that is technically imposed on the imported goods will be eliminated by a full tax credit (Deloitte, 2014).

The revision essentially changes government's fundamental take on the activities of maquiladoras by assuming that finished products are sold domestically and it is firms' responsibility to prove otherwise. As such, the process of getting reimbursement becomes very bureaucratic and firms have to produce many documents in order to get its reimbursement request processed. The process is so tedious that firm B has to hire a full-time additional headcount just to handle reimbursement matters. Firm further added that although it was stated on paper that firms with certification need to wait for a certain number of days to get reimbursed, firm has waited beyond that to obtain its reimbursement.

Interestingly, the revision of the IMMEX Program also has unintended consequences on entities such as firm A. The fact that majority of firm A's clients are based domestically means that it has to

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<sup>11</sup> This is applicable on the condition that imported goods are used to make the finished products and exported out within 18 months from the time of entry of inputs (PwC Mexico, 2014).

eventually pay tax for the finished products that it supplies to these clients and hence does not benefit from the program. However, the way the IMMEX Program was originally implemented essentially means that the firm could reduce its cash outflows for taxation purposes during importation stage, hence allowing it to explore opportunities such as purchasing more productive resources including raw materials. The recent revision, unfortunately, means that it can no longer do so.

### **Reimbursement pertaining to construction**

On a related note of bureaucratic reimbursement process, firm B also indicated that the construction of its facility was taxed and although it can be waived, many documents are needed to obtain the waiver of construction tax.

### ***Minimal and conflicting incentives for investment promotion***

Many governments have rolled out the red carpet to attract foreign investments into their economies. The Mexican Government is not an exception. The IMMEX Program is one such program and in addition to the benefits mentioned in the previous section, there are also income tax benefits including an additional tax deduction which is equal to 47 percent of specific benefits given to employee including contributions to pension and retirement funds, overtime payments, Christmas bonuses, food coupons and those pertaining to vacation (Deloitte, 2014).

It also introduced Sectoral Promotion Programs (PROSEC) in order to promote the manufacture of products in certain industry such as electrical and electronics, chemicals as well as automotive<sup>12</sup>. Under PROSEC, eligible firms can import goods such as material inputs and capital assets at preferential general import duty rates if they would be used in the manufacturing process. Unlike IMMEX where the finished products must be exported, PROSEC is indifferent as to whether the firm exports or not.

The government has also set up the Integral Foreign Trade Information System (SIICEX) website to facilitate access to information such as laws and regulations and most importantly, trade treaties and agreements that have been concluded by Mexico. It should be acknowledged that the market potential made possible by North American Free Trade Agreement (NAFTA) has served as a strong incentive for firms to base their facilities in Mexico.

Despite these incentives, firm B noted that it has received minimal support from the Mexican Government to set up its manufacturing facility. So far, it has only received travel grants for the firm's Mexican engineers to attend training in Japan.

### ***Availability of qualified suppliers and human capital***

The manufacturing of automotive components usually requires several processes which are shown in Table 14.4. Depending on various reasons such as economies of scale and availability of equipment, firms tend to outsource some of these processes to external providers. However, firm A shared that so far, it only outsourced painting activities to a local firm in Mexico. The other processes are either performed in-house or were carried out by suppliers of its raw materials in Japan and Korea. The same can be said for firm B which outsources minimal processes locally. One of the primary reasons for these decisions is the absence of qualified providers for such processes in Mexico. All three firms also noted that it is a challenge to obtain good quality inputs locally despite continuous attempts to do so.

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<sup>12</sup> For a complete listing of industry covered by PROSEC, please refer to: <http://www.economia.gob.mx/industry/foreign-trade-instruments/prosec>.



**Table 14.4. Possible processes involved in the manufacturing of different automotive parts**

<b>Suspension system</b>	<b>Body</b>	<b>Braking systems</b>
<ul style="list-style-type: none"> <li>• Machining</li> <li>• Forging</li> <li>• Welding</li> <li>• Pressure injection</li> <li>• Thermal treatment</li> <li>• Surface treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Die-cutting</li> <li>• Sheet metal</li> <li>• Electrostatic paint</li> <li>• Surface treatment</li> <li>• Plastics</li> <li>• Welding</li> </ul>	<ul style="list-style-type: none"> <li>• Machining</li> <li>• Die-cutting</li> <li>• Forging</li> <li>• Welding</li> <li>• Sintering</li> <li>• Thermal treatment</li> <li>• Surface treatment</li> </ul>
<b>Transmission system</b>	<b>Traction system</b>	<b>Cooling system</b>
<ul style="list-style-type: none"> <li>• Machining</li> <li>• Forging</li> <li>• Die-cutting</li> <li>• Pressure injection</li> <li>• Sintering</li> <li>• Mechanic assembly</li> <li>• Thermal treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Machining</li> <li>• Forging</li> <li>• Die-cutting</li> <li>• Welding</li> <li>• Pressure injection</li> <li>• Mechanic assembly</li> <li>• Thermal treatment</li> <li>• Surface treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Machining</li> <li>• Die-cutting</li> <li>• Sheet metal</li> <li>• Welding</li> <li>• Mechanic assembly</li> <li>• Thermal treatment</li> <li>• Surface treatment</li> <li>• Plastics</li> </ul>
<b>Steering system</b>	<b>Safety system</b>	<b>Electric and electronic components</b>
<ul style="list-style-type: none"> <li>• Pressure injection</li> <li>• Mechanic assembly</li> <li>• Surface treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Machining</li> <li>• Die-cutting</li> <li>• Mechanic assembly</li> <li>• Thermal treatment</li> <li>• Surface treatment</li> <li>• Plastics</li> </ul>	<ul style="list-style-type: none"> <li>• Machining</li> <li>• Die-cutting</li> <li>• Welding</li> <li>• Mechanic assembly</li> <li>• Plastics</li> </ul>
<b>Exhaust system</b>	<b>Rims and tires</b>	<b>Fuel consumption</b>
<ul style="list-style-type: none"> <li>• Machining</li> <li>• Die-cutting</li> <li>• Welding</li> <li>• Pressure injection</li> <li>• Mechanic assembly</li> <li>• Thermal treatment</li> <li>• Surface treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Machining</li> <li>• Die-cutting</li> <li>• Sheet metal</li> <li>• Thermal treatment</li> <li>• Surface treatment</li> </ul>	<ul style="list-style-type: none"> <li>• Machining</li> <li>• Extrusion</li> <li>• Sheet metal</li> <li>• Welding</li> <li>• Surface treatment</li> <li>• Die-cutting</li> <li>• Stamping</li> <li>• Plastics</li> </ul>

Source: Promexico (<http://www.oesa.org/Doc-Vault/Knowledge-Center/Intl-Markets-and-Trade-Content/ProMexico-Auto-Parts.pdf>).

Pertaining to the hiring of staff, firm A noted that while it faced no significant problem in hiring, it still needs to send its employees for additional training to bring them to the level required by the firm. Indeed, since establishment, firm has organized several training courses for supervisors and operators in Japan. The areas of training for supervisors are very broad and range from human resources and labour relations to quality control and plant management. In addition, firm also provides on-the-job training for its operators through the use of skill maps, a chart-like tools whereby the level of technical skills that each staff has attained are displayed to assist in the training process.

On the other hand, firm B mentioned that it encounters challenges in recruiting managers with the right qualifications in Mexico. The fact that many firms are setting up in the area compound the difficulty from competition in recruiting talent. While the main reason for firm to have 5 Japanese staff in its facility is to ensure that everything starts off properly, it is also partially due to firm's inability to find

competent managers locally. Eventually, firm B hopes to reduce the number of foreign staff considering that it is also not easy to persuade them to relocate to Mexico even with strong incentives.

Firm C, it appears, has similar personnel difficulties faced by both firms A and B, especially because it is seeking approval from its headquarters to set up an R&D department in Mexico which can adjust its products to the local conditions. As a supplier to automotive firms, firm C believes that having an R&D facility in Mexico would go a long way in facilitating collaborations in product development with automotive firms. But in its headquarter's reckoning, the relatively limited availability of skilled labour may put Mexico at a disadvantage as a regional R&D center relative to other neighbouring economies like Brazil and Chile.

The Mexican Government recognizes the presence of education-industry gap and in an effort to minimize it, has created Colegio Nacional de Educacion Profesional Tecnica (CONALEP)/National College of Technical Education whose objective is to be a center for training, evaluation and certification of skills required by the industry<sup>13</sup>. Since its inception in 1978, CONALEP has been initiating reforms to ensure that its educational model remains consistent and relevant to industry's needs. Today, CONALEP is a federalized institution comprising of 30 state colleges located in major cities and industrial areas in Mexico. Despite the progress, there have been feedbacks that CONALEP's curriculum can be further improved in order to produce technicians for tier 1 and 2 automotive suppliers.

### *International labour mobility*

Ley Federal del Trabajo/The Federal Labour Law is the primary law governing employment in Mexico since 1970s<sup>14</sup>. One of the Articles of the Law that usually pose a challenge to most firms is Article 7, which requires that at least 90 percent of a firm's employees must be Mexican nationals except for directors, administrators and other managerial-level employees<sup>15</sup>. Case study firms indicated that they generally do not face any issues in adhering to the Article and the Law as a whole because they bring in far less foreign workers than they are allowed.

However, there are situations when adherence may be a challenge. One such instance is when firm A needed to install a new or overhaul its production line. Depending on the complexity of the tasks, firm may need to host a significant number of Japanese engineers for an extended period of time which creates the possibility that the share of Mexican employees could temporarily fall below the 90 percent threshold level. To overcome this problem, firm A only applies working visa for several of its foreign engineers and asks the rest of the team to enter Mexico on Visitor Permit<sup>16</sup>. Yet, this solution is not foolproof and comes with its own set of restrictions and challenges.

First, holders of Visitor Permit are technically not allowed to undertake paid activities in Mexico and this means that engineers who come in on Visitor Permit are not eligible for all the benefits that come along with having a working visa including being paid for the services they render. Secondly, the Visitor Permit is only valid for up to 180 days and because it cannot be renewed, holders will need to leave Mexico upon its expiry. If the tasks take more than 6 months to complete, engineers with Visitor Permit have to exit Mexico and possibly return to Japan before re-entering Mexico again. This raises the cost

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<sup>13</sup> More information about CONALEP can be obtained at:

<http://www.conalep.edu.mx/qspropuesta/Paginas/default.aspx>.

<sup>14</sup> More information about labour and employment laws in Mexico can be obtained at:

[http://www.naalc.org/migrant/english/pdf/mgmexfwg\\_en.pdf](http://www.naalc.org/migrant/english/pdf/mgmexfwg_en.pdf) and

<http://www.acc.com/accdocket/onlineexclusives/foreign-nationals-mexico.cfm?makepdf=1>.

<sup>15</sup> The Federal Labour Law was last revised substantially in 2012 to promote business competitiveness

(<https://www.dlapiper.com/en/singapore/insights/publications/2012/12/mexico-enacts-amendments-to-federal-labor-law/>). However, the 90 percent rule appears unchanged.

<sup>16</sup> More information about Mexico's immigration policies can be obtained at:

<http://www.mexperience.com/living/immigration-mexico.php>.

of the firm and adds additional burdens to the engineers considering the travel distance between Mexico and Japan.

An alternative solution would be to change the status of the engineers from being holders of Visitor Permit to that of Visa de Residente Temporal/Temporary Resident Visa but this cannot be done domestically in Mexico<sup>17</sup>. As a solution, firm A sends its engineers to go to the Mexican Consulates in the nearest economy, the United States, to apply for the change in status.

Although none of the firms in this case study has encountered this before, other sources mentioned that it may no longer be possible to do so in the Mexican Consulates located in economies neighbouring Mexico. Applicants have to return to their home economy and collect them at the Mexican Consulates there. To add to the regulatory burden, while issuance of Temporary Resident Visa is done by Mexican Consulates, applicants still need to register at the local immigration office within 30 days upon arrival in Mexico so as to acquire the visa card.

### *Logistics, infrastructure and security concerns*

Logistics plays an important role in the smooth functioning of the global value chains (GVCs). It ensures that material inputs reach the firms' facility in time for manufacturing activities to be carried out and thereafter, allows products to be sent to customers. Realizing the importance of transportation and logistics for Mexico, the Transport and Communications Investment Program 2013-2018 was launched by the President in 2013 and total investment was estimated at USD 100 billion (PwC, 2014). As an indication that the investment has improved the economic infrastructure, firm B noted that ports in Mexico are not as saturated as those in the United States such as Los Angeles and that, in fact, during the recent labor strike in Los Angeles ports, the firm exported products from Japan to the United States via the Mexico. This triangulation proved to be cheaper and more efficient compared to airfreighting the products directly to the US.

Despite the improvements over the years, however, Mexico ranks at the bottom 3 among the top 10 car-producing economies in the world in terms of overall LPI score as well as selected logistics index components such as infrastructure, international shipments and logistics quality and competence (Table 14.5). Trucking products from Mexico to the Mexico-US border remains expensive, perhaps partly due to protected competition in freight transport<sup>18</sup>.

**Table 14.5. Logistics Performance Index and selected components in the top 10 car-producing economies in the world (2013)**

No.	Economy	Overall LPI	Infrastructure	International shipments	Logistics quality and competence
1	China	3.53	3.67	3.50	3.46
2	United States	3.92	4.18	3.45	3.97
3	Japan	3.91	4.16	3.52	3.93
4	Germany	4.12	4.32	3.74	4.12
5	Korea	3.67	3.79	3.44	3.66
6	India	3.08	2.88	3.20	3.03
7	Brazil	2.94	2.93	2.80	3.05
8	Mexico	3.13	3.04	3.19	3.12

<sup>17</sup> There are two exceptions where a foreign national can exchange his/her Visitor Permit to Resident Visa in Mexico: a) if the foreign national has a close family in Mexico; and b) if the foreign national applies for residency on humanitarian grounds.

<sup>18</sup> Domestic transportation of freight (with the exception of messenger or package delivery services) is reserved for Mexican nationals only.

9	<b>Thailand</b>	<b>3.43</b>	<b>3.40</b>	<b>3.30</b>	<b>3.29</b>
10	<b>Canada</b>	<b>3.86</b>	<b>4.05</b>	<b>3.46</b>	<b>3.94</b>

Source: Ranking of top 10 car-producing economies in the world in 2013 is obtained from PwC Mexico report entitled “Doing Business in Mexico – Automotive Industry”. The scores for overall LPI, infrastructure, international shipments and logistics quality and competence are obtained from World Bank ([http://d21a6b425f3bbaf58824-9ec594b5f9dc5376fe36450505ae1164.r12.cf2.rackcdn.com/LPI\\_Report\\_2014.pdf](http://d21a6b425f3bbaf58824-9ec594b5f9dc5376fe36450505ae1164.r12.cf2.rackcdn.com/LPI_Report_2014.pdf)). The overall LPI score is the weighted average of the scores of an economy on six key dimensions: 1) efficiency of the clearance process by border control agencies including customs; 2) quality of trade and transport related infrastructure; 3) ease of arranging competitively priced shipments; 4) competence and quality of logistics services including transport operator and customs brokers; 5) ability to track and trace consignments; and 6) timeliness of shipments in reaching destination within scheduled or expected delivery time.

Besides infrastructure and logistics limitations, security concerns in some of the ocean-bordering states such as Nayarit, Jalisco, Colima, Michoacán and Guerrero can also affect the firms’ activities<sup>19</sup>. An example is the inability of firm C to gain access to its inputs at the port due to closure of customs in Jalisco a few months ago as a result of attack by gangsters. The tightening of security has also slowed down transportation of goods since there are more inspections by the police and military on the highways. It does not help that the number of highways linking the ports to firm C’s facility are limited.

### *Moving forward*

This case study has attempted to give the perspectives of firms manufacturing different automotive components on the importance of services to its operations in Mexico. It has also identified the policies that are impacting its operations and hence, its overall competitiveness. Without doubt, policies and, consequently, policymakers have a significant role in supporting businesses, specifically in ensuring that their own economies have the right environment in helping businesses to grow.

The inadequate availability of qualified providers of manufacturing-related processes limits firms’ outsourcing abilities. Likewise, the relatively inadequate supply of skilled labor could upset possible plans of expansion such as building R&D departments. While the firms provide training to its employees and on-the-job training is the norm in most firms, minimizing the gap between education and industry would still help the firms by reducing the resources that are currently allocated to staff training and use the savings to explore options to improve its operations.

Most importantly, this specific case study has shown that government regulations and procedures can have large implications on the firms. A case in point is the IMMEX program whose revision of tax collection period essentially meant bigger cash outflow for the firm upfront when raw materials arrive at the Mexican port compared to before the revision. Other cases include the fact that Visitor Permit could not be renewed domestically in Mexico and the change of status from being holders of Visitor Permit to that of Temporary Resident Visa has to be done in Mexican Consulates located in the economy of origin. Firms would benefit if policies take into considerations the policies’ impacts on affected firms.

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<sup>19</sup> More details on the state of security in these states can be obtained at: <http://travel.state.gov/content/passports/english/alertswarnings/mexico-travel-warning.html>

## Appendix A

### Summary of services utilized and provided by all three firms

Table A.1. Establishment phase

Service	Corresponding CPC Ver. 2 Code	Firm A	Firm B	Firm C
1 Business liaison services (for example, services from trade development centres or SME centres)	9113 - Public administrative services related to the more efficient operation of business	Fully outsourced, efficiency; economies of scale	Fully outsourced, lack of expertise	
2 Company registration and licensing services	91138 - Public administrative services related to general economic, commercial and labour affairs	Fully outsourced, efficiency; economies of scale; government services; strong relationship with government agencies	Partially outsourced, government services; strong relationship with government agencies	
3 Information and statistical services	9113 - Public administrative services related to the more efficient operation of business	Fully outsourced, efficiency; economies of scale	Partially outsourced, government services	
4 Visa and immigration services for foreign investors/ employees (if any)	91290 - Public administrative services related to other public order and safety affairs	Fully outsourced, efficiency; economies of scale; government services; strong relationship with government agencies	Fully outsourced, strong relationship with government agencies; government services	
5 Business consultant services	8311 - Management consulting and management services	Fully outsourced, efficiency; economies of scale; lack of expertise		
	83129 - Other business consulting services	Fully outsourced, efficiency; economies of scale; lack of expertise	Fully outsourced, lack of expertise	

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6	Banking and finance services	71121 - Deposit services to corporate and institutional depositors	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, not possible to supply in-house	
		71135 - Non-mortgage loan services for business purposes	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, not possible to supply in-house	
7	Legal services	82130 - Legal documentation and certification services	Fully outsourced, efficiency; economies of scale; lack of expertise	Fully outsourced, lack of expertise	

*Source: Authors' own understanding of firms' value chain.*

**Table A.2. Pre-manufacturing stage including sourcing and importation of raw materials**

Service		Corresponding CPC Ver. 2 Code	Firm A	Firm B	Firm C
8	Product research and development	81129 – Research and experimental development services in other engineering and technology	In-house	Partially outsourced, lack of expertise	In-house
		81400 – Research and development originals	In-house	In-house	In-house
		83700 – Market research and public opinion polling services	In-house		In-house
9	Product design services	83920 – Design originals	In-house	In-house	In-house
		83912 – Industrial design services	In-house	In-house	In-house
10	Engineering services	83310 – Engineering advisory services	In-house	In-house	In-house
		8332 – Engineering services for specific projects	In-house	In-house	In-house
11	Sales and marketing services	83700 – Market research and public opinion polling services		In-house	In-house
		8311 – Management consulting and management services (may include customer relationship management)		In-house	In-house
12	Procurement services	83116 – Supply chain and other management consulting services	In-house	Partially outsourced, efficiency; lack of expertise	In-house
		85999 – Other support services n.e.c.			In-house
13	Customs clearance services and logistics of raw materials	67110 – Container handling services	Fully outsourced, efficiency; economies of scale; strong relationship with government agencies; government services	Fully outsourced, efficiency; strong relationship with government agencies; government services	Fully outsourced, efficiency; strong relationship with government agencies; government services

		85999 – Other support services n.e.c.	Fully outsourced, efficiency; economies of scale; strong relationship with government agencies; government services	Fully outsourced, efficiency; strong relationship with government agencies; government services	Fully outsourced, efficiency; strong relationship with government agencies; government services
14	Technical testing of raw materials	83441 – Composition and purity testing and analysis services	Partially outsourced, raw materials providers	Partially outsourced, lack of expertise/equipment; not possible to supply in-house	Partially outsourced, not possible to supply in-house due to lack of equipment
15	Transport services of raw materials	651 – Land transport services of freight	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale
		652 – Water transport services of freight	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale
		6531 – Air transport services of freight	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale
		67910 – Freight transport agency services and other freight transport services	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale
16	Freight insurance of raw materials	71333 – Freight insurance services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, not possible to supply in house	Fully outsourced, not possible to supply in house
17	Storage and warehousing services of raw materials	67290 – Other storage and warehousing services	Partially outsourced, efficiency; economies of scale	Partially outsourced, leased warehouse for overcapacity	In-house
18	Training services for staffs	92919 – Other education and training services, n.e.c.	In-house	Partially outsourced, lack of expertise	Partially outsourced, not possible to supply in-house; need access to best services



19	Construction services	54 – Construction services	Fully outsourced, lack of expertise; need access to best services	Fully outsourced, lack of expertise; need access to best services	
20	Installation services of equipment	873 – Installation services (other than construction)	In-house	Partially outsourced, lack of expertise; by equipment suppliers	Partially outsourced, lack of expertise; by equipment suppliers

*Source: Authors' own understanding of firms' value chain.*

**Table A.3. Manufacturing stage**

Service		Corresponding CPC Ver. 2 Code	Firm A	Firm B	Firm C
21	Production administration – Production management	83115 – Operations management consulting services	In-house	In-house	In-house
22	Maintenance and repair of factory equipment	87156 – Maintenance and repair services of commercial and industrial machinery	Partially outsourced, lack of expertise; by equipment suppliers	Partially outsourced, lack of expertise; by equipment suppliers	Partially outsourced, to equipment suppliers
23	Utilities (electricity, gas and water supply)	691 – Electricity and gas distribution (on own account)	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house
		692 – Water distribution (on own account)	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house
24	Water purification services	8344 – Technical testing and analysis services		In-house	
25	Manufacturing services provided in-house and by suppliers of activities such as basic machining	886 – Basic metal manufacturing services	Fully outsourced, efficiency; economies of scale; lack of in-house equipment; services provided as part of raw materials	Usually in-house but may be outsourced for specific cases (e.g. if customers order non-finished products)	Partially outsourced, comes together with raw materials that are in processed form.
		887 – Fabricated metal product, machinery and equipment manufacturing services	Fully outsourced, efficiency; economies of scale; lack of in-house equipment; services provided as part of raw materials	Usually in-house but may be outsourced for specific cases (e.g. if customers order non-finished products)	Partially outsourced, comes together with raw materials that are in processed form.
		885 – Rubber, plastic and other non-metallic mineral product manufacturing services			Partially outsourced, comes together with raw materials that are in processed form.
26		83310 – Engineering advisory services	In-house	In-house	In-house

	Engineering services during manufacturing	8332 – Engineering services for specific projects	In-house	In-house	In-house
27	Warehousing services for intermediate goods	67290 – Other storage and warehousing services	Partially outsourced, efficiency; economies of scale	Partially outsourced, leased warehouse for overcapacity	In-house
28	Quality control and assurance as well as compliance with ISO	8344 – Technical testing and analysis services	In-house	Partially outsourced, lack of expertise/equipment; not possible to supply in-house	In-house
29	Product testing to obtain certification at export market	8344 – Technical testing and analysis services	Partially outsourced, customer requirement; performed by customers	Partially outsourced, lack of expertise/equipment; not possible to supply in-house	Partially outsourced, required by some customers
30	Sewage water treatment services	94110 – Sewerage and sewage treatment services	Fully outsourced, lack of expertise; performed by industrial park operator	In-house	Fully outsourced, lack of expertise; performed by estate manager
		943 – Waste treatment and disposal services	Fully outsourced, lack of expertise; performed by industrial park operator	Partially outsourced, for hazardous waste (i.e those containing oil); required by laws and regulations	Fully outsourced, lack of expertise; performed by estate manager
31	Specialized cleaning services for machines and equipment	85340 – Specialized cleaning services	In-house	Partially outsourced, lack of expertise; by equipment suppliers	Partially outsourced, to equipment suppliers
32	Waste collection and recycling services	894 – Materials recovery (recycling) services, on a fee or contract basis	Fully outsourced, lack of expertise	Fully outsourced, lack of expertise	
		942 – Waste collection services	Fully outsourced, lack of expertise	Fully outsourced, lack of expertise	Fully outsourced, lack of expertise; performed by estate manager

Source: Authors' own understanding of firms' value chain.

**Table A.4. Post-manufacturing stage**

Service	Corresponding CPC Ver. 2 Code	Firm A	Firm B	Firm C
33 Packaging services	83919 – Other specialty design services	In-house	Partially outsourced, may be provided by logistics firms or firm’s customers	Partially outsourced, required by some customers to use certain logistics company which also provides packaging services
	85400 – Packaging services	In-house	In-house	Partially outsourced, required by some customers to use certain logistics company which also provides packaging services
34 Warehousing services for products	67290 – Other storage and warehousing services	Partially outsourced, efficiency; economies of scale	Partially outsourced, leased warehouse for overcapacity	In-house
35 Customs clearance services and logistics of products	67110 – Container handling services	Fully outsourced, efficiency; economies of scale; strong relationship with government agencies; government services	Partially outsourced, efficiency; strong relationship with government agencies; government services	Fully outsourced, efficiency; strong relationship with government agencies; government services
	85999 – Other support services n.e.c.	Fully outsourced, efficiency; economies of scale; strong relationship with government agencies; government services	Partially outsourced, efficiency; strong relationship with government agencies; government services	Fully outsourced, efficiency; strong relationship with government agencies; government services
36 Transport services of products	651 – Land transport services of freight	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale

		652 – Water transport services of freight	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale
		6531 – Air transport services of freight	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale
		67910 – Freight transport agency services and other freight transport services	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; economies of scale
37	Freight insurance of products	71333 – Freight insurance services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, not possible to supply in house	Fully outsourced, not possible to supply in house

*Source: Authors' own understanding of firms' value chain.*

**Table A.5. After-sales services**

Service		Corresponding CPC Ver. 2 Code	Firm A	Firm B	Firm C
38	Travel services for engineers and other staffs pertaining to after-sales services	8551 – Reservation services for transportation	Fully outsourced, efficiency; economies of scale		
		85521 – Reservation services for accommodation	Fully outsourced, efficiency; economies of scale		
39	Accommodation services	6311 - Room or unit accommodation services for visitors	Fully outsourced, efficiency; economies of scale		
		63220 - Room or unit accommodation services for workers in workers hostels or camps	Fully outsourced, efficiency; economies of scale		
40	Visa and immigration services for staffs	91290 – Public administrative services related to other public order and safety affairs	Fully outsourced, efficiency; economies of scale; government services; strong relationship with government agencies		
41	Warehousing services for after-sales inventories	67290 – Other storage and warehousing services	In-house	In-house	
42	Inventory management services	83116 – Supply chain and other management consulting services	In-house	In-house	In-house

Source: Authors' own understanding of firms' value chain.

**Table A.6. Business processes (Back-office support)**

Service	Corresponding CPC Ver. 2 Code	Firm A	Firm B	Firm C	
43	Company registration and licensing services (obtaining permit to operate)	91138 – Public administrative services related to general economic, commercial and labour affairs			Fully outsourced, government services
44	Government licensing and inspections on fire prevention, health hazards, environmental protection and other aspects	91133 – Public administrative services related to mining and mineral resources, manufacturing and construction	Fully outsourced, efficiency; economies of scale; government services; lack of expertise	Partially outsourced, lack of expertise	Fully outsourced, government services
		91290 – Public administrative services related to other public order and safety affairs	Fully outsourced, efficiency; economies of scale; government services; lack of expertise	Partially outsourced, lack of expertise	Fully outsourced, government services
45	Headquarter services	83118 – Head office services	In-house	In-house	In-house
46	Management services	83111 – Strategic management consulting services	In-house		In-house
47	Accounting, auditing and bookkeeping services	82210 – Financial auditing services	Fully outsourced, efficiency; economies of scale; required by laws and regulations	Fully outsourced, required by laws and regulations	Fully outsourced, required by laws and regulations
		8222 – Accounting and bookkeeping services	Fully outsourced, efficiency; economies of scale	In-house	In-house
48	Financial services	71121 – Deposit services to corporate and institutional depositors	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house
		71140 – Financial leasing services	Fully outsourced, efficiency; economies of	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house

			scale; not possible to supply in-house		
		71313 – Group pension services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, not possible to supply in house	Fully outsourced, not possible to supply in-house
		83112 – Financial management consulting services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house		Fully outsourced, not possible to supply in-house
49	Legal services	82120 – Legal advisory and representation services concerning other fields of law	Fully outsourced, efficiency; economies of scale; lack of expertise	Fully outsourced, lack of expertise	Fully outsourced, lack of expertise
		82130 – Legal documentation and certification services	Fully outsourced, efficiency; economies of scale; lack of expertise	Fully outsourced, lack of expertise	Fully outsourced, lack of expertise
50	Insurance services (commercial life and accident/health insurance, property insurance for the factory compound, product quality insurance, management liability insurance)	7131 – Life insurance and pension services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, better portfolio; not possible to supply in-house	Fully outsourced, not possible to supply in-house
		7132 – Accident and health insurance services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, better portfolio; not possible to supply in-house	Fully outsourced, not possible to supply in-house
		71334 – Other property insurance services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, better portfolio; not possible to supply in-house	Fully outsourced, not possible to supply in-house
		71335 – General liability insurance services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house	Fully outsourced, better portfolio; not possible to supply in-house	Fully outsourced, not possible to supply in-house



		714 - Reinsurance services	Fully outsourced, efficiency; economies of scale; not possible to supply in-house		
51	Human resources services	91320 – Administrative services related to government employee pension schemes; old-age disability or survivors’ benefit schemes, other than for government employees	Fully outsourced, efficiency; economies of scale; lack of expertise; government services	Partially outsourced, lack of expertise; government services	Partially outsourced, government services
		91330 – Administrative services related to unemployment compensation benefit schemes	Fully outsourced, efficiency; economies of scale; lack of expertise; government services		Partially outsourced, government services
		8511 – Personnel search and referral services	Fully outsourced, efficiency; economies of scale	Partially outsourced, efficiency	Partially outsourced, efficiency; cost consideration
		8512 – Labour supply services	Fully outsourced, efficiency; economies of scale; network economies	Partially outsourced, efficiency; network economies	Partially outsourced, network economies
		83113 – Human resources management consulting services	Fully outsourced, efficiency; economies of scale	In-house	Partially outsourced, lack of expertise
52	Business and management consultancy services	8311 – Management consulting and management services	In-house		Fully outsourced, lack of expertise
53	Corporate communications and public relationship	83114 – Marketing management consulting services	In-house		In-house
		83121 – Public relations services	In-house	In-house	
54	Courier, postal and local delivery services	681 – Postal and courier services	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house
55	Information technology services	8313 – Information technology (IT) consulting and support services	Fully outsourced, lack of expertise	Partially outsourced, lack of expertise	Partially outsourced, lack of expertise

		8314 – Information technology (IT) design and development services	Fully outsourced, lack of expertise	Partially outsourced, lack of expertise	Partially outsourced, lack of expertise
		83151 – Website hosting services	Fully outsourced, lack of expertise	Partially outsourced, lack of expertise	In-house
		8316 – IT infrastructure and network management services	Fully outsourced, lack of expertise	Partially outsourced, lack of expertise	Fully outsourced, lack of expertise
56	Telecommunication services	841 – Telephony and other telecommunications services	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house
		84210 – Internet backbone services	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house
		8422 – Internet access services	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house	Fully outsourced, not possible to supply in-house
57	Uniform design, alteration and laundry	83919 – Other specialty design services	In-house	Partially outsourced, cost consideration	In-house
		97130 – Other textile cleaning services	Fully outsourced, efficiency; economies of scale	Fully outsourced, for specific clothings; cost consideration	
58	Transport services for staffs	641 – Local transport and sightseeing transportation services of passengers	Fully outsourced, efficiency; economies of scale	Fully outsourced, efficiency; cost consideration	
59	Property management services	72212 – Non-residential property management services on a fee or contract basis	Partially outsourced, efficiency; lack of expertise	Fully outsourced, efficiency cost consideration	Fully outsourced, efficiency; lack of expertise
60	Real estate services	72112 – Rental or leasing services involving own or leased non-residential property	In-house		
61	Medical services	93121 – General medical services	Fully outsourced, lack of expertise		Partially outsourced, lack of expertise
62	Catering services	63393 – Other contract food services	Fully outsourced, lack of expertise		Fully outsourced, lack of expertise

63	Security services	85230 – Security systems services	Fully outsourced, lack of expertise	Partially outsourced, lack of expertise	Fully outsourced, lack of expertise
		85250 – Guard services	Fully outsourced, lack of expertise; network economies	Partially outsourced, lack of expertise; network economies	Fully outsourced, lack of expertise; network economies
64	Cleaning services	853 – Cleaning services	Fully outsourced, lack of expertise		Fully outsourced, lack of expertise

*Source: Authors' own understanding of firms' value chain.*

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