

Chapter 6

Wastewater Treatment Services in GVCs

Arian Hassani¹ and Andre Wirjo²

6.1. Industry Overview

Driven by various issues such as rapid urbanization, growing populations, the importance of sustainability and the need to mitigate climate change, issues related to water have gained significant prominence in recent years. The 2015 United Nations World Water Development Report noted that the planet is expected to face a 40 per cent shortfall in water supply by 2030 unless the management of this resource is dramatically improved.

With such information widely available, it is no surprise that the water DBO market is estimated to grow at a compound annual growth rate (CAGR) of 8.6 per cent between 2010 and 2020 (Royan, 2012). However, it is worthwhile to mention that the global expansion is not only led by the emerging needs of developing economies, but also by the upgrading requirements of plants in developed economies. Indeed, while the CAGR for the Asia-Pacific region is forecast to grow at 10.4 per cent between 2010 and 2020, the CAGR for North America is also growing healthily at 7.8 per cent over the same period.

As an industry, water treatment evolves continuously with time. The technological, logistical, and regulatory complexities associated with water treatment make bundled design, construction, and operation service packages highly profitable. Water infrastructure, industrial needs and uses, in addition to environmental norms and regulations, make the water DBO market highly sensitive to local conditions and know-how. In line with the idea of sustainability, the trend for water treatment has also moved toward sustainable water management solutions³. Among newly-employed technologies are the use of membrane bioreactors and organisms to treat wastewater.

The key to competitive positioning in water DBO market appears to lie in the provision of fast, low-cost, and environmentally-friendly services that embody a “plug-and-play” component. This is especially true in markets where the labour pool tends to be made up of low-skilled workers because it minimizes knowledge-specific/specialized local interventions. To maintain a competitive edge, industry players need to carve out “clear geographic priorities, balanced business models, and state-of-art technologies so as to constantly stay ahead of environmental challenges and client needs” (Royan, 2012).

6.2. Background Information of Firm⁴

The firm depicted in this case study provides end-to-end waste water treatment and management services, from data gathering and analysis, to the design and construction of water treatment plants, and the manufacturing and sales of water treatment products and chemicals. It is headquartered in Japan and currently has operations in China, Chinese Taipei, Thailand as well as Viet Nam. It has plans to expand to Indonesia and other economies in Southeast Asia.

¹ Research Manager at Fung Global Institute

² Researcher at APEC Policy Support Unit

³ In terms of water reuse and recycling, in addition to adopting more sophisticated technologies and reducing the carbon footprint.

⁴ All information about the firm in this case study is from its corporate brochure as well as from the interview.

The firm’s client base generally stems from the automotive and food and beverage industries. To meet customers’ diverse wastewater treatment needs, the firm determines the optimum processing conditions and proposes the use of its proprietary treatment procedures. The firm does not only deal with the establishment of new water treatment plants, but also meets the modification and enhancement needs of already-existing plants.

Central to the firm’s business model is its proprietary biological chemical which has been developed in-house and used in virtually all of the firm’s recommended treatment procedures. This chemical contains living microbes/bacteria that can decompose various kinds of organic matter commonly found in wastewater discharged by manufacturing plants. More importantly and in the context of environmental-friendliness, water and carbon dioxide are the two main by-products generated by the firm’s treatment procedures. In contrast, other wastewater treatment procedures usually lead to the formation of larger quantity of sludge (see Table 6.1).

Table 6.1. Comparison between firm’s and other physicochemical treatment process

Firm’s treatment process	Other physicochemical treatment process
Automated operation, require fewer staff	Manual operation, require more staff
Minimal sludge and other by-products	Abundant sludge and other by-products
Utilize less chemicals	Utilize more chemicals
Treatment plants occupy smaller area	Treatment plants occupy larger area
Treatment cost for different industry and type of wastewater ranges between ¥ 1 million and ¥ 20 million	Treatment cost for different industry and type of wastewater ranges between ¥ 18 million and ¥ 80 million

Source: Courtesy of the firm with modifications by APEC Policy Support Unit.

As sludge treatment costs continue to rise worldwide, many companies are starting to avoid processes that will lead to the production of large quantities of sludge. Depending on the industry and type of wastewater, firm’s technology can reduce the cost of its clients’ wastewater treatment process to between 1/3 and 1/25 the original cost. Even in Thailand, where sludge treatment has remained affordable, the firm continues to grow its customer base. Other advantages of firm’s treatment process vis-à-vis other treatment process include automation, less chemical utilization and more compact treatment plants (see Figure 6.1).

Figure 6.1. Layout of wastewater treatment facility of a client before and after installation of firm’s wastewater treatment plant

Before: old facility required more space



After: minimal space required



Source: Courtesy of the firm

6.3. Description of the Value Chain

This case study will focus on the firm's Thailand subsidiary and examines a particular water DBO value chain that the subsidiary provides to its automotive client in Thailand.

Although the case study has focused on a value chain specific to a client to facilitate the mapping process of services needed, it should be noted that a similar value chain generally applies to clients from different industries. Variations, if any, are usually observed in the type of biological chemicals used to treat the wastewater considering that different wastewater are made up of different components. As an illustration, wastewater produced by sugar manufacturing plant may be different in content from that produced by automotive manufacturing plant. In addition, firm shared that wastewater produced by certain industries such as automotive need to be pre-treated prior to treatment with its biological chemical while that from industries such as food do not need pre-treatment.

For the purpose of this case study, the value chain begins when the firm receives a request from its client to provide water treatment DBO services and ends when the firm operates the treatment plant on behalf of its client, which includes services such as monitoring and maintenance and disposal of treatment by-products (see Figure 6.2)

Figure 6.2. Dimension of the value chain covered by case study



Source: APEC Policy Support Unit based on firm interview

Design

Upon receiving a request from its client in the automotive industry to provide water DBO services to its manufacturing facility in Thailand, the firm flies in engineers from its headquarters in Japan to collect, analyze, and run tests on samples from the client's existing water treatment plant. The entire process has to be done in Thailand because of the instability of the contents within the wastewater.

Based on the test results, the engineers design and suggest a customized treatment solution that is tested on-site and fine-tuned as the pilot proceeds. Past experience in working with the client on the same project for its facility in Japan also helped the firm to quickly identify the client's needs.

Pre-building

Once the samples from its initial pilot are further assessed and its client is satisfied with the proposed solution, the firm moves to the pre-building stage of the treatment plant where among others, it carries out an assessment of the prospective site for the plant and fine-tunes the design and customization of its equipment.

In addition, the firm has to obtain construction permits from relevant government agencies and identify contractors to outsource construction activities such as welding and piping work, which very often have to be local firms.

Building

The construction period for a treatment plant usually takes approximately six months. During this time, the firm will also be importing core equipment and chemicals from Japan so that they can be installed when the plant is ready. The firm takes care of the certification and commissioning services of the equipment as well.

Operation

As part of its strategy to capture more from its value chain, the firm never supplies its proprietary biological chemical on its own. Instead, it provides them together with wastewater treatment services. In order to make sure its proprietary technology is well-protected, it essentially undertakes all operational activities of the treatment plant, including regular testing of treated water, remote monitoring of the plant, maintenance and repair of installed equipment, as well as continuous research and development to identify new chemicals that need to be removed from the water prior to discharge into public area. Firm also takes care of arranging logistics firm to collect the oil by-products produced by its treatment process.

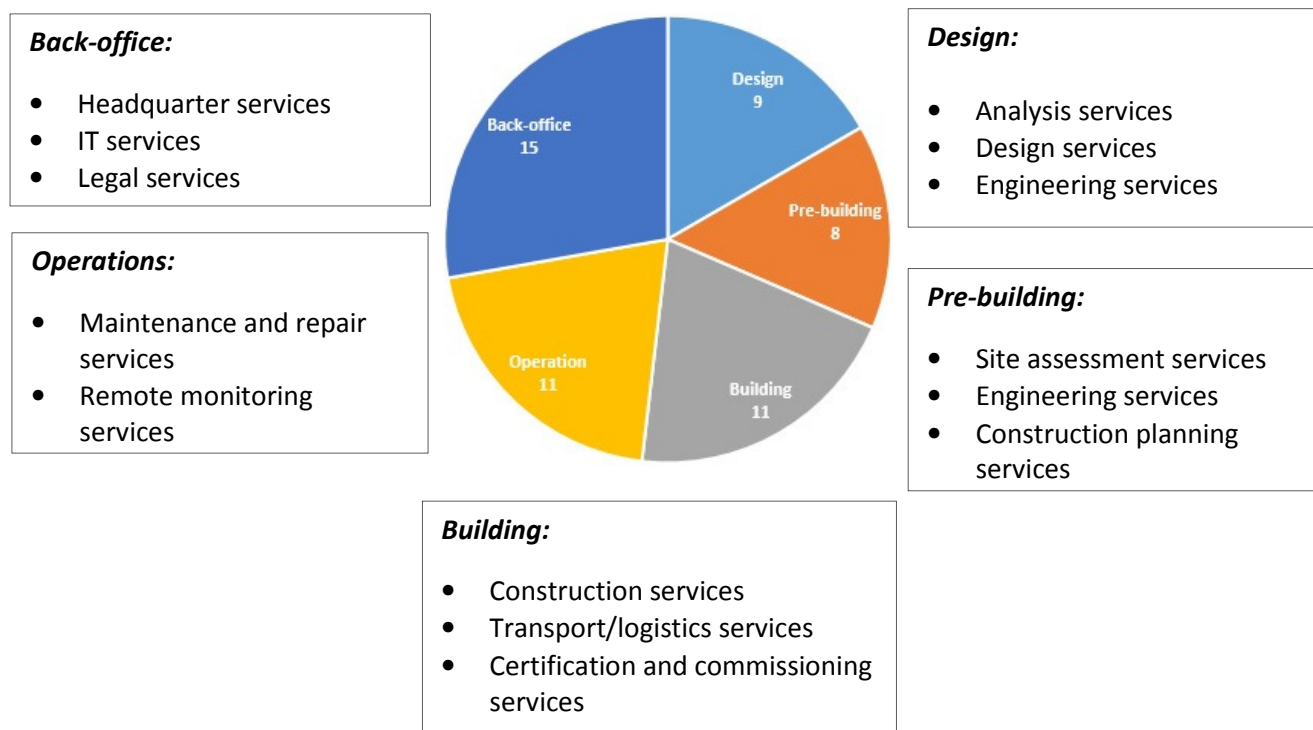
6.4. Services along the Value Chain

Services identification and value contribution

A total of at least 118 services can be identified in this value chain, and have been listed in Appendix A under 54 more aggregated categories. The services have been grouped according to the various stages within the chain: i) services provided during the design stage, ii) pre-building services, iii) services

provided during the building stage, iv) services during the operation stage, and v) back-office services (see Figure 6.3).

Figure 6.3. Breakdown of services by stage and examples of key services



Source: Compiled by APEC Policy Support Unit

Although there is limited information on which services inputs are the most important in terms of value added, it can be surmised that engineering services are perhaps among the most critical inputs because they are pervasive throughout the entire DBO chain, with the exception of back-office support. The substantial number of services entering the value chain described in this case study shows that services are ubiquitous and crucial for the value chain to function properly.

The important role of services in the value chain can also be seen in the number of staff involved. The complement of five staff in the firm's Thailand subsidiary is generally providing services to clients and none are directly involved in the chemicals and equipment manufacturing processes. Among the services activities provided are engineering services throughout the entire DBO value chain, remote monitoring services of installed equipment, as well as sales & marketing services for its product-cum-services offerings.

From a cost perspective, the firm indicated that the cost of the chemicals and equipment is relatively low compared to the costs of services identified in Figure 6.3. Moreover, the cost of chemicals and equipment also embodies a number of services inputs such as research & development activities undertaken to formulate the chemicals, and design services for the equipment.

In the near future, the share of services in the value chain is expected to fall slightly as the firm is currently building a chemical manufacturing and centralized wastewater treatment facility in Chonburi Province. The facility is expected to become operational by mid-2015. The services share in total value will nevertheless remain significant because the facility intends to expand its customer base to include

clients who prefer to have their wastewater treated at a central location. Among the additional services that will be required for this new offering is transport/logistics services to transport wastewater from clients' plants to the firm's facility. The firm's expansion plans in Southeast Asia also suggest that the Thailand office may have a regional role to play, such as the provision of regional headquarters services.

Outsourcing, bundling and other aspects of services supply

Among the 118 services identified in this value chain, 54 are supplied in-house, 3 are partially outsourced and the remaining 61 services are fully outsourced (see Appendix A)⁵.

Services provided entirely in-house are those that the firm considers core services activities such as project-specific design and engineering services, analysis services of samples, installation and commissioning services as well as remote monitoring of treatment plants. These services are provided in-house to minimize the risk of proprietary information leakage. In fact, the firm not only keeps most of its core services in-house (i.e. within its Thailand operations), but it actually obtains them from its headquarters in Japan. From the collection and analysis of a client's wastewater, to the testing, design, and implementation of treatment systems, in-house talent is solicited from Japan. Even the core components of a treatment plant are produced in-house in Japan and shipped to Thailand for assembly. Besides ensuring the security of its proprietary information, these arrangements allow the firm to overcome the lack of skilled labour locally. Furthermore, firm representatives noted that it takes years of on-the-job training to reach the required level of expertise.

In addition to its stringent outsourcing ethos, the firm also relies upon a strategic bundling of services to ensure the sustainability of its cash flow generation model. As indicated earlier, the firm's core asset is the proprietary biological chemical which it manufactures in-house in Japan. If this product were sold by itself in the market, clients would simply integrate it into their wastewater treatment procedures and firm would not be able to obtain more value from its value chain. The biological chemical is not complicated to produce, and when patents on the product run out, the firm will face heavy competition and significant pressure to capture market share.

The firm realized that it could not depend on this core proprietary product alone to ensure the sustainability of its business model. Instead, it decided to offer this proprietary chemical as a bundled package of services that also includes proprietary treatment procedures. This particular addition makes the core service more difficult to mimic as a bundle. With a relatively small initial investment (when compared to ensuing cost savings) to build the water treatment plant, clients enter into what could virtually be referred to as a "lifelong" (the duration of the life of the water treatment plant) contractual agreement with the firm. As a result, the firm does not have to constantly seek new clients. Rather, it can focus on providing top-notch, cutting-edge services to a few major clients who are bound to the firm's services over the long term.

⁵ The reasons identified by the firm for outsourcing depend on the services involved, but can generally be grouped into the following explanation categories: i) government services, such as company licensing and issuance of construction permits for plants; ii) services required by laws and regulations, such as by-product collection services following wastewater treatment and auditing services; iii) lack of feasibility to supply service in-house, such as utilities and freight insurance services; iv) lack of expertise such as site assessment and preparation services; v) external economies of scale such as transport/shipping services of chemical solutions and equipment; vi) need access to the best services, such as metalwork and piping services for its plants; vii) need for strong relationships with government agencies, such as customs clearance services and viii) network economies such as personnel search and referral services.

Several of the firm's offerings are provided as bundled services. One example of such bundled services is transport/shipping services of chemical solutions. The package offered by the third-party logistics firm includes customs clearance, a vehicle and driver (as well as vehicle repair and maintenance) if land transportation is involved, the unloading and transfer of goods at the warehouse, insurance and other financial services. Another important example in this value chain is construction services where in addition to the construction itself, the contractor would be responsible for a range of other services, including sourcing of workers and construction equipment, providing training to workers, purchasing their insurance and possibly housing them in temporary accommodation throughout the entire construction period.

6.5. Policies Affecting the Value Chain

An important part of this study involves the analysis of how government policies affect the value chain (see Appendix B). The case study firm has constructed a business model that combines the manufacture of proprietary biological chemical and other products with customer contracts that embody a range of services. This multi-product business model is not uncommon in the world of global value chains and it makes enterprises sensitive to a range of possible policy risks, including in respect of services. A number of different policies could therefore undermine the firm's strategy and overall viability.

Enforcement of environmental laws and regulations

The firm's product-cum-service offerings are competitive both in terms of cost and environmental friendliness. Its wastewater treatment technology reduces cost by between 1/3 and 1/25 of the previous cost. The firm's proprietary process also utilizes a lesser quantity of chemicals and produces less sludge compared to other treatment procedures. An increasing awareness among individuals and firms of the need to minimize environmental degradation might have served to increase the firm's client base. But interest in Thailand and a few neighboring economies in the company's offerings has seemingly been driven more by cost considerations. The environmental-friendliness aspect comes either: 1) as a bonus; 2) because it comprises part of the corporate social responsibility (CSR) policy of its clients; or 3) because it is a requirement of clients of firms supplied by the case study company.

One explanation for a weak response on the environmental side of things could be a lack of enforcement of environmental laws and regulations, notwithstanding strict laws on the maximum allowable limit for treated wastewater discharged in public domains (Chemical Oxygen Demand (COD) of less than 120mg/l)⁶. This leads to situations where treatment of industrial wastewater is more process-driven to adhere to Section 70 of the Enhancement and Conservation of National Environmental Quality Act B.E. 2535⁷; despite not observing the stipulated limits for industrial discharge, firms try to build water treatment facilities as required in order to minimize the risk of being found non-compliant.

⁶ Chemical Oxygen Demand (COD) of up to 400mg/l is allowed for food furnishing factories, animal food factories, textile factories and pulp and paper factories (http://www.pcd.go.th/info_serv/en_reg_std_water04.html).

⁷ Section 70 of the Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992) states that as determined by the pollution control authorities, the owner or possessor of the point of source of pollution may have the duty to construct, install or bring into operation an on-site facility for wastewater treatment or waste disposal. For this purpose, the firm concerned may be required to commission a Monitoring Control Operator to control wastewater treatment or a waste disposal facility that shall be constructed, installed or brought into operation accordingly. More details can be obtained at: http://www.pcd.go.th/info_serv/en_reg_envi.html.

The issue is further compounded when even Section 70 as well as related Sections 71 and 72⁸ are not fully enforced, leading to many firms not installing wastewater treatment operations on-site or sending their wastewater to centralized wastewater treatment plants. Indeed, government regulators rarely check the quality of industrial discharge into public domains such as rivers and appears, for now, to leave compliance to individual firms' responsibility. This leads to a situation where only firms that care about the reputational risk of a lack of enforcement in their own economies, or have their own CSR, to undertake proper wastewater treatment processes.

When government regulators come for inspection visits, they sometimes appear to have limited knowledge of the technology behind wastewater treatment. In such cases they may sign off on reports with whose contents they are not entirely familiar. This will tend to make site visits more of a cost than a benefit.

Intellectual property (IP) regime

As a developing, middle-income economy, the economic prospects of Thailand are attractive to businesses. Besides hoping to reach out to more clients via its current offerings, the firm is currently constructing a chemical manufacturing and centralized wastewater treatment facility in Chonburi Province. The facility, when operational in mid-2015, will treat wastewater from clients that do not have their own treatment facilities, or prefer to treat them in a centralized facility.

One important consideration among businesses, including the firm when executing its expansion plan, pertains to the host economy's intellectual property (IP) regime. Depending on its perception of the current IP regime, businesses may exercise more caution about transferring technology and knowledge to their local operations.

Acknowledging the importance of IP protection, the Thai government has taken steps to enhance its IP regime so that it is more in line with international standards of protection and enforcement. It established the Central Intellectual Property and International Trade Court (CIPITC) in 1997 to adjudicate cases involving IP⁹. It also signed the Paris Convention for the Protection of Industrial Property and the Patent Cooperation Treaty, in 2008 and 2009 respectively, to align its national standards better with those set out in the WTO Agreement on Trade Related Aspects of International Property Rights (TRIPS) agreement. More recently, it has established the National IPR Centre of Enforcement (NICE) to coordinate efforts to prevent IP violations¹⁰.

Yet, the firm continues to express concerns about transferring technology and technical know-how to its local operations. This is not a surprising finding because despite the steps mentioned above, Thailand has been in the Watch List (WL) or Priority Watch List (PWL) of the US Trade Representative (USTR) Special 301 Report since its inception in 1989¹¹. The annual report provides a review of the state of IP protection and enforcement by US trading partners.

⁸ Section 71 and 72 of the Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992) require the owner or possessor of any point source of pollution to send its wastewater to the centralized treatment plant if the operation concerned does not have on-site facility. More details can be obtained at: http://www.pcd.go.th/info_serv/en_reg_envi.html.

⁹ More information about the Central Intellectual Property and International Trade Court (CIPITC) can be obtained at: <http://www.ipitc.coj.go.th/?co=en>

¹⁰ <http://www.aseanbriefing.com/news/2014/08/21/thailands-intellectual-property-regime.html>

¹¹

<https://ustr.gov/sites/default/files/USTR%202014%20Special%20301%20Report%20to%20Congress%20FINAL.pdf> and <http://www.iipa.com/pdf/2014SPEC301HISTORICALCHART.pdf>

International labour mobility

One option utilized by firm to alleviate its IP concerns is to entrust staff from its headquarters in Japan to carry out tasks requiring higher technical expertise in Thailand and potentially other economies such as Indonesia. While the firm faces no significant issues in obtaining temporary-stay visa for its staff in Thailand, it indicated that it may face challenges in obtaining temporary-stay visas or work permits for its international staff in Indonesia and other economies where it plans to have operations.

The main issue is likely related to whether the economy of interest has put in place some form of quota system, or requires a labour market test before it will issue a temporary-stay visa or work permit for intra-corporate transferees. Even if these do not pose barriers to firm, the permitted length of stay may be an issue. The OECD Services Trade Restrictiveness Index (STRI) regulatory database for cross-border provision of engineering services in economies where the firm has or plans to have operations, and where data are available (China and Indonesia), show that both economies require a labour market test for intra-corporate transferees (see Table 6.2).

Table 6.2. Policies Affecting Intra-Corporate Transferees in China and Indonesia

	China	Indonesia
Quota for intra-corporate transferees	No	No
Labour market test for intra-corporate transferees	Yes	Yes
Limitation on stay for intra-corporate transferees	More than 36 months	Between 12 and 36 months

Source: OECD STRI regulatory database

Besides limiting the stays of intra-corporate transferees to between 12 and 36 months, the Ministry of Manpower of Indonesia is reported to be working on an Indonesian language proficiency test for both existing international staff who are already based in Indonesia as well as prospective international staff^{12,13}. The provision, which reportedly requires foreigners (excluding commissioners, directors and those in temporary employment) to master the Indonesian language before they are able to obtain a work permit, would further strengthen the 2013 Indonesian Minister of Manpower Regulation No. 12.

Local third-party logistics

The Foreign Business Act B.E. 2542 (1999) determines the extent of foreign business activities and limits the rights of foreigners to undertake certain business activities in Thailand. Activities that are controlled are categorized into three schedules and transportation/logistics industry can be found in schedule 2 of the Act¹⁴. This essentially means that the case study firm has to utilize locally-licensed third party logistics firms to transport imported equipment and chemicals as well as to collect the oil by-products produced by its treatment process. Such arrangements reduce competition in the logistics sector and are likely to raise the costs of these services.

The firm may also face a challenge in finding reliable logistics firms to transport wastewater from clients' premises to its new facility when this becomes operational. Of late, there have been news reports

¹² <http://www.thejakartapost.com/news/2015/03/05/minister-prepares-language-proficiency-test.html>

¹³ There is an indication that the plan for language proficiency test will be withdrawn but this has not been announced officially (<http://thejakartaglobe.beritasatu.com/news/indonesia-withdraw-local-language-plan-foreign-workers-sources/>)

¹⁴ <http://bic.thaiembassy.sg/node/104>

have circulated about the illegal disposal of waste, with detrimental effects on the environment and nearby communities¹⁵. The possibility of hiring a logistics company that does not comply with regulations represents a reputational risk for the firm.

The way forward

This case study has attempted to give a wastewater treatment firm's perspectives on the importance of services to its operations. Government policies clearly impact the firm's ability to access and provide services and hence, its overall viability. More importantly, policies may have unintended consequences on the economy as a whole when businesses find ways to go around them. Policymakers, therefore, have a significant role in supporting businesses to the benefit of their own economies.

Lack of enforcement of environmental laws and regulations, for example, leads to situations where the firm is unable to reach its full potential. By strengthening the enforcement of these laws, governments facilitate the operations of firms, bringing economic and social benefits, both in terms of employment and environmental improvements.

Similarly, regulations affecting the movement of natural persons such as stay limitations, labour market tests and language proficiency requirements may also cause firms to reconsider their present operations and future plans for the region. Governments may want to weigh the costs of such limitations, in terms of their effects on foreign direct investment (FDI) flows, against their perceived benefits.

Finally, despite improvements, the current IP regime in Thailand remains a concern to firms when considering the transfer of technology and know-how to their local operations. More technology and knowledge transfer will foster domestic innovation and ultimately greater upgrading opportunities in value chains. It may also encourage additional expansion by firms, and increase output and employment opportunities.

¹⁵ <http://www.nationmultimedia.com/national/Praksa-fire-leads-to-calls-for-nationwide-dumpsite-30230655.html> and <http://news.yahoo.com/thailand-totters-towards-waste-crisis-041321001.html>

Appendix A

Table A.1. Services during design stage

Service	Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers/ government and reasons	Bundled	
1	Travel services for engineers and other staff to collect and analyse samples	8551 – Reservation services for transportation	No	No	Yes, efficiency	n/a
		85521 – Reservation services for accommodation	No	No	Yes, efficiency	n/a
2	Visa and immigration services for staff	91290 – Public administrative services related to other public order and safety affairs	No	No	Yes, government services	n/a
3	Analysis services of samples	8344 – Technical testing and analysis services	Yes	No	No	n/a
4	Design services to support proposed solution	8314 – Information technology design and development services	Yes	No	No	n/a
		83920 – Design originals	Yes	No	No	n/a
		83912 – Industrial design services	Yes	No	No	n/a
		8393 – Scientific and technical consulting services n.e.c.	Yes	No	No	n/a
		83142 – IT design and development services for networks and systems	Yes	No	No	n/a
		83143 – Software originals	Yes	No	No	n/a
5	Engineering services to support proposed solution	83310 – Engineering advisory services	Yes	No	No	n/a
		83326 – Engineering services for waste management projects (hazardous and non-hazardous)	Yes	No	No	n/a

		83327 – Engineering services for water, sewerage and drainage projects	Yes	No	No	n/a
6	Transport/ shipping services of chemical solutions	651 – Land transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel, repair and insurance
		652 – Water transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel, repair and insurance
		6531 – Air transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel repair and insurance
		67910 – Freight transport agency services and other freight transport services	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel, repair and insurance
7	Freight insurance of chemical solutions	71333 – Freight insurance services	No	No	Yes, not possible to supply in-house service in-house	Bundled with transport
8	Customs clearance services and logistics of chemical solutions	67110 – Container handling services	No	No	Yes, efficiency; strong relationship with government agencies; government services	Bundled with transport, personnel, repair and insurance
		85999 – Other support services n.e.c.	No	No	Yes, efficiency; strong relationship with government agencies;	Bundled with transport, personnel, repair and insurance

Services in Global Value Chains: Manufacturing Related Services

					government services	
9	Storage and warehousing services of chemicals solutions	67220 –Bulk liquid or gas storage services	Yes	No	No	n/a
		67290 – Other storage and warehousing services	Yes	No	No	n/a

Table A.2. Services during pre-build stage

Service	Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers/ government and reasons	Bundled
10 Site assessment services	83411 – Geological and geophysical consulting services	No	No	Yes, lack of expertise	n/a
	83412 – Geophysical services	No	No	Yes, lack of expertise	n/a
	83421 – Surface surveying services	No	No	Yes, lack of expertise	n/a
	83442 – Testing and analysis services of physical properties	No	No	Yes, lack of expertise	n/a
11 Architectural services for plant	8321 – Architectural services and advisory services	No	No	Yes, lack of expertise	n/a
	8323 – Landscape architectural services and advisory services	No	No	Yes, lack of expertise	n/a
12 Design services for equipment as well as analysis and monitoring software	83912 – Industrial design services	Yes	No	No	n/a
	83920 – Design originals	Yes	No	No	n/a
	8393 – Scientific and technical consulting services n.e.c.	Yes	No	No	n/a
	83141 – IT design and development services for applications	Yes	No	No	n/a
	83142 – IT design and development services for networks and systems	Yes	No	No	n/a
	83143 – Software originals	Yes	No	No	n/a
13 Engineering services for equipment	83310 – Engineering advisory services	Yes	No	No	n/a
	83326 – Engineering services for waste management projects (hazardous and non-hazardous)	Yes	No	No	n/a

Services in Global Value Chains: Manufacturing Related Services

		83327 – Engineering services for water, sewerage and drainage projects	Yes	No	No	n/a
14	Environmental consulting services	83931 – Environmental consulting services	No	No	Yes, lack of expertise	n/a
15	Product testing to obtain certification at export market	8344 – Technical testing and analysis services	No	No	Yes, government services	n/a
16	Government-related pre-building services (e.g. securing government permits for construction)	91133 - Public administrative services related to mining and mineral resources, manufacturing and construction	No	No	Yes, government services	n/a
17	Planning and management services	83223 – Project site master planning services	Yes	No	No	n/a
		83330 – Project management services for construction projects	Yes	No	No	n/a
		83990 – All other professional, technical and business services, n.e.c.	Yes	No	No	n/a

Table A.3. Services during build stage

Service	Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers/ government and reasons	Bundled
18 Engineering services during building/construction	83310 – Engineering advisory services	Yes	No	No	n/a
	83321 – Engineering services for building projects	Yes	No	No	n/a
	83326 – Engineering services for waste management projects (hazardous and non-hazardous)	Yes	No	No	n/a
	83327 – Engineering services for water, sewerage and drainage projects	Yes	No	No	n/a
19 Site preparation services	54310 – Demolition services	No	No	Yes, lack of expertise	n/a
	54320 – Site formation and clearance services	No	No	Yes, lack of expertise	n/a
	54330 – Excavating and earthmoving services	No	No	Yes, lack of expertise	n/a
20 Importation of core equipment and chemicals: Customs clearance and logistics	67110 – Container handling services	No	No	Yes, efficiency; strong relationship with government agencies; government services	Bundled with transport, personnel, repair and insurance

		85999 – Other support services n.e.c.	No	No	Yes, efficiency; strong relationship with government agencies; government services	Bundled with transport, personnel, repair and insurance
21	Importation of core equipment and chemicals: Freight transportation services	651 – Land transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel, repair and insurance
		652 – Water transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel, repair and insurance
		6531 – Air transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel, repair and insurance
		67910 – Freight transport agency services and other freight transport services	No	No	Yes, efficiency; economies of scale	Bundled with transport, personnel, repair and insurance
22	Freight insurance of chemical solutions and equipment	71333 – Freight insurance services	No	No	Yes, not possible to supply in-house service in-house	Bundled with transport
23	Importation of core equipment and chemicals: Storage and warehousing services	67220 – Bulk liquid or gas storage services	Yes	No	No	n/a
		67290 – Other storage and warehousing services	Yes	No	No	n/a
24	Construction services	54 – Construction services	No	No	Yes, lack of expertise	n/a
25	Manufacturing services provided by suppliers of	886 – Basic metal manufacturing services	No	No	Yes, required by laws and	n/a

	activities such as welding, coating, etc.				regulations; lack of expertise	
		887 – Fabricated metal product, machinery and equipment manufacturing services	No	No	Yes, required by laws and regulations; lack of expertise	n/a
26	Installation services for equipment and related components such as wiring	5461 – Electrical installation services	Yes	No	No	n/a
		873 – Installation services (other than construction)	Yes	No	No	n/a
27	Certification and commissioning services of plant and equipment by firm	8344 – Technical testing and analysis services	Yes	No	No	n/a
28	Government inspections on fire prevention, health hazards, environmental protection and other aspects	91133 – Public administrative services related to mining and mineral resources, manufacturing and construction	No	No	Yes, government services	n/a
		9129 – Public administrative services related to other public order and safety affairs	No	No	Yes, government services	n/a

Table A.4. Services during operate stage

Service	Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers/ government and reasons	Bundled	
29	Production administration – Production management	83115 – Operations management consulting services	Yes	No	No	n/a
30	Procurement services	83116 – Supply chain and other management consulting services	Yes	No	No	n/a
		85999 – Other support services n.e.c.	Yes	No	No	n/a
31	Utilities (electricity, gas and water supply)	691 – Electricity and gas distribution (on own account)	No	No	Yes, not possible to supply in-house	n/a
		692 – Water distribution (on own account)	No	No	Yes, not possible to supply in-house	n/a
32	Engineering services during operations	83310 – Engineering advisory services	Yes	No	No	n/a
		83326 – Engineering services for waste management projects (hazardous and non-hazardous)	Yes	No	No	n/a
		83327 – Engineering services for water, sewerage and drainage projects	Yes	No	No	n/a
33	Testing services for quality control and assurance	8344 – Technical testing and analysis services	Yes	No	No	n/a
34	By-product collection services	942 – Waste collection services	No	No	Yes, required by laws and regulations	n/a
35	Information technology (IT) services for on-site and remote monitoring of plant	8315 – Hosting and information technology (IT) infrastructure provisioning services	Yes	No	No	n/a

		8316 – IT infrastructure and network management services	Yes	No	No	n/a
36	Telephone-based support services	85931 – Telephone call centre services	Yes	No	No	n/a
37	Diagnostic, inspection, maintenance and repair of equipment	87156 – Maintenance and repair services of commercial and industrial machinery	Yes	No	No	n/a
38	Training services for workers	9291 – Other education and training services	Yes	No	No	n/a
39	Research and development services for continuous upgrading	81112 – Research and experimental development services in chemistry and biology	Yes	No	No	n/a

Table A.5. Business processes (Back-office support)

Service	Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers and reasons	Bundled	
40	Company registration and licensing services (obtaining permit to operate)	91138 – Public administrative services related to general economic, commercial and labour affairs	No	No	Yes, government services	n/a
41	Headquarter services	83118 – Head office services	No	Yes, economies of scale	No	n/a
42	Management services	83111 – Strategic management consulting services	Yes	Yes, economies of scale	No	n/a
43	Accounting, auditing and bookkeeping services	82210 – Financial auditing services	Yes	No	Yes, required by laws and regulations	n/a
		8222 – Accounting and bookkeeping services	Yes	No	No	n/a
44	Sales and marketing services	83612 – Direct marketing and direct mail services	Yes	No	No	n/a
		8596 – Convention and trade show assistance and organization services	No	No	Yes, lack of expertise	n/a
		8370 – Market research and public opinion polling services	Yes	No	No	n/a
		8311 – Management consulting and management services	No	No	Yes, lack of expertise	n/a
45	Financial services	7112 – Deposit services	No	No	Yes, not possible to supply in-house	n/a
		7113 – Credit granting services	No	No	Yes, not possible to supply in-house	n/a

		71512 – Corporate finance and venture capital services	No	No	Yes, not possible to supply in-house	n/a
		71591 – Financial consultancy services	No	No	Yes, not possible to supply in-house	n/a
		71592 – Foreign exchange services	No	No	Yes, not possible to supply in-house	n/a
		83112 – Financial management consulting services	No	No	Yes, not possible to supply in-house	n/a
46	Legal services	82120 – Legal advisory and representation services concerning other fields of law	No	No	Yes, lack of expertise	n/a
		82130 – Legal documentation and certification services	No	No	Yes, lack of expertise	n/a
		82191 – Arbitration and conciliation services	No	No	Yes, lack of expertise	n/a
		8396 – Trademark and franchises	No	No	Yes, lack of expertise	n/a
47	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	No	No	Yes, not possible to supply in-house	n/a
		7132 – Accident and health insurance services	No	No	Yes, not possible to supply in-house	n/a
		71334 – Other property insurance services	No	No	Yes, not possible to supply in-house	n/a
		71335 – General liability insurance services	No	No	Yes, not possible to supply in-house	n/a
48	Social insurance for staff	91320 – Administrative services related to government employee pension schemes; old-age disability or survivors'	Yes	No	No	n/a

Services in Global Value Chains: Manufacturing Related Services

		benefit schemes, other than for government employees				
		91330 – Administrative services related to unemployment compensation benefit schemes	Yes	No	No	n/a
49	Corporate communications and public relationship	83121 – Public relations services	Yes	Yes, economies of scale	No	n/a
50	Human resources management	8511 – Personnel search and referral services	Yes	No	Yes, network economies	n/a
		83113 – Human resources management consulting services	No	No	Yes, lack of expertise	n/a
51	Information technology services	83132 – IT support services	Yes	No	Yes, efficiency; lack of expertise	n/a
		83151 – Website hosting services	No	No	Yes, efficiency; lack of expertise	n/a
52	Telecommunication services	841 – Telephony and other telecommunications services	No	No	Yes, not possible to supply in-house	n/a
		8422 – Internet access services	No	No	Yes, not possible to supply in-house	n/a
53	Security services	85230 – Security systems services	No	No	Yes, lack of expertise	n/a
		85250 – Guard services	No	No	Yes, lack of expertise	n/a
54	Cleaning services	853 – Cleaning services	No	No	Yes, lack of expertise	n/a

Source: Compiled by APEC Policy Support Unit

Appendix B

Policies affecting services in the value chain

Government policies/services	Authority(ies) in charge	Details	How the policy affects services in the value chain
Environmental laws and regulations	Pollution Control Department of Thailand (PCD)	Weak enforcement of environmental laws and regulations which are strict on paper	It results in the firm competing only from the cost perspective and not on the environmental-friendliness of its offerings. It may also influence the firm's investment plans
Environmental, health and safety (EHS) inspection	Pollution Control Department of Thailand (PCD)	Low awareness of technology related to wastewater treatment among regulators	It results in inspection visits which are more of a cost than a benefit, considering the time and effort needed to prepare for the visit
Intellectual Property (IP) regime	Department of Intellectual Property of Thailand (DIP) The Central Intellectual Property and International Trade Court (CIPITC)	Absence of strong IP regime despite significant improvements recently	Firm is reluctant to transfer technology and knowledge to its local operations for fear that former staff will share its proprietary technology with competitors. This also hampers the involvement of local staff in tasks requiring higher technical expertise
Movement of natural persons	Various ASEAN economies	They limit stays by firms' foreign engineers and staff. There is also a requirement mooted for a proficiency test in the local language	Certain restrictions may limit the number of days that engineers can stay in the economy and hence affect the quality of services provided. Firms also become more cautious when about increasing foreign direct investments because the role of foreign staff in ensuring the success of operations is very important

<p>Local third-party logistics firms</p>	<p>Thailand Ministry of Transport Thailand Ministry of Industry</p>	<p>Foreign Business Act B.E. 2542 (1999) restricts foreigners' participation in controlled industries such as transport/logistics.</p>	<p>Firm has to engage the services of local third-party logistics firms to transport imported equipment and chemicals as well as to collect oil by-products produced by its treatment process. Restrictions on participation in the logistics industry restrict choice and raises costs.</p> <p>In addition, the firm is worried about identifying unreliable logistics firms which may dispose wastewater illegally, potentially causing the firm and its clients to face reputational risk.</p>

Source: Compiled by APEC Policy Support Unit

References

- AFP (2014). “Thailand totters towards waste crisis.” *The Bangkok Post*, September 1, 2014, accessed April 9, 2015.
<http://www.bangkokpost.com/news/local/429877/thailand-totters-towards-waste-crisis>
- “General Restrictions on Foreign Participation, the Foreign Business Act.” Business Information Centre, Royal Thai Embassy, accessed April 9, 2015.
<http://bic.thaiembassy.sg/node/104>
- International Intellectual Property Alliance (IIPA) (2014). “Appendix C: Chart of Countries’ Special 301 Placement (1989-2013) and IIPA 2014 Special 301 Recommendations.” Washington, D.C.: IIPA, February 2014.
<http://www.iipa.com/pdf/2014SPEC301HISTORICALCHART.pdf>
- OECD Services Trade Restrictiveness Index, accessed April 9, 2015,
<http://www.oecd.org/tad/services-trade/services-trade-restrictiveness-index.htm>
- Parlina, I. (2015). “Minister prepares language proficiency test.” *The Jakarta Post*, March 5, 2015, accessed April 9, 2015.
<http://www.thejakartapost.com/news/2015/03/05/minister-prepares-language-proficiency-test.html>
- Pongrai, J. (2014). “Praksa fire leads to calls for nationwide dumpsite controls.” *The Nation*, April 2, 2014, accessed April 9, 2015.
<http://www.nationmultimedia.com/national/Praksa-fire-leads-to-calls-for-nationwide-dumpsite-30230655.html>
- Royan, F. (2012). “Sustainable Water Treatment Technologies in the 2020 Global Water Market.” Mountain View: Frost & Sullivan, May 2012.
<http://www.forburyinvest.com/fileuploads/Frost%20&%20Sullivan.pdf>
- “Special 301.” Office of the United States Trade Representative, accessed April 9, 2015. <https://ustr.gov/issue-areas/intellectual-property/Special-301>
- Thailand Central Intellectual Property and International Trade Court, accessed April 9, 2015, <http://www.ipitc.coj.go.th/?co=en>
- Thailand Department of Intellectual Property, accessed April 9, 2015,
<http://www.ipthailand.go.th/en/>
- Thailand Pollution Control Department, accessed April 9, 2015,
<http://www.pcd.go.th/indexEng.cfm>
- UN Water (2015). *The United Nations World Water Development Report 2015 – Water For A Sustainable World*. Paris: UNESCO.
<http://unesdoc.unesco.org/images/0023/002318/231823E.pdf>