

## Chapter 8

# Manufacturing of Oil and Gas Industry Equipment in Singapore

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### 8.1. Industry Overview

Energy consumption is projected to increase by 41 percent between 2012 and 2035 (BP, 2014) which means that the oil & gas industry will retain the importance it has held since machines were invented. The Asia Pacific will contribute to meeting this increased demand; its share of global energy production over the same period is estimated to increase to 47 percent. For the oil & gas industry as a whole, compound annual growth is forecasted to be around 6 percent between 2014 and 2017 (GE, 2014).

The oil & gas industry can generally be divided into 3 stages, each requiring specialized equipment and infrastructure (see Figure 8.1). The upstream stage covers the exploration and production of crude oil & gas from both onshore and offshore fields. Firms in the midstream stage then collect the crude oil & gas prior to processing, storing, transporting and distributing the products as feedstock to the petrochemical plants and refineries. Following further processing and refining, downstream firms market and distribute the end product to the gas stations as well as final consumers.

**Figure 8.1. Simplified oil & gas value chain**



Within the upstream stage of the oil & gas industry, subsea<sup>2</sup> appears to be the segment with most promising growth prospects; the capital expenditure for subsea systems is forecasted to increase by about 9 percent annually between 2014 and 2017 (GE, 2014). Oil & gas exploration firms now have to look for resources in more remote and harsher environments to meet global energy demand. Over the last decade, more than half of the main discoveries have been offshore and in the past five years, more than half of these discoveries have been in deep water. In fact, approximately half of the production of international oil companies now comes from deepwater reserves (GE, 2014).

The needs of the oil & gas industry are continuously evolving in line with newer technologies, and manufacturers of equipment used for activities such as exploration and extraction are reacting to the changing needs through various strategies. Firstly, manufacturers have moved to modularization and standardization as opposed to customization so that they are able to provide equipment that is capital-efficient to their customers. Secondly, manufacturers have incorporated remote monitoring technology in their equipment, which together with their service agreements, will ensure full lifecycle productivity of the equipment supplied to their customers. Moreover, manufacturers have to regularly extend the physical boundaries that their equipment can operate in such as newer depths and newer parameters of pressure requirements.

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<sup>2</sup> Subsea systems are equipment used to explore, drill and develop oil & gas fields in underwater locations.

## 8.2. Background Information of Firm<sup>3</sup>

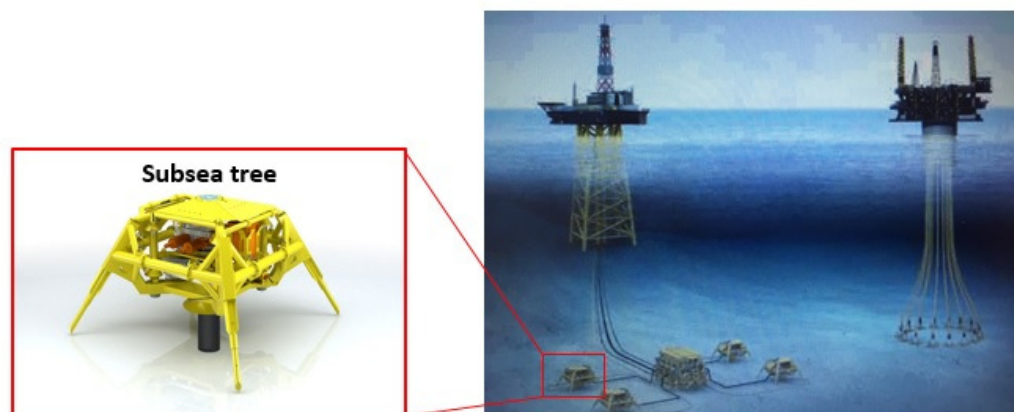
The firm represented in this case study has operations across six continents. The equipment that it supplies to the oil & gas industry can be used in upstream applications as well as downstream processing plants.

Besides selling products, the firm has a business focusing on services. It has over 40 service centers and workshops in many of the world's main oil & gas extraction and production regions. Specifically, it provides upgrades as well as maintenance and repair services to customers' equipment so as to extend their production capability and performance.

## 8.3. Description of the Value Chain

This case study will focus on the firm's Singapore facility, which is one of its main manufacturing and services facilities of products for subsea systems such as subsea trees, controls and wellheads. For tractability, this case study focuses on one product - subsea trees - whose primary function is to control and monitor the flow of oil & gas out of the well. These products are usually built on the sea floor and constitute part of an entire underwater/sea bed production system (see Figure 8.2). The technology system includes other products or structures like manifolds and workover systems, hydraulic power units, subsea compression system, riser base, tie-in and connection systems, hydraulic power units, and others. The technology system's function is to extract oil or gas.

**Figure 8.2. Overview of subsea systems and the position of subsea trees within the system**



Source: Courtesy of the firm

While the intent of the case study is to focus on a single product, the same value chain or process described in what follows applies to other products of the subsea systems such as wellheads and in fact, likewise, to surface systems. Differences are usually in the specifications and life-cycle of the products, since they operate under variable environments such as different pressure and temperature.

For the purpose of this case study, the value chain begins with a Request for Quotation (RFQ) from the customer and ends with the provision of after-sales services to the customer (see Figure 8.3).

<sup>3</sup> All information about the firm in this case study is from its corporate website as well as from the interview.

Figure 8.3. Dimension of the value chain covered by case study



Note: Optional activities in the value chain are indicated by green boxes. Source: APEC Policy Support Unit based on firm interview

### ***From customer specification to product engineering and design***

In the RFQ, the customer lists the requirements that the product(s), such as the ability to withstand a certain temperature range, water pressure, depth, etc. The firm then works with its design and engineering departments as well as its sales team to provide the best possible quote for the RFQ.

The firm's strategy in responding to the RFQ could be simply summarized as standardization first, customization later. Specifically, the firm makes use of its design and engineering departments to determine whether its existing product range can meet the requirements. If not, the firm has to work out how customized products could be manufactured to meet them. Customized products are often needed because either the customer wants exact duplicates of existing assets which they can store and use interchangeably, or the environment in which the products operate is distinct from other situations where the existing range of available products can be used.

The quotation/sales department works in parallel to identify the most cost-competitive way of manufacturing the products. This involves exploring where the most competitively priced inputs could be sourced and to whom certain manufacturing processes could be outsourced. However, it should be noted that while the firm has a wide range of options for minimizing cost, it may be constrained by a customer's requirements that some inputs and processes are (or are not) sourced from certain locations. This could be for various reasons, including previous experience with specific suppliers, or close supplier relationships.

### ***Manufacturing: critical role of industry standards***

The manufacturing process for each subsea tree is generally similar although the specifics, such as resistance to varying degrees of underwater pressure or temperature, may differ among projects. The design and engineering departments would look at the agreed blueprint and finalize it (incorporate additional specs from the customer, if necessary). The relevant department verifies the different inputs as well as processes needed to manufacture the product, which would then be sourced from various channels. The role of its material management team is critical to ensure that all inputs and processes adhere to the contract requirements such as local content, sourcing of inputs from specific suppliers, etc. Depending on the source of inputs, brokerage and customs clearance services would also be needed. For an advanced technology product such as a subsea tree, most of the expensive material inputs are specially engineered products which are either produced in-house or by an affiliate, or outsourced to third party suppliers. It is worth noting that these engineered materials themselves contain significant services value which is not tracked in this study.

The firm noted that in-house activities can only be carried out after the necessary equipment is reserved in advance via the internal shop ordering service. Prototyping may also be required under certain contracts.

Crucial to the manufacturing process is the role of third-party inspectors, who must be present at various stages of the manufacturing process to inspect the equipment and products as well as sign off that the process has adhered to stipulated regulations. A schedule indicating the various manufacturing stages is agreed between the firm and the customer in the presence of inspectors and listed clearly in the signed contract. The inspection is carried out by a third-party, and is either sourced by the firm or by the customer. The inspection may be carried out at the firm's premises or at the suppliers' premises.

The presence of third-party inspectors is a norm agreed by industry players who are members of the American Petroleum Institute (API)<sup>4</sup> to ensure that products will be able to perform reliably in a challenging environment, as well as adhere to health, safety, and environment standards. It is worth

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<sup>4</sup> The American Petroleum Institute is the largest US trade association for the oil & natural gas industry. Among its important functions is the establishment and certification of industry and technical standards.

noting that the oil & gas industry is a highly regulated industry because of the potential risks it poses, particularly for the environment.

Final products are tested in-house. The more challenging the operating environment, the more stringent the requirements are in terms of materials and testing.

### *Post-manufacturing (packing, warehousing, logistics and commissioning)*

Products are packed and stored in a warehouse before they are delivered to customers. The mode of delivery depends on the customer's preference. Customers can collect the product from the factory or the firm delivers to an agreed location. In the latter case, the contract may entail installation services. This could involve installation or the supervision of installation and is an additional source of revenue. The provision of these commissioning services avoids a blame game that may occur if a third party is contracted to undertake installation, and is especially important if the product is still under warranty.

### *After-sales services*

Maintenance and repair services are provided by the firm and are usually provided for between 5 to 20 years, depending on the contractual services agreements which is tailored to suit the needs of customers. Post-sales services agreements may include parts supply; customer property management by fielding service and resident engineers; routine, planned and unplanned maintenance; logistics; and inventory management. More recently, the firm has also been able to remotely access data pertaining to installed products, allowing for round-the-clock monitoring and support to ensure full lifecycle productivity.

In order to ensure quick turn-around and minimize losses caused by breakdowns, the firm has established service facilities close to where its customers are located. Localization shortens transport times and avoids customs and immigration procedures that are commonly associated with crossing borders. Services agreements also sometimes include training services for staff of the customers.

Firm indicates that as original equipment manufacturer (OEM), its after-sales business has been growing since investigation of the Deepwater Horizon accident in the Gulf of Mexico in 2010<sup>5</sup> revealed that layers of subcontracting could have caused the incident. Although exact figures are not provided, publicly-available data of the firm showed that the oil & gas subsidiary contributed to the increase in the sales of product services<sup>6</sup> for the corporations as a whole.

## **8.4. Services along the Value Chain**

### *Services identification and value contribution*

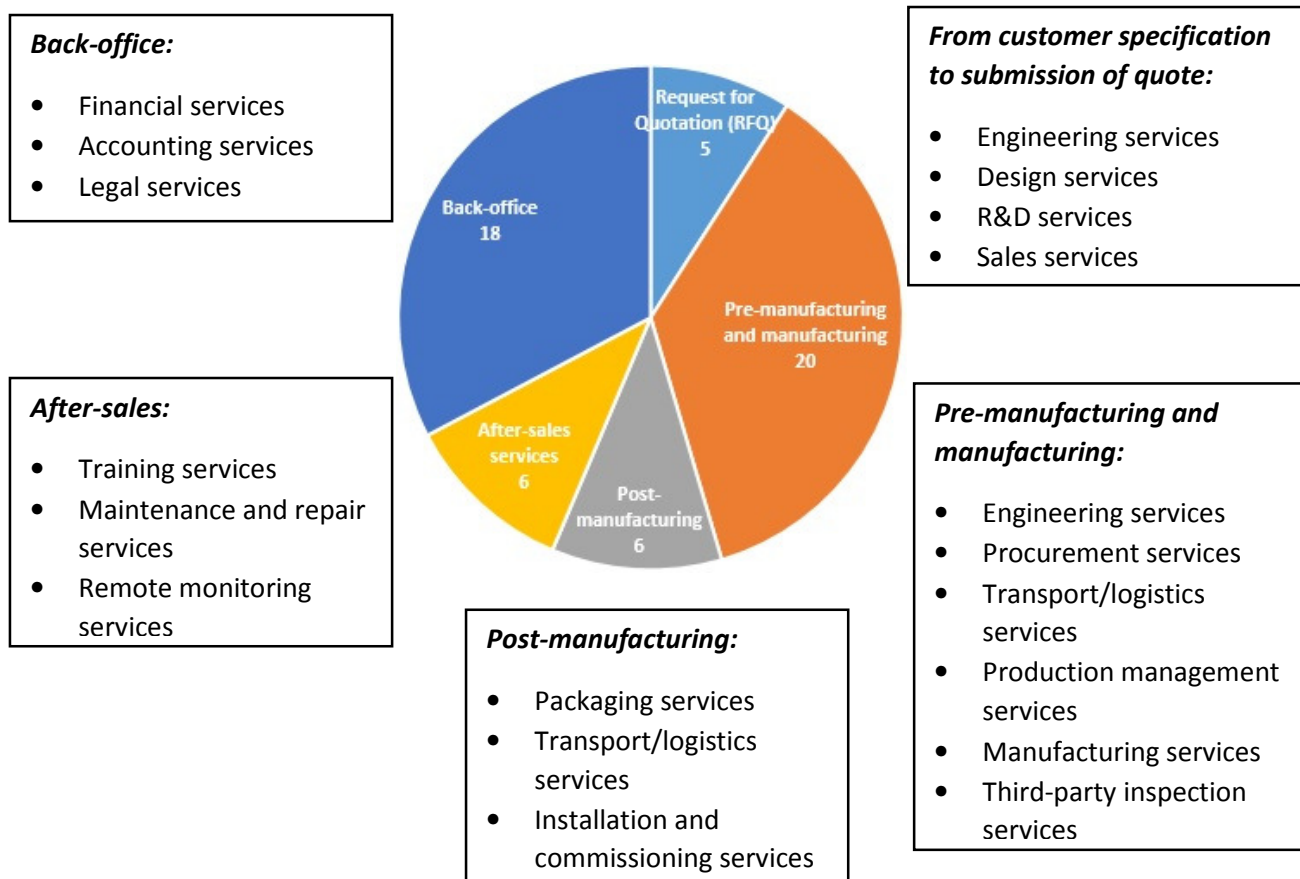
A total of 55 services are identified in this value chain and they have been grouped according to the various stages within the chain: i) services in responding to Request for Quotation (RFQ) from customer, ii) services during pre-manufacturing and manufacturing; iii) post-manufacturing services, iv) after-sales services, and v) back-office services (see Figure 8.4).

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<sup>5</sup> <http://www.theguardian.com/environment/2010/jul/18/deepwater-horizon-blow-out-preventer-china> and <http://www.telegraph.co.uk/finance/newsbysector/energy/oilandgas/10345677/BP-failed-to-plan-for-Deepwater-Horizon-disaster.html>.

<sup>6</sup> The firm defines sales of product services as sales under product services agreements and sales of both goods (such as spare parts and equipment upgrades) and related services (such as monitoring, maintenance and repairs).

**Figure 8.4. Breakdown of services by stage and examples of key services**



Source: Compiled by APEC Policy Support Unit

The 55 services can be further disaggregated into at least 94 services if one is to count individually the sub-services that made up a single services activity<sup>7</sup>. While we have limited specific information on which services inputs are the most important in terms of added value, it can be surmised that engineering and design services are among these. Engineering services, in particular, are required in the design and manufacturing stages (including quality control), as well as in the after-sales phase. The large number of services entering the value chain of subsea tree production validates the view that services are ubiquitous, even in the case of firms that are putatively manufacturing enterprises.

While the services contribution is not easily quantified, it is surely considerable. If data were available for the cost of material and manufacturing-specific labour involved in subsea tree production, we could assume that the remaining portion of what is considered ‘production’ cost can, in fact, be attributed to the various services identified in Tables 8.1.1-8.1.5 and Figure 8.4.

The cost of material inputs is likely to be high in this industry because many of them are engineered materials. However, if one considers that these high-value material inputs have themselves a large component of services value-added, the total services contribution in subsea tree production is magnified. Another difficulty in estimating the services contribution in a particular product is that expenditures on research and development - a service activity, though significant, is difficult to attribute to specific product lines. The firm’s parent company has a strong research and development services

<sup>7</sup> For instance, utilities can be separated into water as well as electricity and gas distribution while legal services can be broken down into legal advisory and representation services, legal documentation and certification services as well as arbitration and conciliation services. Transport/shipping services of raw materials and products can also be broken down into land, water and air transport.

range, from materials research (such as identifying new types of coating that will allow the materials to be resistant to extreme conditions) to other types of basic research which may not (yet) have any immediate application in the oil & gas industry.

Significantly, among the 600 employees in the firm's Singapore facility, two-thirds are involved in the provision of the identified services in Figure 8.4 and Tables 8.1.1-8.1.5 below. Only one-third are in manufacturing positions and this includes supervisors, managers and engineers who provide management and production planning services. Therefore, 'services employees' may well make up more than two-thirds of the facility's total employees.

Looking ahead, the share of services in value addition is likely to remain significant because the firm's long-term operating results depend substantially on its ability to: 1) continually develop, introduce, and market new and innovative products and services; 2) modify existing products and services; 3) customize products and services; and 4) respond to technological change. Many of these functions require services at their core, or are at least heavily reliant on services.

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

Among the 94 services categories identified in this value chain, our analysis estimates 38 services are supplied in-house, 11 are partially outsourced, while 45 are fully outsourced (see Tables 8.1.1-8.1.5).

The reasons for the firm to outsource services vary, but can broadly be grouped into the following: i) government services, such as company licensing, visa and immigration services and inspections pertaining to environmental, health and safety (EHS); ii) services required by laws and regulations, such as the submission of RFQ by local sales agents in partnership or joint ventures with the firm, manufacturing training for staff for professional certification, and third-party inspection services provided by inspectors certified by the American Petroleum Institute (API); iii) a lack of expertise or specialization in-house to provide certain services, such as consulting services, legal services, medical services, catering services and cleaning services; iv) the need to access to the best services, such as market research services and certain types of manufacturing services including basic metal and fabrication services; v) a lack of feasibility in supplying services in-house, such as freight insurance and utilities services; vi) economies of scale, such as transport services; vii) network economies, such as recruitment services; viii) the need for strong relationships with government agencies, such as customs clearance services.

Services provided in-house are generally those that can be considered as core services such as project-specific design and engineering services, procurement and quotation services, prototyping services, production management, quality control and assurance services, installation and commissioning services, remote monitoring services, and maintenance and repair services. These services are provided in-house because they either involve proprietary technology or are essential to the quality of products. Other non-core services such as packaging services, and storage and warehousing services, are also provided in-house because these are continuing, repeated services for which the firm has established the requisite infrastructure to ensure low-cost provision.

Interestingly, the firm does not always base outsourcing decisions on its own assessment of who are the best suppliers because customers sometimes specify their own specific preferred suppliers. This may be result of a customer's own previous experience with a supplier, or its strong relationship with the supplier. Some SMEs are among the firm's suppliers. Often, however, SMEs find it very costly to upgrade their processes and own equipment for products that need to satisfy the exacting standards demanded by the oil & gas industry.<sup>8</sup>

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<sup>8</sup> For example, API has standards for manufactured products such as: precision thread gauges, plain plug and ring gauges, thread measuring systems, metrology and industrial supplies, measuring instruments, custom gauges, precision machining and grinding.

Outsourcing decisions may also be motivated by the need to satisfy local content requirements, particularly if the customer is a state-owned-enterprise.

Activities such as specialized coating, threading and painting are usually outsourced to different external parties because some may involve proprietary technology and the firm does not have the equipment to do them in-house, or it is more cost-efficient to outsource to external parties.

Regarding bundled services, several examples can be found in the value chain. One example pertains to the high-value/engineered inputs purchased by the firm. While the firm views the price it paid as the material cost of these inputs, this price actually has a certain percentage of services inputs embedded in its value, such as the underlying research & development and engineering services carried out by the suppliers in order to produce these inputs.

Another example is the bundling of transport services together with manufacturing processes that are outsourced. Providers of processes (such as machining, welding, coating, etc.) also take care of transportation and logistics to move products from one location to another for further processing. In other words, the price paid by the firm to these suppliers has the cost of transportation and other services imbedded in it. Indeed, bundling can be observed in transport services as well, where the package offered by third-party providers typically includes the driver, insurance, loading of goods at the warehouse, customs clearance and the delivery of goods to customers.

Other examples of bundled services include catering services, where the caterer presumably takes care of recruiting workers and training them, as well as transporting food from the central kitchen to the firm's facility. It is also highly likely that the same bank and insurance firm provide in a single bundle the whole range of financial and insurance services needed by the firm.



**Table 8.1.1. Services in responding to Request for Quotation (RFQ) from customer**

Service		Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers/ and reasons	Bundled
1	Project-specific research and development services to support quotation	8111 – Research and experimental development services in natural sciences	Yes	No	No	n/a
		8112 – Research and experimental development services in engineering and technology	Yes	No	No	n/a
2	Project-specific design services to support quotation	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
3	Project-specific engineering services to support quotation	83310 – Engineering advisory services	Yes	No	No	n/a
		8332 – Engineering services for specific projects	Yes	No	No	n/a
4	Procurement and quotation 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
5	Sales and marketing services	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	No	No	Yes, lack of expertise; need to access the best services	n/a
		8311 – Management consulting and management services (may include customer relationship management)	Yes	No	Yes, lack of expertise; need to access the best services	

Source: Authors' own understanding of firm's value chain

**Table 8.1.2. Services during pre-manufacturing and manufacturing process**

Service		Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers/ government and reasons	Bundled
6	Project-specific research and development services prior to manufacturing	8111 – Research and experimental development services in natural sciences	Yes	No	No	n/a
		8112 – Research and experimental development services in engineering and technology	Yes	No	No	n/a
7	Project-specific design services prior to manufacturing	8314 – Information technology design and development services	Yes	No	Yes, lack of expertise; need to access the best services	n/a
		83920 – Design originals	Yes	No	No	n/a
		83912 – Industrial design services	Yes	No	No	n/a
8	Project-specific engineering services prior and during manufacturing	83310 – Engineering advisory services	Yes	No	No	n/a
		8332 – Engineering services for specific projects	Yes	No	No	n/a
9	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	No	No	Yes, government services	n/a
		91290 – Public administrative services related to other public order and safety affairs	No	No	Yes, government services	n/a
10	Prototyping services	887 – Fabricated metal product, machinery and equipment manufacturing services	Yes	No	No	n/a
11	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
12	Training services for staffs	92919 – Other education and training services, n.e.c.	Yes	No	Yes, professional certification may be	n/a

					required by laws and regulations	
13	Transport services of raw materials	651 – Land transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
		652 – Water transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
		6531 – Air transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
		67910 – Freight transport agency services and other freight transport services	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
14	Freight insurance of raw materials	71333 – Freight insurance services	No	No	Yes, not possible to supply in-house	Bundled with transport, driver, repair and insurance

15	Customs clearance services and logistics of raw materials	67110 – Container handling services	No	No	Yes, efficiency; strong relationship with government agencies	Bundled with transport, driver, repair and insurance
		85999 – Other support services n.e.c.	No	No	Yes, efficiency; strong relationship with government agencies	Bundled with transport, driver, repair and insurance
16	Storage and warehousing services of raw materials	67290 – Other storage and warehousing services	Yes	No	No	n/a
17	Technical testing of raw materials	83441 – Composition and purity testing and analysis services	Yes	No	Yes, required by laws and regulations	n/a
18	Production administration – Production management and shop ordering services	83115 – Operations management consulting services	Yes	No	No	n/a
19	Maintenance and repair of production equipment	87156 – Maintenance and repair services of commercial and industrial machinery	Yes	No	Yes, lack of expertise; by machine vendor	n/a
20	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
21	Manufacturing services provided in-house and by suppliers of activities such as welding, coating, etc.	886 – Basic metal manufacturing services	No	No	Yes, efficiency; need to access the best services	Bundled with transport, driver, repair and insurance

		887 – Fabricated metal product, machinery and equipment manufacturing services	No	No	Yes, efficiency; need to access the best services	Bundled with transport, driver, repair and insurance
22	Testing services for quality control and assurance	8344 – Technical testing and analysis services	Yes	No	No	n/a
23	Third-party inspection services	990 – Services provided by extraterritorial organizations and bodies	No	No	Yes, required by laws and regulations	n/a
24	Product testing to obtain certification at export market	8344 – Technical testing and analysis services	No	No	Yes, required by laws and regulations	n/a
25	Sewage and waste treatment and collection services	94 – Sewage and waste collection, treatment and disposal and other environmental protection services	No	No	Yes, efficiency; not possible to supply in-house	n/a

Source: Authors' own understanding of firm's value chain

**Table 8.1.3. Post-manufacturing services**

Service		Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers and reasons	Bundled
26	Packaging services	83919 – Other specialty design services	Yes	No	No	n/a
		85400 – Packaging services	Yes	No	No	n/a
27	Storage and warehousing services of products	67290 – Other storage and warehousing services	Yes	No	No	n/a
28	Transport services of products	651 – Land transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
		652 – Water transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
		6531 – Air transport services of freight	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
		67910 – Freight transport agency services and other freight transport services	No	No	Yes, efficiency; economies of scale	Bundled with transport, driver, repair and insurance
29	Freight insurance	71333 – Freight insurance services	No	No	Yes, not possible to supply in-house	Bundled with transport, driver, repair

						and insurance
30	Installation services for equipment and related wiring	5461 – Electrical installation services	Yes	No	No	n/a
		873 – Installation services (other than construction)	Yes	No	No	n/a
31	Certification and commissioning services of equipment	8344 – Technical testing and analysis services	Yes	No	No	n/a

*Source: Authors' own understanding of firm's value chain*

**Table 8.1.4. After-sales services**

Service		Corresponding CPC Ver. 2 Code	Supplied in-house	Outsourced to affiliated companies and reasons	Outsourced to third-party suppliers and reasons	Bundled
32	Training services for workers of customers	9291 – Other education and training services	Yes	No	No	n/a
33	Maintenance and repair services	87156 – Maintenance and repair services of commercial and industrial machinery	Yes	No	No	n/a
34	Telephone-based support services	85931 – Telephone call centre services	Yes	No	No	n/a
35	Information technology (IT) services for on-site and remote monitoring of equipment	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	Travel services for engineers and other staffs pertaining to after-sales services	8551 – Reservation services for transportation	No	No	Yes, lack of expertise	n/a
		85521 – Reservation services for accommodation	No	No	Yes, lack of expertise	n/a
37	Visa and immigration services for staffs	91290 – Public administrative services related to other public order and safety affairs	No	No	Yes, government services	n/a

Source: Authors' own understanding of firm's value chain



**Table 8.1.5. 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
38	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
39	Headquarter services	83118 – Head office services	No	Yes, economies of scale	No	n/a
40	Management services	83111 – Strategic management consulting services	Yes	Yes, economies of scale	No	n/a
41	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
42	Financial services	7113 – Credit granting services	No	Yes, economies of scale; not possible to supply in-house	Yes, economies of scale; not possible to supply in-house	n/a
		71512 – Corporate finance and venture capital services	Yes	No	Yes, not possible to supply in-house	n/a
43	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
44	Insurance services (commercial life and accident/health insurance, property insurance for the	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

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	factory compound, product quality insurance, management liability insurance)	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
45	Social insurance for staffs	91320 – Administrative services related to government employee pension schemes; old-age disability or survivors’ benefit schemes, other than for government employees	Yes	No	No	n/a
		91330 – Administrative services related to unemployment compensation benefit schemes	Yes	No	No	n/a
46	Corporate communications and public relationship	83121 – Public relations services	Yes	Yes, economies of scale	No	n/a
47	Human resources management	8511 – Personnel search and referral services	Yes	No	Yes, network economies	n/a
		8512 – Labour supply services	No	No	Yes, network economies	n/a
		83113 – Human resources management consulting services	Yes	No	Yes, lack of expertise	n/a
48	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
49	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
50	Transport services for staffs	641 – Local transport and sightseeing transportation services of passengers	No	No	Yes, efficiency; not possible to supply in-house	n/a
51	Property management services	72212 – Non-residential property management services on a fee or contract basis	No	No	Yes, efficiency; lack of expertise	n/a

52	Medical services	93121 – General medical services	No	No	Yes, lack of expertise	n/a
53	Catering services	63393 – Other contract food services	No	No	Yes, lack of expertise	n/a
54	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
55	Cleaning services	853 – Cleaning services	No	No	Yes, lack of expertise	n/a

*Source: Authors' own understanding of firm's value chain*

## 8.5. Policies Affecting the Value Chain

An important component of this study is the analysis of how policies, both government and private, impact the value chain discussed here, and hopefully, identify areas of improvements (see Appendix A). This firm faces few policy challenges, for example, in trade policy (customs and logistics) and even in labour policies. This is due to the fact that it is located in Singapore which has consistently ranked very high in its business environment quality. But importantly, part of the reasons why it does not face major policy problems is that it is large, it is a subsidiary of a major multinational firm, and possesses the necessary capacity to comply with regulations.

### *Government incentives*

The Singapore Government has always been proactive in providing assistance to the private sector to ensure that businesses remain competitive in the global economy. It gives tax incentives for productivity-enhancing investments in activities such as: i) training of employees; ii) purchase/leasing of specific information technology (IT) and automation equipment; iii) acquisition/licensing of intellectual property; iv) registration of intellectual property; v) research & development; and vi) approved design projects.

The Government also alleviates the rising business costs to firms in the last few years by providing a corporate income tax rebate<sup>9</sup> or by co-funding 40 percent of wage increases given to Singaporean employees earning a gross monthly wage of S\$ 4,000 and below over the period 2013 to 2015<sup>10</sup>. This policy is intended to give businesses more time to adjust to the tight labour market and concurrently, free up resources to undertake productivity investment activities.

### *International labour mobility and equity ownership*

While the government provides incentives to firms to improve productivity, its labour policies result in rising costs to businesses. One such measure is the maximum number of foreign workers that a firm can hire, depending on the sector<sup>11</sup>. For the manufacturing sector, the quota for foreign workers is set at 60 percent, which means that a firm is only allowed to hire up to 1.5 foreign workers for every local full time employee that it employs. Once a firm has reached its quota for foreign workers, it has to employ more local workers before being allowed to hire more foreign workers. Not only does this measure raise the manpower costs of businesses, manufacturing firms also face the problem of meeting their target output and deadlines due to the shortage of manpower.

Through its Fair Consideration Framework (FCF), the Government has also mandated that firms hiring foreigners as Professionals, Managers and Executives (PMEs) after 1 August 2014 need to consider local candidates fairly prior to submitting new Employment Pass (EP) applications to the Ministry of Manpower (MOM). Firms now need to advertise job vacancies on a new jobs data bank administered by the Singapore Workforce Development Agency (WDA) for at least 14 calendar days before making an EP application<sup>12</sup>. This measure lengthens firms' hiring processes and can potentially lead to firms losing ideal candidates for the position because of their nationalities.

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<sup>9</sup> More information about the Corporate Income Tax Rebate can be obtained at:  
<http://www.iras.gov.sg/irasHome/page04.aspx?id=14564>

<sup>10</sup> More information about the Wage Credit Scheme (WCS) can be obtained at:  
<http://www.iras.gov.sg/irashome/WCS.aspx>. Both measures have been extended by two more years (i.e up to 2017) in the recent Budget 2015 announcement although at a lower rate or cap

<sup>11</sup> More information about the quota for foreign workers can be obtained at:  
[http://www.mom.gov.sg/Documents/services-forms/passses/Guidelines\\_on\\_Levy\\_Bill\\_Computation.pdf](http://www.mom.gov.sg/Documents/services-forms/passses/Guidelines_on_Levy_Bill_Computation.pdf)

<sup>12</sup> More information about the Fair Consideration Framework (FCF) can be obtained at:  
<http://www.mom.gov.sg/newsroom/Pages/PressReleasesDetail.aspx?listid=523>

## **Travel outside Singapore**

The firm's after-sales services such as installation services, commissioning services, repairs and maintenance, and training services make up a significant share of the firm's business. To provide this service to customers, the firm needs its staff, particularly engineers, to travel seamlessly from one location to another. However, the firm often encounters challenges in obtaining visas, resulting in situations where the most qualified staff are unable to provide the requisite services. Some economies also restrict the number of days that foreign professionals can go offshore where many of the oil & gas extraction facilities are located. In addition, foreign professionals are subjected to withholding tax if they stay in some economies beyond a certain number of days. To address this, as well as to provide more rapid service, the firm has established local service facilities in close proximity to its customers.

## **Investment restrictions**

In the area of investment, several economies appear to have restrictions on foreign ownership, particularly when it is a service industry. The firm gave an example of an economy which requires the local subsidiary providing after-sales services to its state-owned enterprises to be majority owned by locals, which sometimes complicates decision-making by management.

## ***Local content requirements***

On the manufacturing side, local content requirements feature in several projects, particularly when they bear some relation to the government or a state-owned enterprise. These requirements increase operational costs since the firm has to track the procurement of inputs by source in order to ensure compliance with local content requirements. In addition, local suppliers may not necessarily be the ones giving the most competitive quotes or providing the best service. Despite this, the additional cost is not such a heavy burden because the firm can always pass on the additional cost to the customer. The more difficult part in complying with local content requirements is the absence of local capacities, the lack of local suppliers who can meet the stringent criteria and standards of the firm and industry.

Related to the issue of local content is the regulations in certain jurisdictions which requires a firm to partner with a local agent if it wants to respond to a Request for Quotation (RFQ). Depending on the local market, this requirement may lead to an increase in the firm's costs, which have to be passed on in the final quote for the products, potentially making its price bid less competitive. However, in some cases, the firm itself prefers to work with a local agent because the agent has specific knowledge of the customer and local market conditions.

## ***Other policies***

Other policies identified by the firm as affecting services in manufacturing include periodic visits by government inspectors to ensure that the facility adheres to the stipulated guidelines on environment, health and safety, and the requirement for new staff to attend manufacturing orientation courses given by training agencies appointed by government. These policies are not considered burdensome by the firm.

## ***Private standards: requirement for third-party certification***

Private standards are usually not strictly part of government policies but, for the oil & gas industry, are an important aspect of policy. In particular, the firm must adhere to the standards and requirements by the American Petroleum Institute (API) for third-party inspection at various stages of the manufacturing

process. API is a private trade association which has more than 500 standards and recommended practices. API's Monogram Program verifies that manufacturers of equipment are operating in compliance with these standards and its Witnessing Program provides witnesses to observe critical material and equipment testing and verification. Many manufacturers including the firm in this case study would like to have the API Monogram mark on their products because it serves as a form of quality assurance to their customers, who in effect often make this a requirement.

The firm has no significant issues meeting the requirements of the programs, considering that its facility already has certification and licenses from API. However, this may not be the case for its suppliers, particularly SMEs which also have to be certified if they are interested in being part of the firm's manufacturing value chain. The certification process for API Monogram<sup>13</sup> is not a simple process which can be met by firms with limited resources. Indeed, several of the firm's suppliers had determined that the process is too cumbersome and costly for them to do business with the firm if an API certification is required. Consequently, the firm may have to curtail its outsourcing strategy and will have access to a smaller pool of suppliers of inputs and processes.

As a means of supporting SME access to global value chains, the Singapore Government has established the Partnerships for Capability Transformation (PACT) initiative. The initiative allows large organizations to identify and implement projects between itself and local SMEs in areas such as knowledge transfer, capability upgrading, and the development and testing of innovative solutions<sup>14</sup>.

### *The way forward*

This case study has attempted to give an oil & gas firm's perspectives on the importance of services to its operations. It is evident that policies impact the firm's access to services as well as its ability to provide them. These can have implications on the firm's overall competitiveness. Policymakers have a significant role to play in supporting businesses, particularly in creating the right regulatory environment to facilitate optimal management decisions.

Restrictions on the movement of natural persons impedes the ability of foreign firms to provide after-sales services. Likewise, the restrictions also hamper the access of its customers (such as state-owned enterprises) to the most qualified engineers to resolve the issues at hand. The case study has demonstrated that particularly in the provision of after-sales services, the different modes of supply are in fact complementary to one another. Mode 3 (in the case of establishment of local service facilities) and mode 4 (in the case of movement of engineers) go hand-in-hand in ensuring that customers are provided with the best and most efficient after-sales services.

The same can be said about local content requirements. While these certainly limit the pool of suppliers from whom the firm can source inputs and processes, they may also raise the total cost to customers and possibly diminish product quality where local suppliers do not have the right capabilities.

On the support that can be provided to local suppliers, especially SMEs, in promoting more engagement in global value chains, a good area to explore is how to help them meet global standards and pass various certification processes. This help may take the form of capacity building activities, or the provision of grants and incentives to obviate the costs of certification.

Looking deeper at the regulations mentioned in this case study, it should also be acknowledged that some of them are cross-agency in nature. For example, the restrictions on movement of foreign professionals and capital are likely to have been enacted by agencies whose mandates cover areas such

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<sup>13</sup> <http://www.api.org/certification-programs/api-monogram-program-and-apiqr/certification-process>

<sup>14</sup> More information about the Partnerships for Capability Transformation (PACT) can be obtained at: <http://www.spring.gov.sg/Developing-Industries/Industry-Initiatives/Pages/partnerships-for-capability-transformation.aspx>

as labour or foreign direct investment. For many developing economies, coordination among agencies, and awareness of the effects of policies, pose major challenges.

## Appendix A

### Policies affecting services in the value chain

Government and private policies/services	Authority(ies) in charge	Details	How the policy affects services in the value chain
<b>Productivity and Innovation Credit (PIC) Scheme</b>	Inland Revenue Authority of Singapore (IRAS)	Scheme allows businesses to obtain tax savings in the form of 60 percent cash payout and/or 400 percent tax deduction on qualifying activities.	It encourages businesses to invest in productivity improvement activities.
<b>Corporate Income Tax Rebate</b>	Inland Revenue Authority of Singapore (IRAS)	It allows firms to receive 30 percent Corporate Income Tax Rebate in Years of Assessment (YA) 2013, 2014 and 2015 that is subject to a cap of S\$30,000 per YA. For YA 2016 and 2017, the cap is S\$20,000 per YA.	It helps businesses to cope with rising costs.
<b>Wage Credit Scheme (WCS)</b>	Inland Revenue Authority of Singapore (IRAS)	Scheme enables Government to co-fund 40 percent of wage increases given in the period 2013 to 2015 to Singapore employees earning a gross monthly wage of up to S\$4,000. For 2016 and 2017, lower co-funding rate of 20 percent applies.	It gives businesses time to adjust to rising costs and concurrently, frees up resources to undertake productivity improvement activities.
<b>Quota for foreign workers</b>	Singapore Ministry of Manpower (MOM)	Manufacturing firms can only hire up to 1.5 foreign workers for every local full-time employee that it employs.	It increases business costs to firms because local workers generally receive higher wages than foreign workers.
<b>Fair Consideration Framework (FCF)</b>	Singapore Ministry of Manpower (MOM)	It mandates firms to consider Singaporeans fairly for Professionals, Managers and Executives (PMEs) positions before applying for new Employment Pass (EP) for eligible foreigners by requiring firms to advertise job vacancy on a new jobs bank administered by the Singapore Workforce Development Agency (WDA) for at least 14 calendar days.	It lengthens the hiring process and may potentially lead to firms losing ideal candidates for a position because of their nationalities.
<b>Partnerships for Capability Transformation (PACT)</b>	SPRING Singapore	It allows large organizations to identify and implement collaborative projects with local SMEs in areas of knowledge transfer, capability upgrading as well as development and testing of innovative solutions.	It allows the firm to upgrade the capabilities of its suppliers and potentially widens the pool of suppliers to whom it can outsource inputs and outsource processes.
<b>Third-party inspection requirements as part</b>	American Petroleum Institute (API)	The challenging environment that many of its products have to operate in makes it imperative that third-party	The certification process is a challenge for some of the firm's suppliers, particularly



<b>of American Petroleum Institute (API)'s Monogram and Witnessing Programs</b>		inspectors are on-site to monitor the design, engineering and manufacturing processes as and when necessary.	SMEs, who elect not to do business with the firm if it requires them to be certified by API. This affects firm's outsourcing strategy and restricts the pool of suppliers the firm can access.
<b>Movement of natural persons</b>	Various jurisdictions	They limit the stay by firm's foreign engineers and staff in the jurisdictions.	The restriction may affect the quality of services provided, particularly if the engineers are the most qualified persons for the task.
<b>Withholding tax</b>	Various jurisdictions	They require earnings made by foreign engineers and staff to be subjected to withholding tax if they provide services over a certain period of time.	The restriction may limit the number of days that the engineers can stay in the economy and inadvertently affect the quality of services provided.
<b>Foreign equity restrictions</b>	Various jurisdictions	They restrict the level of foreign equity that local maintenance and repair services facility could have.	The restriction may limit the level of involvement of firms in the decisions and daily operations of the facility.
<b>Local content requirements</b>	Various jurisdictions	They require the products sold to have certain percentage of local content.	The requirements may increase prices and diminish quality because firm has to obtain quotations and secure parts/components and services only from providers who meet the criteria.  In addition, there may be limitations in local capacities.
<b>Use of local agent for submission of quotation and when securing order (if awarded)</b>	Various jurisdictions	Some economies require that the firm's sales team work with local agent when making submission of quotation and when securing order.	The need to involve a local agent may increase firm's operational costs.

Source: Compiled by APEC Policy Support Unit

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