Backward Linkages in the Manufacturing Sector in the Oil and Gas Value Chain in Angola

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The Open University

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Making the Most of Commodities Programme (MMCP)
MAKING THE MOST OF COMMODITIES PROGRAMME

Like many other developing economy regions, Africa is benefitting from a sustained boom in commodities prices. Received wisdom has been that commodities production is an inherently enclave activity and that it undermines the viability of industry. The Making the Most of Commodities Programme challenges this negative view of the commodities sector. It’s research analyses the determinants of backward and forward linkages and identifies policy responses which will broaden and deepen them. In so doing it contributes both to achieving sustainable growth and the spreading of benefits to a wider population. By incorporating younger researchers, building a research network, and through dialogue with policymakers, the MMCP also seeks to both build analytical and policy capacity and to influence policy outcomes.

The MMCP focuses on a diverse range of commodity sectors in a number of African economies, as well as on key infrastructural determinants of effective linkage development. A number of common factors are identified which will increase linkages beneficially and which lend themselves to policy intervention - the role of ownership, the nature and quality of infrastructure, the national system of innovation, spillover of skills to and from the commodities sector, linkages in regional economies and the nature and consistency of policies directed towards the commodities sectors.

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11. ‘Backward Linkages in the Manufacturing Sector in the Oil and Gas Value Chain in Angola’, Zeferino Teka

A MMCP Synthesis Monograph is currently being written by the MMCP Project Leaders: Raphael Kaplinsky (Open University), David Kaplan and Mike Morris (UCT).

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Abstract

This study looks at backward linkages to the manufacturing sector in the oil and gas value chain in Angola as a potential driver of industrial development. The study employs a sub-sectoral approach rather than an aggregate (entire industry) approach in order to better capture opportunities and challenges at micro or firm level. The sub-sectoral approach is based on primary empirical research and complemented with secondary research. The primary research employed semi-structured interviews and scale questionnaires, and secondary research was based on a desk-study of the Angolan oil and gas industry through databases of specialist oil and gas research agencies. The study finds limited local content in the localised manufacturing function. On the one hand, there is high volume of local content in terms of human capital at basic and semi-skilled levels driven by local content policy. On the other hand, there is limited local content in human capital at higher technical level. In addition, the study finds no material inputs (processed intermediate materials) from the local economy into the manufacturing function. This is due to weak local capability i.e. poor metallurgical sector and scarcity of skilled labour. This situation is compounded by an incoherent local content policy which is skewed toward forward linkages, and a disjuncture between the local content policy and the national industrialisation policy.


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Executive Summary

This study has investigated the extent and nature of local linkages (degree of local value added in Angola) to the manufacturing sector in the oil and gas value chain in Angola. The study set out to test a number of hypotheses posited by the Making the Most of the Commodities Project (MMCP) as determinants of linkages. Based on the sub-sectors the study has investigated, findings indicate that:

- Local value-added is *de facto* mostly labour, particularly basic skill and mid-skill labour.

- Much of what is ‘local’ (other than labour) involves only thin degree of value-addition in form of basic services which do not feed into the manufacturing function, and the use of local importers to supply basic goods from overseas.

This situation is currently determined by the following main factors:

- There is weak local capability in terms of human capital at higher technical level (higher education) and in manufacturing, especially metallurgical sector.

- Local Content Policy is currently skewed toward forward linkages whose benefits include localisation of resource revenue and local supply of crude derivatives to the economy. The policy disfavours backward linkages which are critical for industrial development (through technology transfer and/or spillovers).

- There is disjuncture between the development of Industrial Policy and development of Local Content Policy in the oil and gas sector despite the prominent role the oil sector has in the economy.

- Implementation loopholes in both Industrial Policy and Local Content Policy in the oil sector invite systemic corruption.

Therefore, insofar as MMCP hypotheses are concerned, the relevant factors determining the extent and nature of linkages in the oil and gas sector in Angola are policy, skills, NSI (taken to mean local supplier capability rather than R&D) and ownership. The regional South African story does not appear to have much influence on the depth and breadth of linkages. To stimulate greater degree of local linkages, the study considers the following policy issues as critical:

- The need to balance support between forward and backward linkages in the local content policy which currently disfavours the latter. This includes availing the same fiscal and financial incentives being provided for local firms in forward linkages to local firms in backward linkages; prioritising localisation of R&D activities over or alongside ownership which is the main focus of the current policy; picking potential manufacturing firms as champions to enter the supply industry; and inducing the development of knowledge networks between local suppliers and multinational firms and clients.
• The need to invest in human resources training at higher technical level both in the general education and training system and at petroleum institutes in response to the existing capacity gap at this level

• The need for cohesion in policy development between the Ministry of Petroleum and Sonangol (the regulators of the oil sector) and the Ministry of Industry which is leading the country’s industrialisation project (and policy)

• The need for clear policy implementation mechanisms to enable policy efficiency and to stamp out potential channels of corruption.
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Introduction

This study looks at the role the oil sector can play as potential driver of sustainable development in oil-rich developing countries in view of the ongoing commodities boom which is being driven by aggressive demand from rapidly growing Asian economies and particularly China. This boom presents an opportunity, as well as challenges, that endowed developing economies can seize to build sustainable development capital. While the ‘resource-curse’ theory finds evidence of inverse correlation between economic growth and natural resource exports (Sacks and Warner 1995, 1997, 2001), this study draws on the emerging proposition which posits that resources can lead to sustainable economic development through technical transfer and spillovers which in turn can enable the development of the manufacturing sector alongside the commodities sector. In this process, industrial policy is critical to induce diversification from the commodities sector to the manufacturing sector (Lorentzen 2008; Wright and Czelusta 2003). This proposition is based on the ‘Endogenous Growth Theory’ which links economic growth to technological capability (Barro and Sala-i-Martin 1995; Romer 1990; Lucas 1988).

This study looks at backward linkages in the manufacturing sector in the oil and gas value chain in Angola. ‘Staple Theory’ posits backward linkages as the main channel of technology transfer from the commodities sector to the broader economy (Hirschman 1958; Watkins 1963). Literature on backward linkages in the oil and gas sector posits that spillovers between the oil and gas sector and the broader economy have historically occurred in the manufacturing sector. Catalyst in this process is the development of intermediate industry (provider of processed materials and intangible technical inputs) as a link to the manufacturing function. In due course, the intermediate industry can reach main industry stage and become source of innovation in the broader economy and a base of export of technology products (Wood 2007; Dantes 2006; Wade 2004; Noreng 2004; Engen 2002; Surrey 1987).

The study finds that manufacturing linkages in the Angolan oil and gas sector have expanded since the early 2000s. Based on the experience of two subsectors this study covers, intermediate linkages between the manufacturing function and the local economy remain limited. There is high volume of intangible intermediate linkages in form of human capital at basic and mid-skill levels, but limited volume at higher technical level. On the other hand, there are currently no intermediate material linkages and the prospects of this situation changing in the near future are dim. The foremost local linkage is occurring in supply of basic general products which have no direct input in the manufacturing function.

Policy (local content policy) is the main driver of localisation of manufacturing activity in Angola, intangible linkages at basic and mid-skill levels, and of local supply of basic general products. On the other hand, weak local capability (manufacturing and human capital resources) and incoherent local content policy are the limiting factors to intermediate material linkages and local intangible inputs at higher technical level. The local content policy is skewed (providing more support) toward forward linkages and in disfavour of backward linkages. This situation is compounded by the national industrial policy. The design and implementation of the industrial policy is not linked to the design and implementation of local content policy. As such, the industrial policy currently fails to address specific needs and challenges facing the oil sector.
The study recommends balance in the oil and gas local content policy in terms of the support being provided for the development of linkages between the oil and gas sector and the local economy. Moreover, there should be closer and joint-working relationship between the authorities in the oil and gas sector (the National Concessionaire and the Ministry of Petroleum) and the Ministry of Industry which is leading the country’s industrialisation policy.

This report has nine sections. Section 1 looks at the role of the oil and gas sector in the Angolan economy. Section 2 looks at the rules and regulations in the Angolan oil and gas industry. Section 3 reviews literature on linkages in the oil and gas sector both globally and in Angola, and discusses the research gap and potential contribution of the current study. Section 4 maps the oil and gas value chain in Angola, and identifies the case-studies on which this study focuses. Section 5 discusses the methodology and methods employed in the study. Section 6 presents the research findings. Section 7 discusses the determinants of linkages in the oil and gas value chain in Angola. Section 8 discusses macro policy and local capability development. Section 9 discusses oil sector policy and local capability development. This is followed by synthesis of the findings and policy consideration in section 10.
1. Oil and gas sector in the Angolan economy

Before independence in 1975, Angola had a diversified economy with strong agricultural and manufacturing bases. With independence and advent of civil war, the economy became “bi-mineral” (dependent on oil and diamond) and based in the coastal region (Luanda, Benguela, Huila, Cabinda provinces) where the government had a stronghold (Hodges 2004:103). The areas the government controlled in the hinterland were linked to the coastal economy by air transport. Thus, non-mineral sectors gradually declined and many ceased to function completely. Agriculture came to a standstill except for intermittent and limited levels of subsistence farming. By the late 1990s only 3% of the country’s arable cropland was cultivated and over 80% of food stock was imported. Industry also collapsed following the nationalisation of the sector (ibid) (Table 1).

Table 1: Percentage share of GDP per sector for selected years (1963-2008)

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Forestry, Fishing</td>
<td>14.2</td>
<td>13.6</td>
<td>10.2</td>
<td>9.8</td>
<td>9.0</td>
<td>12.2</td>
<td>8.3</td>
<td>8.6</td>
<td>7.2</td>
<td>7.3</td>
<td>7.7</td>
<td>8.2</td>
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<tr>
<td>Extractive Industry</td>
<td>6.3</td>
<td>3.5</td>
<td>3.0</td>
<td>7.1</td>
<td>10.7</td>
<td>9.8</td>
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<td>67.2</td>
<td>58</td>
<td>57.6</td>
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<td>62.9</td>
<td>55.7</td>
<td>55.8</td>
<td>58.3</td>
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<tr>
<td>Diamond</td>
<td>8.7</td>
<td>9.6</td>
<td>9.5</td>
<td>10.4</td>
<td>10.7</td>
<td>11.6</td>
<td>3.9</td>
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<td>3.6</td>
<td>4.8</td>
<td>5.3</td>
<td>6.6</td>
</tr>
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<td>Manufacturing</td>
<td>2.7</td>
<td>2.8</td>
<td>3.2</td>
<td>3.2</td>
<td>3.1</td>
<td>3.6</td>
<td>3.8</td>
<td>3.2</td>
<td>4.3</td>
<td>4.9</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>0.9</td>
<td>0.9</td>
<td>1.1</td>
<td>1.0</td>
<td>0.9</td>
<td>0.6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Electricity/Water</td>
<td>6.3</td>
<td>6.6</td>
<td>7.0</td>
<td>6.5</td>
<td>5.9</td>
<td>4.6</td>
<td>--</td>
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<td></td>
</tr>
<tr>
<td>Transport &amp; Communication</td>
<td>34.0</td>
<td>34.0</td>
<td>29.7</td>
<td>31.4</td>
<td>30.3</td>
<td>24.5</td>
<td>15.9</td>
<td>15.9</td>
<td>12.4</td>
<td>16.8</td>
<td>16.9</td>
<td>15.3</td>
</tr>
<tr>
<td>Commerce</td>
<td>28.2</td>
<td>12.6</td>
<td>3.5</td>
<td>3.2</td>
<td>3.3</td>
<td>2.8</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Baking &amp; Insurance</td>
<td>3.6</td>
<td>4.0</td>
<td>4.6</td>
<td>4.4</td>
<td>4.1</td>
<td>4.9</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Housing</td>
<td>8.3</td>
<td>10.9</td>
<td>11.3</td>
<td>11.3</td>
<td>11.0</td>
<td>11.3</td>
<td>--</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Public Administration</td>
<td>12.0</td>
<td>11.3</td>
<td>11.5</td>
<td>11.6</td>
<td>11.8</td>
<td>14.7</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: MIND (2009); IMF (2009)

1.1 Angola in the global oil value chain

Angola is the 15th largest proven oil reserve in the world and second in Africa after Nigeria. In 2009 Angola was the 15th top world oil producer and second to Nigeria in Africa (see Figure 1). Currently, Angola refines 39,000 barrels of crude per day contra the 85,000 barrels it consumes per day. It exports 90% of its oil produce whose top destination has been primarily China and the United States of America. In 2007 China toppled the United States as the top destination of Angola’s crude and it now accounts for 40% contra 25% of the United States (EM 2010) (Figures 1-2).
Since the mid-1990s, the Angolan upstream sector has been fast moving deepwater from onshore and shallow waters. Deepwater is where most of the crude is currently being extracted and it is projected to be the future of the sector.
2. Rules and regulations in the Angolan oil sector

The Petroleum Activity Law (Law No. 13/76)\(^1\) assigns the sole ownership of Angola’s hydrocarbon resources and mining rights to the Angolan State. In turn, the State manages the sector via Sonangol Public Company (Sonangol E.P.)\(^2\) under the supervision of the Ministry of Petroleum. Thus, Sonangol, the State National Oil Company, is the Concessionaire of Angola’s oil industry and the sole owner of mining rights. Other entities may access Angolan hydrocarbon resources only in partnership with Sonangol mediated by Concession Agreements (CAs) and Production Sharing Agreements (PSAs). PSAs are now the main regime as CAs now only apply to old concessions. PSAs are preceded by licensing rounds in which bidders compete for exploration and production equities in public bidding (Figure 3).

Figure 3: Governance structure of the oil and gas industry

The Council of Ministers, which is chaired by the President of the Republic, is the highest decision-making body of the State. It uses concession decrees to confer concession rights upon the Concessionaire (Sonangol) and to determine the main tasks that come with it (e.g. seismic reports, holding licensing rounds, monitoring contract proposals, remitting and marketing of royalty or profit oil). Despite this direct link between the Council and Sonangol, the Ministry of Petroleum holds the overarching regulatory role in the industry, and its task includes formulation and enforcement of operation and taxation regime. Institutionally, oil taxes are to be channelled directly to the Ministry of Finance via the Central Bank (BNA). However, reviews on the sector’s fiscal linkages indicate existence of institutional conflict regarding the role of oil tax collector between Sonangol, the Ministry of Finance and the Central Bank (BNA) (KPMG 2008; Aguilar 2003).

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\(^1\) This law has been updated by new decrees particularly the 1982 and 2003 decrees on local content regulations.

\(^2\) Sonangol E.P. stands for Sonangol public corporation. In 1994, Sonangol E.P. opened a subsidiary, Sonangol E&P (Sonangol Exploration and Production), through which it became directly involved in exploration and production activities. Hereafter, use of Sonangol will refer to Sonangol E.P., and use of Sonangol E&P will refer to the operating subsidiary.
2.1 Implications of national ownership of resources

National ownership of resources and mining rights gives the State, through Sonangol, bargaining leverage with oil companies (oil exploiters) and oil services companies (providers of production factors). The government has used this leverage to advance national interests in the oil sector through local content policy. There is not yet a comprehensive local content policy package. Such package is currently being devised (Interviews 2009)\(^3\). The Petroleum Activity Law (Law No.10/04) and the existing local content decrees (Decree 20/82; Decree 127/03) contain two main local content requirements: (i) Angolanisation of human resources and (ii) preferential treatment of national firms in the supply of goods and services.

2.2 Angolanisation of human resources

Angolanisation of human resources means gradual replacement of expatriate workers with Angolan workers at all levels of activity by companies operating in the Angolan oil industry. The policy ratifies the following: (i) preferential employment of Angolans unless lack of competent Angolans is proved; (ii) equal treatment of Angolan and expatriate workers regarding professional and social benefits; (iii) for every contract and on annual basis companies must have a plan of recruitment and training of Angolans according to the targets set out by the government; (iv) companies must contribute an annual levy towards the development of Angolan human resources. Table 2 below shows the targets set out in 1982 by the government for the Angolanisation of human resources in the oil sector (Table 2).

<table>
<thead>
<tr>
<th>Levels (Grades)</th>
<th>1985</th>
<th>1987</th>
<th>1990</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to Grade VI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Unskilled/Semi-Skilled)</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Grades VII-XI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Mid-Level Technicians)</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
</tr>
<tr>
<td>Grades XII-XIII</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Higher Level Personnel)</td>
<td>--</td>
<td>50%</td>
<td>80%</td>
</tr>
</tbody>
</table>

As can be observed, the Angolanisation targets, which are based on Decree 20/82, are now out of date. They are now being updated in a comprehensive local content package which is currently being devised by Sonangol’s Local Content Department (Interviews).

Table 3 below shows designated annual levies the different actors operating in the Angolan oil market must contribute for the development of Angolan human resources. This information is enclosed in the Petroleum Activity Law (Law No.10/04 pursuant of Law No.13/78). Operators (oil producing companies) must contribute 15 cents of dollar per barrel produced per year. Associate operators (oil companies without operator status) must contribute $200,000 per year. And oil services

\(^3\) Interviews related to local content policy were held with Sonangol’s Local Content Department
companies must contribute amounts discretely agreed with the Ministry of Petroleum following consultations (Table 3).

**Table 3: Annual levy for development of Angolan human resources**

<table>
<thead>
<tr>
<th>Types of Contributors</th>
<th>Annual Levy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operators</td>
<td>15 cents of $ per barrel produced</td>
</tr>
<tr>
<td>Associate Operators</td>
<td>$200,000 $ per annum</td>
</tr>
<tr>
<td>Oil Services Companies</td>
<td>Discrete amount</td>
</tr>
</tbody>
</table>

**2.3 Preference for national and joint-venture suppliers**

Decree 127/03 establishes basic rules for inclusion of national suppliers in the supply of goods and services to the oil sector. National suppliers are defined as firms that are fully-owned by Angolan citizens or 51% of share capital owned by Angolan citizens. There are three provisions for the inclusion of national suppliers in the supply chain: (i) the rule of exclusivity, (ii) the system of semi-compliance and (iii) the total competition system.

First, the rule of exclusivity posits that all goods and services that do not involve high capital value (the decree does not define this amount) and non in-depth and specialised know-how must be sourced from national suppliers unless their price is 10% higher than the price proposed by foreign suppliers. Second, the system of semi-compliance posits that participation of foreign companies in the supply of goods and services that involve average level of capital and in-depth but not specialised know-how may only occur in association with national companies. The only exception is when the product cost is 10% higher than it would be without such an association. Third, the competition system posits that all goods and services of higher capital value and higher technical in-depth than the ones mentioned in the two previous provisions are to be sourced through competitive public bidding. But this does not exclude the possibility of partnerships between national and foreign companies. In addition, and very critical for discussion on linkage drivers on Section Six, firms may directly contract goods and services from any supplier from anywhere provided that urgent technical reasons are provided or when there is insufficiency of required product in the local market. In such circumstances, firms must apply in advance for authorisation from the Ministry of Petroleum. Table 4 below shows the main products that are included in each of the three provisions, namely, exclusive products, semi-exclusive products and competitive products (Table 4).


Table 4: Categories of preferential products since 2003

<table>
<thead>
<tr>
<th>Exclusive to local firms</th>
<th>Open to foreign controlled firms</th>
<th>Competitive Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Food stuffs &amp; Catering,</td>
<td>- Purchase/processing of geographical data;</td>
<td>None</td>
</tr>
<tr>
<td>- Transportation of equipment &amp; materials,</td>
<td>- Vertical, directional, horizontal drilling of wells &amp; completion;</td>
<td></td>
</tr>
<tr>
<td>- Supply of technical materials (IT &amp; electric equipment, etc),</td>
<td>- Geological control of drilling (mud logging);</td>
<td></td>
</tr>
<tr>
<td>- General Cleaning &amp; Gardening</td>
<td>- Production tests;</td>
<td></td>
</tr>
<tr>
<td>- General maintenance of equipment &amp; vehicles,</td>
<td>- Operation &amp; maintenance of oil production installation;</td>
<td></td>
</tr>
<tr>
<td>- Operation and management of supply points (service stations),</td>
<td>- Operators &amp; managers of terminals;</td>
<td></td>
</tr>
<tr>
<td>- Retailers of lighting oil, gas &amp; lubricants, and</td>
<td>- Manufacture of plastic/synthetic fibres for the oil industry;</td>
<td></td>
</tr>
<tr>
<td>- Transport of goods from terminals to supply points</td>
<td>- Drilling, production material, etc</td>
<td></td>
</tr>
</tbody>
</table>

Considering the nature of technologies and level of costs involved in the three product categories, only the products on column one, which are made exclusive to national suppliers make an achievable target in light of the country’s current technical capacity. The determination of the products on column two as semi-exclusive is inadequate because of the level of both technology and capital they require. There is limited local capacity to enable these products to be locally supplied. Almost all of these products pertain to column three because they are of highest technical and capital nature. That is probably why column three is empty. As such, this localisation scheme, as posited in the Decree 127/03, can be considered highly ambitious, while at the same time failing to show competence and accuracy in the differentiation of products according to their technological and capital nature.

2.4 Law on promotion of Angolan private enterprise

In 2003 the National Assembly passed Law No.14/03 as a framework for the promotion of Angolan private enterprise in all the sectors of the economy. The heart of the framework is the need to provide preferential opportunities and benefits for national private companies (51% Angolan ownership) within a competitive market environment. For this effect, public institutions that coordinate the different economic sectors are mandated to act as partners of the State by providing fiscal and financial incentives and technical support to national companies, and to support the creation of professional training centres led by economic or professional associations.

In the oil sector, Sonangol, as public company and concessionaire, is designate partner of the State. It is mandated to provide preferential opportunities and benefits to national companies in the concession market through the following mechanisms: (i) preferential treatment in the awarding of operation rights; (ii) reduction of mining and industrial taxes on concession activity; and (iii) provision of non-refundable subsidies, loans and financial guarantees. Subsidies are conditioned on the allocation of funds in the activities proposed by the beneficiary and on the fulfilment of those activities. Otherwise the subsidies may be refundable. Loan contracts are to be made on more favourable terms than those in the capital market, while interest
may become subsidised based on project success. In terms of financial guarantees, Sonangol may act as financial guarantor of national private companies involved in concession activity before national or international creditors in the capital market.

**Box 1: Oil Taxation Regime in Angola (Law No.13/04)**

There are two distinct oil tax regimes in Angola. One is a tax and royalty regime which applied to operations in Cabinda and in the onshore blocks FS and FST in the province of Zaire. This regime is governed by three tax instruments. (i) Production Tax (royalty) is an *ad valorem* tax levied on the value of output (oil output is valued monthly at an agreed average market price). The rate is 20% in the Cabinda blocks and 16.6% in blocks FS and FST. Tax is payable in kind or in cash. (ii) Petroleum Income Tax has a flat rate of 65.7% which is levied on taxable income. The latter is computed as the oil output value minus operating and amortisation costs. (iii) Petroleum Transaction Tax only applies in the Cabinda blocks and is levied on taxable income with a fixed rate of 70%.

The second and the main regime is Production Sharing Agreements (PSAs) which applies everywhere except in Cabinda and FS and FST blocks in the province of Zaire. In PSA regime, companies function as contractors to Sonangol by either forming consortiums or acting individually. If a consortium is formed, exploitation activities are carried out by an operator which may or may not be the company holding the largest equity share. In the PSA regime, taxation is governed by three instruments. (i) Cost Oil is the right of costs recovery that investors may have up to a fixed proportion of gross revenue from a given field (the cap is normally set at 50%). (ii) Profit Oil is split of oil output between government and investors (oil companies) after the deduction of cost oil. Normally, the government’s share varies between 20% of profit oil when the rate of return is below 25%, and 90% when the rate of return is above 40%. These rates vary from block to block. (iii) Income Tax: under the PSA regime, oil companies pay income tax on their share of profit oil at a rate of 50%.

Both the tax/royalty and PSA regimes are ring-fenced (exclusive to individual blocks). The Angolan government also raises revenue from signature bonuses and mining rights.

### 3. Literature on linkages in the oil and gas sector

Research on linkages in the oil and gas sector has four main streams. First, research on fiscal linkages looks at issues of resource management (rent acquisition regimes), revenue utility (consumption linkages), resource depletion, rent distribution and resource-driven socio-political and cultural incidences. This research is essentially premised on the view that mineral wealth can spearhead endowed countries to development through enhancement of rent appropriation using efficient taxation, joint-ventures and production sharing agreements on the one hand, and on the other hand through responsible utilisation and distribution of rent while stamping out potential curse channels (economic mismanagement and distorted institutions) (Auty 2008a, 2001, 1990; Lederman and Maloney 2007). Hence the need to develop the capacity of public institutions and structures in terms of design, negotiation and implementation of rent appropriation instruments, resource management and transparency. This research stream also raises the issue of inter-generational equity which discusses whether resources should be left in the ground or produced now and to invest the revenue for future generations (Stevens and Mitchell 2008; Kalyuzhnova 2006; Marian 1985).

Second, research on environmental linkages looks at the effects of hydrocarbon resources exploitation on resource depletion, poverty and biodegradation. These studies posit that oil exploitation has negatively affected livelihoods and basic survival of communities living in resource generating areas, and on climate change in general. Such effects are being directly emitted by oil and gas activities and
installations (drilling, flaring, refining, flow stations, loading terminals and tank farms) which have polluted the air, land and water resources (Pyagbara 2007; UNDP 2006; Eteng 1997). Thus, these studies posit the need for pollution mitigation regulations, promotion of best environmental practice and accountability in the hydrocarbon sector, and they promote the agenda of energy sustainability through renewable energy resources (UNEP 1997; Turner and David 1980; Rowell 1977).

Third, research on forward linkages looks at three main issues: (i) pricing, (ii) derivatives (petrochemicals) as intermediate inputs into production (economic activity) and (iii) security of energy supply. In terms of pricing, conventional wisdom has promoted ‘international pricing’ for crude via spot markets, although this pricing system can and has been influenced by cartels and price makers (large exporters/importers) (Griffin 1985; Griffin and Steele 1986; Newberry 1981). On the other hand, pricing concerns the final consumption cost of derivatives and living standards of people. On this account, subsidisation is posited as an alternative means of distributing resource benefits to the wider population instead of direct payment of dividends because the latter can and has been affected by institutional shortcomings. However, subsidisation can also distort the working of the economy and encourage excessive consumption (Pirog and Bamberg 2004; Mark 1987; Howard 1980).

The derivatives studies look at the development of petrochemical industry by countries as part of industrialisation strategy. It is posited that the private sector is arguably more efficient at running petrochemical projects than the public sector because the latter is less equipped to pick winners (Davis 2006a; Barsamien 2001; Bindeman 1999; Bacon 1990). Studies on security of energy supply look at the structural shift that has occurred in the oil global value chain from the dominance of the ‘Seven Sisters’ to the rise of National Oil Companies (NOCs). NOCs now control about 80% of the global hydrocarbon reserves and account for about 70% of global crude supply. Since most NOCs are emerging in resource endowed developing countries where exploration is growing most successfully, the future of energy supply is now unprecedentedly tied to that of NOCs. Hence the concern over supply security because unlike the major international oil companies (IOCs) that have controlled resources in the past, most NOCs are state-owned and run and this factor is viewed to present problems on two fronts. One is that management of NOCs is found to be heavily influenced by resource nationalism and social objectives rather than business objectives and competency, and the other is that NOCs’ supply capacity to meet demand is found to remain technically lagging (Stevens 2008; Davis 2006b; Osmundsen et al. 2006; Lewis 2007; Miranda et al. 2007; Heller 1980).

Fourth, backward linkages research looks at the supply industry which involves the production factors i.e. technologies, structures, equipment, materials and services that enable the functioning of both the upstream exploitation activity and the downstream processing activity. The upstream sector relies on oilfield services and the downstream sector relies on processing services. Research shows four main factors that have historically determined the advancement of backward linkages in the oil sector: (i) local content policy and practice, (ii) existence of domestic industrial base, (iii) creation of knowledge networks and (iv) supportive institutions for the development of technological and innovative capabilities of domestic actors and enterprise. These four factors underline the successful backward integration
experience of the United Kingdom, Canada, Norway, Australia, Malaysia and Brazil. The absence or weakness of these factors has undermined the same integration agenda in many endowed countries, such as Nigeria, Indonesia and Mexico.

Local content policy has been a key enabler of development of backward linkages because it has been used to induce local sourcing. Local content frameworks have varied from restrictive to market-based regimes. A major leverage of local content policy is national ownership of resources (Klueh et al 2007; INTSOK 2003).

Domestic industrial base relates to ‘sideway movers’. That is, entry into the oil services supply chain has historically been achieved by local firms with industrial background, such as civil and mechanical engineering, marine and shipbuilding industries, steel industry (fabrication and repair of steel structures), capital goods industry, design and manufacture and assembly of heavy industrial equipment. Generally, the participation of firms without such industrial background has been limited to the supply of basic goods and services unrelated to oil production processes (Cappelen and Mjøset 2009; Surrey 1987; Lange 1977).

Knowledge networks and supportive institutions have been central in the development of local absorptive capacity. Knowledge networks are often government induced clusters between public petroleum agencies or national oil companies, oil producing companies, oil services companies and local suppliers to foster partnerships between them in order to enable early involvement of local firms in oil production projects so that they may learn and acquire tacit know-how. Networks have also been used to enable harmonisation of business practice and reduction of transaction-costs (Fagerberg et al 2009; Dantes 2006; Bjørnstad 2004).

Supportive institutions involve two major components. One is the development of petroleum agglomerations, petroleum R&D and training institutes to grow human capital, incorporation of petro-science in general education curricula, and development of ICT infrastructure. The other component involves provision of tax incentives in the petroleum market and financing of oil-related local firms. Such institutions can motivate localisation by international firms and encourage investment in upgrading by local firms (Wood 2007; OG21 2006; Engen 2002).

3.1 Literature on linkages in the oil and gas sector in Angola

Reviews on linkages in the Angolan oil sector have mostly focused on fiscal linkages. Some reviews look at the need to utilise the revenue windfall to diversify the economy from oil dependence to other sectors particularly agriculture since 60-70% of the population depend on it (Auty 2008b; Heller 2007; Collier 2006; Shields et al 2005; Olsen 2002). Some reviews find it critical to complete the transition from the command economy the country adopted at independence to market economy. Central in this process is to restructure the current rentier and elitist nature of the private sector which is being driven by political patronage (Aguilar 2003). Some reviews find lack of transparency in the management of oil revenue (KPMG 2008; Hodges 2004). Some reviews look at monetary issues and how fiscal instruments can be used to stabilise inflation in order to pre-empt the Dutch-disease syndrome. These reviews find that inflation has resulted mainly from the practice of wasteful spending and monetisation of public deficits (WB 2007; Kyle 2005; Leite et al 2005).
Three studies have been found on backward linkages in the Angolan oil sector. Wiig (2006) compared the structures of oilfield services supply chain management in Norway and Angola. He found that fewer and more integrated (bundled) contracts are used in Angola than in Norway. This makes the supply chain more integrated (with fewer and larger contractors) in Angola than in Norway. This is because higher level of asset specificity is required in the Angolan market. Since oil is mostly produced deepwater in Angola more tailor-made and technically intensive and integrated solutions are required. Thus, oil companies prefer to source oilfield services in bundled contracts to few contractors to spread risk and reduce transaction costs. He also found that unlike Norway, there are no policy induced knowledge network initiatives in Angola, and large contractors strategically establish associations with local firms to meet the country’s local content requirements.

In their paper on local content in São Tomé e Príncipe, Klueh et al (2007) reported two main localised oilfield services linkages in Angola, namely, assembly of oil platforms and maintenance thereof, and supply of services vessels to offshore oil exploitation activity. In his study on human resources linkages in the Angolan oil sector, Mangueira (2004) found that the Angolanisation targets set out by the local content policy since 1979 were achieved at basic and mid-levels, but remained much below target at higher technical level.

3.2 Research gap and contribution of the current study

Studies in the Angolan oil sector have mostly focused on fiscal linkages but limitedly on backward linkages. The few studies that have looked at backward linkages are limited to supply chain management (Wiig 2006), localisation (Klueh et al 2007), and human resources linkages (Mangueira 2004). The current study pioneers work on the extent and nature of linkages in the manufacturing sector which literature posits as the main channel of transfer of capabilities and sustainable spillovers between the oil sector and the economy. Findings from this study can shed light on the nature of linkages between the manufacturing sector in the oil industry in Angola and serve as reference to other oil-rich developing countries. Furthermore, it explores a set of determinants to backward linkages, only some of which have been the subject of previous research in Angola.

4. Oil and gas value chain in Angola

The oil and gas value chain in Angola has two major sectors. First is the upstream sector which is divided into oil exploration and oil production. Exploration is the first stage of oil exploitation. It involves prospecting and development (oil discovery, field appraisal and field development). Production is the main stage of oil exploitation. It is the process of oil extraction after field development. The second sector is downstream which is divided into crude processing and distribution and marketing of derivatives. Both the upstream and downstream sectors rely on two sets of production factors. (i) Oilfield services comprise the embodied and disembodied inputs (equipment, structures, human resources and services) which enable the upstream activity of oil exploitation to function. (ii) Processing infrastructure comprise the embodied and disembodied inputs (machinery, equipment, human resources and
services) which enable the functioning of the crude processing activity and the activities of distribution and marketing of derivatives (Figure 4).

**Figure 4: Oil and gas value chain in Angola**

The upstream sector involved investments of $70 billion in capital expenditure in 2004-2010 (INTSOK 2010). Of this total value, 6% ($4 billion) was spent in exploration activity, 20% ($15 billion) was spent in production activity, and 74% ($51 billion) was spent in oilfield services sector (ibid). In 2006-2014, the downstream sector will require investments of $15 billion of expenditure in new processing infrastructure (one refinery and one LNG plant). The domestic processing and distribution market is worth an annual average of $150 million in sales, but there is no available data on the share between processing and distribution activities (Sonangol 2010) (Table 5).

**Table 5: Angola’s oil and gas value-added chain**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Upstream (2004-2010)</th>
<th>% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploration</td>
<td>$70 bn Capex</td>
<td>6</td>
</tr>
<tr>
<td>Production</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Oilfield Services</td>
<td>51</td>
<td>74</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector</th>
<th>Downstream (2006-2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refining</td>
<td>$1.2 bn in sale</td>
</tr>
<tr>
<td>Marketing</td>
<td>$15 bn in capex</td>
</tr>
</tbody>
</table>

Source: INTSOK (2010); Sonangol (2010)
4.1 Upstream sector

The upstream sector is of fixed nature as resources are immobile. Since the mid-1990s, most of the crude in Angola has been produced offshore (deepwater). North Sea and North American companies combined own 40.6% of the licensed exploration equity, 46.2% of the production equity, and 76.5% of the deepwater production equity. Sonangol owns 25.2% of the exploration equity, 33.5% of the production equity, and 6.7% of the deepwater equity. Sonangol Sinopec International (SSI – joint-venture company between Sonangol and Sinopec) owns 5.4% of the exploration equity, 7% of the production equity and 16.7% of the deepwater equity. Private Angolan companies own 8.8% of the exploration equity and 6.3% of the production equity. Companies from Latin America own 9.8% of the exploration equity and 2.5% of the production equity. Companies from Asia own 9.7% of the exploration equity and 4.2% of the production equity. Thus, besides Sonangol, which is the national Angolan oil company and the market concessionaire, the concession market is dominated by North Sea and North America companies. Also significant is the fact that since 2005 private Angolan companies have claimed considerable stake in the country’s concession market alongside Sonangol (Figure 5).

![Figure 5: Ownership of the concession market in Angola (2009)](image)

Source: Sonangol (2010)

4.2 Downstream sector

The downstream sector in Angola remains limited. There is currently one operating refinery that produces 39,000 barrels p/d in deficit to the current domestic consumption of 85,000 barrels p/d (BM 2010). Yearly Angola imports around $250 million worth of derivatives except for LPG. LPG stopped being imported in late 2005 when Chevron (American Oil Company and a leader in the country’s upstream sector) began producing LPG offshore Angola. There are two ongoing downstream projects in the country, a refinery with capacity to produce 200,000 b/d by 2014 worth about $5 billion, and one LNG project worth about $10 billion (Sonangol 2010).

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4 This data does not include the February 2011 licensing round for 11 pre-salt concessions. Ownership data on this licensing round is not yet publicly available.
Sonangol, the State oil company, dominates the downstream sector. It owns and runs the current existing refinery. It commissioned the building of the new refinery which is projected to start operating by 2014. In the LNG project Sonangol holds 22.8% and its partners are Chevron (36.4%), BP (13.6%), Total (13.6%) and ENI S.p.A (13.6%). The project is being built in Soyo, the capital of Angola’s North-western province of Zaire. The plant is projected to start production in 2014 with a capacity of 5 million tons of LNG per year (Interviews 2009; Sonangol 2010). Sonangol Distribuidora, an autonomous branch of Sonangol, is the leading distributor of fuel throughout the country. The only other player in the crude derivatives distribution market is SonanGalp which is a joint-venture company between Sonangol and the Portuguese company Galp Energia. This joint-venture was formed in 1994 with Sonangol holding 51% shares (Sonangol 2010). Sonangol is also involved in commercialisation of derivatives internationally in São Tomé e Príncipe, Cabo Verde Island, Portugal and in the Democratic Republic of Congo through four different joint-ventures (ibid)\(^5\).

### 4.3 Focus of the current study

The current study is based on the upstream sector which remains the nucleus of Angola’s oil industry with 80% of the total capital expenditure. Within the upstream sector, the study looks at the supply industry (oilfield services value chain) which accounts for 74% of the total capital expenditure in the upstream sector. Literature on linkages posits that the ‘production function’ (technology of the industry) is the main source of sustainable spillovers between the commodities sector and the local, broader economy (Hirschman 1958; Watkins 1963).

The oilfield services sector spreads across three distinct operation areas: (i) well activities which occur under-the-water or in the mud area, (ii) subsea activities which occur on the seabed or ocean floor, and (iii) topside activities which occur above-the-water. Table 6 below presents the oilfield sector’s value-added chain and the local links in individual segments. It shows that the only segment with localised manufacturing link in Angola is subsea umbilicals, risers and flowlines (SURF). Local links in other segments are limited to sale, contracting and aftermarket services. Activities that can only be done in situ include construction and installation of systems under water, on the seabed and above-the-water. However, local links in these activities are also limited to services. In terms of economic value, the largest oilfield services segments are, in descending order, drilling services (23%), SURF – subsea umbilicals, risers and flowlines (21%), sale and servicing of well equipment (16%), and sale and construction of subsea production systems (11%) (Table 6).

\(^5\) Sonangol holds 40% shares in ENCO S.A.R.L in S. Tome e Principe; 33% in ENACOL in Cabo Verde; 49% in SOPOR in Portugal; 60% in Sonangol-Congo Distribution Company (Sonangol 2010).
### Table 6: Oilfield services value-added chain (2004-2009)\(^6\)

<table>
<thead>
<tr>
<th>Oilfield segments</th>
<th>Capex (Bn$)</th>
<th>% Share</th>
<th>Local links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>4</td>
<td>8</td>
<td>Services</td>
</tr>
<tr>
<td>[Procurement] Construction &amp; installation</td>
<td>4</td>
<td>8</td>
<td>Systems construction</td>
</tr>
<tr>
<td>Systems, equipment, piping &amp; valves</td>
<td>2</td>
<td>4</td>
<td>Systems sale &amp; construction</td>
</tr>
<tr>
<td>SURF</td>
<td>11</td>
<td>21</td>
<td>Manufacture, sale &amp; services</td>
</tr>
<tr>
<td>Subsea production systems</td>
<td>6</td>
<td>11</td>
<td>Systems sale &amp; installation</td>
</tr>
<tr>
<td>Subsea services</td>
<td>787 (Million)</td>
<td>2</td>
<td>Construction &amp; services</td>
</tr>
<tr>
<td>Rigs &amp; drilling</td>
<td>12</td>
<td>23</td>
<td>Drilling services</td>
</tr>
<tr>
<td>Drilling systems</td>
<td>3</td>
<td>6</td>
<td>Contracting &amp; services</td>
</tr>
<tr>
<td>Downhole &amp; well</td>
<td>8</td>
<td>16</td>
<td>Equipment sale &amp; services</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>1 (Million)</td>
<td>2</td>
<td>Services</td>
</tr>
</tbody>
</table>

Source: Interviews (2009/10); INTOSK (2010)

As discussed in the methodology section below, the current study takes a sub-sectoral approach rather than an aggregate approach (entire industry). As such, the study focuses on the SURF segment as case-study which involves two sub-segments, namely, *Subsea Control Lines* (umbilicals) and *Subsea Flowlines* (risers, manifolds, jumpers, pumps, etc). Focus on the SURF segment is based on two main factors. First, it is the second largest economic segment after the drilling services segment. Second, SURF is the only segment with localised manufacturing link in Angola. This factor is critical because literature on backward linkages in the oil sector posits that spillovers between the oil sector and the economy have historically occurred in the manufacturing sector because of its stronger multiplier effect potential based on the fact that manufacturing or industry requires wider variety of inputs on continuous basis, and not least because its value as the main basis of sustainable economic development and links to other manufacturing sectors (Dantes 2008; Wood 2007; Surrey 1987). Thus, the study sought to investigate the development of intermediate industrial linkages (processed material inputs and intangible technical services) between the localised manufacturing activities and the local economy. These linkages are a catalyst stepping stone for spillovers between the manufacturing activity and the local economy because they can be a building block for technical transfer from localised SURF manufacturing activity and the local industrial sector as a potential supplier.

---

\(^6\) This table is based on both primary research (interviews) conducted in 2009-2010 in Angola and on secondary research. In primary research, detailed interviews were conducted with oil operating companies which are the end-users of oilfield services, and the SURF (subsea umbilical, risers and flowlines) segments which are the focus of the study (see methodology section four). However, the author also engaged with actors in all the segments in order to obtain a holistic understanding on what links of the different segments are localised in Angola. Secondary research has been based on databases of specialist oil and gas research agencies, particularly the Norwegian Oil and Gas Partners (INTSOK). INTSOK is a global cluster of leading oil and gas Norwegian companies.
As can be observed on Figure 6 above, subsea control lines (umbilicals) serve as data or information conduit between subsea production systems and stationary production units (rigs) on the surface. Subsea flowlines serve as conduit between subsea production systems and stationary production units and oil tankers.

5. Methodology and methods

The study set out to test a number of hypotheses posited by the Making the Most of the Commodities Project (MMCP) as determinants of the extent and nature of local linkages (degree of value-added in Angola). Following a pilot study, the following hypotheses were selected as being relevant to the oil and gas sectors’ operations in Angola, namely, policy, national system of innovation (NSI), ownership and infrastructure. Thus, the study sought to answer the following research questions:

- How does policy affect the extent and nature of linkages?
- How does NSI affect the extent and nature of linkages?
- How does ownership affect the extent and nature of linkages?
- How does infrastructure affect the extent and nature of linkages?
5.1 Methodology

Studies on local content capturing in the oil and gas sector have been generally based on project-specific methodology i.e. focus on case-studies of development projects of individual oilfields and/or projects of systems construction within an oilfield\(^7\). The methods or tools most used to capture local content are local expenditure, local employment, and local supply of goods and services (e.g. Klueh et al 2009; Dantes 2006, Wiig 2006). As Wade (2004:20) observes, these are “sound and appropriate” measurements as they capture local impact in terms of income and technology transfer. However, Wade (2004) remarks, these measurements do not provide qualified understanding of local content unless they are disaggregated in terms of type of employees and types of goods and services in which expenditures are made. This is a critical point because oil-rich countries that have successfully diversified in the past have prioritised technological transfer and localisation of R&D activities as key contributors to the development of local industrial capacity (ibid).

The current study does not employ a project-specific approach which relies on indicators such as man-hours employed and on-off expenditures. Rather, it employs a sub-sectoral approach. Unlike the project-specific approach which is temporal, sub-sectoral approach is long-term and can better capture long-term trends. However, given the resources and time that would be required in an industry wide study covering all the major 10 oilfield segments, the study looks at the SURF segment as case-study which consists of two sub-segments, namely, subsea control lines (umbilicals) and flowlines (risers, manifolds, jumpers, pumps, etc). This is because SURF is the only segment with localised manufacturing links in Angola, and manufacturing activity has been the main channel of industrial spillovers between the oil sector and the broader economy in the experience of many of today’s oil-rich developed economies. The study also draws on Wade’s (2004) recommendations\(^8\) to enable capturing of local content, including categories of local employees, types of local goods and services, and specific localised links in which the previous local variables are involved and/or invested. In this way, the study can better differentiate between locally supplied and locally produced products.

5.2 Population and sample representativeness

The main populations of the study are (i) control lines suppliers, (ii) flowlines suppliers, and (iii) operators or oil producing companies who are the end-users of oilfield services. The study also engaged with public institutions for policy matters. Delineation of the control lines and flowlines contractors and oil operators was based on official record obtained from the Ministry of Petroleum which is the overarching regulator of the country’s oil and gas sector. Selection of public institutions was based on their relevance to the development of linkages in the oil sector (Table 7).

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\(^7\) Aggregate approach has also been employed mainly by major research units, such the World Bank and IMF, to capture the impact of expenditures in the oil and gas sector on the local GDP. But effects of such expenditures on GDP do not necessarily translate into local beneficiation because much of such value can be retained by multinational corporates and remitted outside the local market and used or paid out as dividends to economic agents residing in foreign markets (Wade 2004).

\(^8\) Wade (2004)’s recommendations were made to the Atlantic Canada Opportunity Agency (ACOA) concerning local content beneficiation in Atlantic Canada’s Oil and Gas Industry.
Table 7: Population description and sample representativeness

<table>
<thead>
<tr>
<th>Sector</th>
<th>North America</th>
<th>North Sea</th>
<th>South Africa</th>
<th>Angola</th>
<th>Others</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Sample</td>
<td>Total Sample</td>
<td>Total Sample</td>
<td>Total Sample</td>
<td>Total Sample</td>
<td>Total Sample</td>
</tr>
<tr>
<td>Operators</td>
<td>7 3</td>
<td>3 2</td>
<td>0 0</td>
<td>2 2</td>
<td>2 1</td>
<td>14 8</td>
</tr>
<tr>
<td>Control lines</td>
<td>1 1</td>
<td>3 3</td>
<td>0 0</td>
<td>0 0</td>
<td>0 0</td>
<td>4 4</td>
</tr>
<tr>
<td>Flowlines</td>
<td>3 3</td>
<td>7 5</td>
<td>1 1</td>
<td>0 0</td>
<td>0 0</td>
<td>11 9</td>
</tr>
</tbody>
</table>

The sample covered firms which are locally stationed in Angola i.e. with permanent operating bases or facilities. On this account, the sample covered 100% of control lines contractors, 82% of flowlines contractors, and 57% of oil operators. A total of 20 interviews were conducted with these three population groups. Respondents included operations and supply chain managers, human resource managers and chief executive officers.

A total of 17 interviews were conducted with operations and supply chain managers from firms involved in the other nine oilfield segments which are not the focus of the current study. However, these interviews were critical in determining which activity links in the different segments are localised in Angola.

Four relevant public institutions were consulted, namely, the ministries of petroleum, science and technology and industry, and Sonangol’s local content department. Two interviews were conducted with the Deputy Director and Director of the Department of Research and Planning in the Ministry of Petroleum. Two interviews were separately conducted with the Directors of the departments of research and planning in the ministries of industry and science and technology. And one interview was conducted with Sonangol’s local content policy department.

Although not a focus of the current study, 11 interviews were also conducted with SMEs which have links with the oil and gas sector as suppliers of basic general products. To identify these firms, the study used the record of one of the two identified oil sector-based institutions that have provided business development services to SMEs with links to the oil sector. The institution’s name is CAE (Centro de Apoio Empresarial – Business Support Centre) which is recognised by the Ministry of Petroleum, the State Oil Company, oil operators and by numerous oilfield services companies. One interview was conducted with CAE’s management besides the 11 interviews that were conducted with SMEs based on random selection from the 111 SMEs certified by CAE. These are at least 51% Angolan owned firms.

Further five interviews were conducted with key learning institutions, namely, the pedagogical direction of the country’s main university – Universidade Agostinho Neto, the pedagogical direction of the National Petroleum Institute, and the coordinators of the Petroleum Training Programme at Universidade Agostinho Neto.
5.3 Methods of data collection

The study used two sampling methods. Purposive sampling was used for the control lines and flowlines segments on which the study focuses. Random sampling was used for oil operators, the broader oilfield services segments and suppliers of basic general products. The primary aim was to obtain qualitative data on linkages based on experiences of stakeholders. Thus, open-ended interviews were used as main tool to collect data. Qualitative data was supplemented with quantitative data using two sets of tools: (i) semi-structured and likert scale questionnaires were used during interviews with stakeholders, and (ii) secondary sources have also been used based on company homepages and reports, reports and publications by independent research services agencies, and reports by international oil and gas organisations.

5.4 Methodological issues and implications

The methodology used has four main implications. First, the study is based on the manufacturing sector. It does not cover the entire oilfield services supply chain. As a result, the findings are more specific to the manufacturing sector. Second, the study engaged mainly with main contractors (control lines and flowlines suppliers) and oilfield products end-users (operators). Thus, the findings reflect mostly the experience of main contractors but limited experience of second and third tier suppliers. Third, there was limited access to some critical quantitative data in the course of the fieldwork because of data sensitivity, such as financial records, in-depth data on cost structures, contract records, market relationships and political factors. Thus, the findings are primarily qualitative rather than quantitative. Fourth, engagement with the other oilfield segments beyond the case studies provides an empirical basis for ascertaining the extent to which the experiences of the two case-studies can reflect the experience of the oilfield services value chain as a whole.

6. Research findings

This section presents findings from the two case-studies this study covers, namely, control lines and flowlines segments. The study finds that manufacturing activity was localised in Angola in the early 2000s (flowlines in 2003 and control lines in 2004).

6.1 Control lines value chain

The control lines value chain (CLVC) has three main chain links: (i) manufacture, (ii) installation and (iii) aftermarket services (maintenance).

Manufacture link

The manufacture link consists of design and fabrication of the umbilical equipment. Product design and development is the initial activity chain since umbilicals are custom designed and manufactured according to the client’s operational requirements and the marine conditions of the production locale. It is based on specific operational purpose and marine conditions that the composition of an umbilical package is determined and configured. This activity requires specialised engineering, operational and management know-how. Production manufacture
involves turning design into finished product, including the functional components of an umbilical (electric power cables and optical fibres) and spinning the functional components into a covering sheath. The critical inputs that go into the fabrication activity are specialised engineering skills and know-how, fabrication workshop, plastic and steel materials and alloys, carousel and reelers (main manufacturing machinery), and supportive metallurgical services (Interviews).

**Installation link**

The manufacturing link concerns the placement of the umbilical product in production systems, including connecting it with subsea production systems (wellhead and x-tree) and stationary production units (rigs) on the surface. The installation activity can be performed by the umbilical manufacturer or by a construction contractor.

**Maintenance (aftermarket services)**

The maintenance link has two components: routine maintenance and corrective maintenance. Routine maintenance constitutes 90% of all maintenance services and it is performed in-house by clients (operators). Corrective maintenance constitutes 10% of all maintenance services and it can only be performed by the umbilical product’s original manufacturers because of the tacit, specialised knowledge involved in its manufacturing. Thus, corrective maintenance is subsumed in the fabrication link as it is part of purchasing contract because manufacturers sell umbilical products with warranty for determined period of time (generally 18 months). This warranty is fulfilled through aftermarket corrective services (Interviews).

**Control lines value-added chain**

Table 8 below shows the three chain links of the control lines segment, value distribution per link, and the location where each activity is produced or based.

*Table 8: Control lines value-added chain ($7bn in contracts for 2004-2010)*

<table>
<thead>
<tr>
<th>Activity Chain</th>
<th>Production Cost (%)</th>
<th>Location of Production (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>15%</td>
<td>Angola 40%</td>
</tr>
<tr>
<td>Fabrication</td>
<td>65%</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>10%</td>
<td>Angola N/A</td>
</tr>
<tr>
<td>Aftermarket service</td>
<td>10%</td>
<td>Angola 0%</td>
</tr>
</tbody>
</table>
Table 8 above is based on interviews and secondary sources (Upstream 2010; Quest Offshore 2009). Installation and maintenance activities are fixed i.e. performed *in situ*. As such, they have always been performed on the Angolan offshore. However, these services are not necessarily produced locally in Angola (localised production). Installation services account for 10% of the control lines value chain. But data is not available on how much of these services are produced locally in Angola and how much is produced abroad. Maintenance services also account for 10% of the control lines value chain, but 100% of these activities are produced between the USA and Europe and performed in Angola. These are corrective maintenance services which require original manufacturer knowledge. Buyers can call on sellers (manufacturers) for these aftermarket services within a warranty period (lasting 18 months on average) enclosed in purchasing contract (‘call-on-contract’).

Manufacturing activity, which is the focus of the study, accounts for 80% of the total cost of the control lines value chain. Since 2004, 40% of the control lines equipment supplied to the Angolan market has been produced in Angola and 60% produced between the USA and Europe. The following subsections look at the types of inputs that have supported the manufacturing activity and how much of these inputs are local.

**Non-material inputs in the manufacturing activity**

Gross expenditure on labour accounts for 15-20% of the total operating costs, but there is no available data on annual and functional (skill level) cost differences. Table 8 below shows that when the manufacture activity was localised in 2004, 80% of the total basic and mid-level workforce was local and 20% was expatriate. In 2009, the total share of local labour grew to 90%. This figure is projected to remain at the same level by 2014. At management level, local personnel grew from 30% in 2004 to 45% in 2009 and it is projected to increase to 60% by 2014. But at higher technical level, there were zero local engineers in 2004. This figure changed to 17% in 2009 and is projected to increase to 52% by 2014 (Table 9).

<table>
<thead>
<tr>
<th>Period</th>
<th>Total Workforce</th>
<th>Local (Angolan) workforce</th>
<th>Expatriate workforce</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Basic &amp; Mid-Skilled</td>
<td>Managers</td>
</tr>
<tr>
<td>2004</td>
<td>50</td>
<td>80%</td>
<td>30%</td>
</tr>
<tr>
<td>2009</td>
<td>160</td>
<td>90%</td>
<td>45%</td>
</tr>
<tr>
<td>2014*</td>
<td>180</td>
<td>90%</td>
<td>60%</td>
</tr>
</tbody>
</table>

*Estimated by respondents

Source: Interviews (2009/10)

**Material inputs in the manufacturing activity**

Table 10 shows the types of material inputs for which data could be obtained that have supported the manufacturing activity and where they have been produced, as well as their economic value as measured by share in total operating cost (OPEX).
Table 10: Types of material inputs and their provenance

<table>
<thead>
<tr>
<th>Types of Inputs</th>
<th>% of total OPEX</th>
<th>Description</th>
<th>Provenance</th>
<th>Imported</th>
<th>Locally Produced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Machinery</td>
<td>70-75</td>
<td>Carousels &amp; Reelers, Amortisation</td>
<td>✓</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Intermediate Goods</td>
<td></td>
<td>Carbon &amp; stainless steel, brass, inconel, monel, polyethylene, services, etc</td>
<td>✓</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Raw Material</td>
<td></td>
<td>Metal, steel, copper</td>
<td>✓</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>Labour (skilled/unskilled)</td>
<td>15-20</td>
<td>Engineers, managers, welders, etc.</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Basic General Services</td>
<td>4</td>
<td>HSE, catering, cleaning, security, civil construction, labour recruitment, lease</td>
<td>--</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Basic General Goods</td>
<td>2</td>
<td>PPE, IT &amp; electronic equipment, office furniture, stationary, etc</td>
<td>✓</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

Source: Interviews (2009/10)

Table 10 shows five types of inputs: (i) production machinery, (ii) intermediate goods (processed materials) and (iii) raw materials which account for estimated 70-75% of total operating cost, (iv) basic general products which are divided into basic general services and basic general goods and account for 4% and 2% of total operating cost respectively, and (v) labour (skilled and unskilled) which account for 15-20% of total operating cost. Production machinery, intermediate goods, raw material and basic general goods have been fully imported from abroad. Labour has been sourced both locally and abroad (see Table 9 above). However, basic general services have been locally produced. Table 11 below shows how much of these inputs the manufacturers have sourced directly in-house and/or through local suppliers.

Table 11: Sourcing of material inputs in manufacturing activity (2004-2014)

<table>
<thead>
<tr>
<th>Period</th>
<th>Machinery</th>
<th>Intermediates goods</th>
<th>Raw material</th>
<th>General products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
<td>Local</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>2004</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>80%</td>
</tr>
<tr>
<td>2009</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>90%</td>
</tr>
<tr>
<td>2014*</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>&gt;90%</td>
</tr>
</tbody>
</table>

*Estimated by respondents

Source: Interviews (2009/10)

Table 11 shows that since 2004, the manufacturers have imported all the production machinery, intermediate goods and raw materials and this trend is unlikely to change in the near future. But they have sourced general products both in-house and through local suppliers. Share of local sourcing grew from 80% in 2004 to 90% in 2009. This share is projected to increase beyond 90% in the near future.

6.2 Flowlines value chain

The flowlines value chain (FVC) has four main chain links: (i) manufacture, (ii) assembly, (iii) installation and (iv) aftermarket services (maintenance).
Manufacture link

The manufacture link involves design and fabrication of flowlines product. Product design is the initial stage of the fabrication activity and it consists of product development according to the client’s specifications i.e. operational requirements and marine conditions of the production locale. Critical inputs in this activity include specialised engineering, operational and management skills and know-how. Product fabrication activity is defined at the planning and design stage. It involves the transformation of design into finished product. The critical inputs for the fabrication activity are manufacture workshop and machinery, engineering skills and know-how, raw materials (mainly steel), and processed materials (ferrous/non-ferrous alloys).

Assembly link

The assembly activity concerns the composition (putting together) of components prefabricated overseas for key flowline equipment, namely, manifolds, risers, flow pipes and suction anchors. The montage activity includes coating, jolting, pipe-lining, welding, testing, and preparation of equipment for offshore installation. Complementary flowline equipment to manifolds, risers, flow pipes and suction anchors, such as jumpers and clutches, are locally fabricated according to overseas predesigned models. This complementary manufacturing process involves cutting, welding and pipe-rolling. The critical inputs in the assembly link are production yard, production machinery and equipment, specialised engineering skills and know-how, basic steelwork skills, and raw materials (steel and ferrous and non-ferrous alloys).

Installation link

The installation activity is performed offshore and it involves j-laying i.e. construction and placement of equipment in the seabed. The critical inputs required in this activity are subsea engineering skills and know-how, divers, services vessels, installation reel-lay, remotely operated vehicles (ROVs), cranes, pennants, etc. These are the same inputs needed for decommissioning services which involves the removal of equipment from the site following the end of production life cycle. Construction, installation and decommissioning of flowline equipment can be performed by flowlines original manufacturer or contractor and/or by construction contractors.

Maintenance link

The maintenance link has two components: routine maintenance and corrective maintenance. Routine maintenance is mostly performed in-house by clients (operators) and it constitutes 90% of all maintenance. Corrective maintenance constituted 10% of all maintenance and it can only be performed by the original flowlines manufacturer because it requires tacit, specialised knowledge of the original manufacturer. Thus, corrective maintenance is subsumed in the fabrication link as it is part of purchasing contract (‘call-on-contract’) because manufacturers sell flowlines products with warranty for determined period of time. This warranty is fulfilled through aftermarket corrective services.
Flowlines value-added chain

Figure 5 below shows the four chain links of the flowline segment, value distribution per link, and the location where each activity is produced or based (Figure 5 below).

Installation and maintenance activities are of fixed nature and have always been performed *in situ* on the Angolan offshore. However, the services involved in these activities are not necessarily supplied locally in Angola. Installation activity represents 10% of the FVC. But data is not available on how much of these services is produced locally in Angola and how much is produced abroad. Maintenance activity represents 5% of the FVC, but most of the services involved are supplied from abroad, USA and Europe.

The assembly link, which is the focus of this study, concerns the assembly of flowline components designed and prefabricated in the USA and Europe. This assembly link was localised in Angola in 2003 and since then it has represented 5% of the FVC. The following subsections look at the inputs that have supported the localised assembly activity (Table 12).

**Table 12: Flowlines value-added chain ($10bn in contracts for 2004-2010)**

<table>
<thead>
<tr>
<th>Activity Chain</th>
<th>Production Cost (%)</th>
<th>Location of Production (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>10%</td>
<td>Angola 0%</td>
</tr>
<tr>
<td>Fabrication</td>
<td>70%</td>
<td>USA/Europe 100%</td>
</tr>
<tr>
<td>Assembly</td>
<td>5%</td>
<td>Angola 100%</td>
</tr>
<tr>
<td>Installation</td>
<td>10%</td>
<td>Angola N/A</td>
</tr>
<tr>
<td>Aftermarket Service</td>
<td>5%</td>
<td>Angola 0%</td>
</tr>
</tbody>
</table>

Source: Interviews (2009/10)

Non-material inputs in the manufacturing (assembly) activity

Expenditure on labour accounts for 20% of the total operating cost, but there is no available data on annual and functional (skill level) cost differences. Table 13 below shows that local share of basic and mid-skill workforce grew marginally from 70% in 2003 when the assembly activity was localised in Angola to 72% in 2009. This share is projected to grow to 85% by 2014. However, at higher technical level, local share grew from 5% in 2003 to 20% in 2009 and is projected to grow to 35% by 2014.
Table 13: Non-material inputs in manufacturing (assembly) activity (2004-2014)

<table>
<thead>
<tr>
<th>Period</th>
<th>Local workforce</th>
<th>Expatriate workforce</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic &amp; Mid-Skilled</td>
<td>Basic &amp; Mid-Skilled</td>
</tr>
<tr>
<td>2003</td>
<td>70%</td>
<td>5%</td>
</tr>
<tr>
<td>2009</td>
<td>72%</td>
<td>20%</td>
</tr>
<tr>
<td>2014*</td>
<td>85%</td>
<td>35%</td>
</tr>
</tbody>
</table>

*Estimated by respondents

Source: Interviews (2009/10)

Material inputs in the manufacturing (assembly) activity

Table 14 below shows the types of material inputs that have supported the flowlines assembly activity for which data could be obtained and where they are produced, abroad or locally.

Table 14: Types material inputs and their provenance

<table>
<thead>
<tr>
<th>Types of Inputs</th>
<th>% of total OPEX</th>
<th>Description</th>
<th>Provenance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Imported</td>
</tr>
<tr>
<td>Production Machinery</td>
<td>75</td>
<td>Pipe pincers, loaders, rollers, stalk racks, cranes, Amortisation</td>
<td>✓</td>
</tr>
<tr>
<td>Raw Material</td>
<td></td>
<td>Metal, steel, copper</td>
<td>✓</td>
</tr>
<tr>
<td>Labour (skilled/unskilled)</td>
<td>20</td>
<td>Engineers, managers, welders, etc.</td>
<td>✓</td>
</tr>
<tr>
<td>Basic General Services</td>
<td>3</td>
<td>HSE, catering, cleaning, security, civil construction, labour recruitment, lease</td>
<td>--</td>
</tr>
<tr>
<td>Basic General Goods</td>
<td>2</td>
<td>PPE, IT &amp; electronic equipment, office furniture, stationary, etc</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: Interviews (2009/10)

Table 14 shows four types of inputs: (i) production equipment, (ii) raw material, (iii) labour (skilled and unskilled), and (iv) basic general products which are divided into basic general services and basic general goods. Production equipment, raw material and basic general goods have been fully imported. Labour have been both locally sourced and imported. However, basic general services have been locally produced. Table 15 below shows how much of the material inputs the assembly firms have sourced directly in-house and/or through local suppliers.

Table 15: Material inputs in manufacturing (assembly) activity (2004-2014)

<table>
<thead>
<tr>
<th>Period</th>
<th>Equipment</th>
<th>Raw Material</th>
<th>General Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Local</td>
<td>Local</td>
<td>Local</td>
</tr>
<tr>
<td>2003</td>
<td>0%</td>
<td>0%</td>
<td>70%</td>
</tr>
<tr>
<td>2009</td>
<td>0%</td>
<td>0%</td>
<td>90%</td>
</tr>
<tr>
<td>2014X</td>
<td>0%</td>
<td>0%</td>
<td>90%</td>
</tr>
</tbody>
</table>

Source: Interviews (2009/10)
Table 13 shows that the assembly firms have imported all the production equipment and raw material directly in-house from abroad since 2003. However, in terms of general products (services and goods), the aggregate share of local sourcing grew from 70% in 2003 to 90% in 2009. This share is projected to remain at 90% by 2014.

### 6.3 Conclusion

Findings from the two case-studies indicate that for the nearly 10 years of localised manufacturing activity in the oil and gas value chain in Angola, intermediate linkages between the manufacturing function and the local economy remain limited. All material inputs have been imported. Intangible intermediate inputs are limited to local human capital. However, while the volume of local human capital is high at basic and mid-technical levels, this is low at higher technical level (engineers). The foremost local linkage is in supply of basic general products which have no direct input in the manufacturing function. Within these inputs, only general services are locally produced. General goods are fully imported.

Figure 7 below shows a typology of inputs in terms of volume of import intensity and technical intensity. Production equipment and/or machinery, material intermediate goods and high skilled labour are imported and technology intensive. Raw material and basic general goods are low-tech but import-intensive. Basic and mid-skilled labour and basic general services are low-tech and local-intensive.

![Figure 7: Typology of inputs](image-url)
7. Determinants of linkages

This section discusses the determinants of linkages between the manufacturing sector in the oil and gas value chain and the local economy in Angola. The study finds that policy, local capability (NSI), corporate strategy, ownership and regional factors are the critical drivers of linkages. However, policy and NSI are the main and overarching drivers. Local content policy pressure is the main factor behind the localisation of manufacturing activity in Angola, of high volume of intangible intermediate linkages at basic and mid-skill levels, and of high volume of local sourcing of general products. In turn, weak capacity in local manufacturing and skills and incoherent local content policy are the limiting factors to the lack of material intermediate linkages between the manufacturing function and the local economy.

7.1 Infrastructure

From the point of view of the manufacturers (control lines and flowlines contractors), infrastructure (existence or lack of it) does not determine the limited intermediate linkages between the manufacturing function and the local economy. In fact, the state of the country’s infrastructure does not have a bearing on localisation decision because the most immediate infrastructure these actors need are land-based operation facilities, including oil terminals and production yards, which the industry itself continues to build. These facilities have in-built resources such as fuel, water, electricity and information systems. As such, these facilities are insulated from the country’s poor infrastructural condition. There are currently eight major oil terminals strategically spread across the country’s concession basins. Oil terminals are equipped with fuel facilities, workshops, servicing equipment (cranes, straddle carriers, work trucks, lifting frames and docking areas) and office spaces for administrative and sales activities. Because of their long stay in the market, oil operators own private operating facilities, although they also lease facilities in concession areas where they may not have their own facilities. Oil services companies generally lease oil terminal facilities for their operations. Production yards are facilities where oil services companies carry out manufacturing activity. These facilities are agglomerating in an expanding industrial park located along the Kwanza Basin in Lobito where the country’s major offshore blocks are located (Interviews).

There are however critical infrastructural issues affecting the development of local SMEs which have supplied basic general products to the oil sector. Based on interviews with these actors, the main issues affecting them are poor and unstable electricity and water supply, and inefficient customs services and lack of access to financial services as institutional infrastructural problems. Information technology is also a problem because their clients (oil operators and oil services companies) have had difficulties locating them when they have been needed (Interviews) (Box 2).

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9 In some cases substitutes are used. For example, electricity generators are used to buffer the country's poor and unstable electricity supply, and hydro-generators are used to buffer the country's poor water supply system.
Box 2: Infrastructure Problems Affecting Local SMEs (Interviews 2009/10)

“Credit for small suppliers is very important. In fact it is a topic that we talk about frequently inside X [firm name omitted]. The people you are trying to reach that need credit from the banks of Angola are the small people who are trying to start. The people that get credit are the people that already have lots of money. They do not need it much. So how do you get the credit for small companies that have ideas and entrepreneurial abilities to contribute? This is because they are just starting now. Perhaps they do not have a great name behind them or a great person standing behind them. But they are a great person with a great idea trying to start something. So access to the credit market is critical to them. To me it is an opportunity again, especially for banks. If the bank industry see it as an opportunity for growth that they can loan money to companies to get the supply chain and the economy stimulated. That is something that needs to happen” (Oil Operator).

“We local companies have to have power generators because of poor electricity supply for example and a generator costs $20,000 to $25,000. We need establishments and rent is very expensive. Labour is also very costly. So we have a feeling that we are not competing in the same playing field as foreign companies” (Labour Recruitment Services SME).

“Local companies have other issues...there is still infrastructure problem...there are information and marketing deficiencies on the part of local companies. It is difficult to find local firms, to know what they do and about their business performance. Right now the most helpful tool we have used is the yellow page book...it has been our only help” (Oilfield Services Main Contractor).

“This item [recording equipment] cost me $1000 in South Africa. For customs I paid $500 and something almost 60% of its purchase value. Tariff is over half the price of an item including transport. Why should I pay for transport cost as a tariff? They apply 10% tariff on any manufactured product. Here I have to add 30% to make some profit. If in South Africa it cost $1000 here it costs $1800 or $2000...something I really do not understand, I also have to pay a service tax fund. I asked a customs’ officer why he said he did not know he is a simple worker. I do not know what all the economists are doing. This is damaging business” (SME).

7.2 Ownership

Ownership of Angolan hydrocarbon resources by the Angolan State (Law No.13/76) gives the State power to induce local linkages through local content policy. The local content policy statutes (discussed on Section 2) are the (i) Angolanisation of human resources statute (Law 20/82), (ii) the rule of exclusivity that reserves the supply of basic general products that do not involve high capital value and in-depth specialised technical knowledge for local suppliers, and (iii) the rule of semi-compliance which ratifies preference for joint-venture firms between Angolan and foreign companies in supply of semi-exclusive products that involve average level of capital and in-depth but not specialised technology (Decree 127/03) (see Section 2.3).

The findings on Section 6 parallel the Angolanisation policy since human resources are the main intermediate linkage between the localised manufacturing function and the local economy. Table 16 below shows responses of stakeholders on in-house training of local human resources. All the respondents (100%) claim to have in-house training programmes for local labour which is done both on-the-job and abroad. Most of the training abroad is done in the USA and Europe (83%), and limitedly in Brazil (25%) and South Africa (10%). Most of the respondents (88%) have funded local learning institutions, of which 54% have directed their funding to the National Petroleum Institute (INP), and 46% to different institutions. Nearly half of the respondents (43%) have collaborated with local institutions in curriculum
development, of which 83% have had such collaboration with the INP, while 27% have collaborated with different institutions (Interviews) (Table 16).

**Table 16: Linkages between local content and intra-firm HR training**

<table>
<thead>
<tr>
<th>Frequency (%)</th>
<th>Yes</th>
<th>No</th>
<th>INP</th>
<th>Various</th>
<th>USA/EU</th>
<th>USA/EU Brazil</th>
<th>South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Do you have in-house training programmes</td>
<td>100</td>
<td>0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2 Do you train employees on-the-job</td>
<td>100</td>
<td>0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3 Do you train employees Abroad</td>
<td>100</td>
<td>0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4 Where abroad have you trained employees</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>83</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>5 Do you have a funding policy for local learning institutions</td>
<td>88</td>
<td>12</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>6 Which local learning institutions have you funded to date</td>
<td>--</td>
<td>--</td>
<td>54</td>
<td>46</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7 Have you collaborated in curriculum development with any local institution</td>
<td>43</td>
<td>57</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>8 Which local institutions have you collaborated with in curriculum development</td>
<td>--</td>
<td>--</td>
<td>83</td>
<td>27</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Source: Interviews (2009/10)

The findings also parallel the rule of exclusivity policy as local supply of basic general products is the foremost local linkage between the local production activity (not directly linked to manufacturing function) and the local economy. For oil services companies and oil operators it is strategic to source these items locally to produce local content. For the former, local content puts them in good contracting terms with the client or oil operators who are the end-users of oilfield services. In turn, local content puts oil operators in good terms with the concessionaire (Sonangol). This is a critical policy rent for successful bidding in resource acreage licensing (Box 3).

**Box 3: Sourcing of General Products Locally (Interviews 2009/10)**

“...as far as local firms without joint-venture are concerned, their involvement is very limited. They are only involved in the low end activities. Local content policy is clear, it has requirements. It only allows you to obtain products from abroad that are not locally available” (Oil Operator).

“National companies provide us with basic services such as security services, accommodation for rent, rent and purchase of vehicles, catering, printers, papers, computers, etc. Names? No idea. Sometimes these are not real companies, just individuals” (Oilfield Services Main Contractor).

The rule of semi-compliance (semi-exclusive products) which gives preference for joint-venture firms between national and foreign companies to supply products that involve average level of capital and technology is the main driver of localisation of manufacturing activity in Angola by multinational companies. As earlier discussed (Section 2.2), although most of the products defined as semi-exclusive actually involve high levels of capital and technology instead of average levels of capital and technology as posited by the local content policy, the policy preference for joint-venture companies over wholly-foreign-owned companies has created a market
niche that has been seized by the control lines and flowlines contractors which have localised manufacturing activity in Angola.

Figure 8 below illustrates how oil producing companies (the end-users of oilfield products) normally source flowlines and control lines as adjunct packages to subsea production systems equipment through EPCI or turnkey contracts (EPCI stands for engineering, procurement, construction and installation) which are awarded to subsea production systems contractors. Only limitedly have oil operators sourced flowlines and control lines equipment directly from core flowlines and control lines contractors (as indicated by the long arrow). Thus, in the normal indirect contracting model (via subsea production systems contractors), core flowlines and control lines contractors act as subcontractors to subsea production systems contractors. This fact has limited market access for core flowlines and control lines contractors. With the local content policy assigning preference for joint-venture companies, some control lines and flowlines companies which in the past experienced limited market access have strategically localised manufacturing activities in Angola in joint-venture with Sonangol, the Angolan State National Oil Company, in order to gain greater access because they now have first preference advantage (Interviews) (Figure 8).

**Figure 8: Subsea market supply chain (producer-driven chain)**

Box 4 below captures interview excerpts, one from an oil producing company or oil operator (end-user of flowlines and control lines equipment), and another from a core control lines contractor with localised manufacturing activity in Angolan. The first

---

10 SPS: subsea production systems which include wellheads, Christmas Trees and construction of subsea production environment. FL: flowline equipment. CL: control lines equipment. EPCI: turnkey contract (engineering, procurement, construction and installation).
excerpt illustrates the fact that oil operators prefer to limit the number of contractors they have to deal with directly to a minimum in order to reduce transaction costs and spread the risk. This is because the level of technology required in deepwater environment is highly intensive and specific (asset specificity instead of standard products). Through EPCI contracts, operators can minimise these risk factors and limit the number of suppliers they have to deal with directly by devolving the subcontracting role to main contractors. The second excerpt illustrates the localisation strategy of core flowlines and control lines contractors (Box 4).

**Box 4: Interviews (2009/10)**

“As an operator you buy technical knowledge...if I were doing something here in Angola, I would probably not only focus on the field to be developed but rather focus on my whole concession, and part of that is that the efficiency of the operation...you are trying to streamline as much as possible your knowledge base. So if I could train people to do work then I could train them all in one system and it is easier to do that. If I only have to maintain a part's inventory for one type of subsea environment then my inventory levels and my investment in inventory go way down. If I have to maintain three or four different suppliers in a concession then my inventory levels go up. I have to have an individual that knows not only how to work on apple but also on windows. So you have to have one person who can work on multiple things at one time and that does not lead to efficiency”.

“Local content for us is a legal motivation. Why is there X (firm name omitted) joint-venture with Sonangol? Without it, it was hard to have contracts. That is why we chose to do joint-venture and enter the umbilical cable [control lines] manufacturing in Angola because it was a niche market despite all the technical difficulties to make it. Everybody who heard of it was sceptical. But we have now made it a reality. We had the experience of bidding for tenders but not winning not because we lacked in any technical requirement but because we did not have the local content advantage...”

Table 17 below shows all the firms with local representation that are involved in the control lines and flowlines value chains. Only joint-venture firms have localised manufacture link in Angola. These joint-ventures are formed between Western MNCs and Sonangol, the Angolan State National Oil Company. They are not formed with private Angolan companies. Nevertheless, these joint-ventures qualify them as beneficiaries of preferential treatment ratified in the local content policy (Table 17).

As can be further observed from the critical contracting success factors posited by operators (end-users of oilfield products) on Figure 9 below, the joint-venture firms have the same technical credibility as multinational firms since they bear the brand and rely on the technical resources of their parent companies. In addition, the competitive advantages that joint-ventures have are proximity (efficient delivery time) and local content (local capital ownership and provision of long-term and higher volume of local employment). However, the main trade-off that both subsea production systems contractors (who act as main contractors in the subsea supply chain market) and oil operators and oil services companies have to make is between the higher cost of products by joint-venture firms. For subsea production systems contractors, it is strategic to have as much local content as possible because it puts them in good contracting terms with the client i.e. oil operators who are the end-users of oilfield services. In turn, it is strategic for oil operators to have satisfactory local content in their contracting record because it puts them in favourable terms with the concessionaire (Sonangol). This is a critical policy rent for successful bidding in the licensing of future resource acreage (see Table 17 and Figure 9).
### Table 17: Firms involved in control lines and flowlines value chains

<table>
<thead>
<tr>
<th>Firm Name</th>
<th>Type</th>
<th>Core Competence</th>
<th>Localised Manufacture</th>
<th>Ownership</th>
<th>Parent Firm</th>
<th>Headquarters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angoflex</td>
<td>Joint-venture</td>
<td>Control lines</td>
<td>✓</td>
<td>30%</td>
<td>70%</td>
<td>Technip</td>
</tr>
<tr>
<td>Petromar Ltd</td>
<td>Joint-venture</td>
<td>Flowlines</td>
<td>✓</td>
<td>40%</td>
<td>60%</td>
<td>Saipem</td>
</tr>
<tr>
<td>Sonamet Industrial</td>
<td>Joint-venture</td>
<td>Flowlines</td>
<td>✓</td>
<td>40%</td>
<td>60%</td>
<td>Acergy</td>
</tr>
<tr>
<td>Oceaneering Multiplex</td>
<td>MNC</td>
<td>Control lines &amp; flexible cables</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Oceaneering</td>
</tr>
<tr>
<td>Sevenseas</td>
<td>MNC</td>
<td>Flowlines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Subsea 7</td>
</tr>
<tr>
<td>Saipem S.p.A.</td>
<td>MNC</td>
<td>Drilling systems</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>ENI</td>
</tr>
<tr>
<td>Vetco Gray</td>
<td>MNC</td>
<td>Subsea systems</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>General Electrics</td>
</tr>
<tr>
<td>Cameron</td>
<td>MNC</td>
<td>Subsea systems</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Cameron</td>
</tr>
<tr>
<td>Aker Kvaerner</td>
<td>MNC</td>
<td>Subsea systems &amp; control lines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Aker Kvaerner</td>
</tr>
<tr>
<td>FMC Technologies</td>
<td>MNC</td>
<td>Subsea systems</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>FMC Technologies</td>
</tr>
<tr>
<td>FMC Kongsberg</td>
<td>MNC</td>
<td>Control lines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>FMC Technologies</td>
</tr>
<tr>
<td>Subsea 7</td>
<td>MNC</td>
<td>Flowlines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Subsea 7</td>
</tr>
<tr>
<td>Acergy</td>
<td>MNC</td>
<td>Flowlines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Acergy</td>
</tr>
<tr>
<td>Heerema HFG</td>
<td>International</td>
<td>Flowlines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Heerema Group</td>
</tr>
<tr>
<td>Le Trait</td>
<td>International</td>
<td>Engineering &amp; flowlines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Technip</td>
</tr>
<tr>
<td>Friedlander</td>
<td>International</td>
<td>Engineering</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>ORTEC Group</td>
</tr>
<tr>
<td>Duco Ltd</td>
<td>MNC</td>
<td>Control lines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Technip</td>
</tr>
<tr>
<td>Technip Coflexip</td>
<td>MNC</td>
<td>Control lines</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>Technip</td>
</tr>
<tr>
<td>JDR Cables</td>
<td>MNC</td>
<td>Control lines &amp; flexible cables</td>
<td>No</td>
<td>0%</td>
<td>100%</td>
<td>JDR Cables</td>
</tr>
</tbody>
</table>

Source: Interviews (2009/10)
Oil operators posit as critical contracting success factors the following: (i) technical competence, (ii) supply capacity, (iii) cost-efficiency, (iv) quality, safety and environmental standards (QSHE), (v) Angolan content, (vi) experience (brand and reputation), (vii) delivery time and (viii) financial strength. Technical competence concerns supplier ability to provide customised products according to client specifications and operational conditions. Supply capacity concerns supplier ability to deliver products according to volume required by client. Cost-efficiency is a key factor given the industry’s capital intensity. In every procurement and operation, cost-saving is strategic to increase profit. QSHE concerns supplier ability and/or culture to observe safety regulations without compromising quality. Angolan content is critical because it is a key determinant in the process of contract approval by the concessionaire (Sonangol). Sonangol has the onus to clear or decline contract proposals based on discrete judgement of whether a proposal satisfies local content requirements. Financial strength concerns supplier financial capacity to deliver services under the credit regime employed in the industry (45 days on average), and supplier credit liability to compensate in eventuality of failure to deliver a contract.

Given their tradition in the oilfield market, superior R&D capacity, mergers and acquisitions, the MNCs (firms with intercontinental/global operations) dominate the oilfield market. They only come second to joint-venture firms in terms of Angolan content and delivery time as the latter have comparative advantage of being co-owned by Sonangol and of being fully localised. International firms (independent firms with international but not intercontinental operations) are only more competitive than joint-venture firms in terms of supply capacity, cost-efficiency and experience.

There is close interaction between market ownership, corporate strategy and region. The supply chain is dominated by suppliers from North America and North Sea just as the concession market is dominated by operators from these regions (see Section 4.1 Figure 5). They hold 76.5% of all licensed equity in deepwater concessions which are the main source of current and future oil in Angola (Section 1.1), and to-date they
remain the only operators. The remainder equity is held by Sonangol (6.7%) and Sonangol China International (16.7%). But neither of the latter operates deepwater concessions. The dominance of the supply chain by North Sea and North America firms is evidenced in the distribution of the major contracts awarded by oil operators for control lines and flowlines equipment in 2004-2010 (Table 18).

**Table 18: Major SURF [EPCI] contracts awarded (2004-2010)**

<table>
<thead>
<tr>
<th>Operator</th>
<th>No. of contracts</th>
<th>North Sea Contractors</th>
<th>N. America Contractors</th>
<th>North Sea Subcontractors</th>
<th>N. America Subcontractors</th>
<th>Other subcontractors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chevron</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>ExxonMobil</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total E&amp;P</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>BP Angola</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: Upstream Magazine (2010); Infield (2010); QuestOffshore (2010)

As can be observed on Table 18, all the major EPCI contracts awarded by operators remained within the North Sea and North American regions, just as almost all the subcontracts remained within the North Sea and North American regions.

**7.3 Human resources and industrial capabilities**

As evidenced on Section 6, human capital is the main form of intermediate linkages occurring between the manufacturing function and the local economy. But even these inputs remain limited at higher technical level. There are no material intermediate linkages between the manufacturing function and the local economy, and the prospects of such linkages developing in the near future are dim. Stakeholders posit that the main factor challenging the development of this middle industry in Angola to support the manufacturing function is poor local capability. This includes a weak manufacturing sector particularly the metallurgical industry, and a lack of qualified and/or skilled human resources in the local labour market. Figure 10 below shows the industry’s assessment (based on a likert scale questionnaire) of the capability of the local economy in view of these factors (Figure 10).

Figure 10 below shows the capability factors that the industry stakeholders find most critical for the development of linkages in the manufacturing function between the oil sector and the local economy. The industry’s assessment of these factors shows a large capability gap particularly in the country’s industrial base. While the human resources situation is being helped by intra-firm training, local labour skills are in general very weak. And there is scarcity of local firms with ability to provide adequate metallurgy services and products (Interviews) (see Figure 10 and Box 5).
**Figure 10: Industry assessment of local capabilities**

- Prerequisite
- Angola's condition

Source: Interviews (2009/10)

**Box 5: Interviews Excerpts (2009/10)**

"It is very difficult to find technically trained people locally. There is no such capacity. We have an Angolan lady in charge of the finance department, but she is someone with international experience, training and work experience from abroad...we recruit anybody and we train them. General education at local universities to help improve the academic capacity and technical training we provide in-house. For example, in Lobito we have 26 employees and in Luanda 15 employees who work during the day and study at night...within in-house training we also send people overseas to American, European institutions. For example in Brazil we have 11 students" (Control Lines Contractor).

"Local steel industry is still very, very, very weak...they lack computerised systems, types of technology, equipment for various types of steels" (Oilfield Services Main Contractor).

8. **Industrial policy**

The previous section argued that policy and local capabilities are the main determinants of linkages in the manufacturing sector in the oil and gas value chain in Angola. Local content policy pressure is the main driver of localisation of manufacturing activity and of high volume of intangible intermediate inputs (labour) at basic and mid skill levels in the manufacturing function. But weak manufacturing and unavailability of skilled labour is the limiting factor to the low volume of intangible intermediate inputs at higher technical level and the current lack of tangible or material intermediate linkages. This section looks at policies on manufacturing and human capital development at macro (national) level. The section finds inefficiency in the macro policy caused by lack of clear implementation and review mechanisms.

With the end of the civil war in 2002, Angola's public policy initially focused on national reconstruction i.e. consolidation of peace and national reconciliation. The priorities in this agenda were social reintegration and safety, food security and
rehabilitation of basic infrastructure (health, education, roads) (GOA 2005). In the latter part of the decade, the policy focus has been shifting toward sustainable development through economic diversification and promotion of private enterprise. This new policy focus is at the core of the mid-term government programme for 2009-2013 whose theme is Sustainable Development Programme for 2009-2013 (PDS 2009-2013) (GOA 2009).

In the context of the PDS 2009-2013, The Ministry of Industry (MIND) is the leader of the country’s project for industrial and dynamic capabilities development. In February 2009, the MIND’s plan entitled Mid-Term Industrial Restructuring Plan (2009-2013) was approved by The Council of Ministers, the highest executive organ of the State. The plan proposes to (i) strengthen the institutional capacity of the Ministry of Industry, (ii) to rehabilitate and develop productive activities, (iii) to rehabilitate and create industrial infrastructure, (iv) to promote technological development, (v) to strengthen the private sector and (vi) to rebuild and develop the country’s human capital capacity (MIND 2009).

First, to strengthen the capacity of the MIND, the MIND plans to create a special fund for conducting viability studies to support funding projects by the local capital market; digitise the MIND’s information system; rehabilitate the MIND’s physical establishment; legal structuring and legalisation of industrial firms; and organisation of industrial fairs. Cost of this programme is estimated at $71.2 million which is to be funded by State budget (DAR 2009).

The second programme is to build 13 industrial poles in strategic regions of the country. These poles will consist of provision of infrastructure, including roads, pavements, sewage systems, water canalisation, electrification, telecommunication, petrol stations, fire systems, etc. Through these infrastructure poles, the government aims to induce the private sector to invest in productive activities in the identified strategic regions. This is based on the rationale that concentrated infrastructure resources can stimulate agglomeration economies and at the same time protect residential areas from direct environmental effects. Seven poles are to be built in Zones A-B (Luanda, Benguela, Cabinda and Huila) and six in Zone C (Kwanza Norte, Zaire, Uige and Huambo) (see Box 6 below for the economic significance of the different zones or regions). These programmes will cost an estimated $377.7 million to be funded by local banks based on State guarantees (47%), Chinese credit line (41.6%), State budget (6.5%) and India’s Angellique (4.7%) (DAR 2009).

### Box 6: Fiscal Incentives for Industrialisation (ANIP 2010)

The Law on Tax and Incentives (Law No.17/03) was issued in 2003 by the National Private Investment Agency (ANIP) which operates under the jurisdiction of the Ministry of Industry. First, it grants exemption on duty and tariffs (with exception of stamp duty and charges for service provision) on import of new capital goods for three years for investment made in Development Zone A which includes the capital city Luanda and major districts of the provinces of Benguela, Huila and Cabinda. This is the coastal region where post-independence bi-mineral economy was based and remains the most active economic zone in the country. Second, the law warrants four year exemption for Zone B which includes remote districts in the provinces of Benguela and Cabinda. This is considered the country’s second most active economic zone. Third, the law warrants six year exemption for Zone C which includes the hinterland provinces that were completely unproductive during the civil war and are...
considered the least active economic areas. For import of used capital goods the previous provisions are reduced to 50%. However, all intermediate production inputs are exempt from duty and tariffs for five years. Capital gains tax exemption is warranted for eight years for Zone A, 12 years for Zone B, and 15 years for Zone C. Real estate tax exemption is warranted on acquisition of land and buildings pertaining to business investment projects. Income tax on private education institutions and clinics is limited to 20% rate and reducible to 10% when education establishments offer 10% of their capacity to students from underprivileged backgrounds.

The third programme remains vague. It involves the creation of a Special Economic Zone (SEZ) to promote import substitution and export growth in different processing sectors, including food, construction material, milling, paper and packaging, textile, electrical equipment, chemicals, steel, brewery, aluminium, ammonia, metal, pesticide, ethylene, polymers, phosphorite and automobile industries. This project is to be supported by special fiscal incentives, including customs exemption, industrial and income tax exemptions, special credit mechanisms to facilitate acquisition of capital based on government guarantees and assistance from the Angolan Development Bank (BDA). The plan is to induce private investment in the SEZ and to have an estimated 243 factories built to stimulate export growth by 2013. This estimate is based on baseline study the MIND conducted countrywide during 2006-2007 assessing the state of the country’s industry and the industry’s needs and competitive areas in consultation with the private sector. The cost of this project is estimated at $8.1 trillion to be funded by local private banks (98%) based on government guarantees, and by State budget (2%) (DAR 2009). However, there are no details or clarity on where the SEZ will be located, what the specific special fiscal incentives are or how they differ from the incentives provided in the Basic Investment Law (Law 11/03), and what the implementation process is. Neither the Mid-Term Industrial Restructuring Plan (2009-2013) by MIND nor the Government Gazette (Diário da República) of 13 March 2009 which ratifies the MIND’s plan provides information for the referred policy mechanisms.

The fourth programme concerns the development of national human capital. For this, the MIND plans to promote training in the country and abroad. In the country, it plans to build five major pre-university technical training centres to train welders, electricians, mechanics, instrumentation technicians, carpenters, locksmiths, accountants, administrators and IT technicians. Three centres are to be built in Zone A (Luanda) and one centre is to be built in Zone C (Huambo). But there is no mention of the location of the fifth centre neither mention of what will constitute training abroad. This project will cost an estimated $86.1 million which will be funded by State budget (72%) and credit line from South Korea (28%) (DAR 2009).

Apart from the five major technical centres, the government is promoting broader vocation and professional training programmes (VTP). In its 2005/2006 programme, the government proposed an overhaul in the country’s education system. One key measure of the overhaul was the integration of vocational and professional training in the general education system under the coordination of the Ministry of Education. Recent reports indicate the existence of 304 vocational training centres countrywide, 36 of which are under the coordination of the Ministry of Industry and the rest are private sector initiatives. Estimated capacity of these training centres is 24,564 graduates per year. But this number is only a fraction of market demand as each year around 300,000 new job seekers are entering the labour market. It is also argued that the trainees the centres are producing have exhibited skills that are
incompatible with the market demand because the private sector has not been consulted in the process of training programmes design, and because of lack of coordination between the different centres and the education system (CRES 2009).

**Table 19: Industrial programmes and funding (2009-2013)**

<table>
<thead>
<tr>
<th>Programme</th>
<th>Est. cost ($)</th>
<th>Source of funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical centres</td>
<td>86.1 Million</td>
<td>State budget 72%</td>
</tr>
<tr>
<td>Industrial poles</td>
<td>397.7 Million</td>
<td>Local banks 47%</td>
</tr>
<tr>
<td>Special economic zone &amp; processing industries</td>
<td>8.1 Trillion</td>
<td>External credit 46.3%</td>
</tr>
<tr>
<td>Strengthening MIND’s capacity</td>
<td>71.2 Million</td>
<td>--</td>
</tr>
<tr>
<td><strong>Total est. cost: $8.6 Trillion</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: MIND (2009); Diário da República (2009)

8.1 Training institutions: universities

Since independence, there has only been one public university in Angola, Agostinho Neto University (UAN). UAN is located in eight of the 18 provinces of Angola, and it provides the following engineering courses: mechanical, civil, computer, mining, geophysics and geological engineering. Over time data on graduation/enrolment is not available, but Table 20 below shows graduation data for 2007 as indication of UAN’s capacity to produce graduates. It shows that engineering is not the strongest field in UAN’s graduation record as it has the lowest number of graduates compared to the other fields of training (Table 20).

**Table 20: Agostinho Neto university’s graduation statistics for 2007**

<table>
<thead>
<tr>
<th>Field of study</th>
<th>No. of graduates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td>77</td>
</tr>
<tr>
<td>Agricultural Sciences</td>
<td>163</td>
</tr>
<tr>
<td>Engineering</td>
<td>32</td>
</tr>
<tr>
<td>Law</td>
<td>127</td>
</tr>
<tr>
<td>Economics</td>
<td>141</td>
</tr>
<tr>
<td>Education Sciences</td>
<td>90</td>
</tr>
<tr>
<td>Arts and Social Sciences</td>
<td>212</td>
</tr>
</tbody>
</table>

Source: UNCTAD (2008)

Public expenditure in education has increased in recent years reaching nearly 8% of State budget. UNCTAD (2008) posits that education is one area where Angola is on track to meet the MDG target of universal access to education by 2015. It also indicates that adult literacy in Angola has been rising since 1975 from 15% to 67% in 2007. Between 2002 and 2007 the number of students rose threefold to 5.8 million (4.7 million in primary school); the number of teachers grew from 75,000 to 115,740; the number of schools rose from 2,282 to 3,728. In 2005 10,000 new classrooms were built. But the country’s output in terms of research, science and technology remains very weak as Table 21 below shows.
**Table 21: Education expenditure and research output**

<table>
<thead>
<tr>
<th>Year</th>
<th>% share of budget</th>
<th>Year</th>
<th>Science &amp; technical journals</th>
<th>Patents granted by USPTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>7.9%</td>
<td>2009/10</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2008</td>
<td>7.9%</td>
<td>2004-5</td>
<td>0.22</td>
<td>--</td>
</tr>
<tr>
<td>2007</td>
<td>5.6%</td>
<td>2001-5</td>
<td>--</td>
<td>0.01</td>
</tr>
<tr>
<td>2006</td>
<td>3.8%</td>
<td>1995</td>
<td>0.16</td>
<td>--</td>
</tr>
<tr>
<td>2005</td>
<td>7.1%</td>
<td>1993-7</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2004</td>
<td>10.4%</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2003</td>
<td>6.2%</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2002</td>
<td>5.1%</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2001</td>
<td>5%</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Source: MINFIN (2010); GOA (2007/8); UNCTAD (2008)

With the legalisation of private education in 1991, private universities have been springing up alongside UAN. Table 22 below shows the currently existing private universities in Angola.

**Table 22: Current private universities in Angola**

<table>
<thead>
<tr>
<th>Name of Institution</th>
<th>Start-Up</th>
<th>Courses Provided</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universidade Lusíada</td>
<td>1999</td>
<td>Economics, Law, Business Management, ICT, International Relations, Accounting</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Jean Piaget</td>
<td>1998</td>
<td>Food Engineering, petrol engineering, ICT</td>
<td>815 enrolled in 2005</td>
</tr>
<tr>
<td>Universidade Nova de Angola</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universidade Independente</td>
<td></td>
<td>Communication Science, Law, ICT, Business Studies, Civil Engineering,</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Técnica de Angola</td>
<td>2007</td>
<td>Mine Engineering, IT, Environment, Architecture, Accounting</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Metropolitana de Angola</td>
<td></td>
<td>Education, Literature, Arts, Civil engineering, Architecture, ICT, Economics, Management</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Apostólica de Angola</td>
<td>2007</td>
<td>Business Studies, ICT, Architecture, Civil Engineering, Literature</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Gregório Semedo</td>
<td>2004</td>
<td>Economics, Law, Business Studies, ICT, Human Resources,</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Óscar Ribas</td>
<td>2007</td>
<td>Civil &amp; ICT Engineering, Business Studies, Law, International Relations</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Metodísta de Angola</td>
<td>2006</td>
<td>Business Studies, ICT, Architecture, Civil Engineering</td>
<td>--</td>
</tr>
<tr>
<td>Universidade de Belas</td>
<td>2007</td>
<td>Law, International Relations, Nursing, Business Management, ICT, Marketing</td>
<td>--</td>
</tr>
<tr>
<td>Universidade Privada de Angola</td>
<td>2007</td>
<td>Accounting, Business Studies, Nursing, ICT, International Relations, Public Relations</td>
<td>--</td>
</tr>
</tbody>
</table>

Source: Portal do Governo (2009); Homepages (2009/10)

It was not possible to obtain enrolment and graduation data for most of these universities. But it can be observed that training in engineering, particularly computer engineering, is prominent in these universities curricula, although only a couple
provide courses in mineral engineering. However, overall, social science subjects are the predominant field of training.

9. Oil sector’s capability development policy

Historically, policies for the oil sector have been separately designed and implemented by the Ministry of Petroleum and Sonangol with direct approval by the Council of Ministers, the highest executive organ of the State, and the Presidency. As discussed earlier (Section 2), the main statutes in the Angolan oil and gas local content policy are Angolanisation of human resources, preferential treatment of local firms in supply of basic general products and joint-venture firms in supply of products of average technology level and capital value, and promotion of Angolan private enterprise in concession market.

9.1 Angolanisation of human resources

The Angolanisation targets set out in 1982 expired in 1990, and since then there have been no new documented official targets (see Section 2.2). In 2009, Sonangol Local Content Department started developing a new comprehensive local content policy for the oil sector but this document has not been published yet (Interview). In the meantime, much intra-firm (micro) training of local labour is being done both in Angola and abroad (Box 7).

Box 7: Interview excerpt (2009)

‘Training at X (firm name omitted) is built on our Technical Career Development Programme (TCDP). TCDP is a career long training programme. It begins when a recruit arrives at our doors. TCDP involves theoretical and practical training and it is provided in Angola and abroad. In Angola, theoretical training is provided in our training facilities and practical training on-the-job. Abroad training includes on-line-learning (company’s international capacity development programme shared by all our branches worldwide), in our company’s international training programmes done at the company’s international training academy in Aberdeen, and in the company’s other training programmes organised in the company’s other facilities worldwide, such as in Norway, United States, etc’.

9.2 Petroleum training institutes

The National Petroleum Institute (INP) was established in 1983 to provide technical and professional training for oil industry workers. The INP has two sets of training. (i) Technical Training is a three year programme provided at secondary level with courses on technical industrial maintenance, geology and mining, drilling and production, and petroleum operations. (ii) Professional Training is for candidates with secondary level qualification. It has 12 month and 18 month programmes on electrical engineering, production operations, mechanics and maintenance, refrigeration, instrumentation, English and IT. Since 2004 a course on Seabed Studies was added to the professional training curriculum (INP 2009). The INP has collaborated with oil companies and oil services companies in the Angolan oil market, the Algerian Petroleum Institute since 2000, and other international petroleum organisations and institutions (such as the French Petroleum Institute, Norwegian Oil and Gas Partners – INTSOK, the Norwegian Rogaland Education Training Centre – RKK and Stavanger Offshore Technical College – SOTS. Since it was established in
1983, the INP has produced 1910 graduates at an average of 72 graduates per annum (Table 23).

**Table 23: Training at INP (1983-2008)**

<table>
<thead>
<tr>
<th>Angolan graduates produced: 1790</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology &amp; Prospection</td>
</tr>
<tr>
<td>Drilling &amp; Production</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Geology &amp; Mining</td>
</tr>
<tr>
<td>Subsea Technology</td>
</tr>
</tbody>
</table>

Source: INP (2009/2010)

Other existing petroleum institutes are Empresa de Serviços e Sondagens de Angola (ESSA), Universidade de Tecnologias e Ciências (UTEC), and Centro de Treinamento Marítimo (CTM). They are all owned and funded by Sonangol, the Angolan State Oil Company and concessionaire) as shown on Table 24 below.

**Table 24: Other technical training institutions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Ownership</th>
<th>Start-up</th>
<th>Areas of training</th>
<th>Level</th>
<th>Statistics p.a.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESSA</td>
<td>Sonangol</td>
<td>1995</td>
<td>QSHE Courses (standard)</td>
<td>Basic &amp; Professional</td>
<td>250 Candidates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Basic Welding (on demand)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Industrial Painting (on demand)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Basic FPSO Operation Skills (demand)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UTEC</td>
<td>Sonangol</td>
<td>2007</td>
<td>Mechanic &amp; Civil Engineering</td>
<td>University Level</td>
<td>480 Candidates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Production &amp; Chemical Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Computer &amp; Electric Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTM</td>
<td>Sonangol</td>
<td>2010</td>
<td>Mechanic Engineering</td>
<td>Medium Professional</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Environmental Engineering</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Sonangol (2010); Interviews (2009/10); Homepages (2010)

ESSA is a subsidiary of Sonangol and offers two types of courses: 32 standard courses on basic offshore safety and environmental skills, and seven courses on demand on basic industrial skills and FPSO operations. Its courses last between two and five days and are certified by the International Maritime Organisation (IMO) which regulates standards of training for seafarers. Most oil and services companies interviewed in the field have used ESSA’s services for training of their personnel. UTEC is a Sonangol higher technical education institute established in 2007. Its courses have a four year curriculum which means graduates are still to emerge from this institution. UTEC also provides some social sciences courses, including Business Management, Economics, and Accounting. This means that the 480 candidate capacity it can accommodate per year spreads across all these various disciplines. In turn, CTM is also a Sonangol institute being funded by Sonangol Shipping, branch of Sonangol Holding involved in the shipping and services vessels market. CTM is a medium level training institute, and it provides courses in the area of maritime services. Its doors are only envisaged to open in late 2010 and there is no data on its training capacity.
9.3 Petroleum engineering programme

A special petroleum programme was started in 2002 by oil producing companies and oil services companies in collaboration with the Faculty of Engineering at the Universidade Agostinho Neto (UAN). The programme is called Petroleum Engineering Programme (PEP). The PEP has produced on average 20 graduates per year in the following engineering fields: mining, steel, chemistry and civil engineering. The coordinators of the programme at UAN posit that PEP is a superior programme to the programmes provided by the National Petroleum Institute (INP) because PEP is provided at post-graduate level and is more specialised, while the INP programmes are of secondary and professional (mid) technical levels and involve lower degree of specialisation (Interviews).

9.4 Rule of exclusivity

The preferential treatment statute for local firms in supply of basic general products does not provide any fiscal and/or financial incentives. It is limited to the provision that such basic general products must be sourced from local suppliers only unless local price is above 10% of the price offered by foreign suppliers. A further provision involves support of Business Development Services centres (BDS) being established to support local firms in business skills and understanding of business dynamics in the oil sector. BDS centres are part of a public-private initiative between the Angolan government, UNDP and Chevron (American oil producing company and the oldest operator in the Angolan oil market) called 'Angolan Enterprise Programme' (SAGCH 2008). In the oil sector, there are now two identifiable BDS centres. One is Centro de Apoio Empresarial (CAE) which was established in 2005 by oil producing companies with the support of Sonangol and the Ministry of Petroleum. The other is Centro de Incubação de Negocios de Cabinda (N’kondo) which was created in 2006 by the consortium of oil producing companies operating in Block 0 in Cabinda (ibid).

9.5 Semi-compliance system

The provision for preferential treatment of joint-venture companies between Angolan and foreign companies in supply of products designated to be of average technology level and average capital value is directly monitored by Sonangol. That is, all contracts or tenders above the $150,000 threshold have to be authorised by Sonangol. In turn, Sonangol may approve or decline such proposals based on satisfactory compliance with local content requirements that it discretionarily determines. This regulation has by default induced localisation of manufacturing activities in Angola. It is inducement by default because most of the products the policy designates to be of average technology level and average capital value (see Table 4 on Section 2.3) actually are of high technology level and capital value. Nevertheless, some firms have seized the opportunity in view of their position in the value chain to expand their market share. This is the case with the two manufacturing case-studies that this study presents. Thus, despite the positive default outcome, there is need for greater capacity in Sonangol’s Local Content Policy Department to enable it to accurately differentiate between types of technologies and their values.

Compared to the provisions made for the promotion of Angolan private enterprise in the concession market (see Section 2.4), the preferential treatment for local firms in
the supply of general products and joint-venture firms in the supply of designated average technology and average capital value products are short-changed. This is because greater incentives are channelled toward the concession market, which is a forward linkage, than to supply chain market (backward linkage). Provisions for the concession market go beyond preferential treatment for local companies in the awarding of mining rights. It also includes fiscal and financial incentives which are not provided for the supply chain linkages. These include (i) reduction on royalty, profit oil and income taxes, and (ii) non-refundable subsidies, loans and financial guarantees (see Section 2.4). Although this study has not specifically investigated the link between local content policy and local participation in concession market to establish causality, the fact that privately owned Angolan firms entered the concession market in 2005 (two years after these provisions were made) and now hold 8.8% of the total licensed exploration equity and 6.3% of the total production equity in the concession market (see Section 4.1 Figure 5) is indicative of potential benefits these firms have obtained from these provisions.

Therefore, the policy bias in favour of the concession market and in disfavour of the supply chain market is questionable in view of the historical experience of oil-rich countries that have successfully diversified and achieved spillovers. This success has been primarily mediated by the promotion of backward linkages, including preferential treatment of local suppliers, provision of fiscal and financial incentives, policy induced localisation of oil firms’ R&D activities in the host economy, and creation of knowledge networks between potential local industrial suppliers, oil companies, oil services companies and national petroleum agencies or oil companies (Neff 2005; Wade 2004; Surrey 1987). Currently, these instruments do not exist in the Angolan oil sector. In addition, since potential outcomes from the industrial development project being led by the Ministry of Industry can only be reaped in the coming future, Sonangol and the Ministry of Petroleum could adopt a champion approach to identify local companies with current industrial potential to be participants in knowledge networks or clusters that should be created.

9.6 Conclusion

This policy review finds disjuncture between macro (national) level policies and meso (oil sector) level policies. This is because there are no joint-working arrangements in policy design and implementation between the Ministry of Industry which is leading the national industrial project and Sonangol and the Ministry of Petroleum which govern the oil sector. The project led by the Ministry of Industry addresses the needs of the oil sector only broadly through relevant human resources and manufacturing sector development programmes. The training programmes focus on mid-level technical training while the critical human capital problem in the oil sector is higher technical level personnel. There are oil and gas industry training institutes and programmes, but their output is very low. Also, although the number of universities in the country is growing, these universities are providing training mostly in social sciences, but limitedly in engineering and much less in petroleum engineering. The Ministry of Industry led manufacturing development programmes have defined objectives, they are cost estimated, and they are posited to be research based. However, they still lack in various areas. The industrial poles programmes have communication and implementation mechanisms as they are being mediated by the National Private Investment Agency (ANIP). But they lack periodic evaluation and
review instruments which are critical for policy creativity and innovation in the course of implementation (Hirschman 1958:83). The special economic zone project remains vague. It does not define what the *zona franca* is, what the special fiscal incentives and capital acquisition mechanisms are, how the programme will be implemented, reviewed and evaluated. These lacunas are problematic as the project has already been approved and cost estimated without them being factored.

In the oil sector, the Angolanisation benchmarks are outdated, and the petroleum training institutes focus on mid-technical level instead of higher technical level where the problem lies. There is only one higher level petroleum institute in the country which will only start supplying the market in a few years time. The rate of higher level petroleum technicians being produced by the Petroleum Engineering Programme at the Agostinho Neto University is limited (only 20 engineers per annum). On the other hand, the local content preferential treatment policy is skewed toward the concession market and in disfavour of the supply chain market. This is critical as benefits from the former are temporal (localisation of rent) while benefits of the latter are sustainable (industrial development). Moreover, Sonangol’s Local Content Policy Department’s capacity to differentiate between technologies and their capital value is weak as the semi-compliance system is currently faulty. This capacity needs to be built in order to improve the capacity of the department.

10. Conclusion and policy considerations

This study has investigated backward linkages between the manufacturing sector in the oil and gas value chain and the local economy in Angola. Core to these linkages is the development of a manufacturing and services supplier base. The study finds that while local manufacturing linkages have expanded since the early 2000s, intermediate linkages between the localised manufacturing function and the local economy remain limited. There is high volume of intangible intermediate inputs in form of human capital at basic and mid-technical levels, but low at higher technical level. And there are virtually no material intermediate linkages between the manufacturing function and the local economy. The foremost local linkage is occurring in supply of basic general products that have no direct input in the manufacturing function, although they indirectly support production activity in general. Many of these ‘local’ general products are only local in the sense that they are imported by local trading firms.

The study finds that policy and local capabilities are the main determinants of linkages. Local content policy pressure is the main driver of localisation of manufacturing activity in Angola, of the high volume of intangible intermediate inputs at basic and mid-technical levels, and of the high volume of supply of basic general products. On the other hand, incoherent local content policy and poor local manufacturing and human capital bases are the limiting factors to the low volume of intangible intermediate inputs at higher technical level and the lack of material or tangible intermediate linkages between the manufacturing function and the local economy. This situation is compounded by poorly focused industrial policy.

To stimulate the development of intermediate linkages between the manufacturing function and the local economy, six policy issues are considered for the oil sector:
There is need to balance support between forward linkages and backward linkages in the local content policy. At present, support is skewed toward the former and in disfavour of the latter.

Higher technical level training should be a priority at local petroleum institutes because there are limited linkages at this level. At present, training at local petroleum institutes is skewed toward mid-technical level.

The benchmarks for Angolanisation of human resources should be updated and supported by evaluation mechanisms.

The capacity of Sonangol’s Local Content Policy Department to differentiate between types of technologies should be strengthened to enable more competent policy targeting.

Sonangol and the Ministry of Petroleum should review the effectiveness of setting fixed local content benchmarks. Benchmarking is critical to ensure industry compliance and it has been effective in the past in a number of countries, such as Brazil, Singapore and Norway (Neff 2005; Noreng 2004). But in some countries, preferential policy for local suppliers and discretionary resource licensing based on local content considerations have been equally effective (Klueh et al 2009; Wade 2004).

Given the country’s systemic problems with resource management transparency, there should be clear accountability mechanisms to monitor the annual levy that oil firms involved in the country’s oil sector contribute to national human capacity development.

At macro policy level, given the current disjuncture between the Ministry of Industry and Sonangol and the Ministry of Petroleum in industrial policy designing, there should be more joint-working arrangements between them to enable coherence in policy design and implementation. At present, the macro programmes for human capital development fail to address the specific needs of the oil sector which is the supply of higher level technicians. Instead, the macro programmes focus on mid-level technical training. Moreover, macro programmes for the development of the national industry and manufacturing sector in particular lack efficiency. Despite having defined objectives, these programmes lack periodic benchmarks necessary to enable creativity and innovation, and most of them also critically lack implementation, communication, review, and evaluation mechanisms.
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