

Inward foreign direct investment and transfer of environmentally sound technology in Angola

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Many developing countries have relied on foreign direct investment as a primary means to acquire technologies. However, there has been inadequate empirical research on the nexus between foreign direct investment and the transfer of environmentally sound technology (EST), specifically focused on African countries. In this paper I explore whether inward foreign direct investment in Angola's energy sector has indeed transferred ESTs. My study encompasses illustrative case studies specifically related to energy firms, and the data were drawn from literature and in-depth individual interviews. The results indicate that Angola has used its national policy framework and institutions to promote inward foreign direct investment, and has harnessed appropriate international regimes to acquire ESTs. Countries may therefore invoke sovereignty principles enshrined in constitutional provisions, or may utilise international regimes to attract ESTs through foreign direct investment. I recommend that further studies be conducted to explore this subject area, drawing examples from other African countries and differing economic sectors.

Introduction

Foreign direct investment (FDI) is known to be important and necessary for the economic growth and industrial development of many countries, especially developing countries. FDI provides capital, facilitates the transfer and upgrading of technologies, enhances marketing skills of domestic firms, and diffuses organisational and managerial know-how for economic growth.¹ The perceived and actual benefits of FDI have caused many developing countries to implement a regime to attract foreign investors, including aspects such as investment liberalisation and a variety of national and supra-national policies.² Such policies are aimed at reassuring, incentivising, protecting, building trust and confidence, and generally attracting the interest of foreign investors.² Zarsky³ observes that 'from sub-Saharan Africa to East Asia, Russia to Latin America, [the] hunger for FDI has exploded', primarily motivated by the desire to realise economic growth.

Although other channels do exist, the FDI activities of transnational companies (TNCs) are at the forefront of transferring technologies among countries.⁴ This transfer includes environmentally sound technology (EST) and the sharing of knowledge, such as environmentally sound practices.⁵ Thus, ESTs and practices are part-and-parcel of the assets of TNCs. These assets may be deployed through FDI to assist developing host countries to adapt to and mitigate the effects of climate change, to enhance the management of natural resources, and ultimately to achieve sustainable development.

However, African policymakers do not necessarily understand the nexus between FDI and sustainable development. Whilst most African countries want to receive FDI, they still – almost inadvertently – reduce FDI to financial capital flows, and rather parochially view FDI as a potent ingredient to achieve economic growth. However, FDI should be viewed holistically as a bundle of resources that affect economies in a multi-dimensional manner. Also, the role of FDI in the management of environmental resources has tended to be somewhat peripheral to the FDI agenda of African countries. Therefore, in the African context, there is a striking lack of sound evidence for the role of FDI in the transfer of – or FDI-carrying – ESTs and practices. There is general concern about the ability of FDI to carry and transmit ESTs, and specifically whether inward FDI (IFDI) to African countries actually does transfer ESTs.

My analysis focuses on whether IFDI does transfer ESTs within the African context. I used a number of firm-specific case studies from the energy sector in Angola. My two main research questions were: (1) Are increased FDI flows to Angola's energy sector carrying ESTs or associated with the transfer of ESTs? (2) Has FDI actually resulted in such transfers? The results of my study can provide African policymakers with empirical evidence to enable them to engage more effectively in international negotiations, and to develop high-quality, useful FDI policies.

The paper is organised as follows. In the next section I present the conceptual framework that guided my analysis, followed by a description of the methodology used. The fourth section elaborates on the findings of the research, followed by a discussion. In the final section I offer some concluding remarks.

Conceptual framework

The transfer of ESTs has been at the centre of international discussion and debate for several decades.⁶ The acquisition and diffusion of technologies, including ESTs, through FDI is a public policy matter that concerns sovereign states and entities – such as governments and legislatures. Sovereign states are in a position to exercise sovereign principles of autonomy, control and international legal recognition in order to regulate FDI.⁷ They have the necessary resources to deploy structural power⁸ to actively direct FDI to stimulate the transfer of ESTs.

Generally, there are three main reasons why states become involved in processes of transfer, acquisition and diffusion of ESTs. First, the introduction of ESTs in an economy requires the creation of appropriate regulatory frameworks aimed at protecting the environment. Such rules encompass regulations about waste management, wastewater treatment, conservation, poisonous gas emissions and climate change. Governments usually create a raft of policies and legislation that provide incentives for adherence to, and sanctions for non-compliance with, these rules. Second, the development, commercialisation and subsequent transfer of ESTs rely more on

public funds than on private investment.⁹ Finally, as stated by Less and McMillan, 'unlike other types of technology, ESTs often necessitate public seed funds as incentives for companies to initiate EST-related research and development'.¹⁰ Hence in many situations, ESTs are developed and commercialised by small and medium enterprises.¹¹ These enterprises depend heavily on government funding and support to penetrate domestic and international markets.

There are four methods by which countries can obtain technologies – including ESTs – from TNCs. These are FDI; joint ventures; purchase of technology in contractual form; and reverse engineering, copying and imitation.¹² In this paper I focus exclusively on IFDI. TNCs involved in IFDI hold at least 10% of the equity shares in an investment they make in a host country. IFDI activities of TNCs often take the form of setting up local production facilities, known as greenfield investments; or by purchasing existing businesses, known as brownfield investment, through mergers and acquisitions.¹³

Various theories have been put forward to explain the motivation, magnitude and spatial distribution of FDI, including the investment development model¹⁴, the product life cycle model¹⁵ and location-specific advantage theory.¹⁶ Dunning's eclectic paradigm is the most widely used model.¹⁷ The investment development model posits that IFDI to a country is systematically related to the stages and structure of that country's economic development. Therefore, a country can move sequentially through five stages, from being a net IFDI recipient to becoming a net exporter of outward FDI.¹⁸ Using this theory, Angola's energy sector can be viewed as being in an initial phase of the development path, as it still depends considerably on inward flows of FDI.

According to the product life cycle model, products are initially made and sold in the local markets of developed countries. However, as the products mature and production becomes standardised, they are exported to external developing country markets. When the cost of producing a product in the domestic market outweighs the costs in other countries, its production is relocated abroad, mainly through the channel of FDI.¹⁹ The product life cycle model also attempts to explain FDI by third-world TNCs. According to this theory, third-world TNCs have generally bought technology from the developed world. Because such technology is suitable for an area with a large market, firms that import such technology will export their products once local demand has been met. As the products become more familiar to foreign markets and as the markets for such products gradually become established, the third-world firms show a preference for setting up subsidiaries abroad rather than exporting or other channels. Hence, the product life cycle theory provides an explanation for the involvement of TNCs from emerging countries – such as Brazil, China and Argentina – in Angola's energy sector.

The eclectic paradigm explains that TNCs choose FDI over other investment methods in order to obtain ownership, internalisation and location-specific advantages.²⁰ Ownership advantages derive from firm-specific resources and capabilities, including superior intangible and tangible assets and skills – such as multinational corporations' experience, firm size, and ability to develop product differentiation. Internalisation advantages are related to reduction in transaction costs. Location-specific advantages refer to host country characteristics such as policies. The eclectic paradigm explains IFDI to Angola's energy sector through exposing the country's locational advantages and highlighting the ownership advantages inherent in the investing firms.

The eclectic paradigm further clarifies the four motives underlying direct investments: resource-seeking, market-seeking, efficiency-seeking, and strategic asset or capability-seeking.²¹ Resource-seeking IFDI arises from the desire of TNCs to acquire particular types of resources that are not available at home, such as natural resources (raw materials) or resources offered at a lower cost, such as unskilled labour. Market-seeking IFDI involves investments aimed at exploiting the possibilities granted by markets of much greater dimensions, or when TNCs follow suppliers or customers that have built foreign production facilities. This enables the TNC to adapt its goods to local needs or tastes and to save on costs associated with serving other markets from a distance. TNCs

motivated by efficiency-seeking IFDI take advantage of various factor endowments, cultures, institutional arrangements, economic systems and policies, and market structures that are amenable to efficient production methods. Strategic asset-seeking IFDI occurs when a foreign direct investor acquires a foreign entity, not for immediate profit or gain but for long-term strategic purposes. Recent literature indicates that developing countries, including African countries, attract primarily resource-seeking and market-seeking IFDI.²² Resource-seeking IFDI usually targets the extractive economic sectors, such as mining, which are environmentally deleterious.

IFDI may transfer technologies such as ESTs through different channels, including vertical and horizontal linkages, as well as spillovers.²³ On the one hand, the transfer of technologies, in particular ESTs, through vertical linkages encompasses backward and forward linkages. Whereas backward linkages refer to relations with suppliers of parts, components, materials and services, forward linkages refer to relations with buyers – either consumers or other companies that utilise the intermediate products of TNCs in their own processes. On the other hand, the transfer of technologies through horizontal linkages occurs through demonstration, competition and labour migration.²⁴

Transferrable ESTs through FDI may include 'hardware and software elements'²⁵ comprising '(1) capital goods and equipment, (2) skills and know-how for operations and maintenance, and knowledge and expertise for innovation'.²⁶ Mansfield²⁷, for example, distinguishes between material transfer, design transfer and capacity transfer, whereas Bell²⁸ identifies three distinct flows of transferable technology. Bell's categories range from Flow A to Flow C, all generally highlighting the transfer of capital, blueprints and expertise. For these different technologies to constitute ESTs, they should facilitate cleaner production and technological leapfrogging, and abate pollution, thereby creating 'pollution halos' when applied in a given context.²⁹

Methodology

To examine the transfer of ESTs through FDI inflows to Angola's energy sector, I selected a number of illustrative case studies of specifically energy-oriented firms. This case study approach is based on the work of Yin³⁰. Angola was chosen as the FDI host country because it has an extensive energy sector to which there are high FDI inflows, and there is strong government control of this sector. The methodology I used encompassed a thorough review of relevant documents, and face-to-face interviews with key informants.

The documents I reviewed included official reports on FDI and energy, as well as academic literature on a wide range of interdisciplinary fields – including the transfer of technology and ESTs, the nature of FDI, sustainable development in Africa and FDI, and international relations issues related to FDI and the transfer of ESTs. Most of the reports and other documents I reviewed (such as business plans, project plans and project designs) were accessed through internet searches or by contacting various stakeholders (by phone or email). The people I contacted to obtain such documents included government officials, representatives of TNCs and their subsidiaries, and civil society and intergovernmental organisations.

In addition to this documentary review, I collected primary data through structured discussions with 50 interviewees. The participants were accessed through a snowball sampling technique. This technique was chosen because Angola's energy sector is highly securitised, and it is therefore quite difficult for employees to openly share information. The focused interviews were conducted with government officials, members of intergovernmental organisations, non-governmental organisations, and domestic and international firms. To be eligible for interview, participants were required to be knowledgeable about IFDI to Angola, Angola's energy sector, FDI inflows to the energy sector, energy sector projects, and technology transfer, including the diffusion of ESTs. Some interviewees corroborated the information I had collected from various secondary literature sources and reports.

As far as data analysis is concerned, in terms of secondary data I asked reviewers to analyse theme-based summary sheets of triangulated data. The reviewers identified gaps in the data, conflicting data, or areas where

they believed saturation point was not achieved. For gaps and areas where data were perceived not to be saturated, I probed these topics during the interviews. Where secondary data conflicted substantially, I did not analyse the discrepancies and effectively discarded the data in question.

Interview data were collected by note-taking during discussions and information extracted from email correspondence, which was subsequently classified according to subject and summarised. The data were then thematically presented on Microsoft Excel spreadsheets. These theme-based spreadsheets – containing both secondary and primary data – were merged, and the various theme-based findings clearly presented in a case-study format.

Findings

Inward FDI flows to Angola's energy sector

The main research finding was that since 2004 there have been increased inflows of FDI into Angola's energy sector. This has comprised the subsectors of oil and gas, renewables and non-renewables, alternative energy sources, power-generation (electricity) and transmission. Although the oil and gas subsector has historically received the lion's share of IFDI, there have also been direct investments into other subsectors, as shown in Table 1.

Generally, IFDI to the energy sector in Angola can be viewed from the vantage point of two different periods: before and after 2004. In an interview on 14 July 2014, an official from the Angola National Private Investment Agency stated:

The civil war ended in 2002. The government quickly moved to focus on development, and

among the key sectors to be modernised was the energy sector. Several actors were approached between 2002 and 2003. A breakthrough came in late 2004 by way of a Chinese loan and direct investments. We can, therefore, see the era before 2004 as an era where not much was done to attract IFDI to the energy sector, and the period post-2004 as a period of sudden increases in direct investments.

The key differences in terms of FDI inflows to the energy sector in Angola during the pre-2004 and post-2004 periods, respectively, are presented in Table 2.

Since 2004, Angola's energy sector has been receiving direct investment flows. These investments have typically targeted new (greenfield) projects rather than existing (brownfield) enterprises. Furthermore, such investments have mainly been resource-seeking and market-seeking.

State's role in the transfer of ESTs in the energy sector through IFDI

One of my key research findings was that through the active involvement of the government of Angola, the inflows of FDI to Angola's energy sector have indeed transferred ESTs. The Angolan government influences the transfer of ESTs into the energy sector through IFDI using a three-pronged approach. This was explained by an official from the Ministry of Energy and Water in an interview on 14 July 2014:

For foreign investments to bring to a country desired technologies such as those that protect the environment, deliberate actions by the

Table 1: Main inward foreign direct investment into non-oil and gas energy subsectors

Operator	Energy sub-sector	Partners	Location	Project name
BIOCOM	Bio-energy	Sonangol, Odebrecht, Damer Industria SA	Malanje Province	Biocom Project
Hydro Chikapa 1	Hydro-Power	Alrosa, ENE	Lunda Sul Province	Hydro Chikapa 1
Angola Liquefied Natural Gas (LNG) Project	Bio-Energy	Chevron, Sonangol, Total, Eni	Zaire Province	Angola LNG Project
Fortune CP	Solar	Government of Angola	Huíla Province	Solar projects for health centres, community centres, and educational facilities
Proef	Bio-Energy	Sonangol	Zaire Province	Bio-Energy Project

Source: Author's compilation

Table 2: Differences in inward foreign direct investment to the energy sector, before and after 2004

Key variables	IFDI flows to Angola's energy sector, pre-2004	IFDI flows to Angola's energy sector, post-2004
Sources of IFDI	Mainly from developed countries, such as US, UK, France, Spain, Italy, the Netherlands.	From both developed and developing countries, such as China, Argentina, Brazil.
Concentration of IFDI in the sector	Direct investments were mainly into oil and gas.	Diversifying from oil and gas to include renewables, alternative energy sources, and non-renewables.
Policy framework	State-centred delivery of energy to consumers through the national grid, and very little participation of independent power producers.	Reforms now underway to open up the space to independent power producers, and the promotion of off-grid decentralised energy solutions.
Role of the state in projects	Owner of all energy projects through equity shares.	Creates the framework for various stakeholders to operate, and only gets involved in some projects of strategic importance to the country.

Source: Author's compilation

Key: IFDI – inward foreign direct investment

government are necessary. In our case, we created institutions, crafted some policies, and also engaged with various players at international level, and these combined actions have benefited us through increased FDI inflows, some technologies, and new projects.

First, and following from this approach, I found that the Angolan government has created state-owned enterprises that partner with foreign companies in any project arising from IFDI. In the oil and gas subsector, Sonangol is the main state-owned enterprise. For example, in the Angola Liquefied Natural Gas (LNG) Project, Chevron and Sonangol hold 36.4% and 22.8% equity shares respectively, whilst Total, BP and Eni each have 13.6% equity shares. Thus, Chevron and Sonangol are the project core leaders. Similarly, in the bio-energy subsector, the Angolan government has permitted investors to develop projects subject to a partnership with Sonangol. For example, in the Biocom bio-energy project, a 40% equity share is owned by the Brazilian firm Odebrecht, a 40% equity share by the Angolan company Damer Industria SA, and 20% by the state-run petroleum company Sonangol Holdings EP. In an interview on 14 July 2014, an official from the Angola National Private Investment Agency stated that 'Sonangol's involvement in this investment is aimed to ensure that national interests are protected.'

The Angolan state has also established sector-specific state-owned enterprise for the power subsector. These include the power utility company *Empresa Nacional de Electricidade* (ENE), which manages the transmission network and operates over 80% of power-generation facilities and distribution systems outside of Luanda, and *Empresa de Distribuição de Electricidade* (EDEL), which manages power-generation and distribution within Luanda. A third power SEO is *Gabinete de Aproveitamento do Médio Kwanza* (GAMEK), which facilitates the design and development of large hydro-power projects in the Kwanza River Basin. The ENE is a mandatory partner whenever a foreign investor wants to invest in power generation in Angola. For example, ENE owns 45% equity shares in Hydro Chikapa 1, an IFDI project that includes the Alrosa group of Russia, which owns a 55% equity share in the power-generating company Hydrochikapa SARL.

Second, the Angolan government has facilitated FDI to carry or transfer ESTs through explicit policies and legislation that provide incentives for direct investors. The literature³¹ shows that the Angola National Private Investment Agency uses the following criteria in determining tax and duties incentives, or reductions for a given investment: (1) type and value of the investment, (2) contribution towards the realisation of Angola's economic development strategy, (3) views on direct and indirect capital gains, (4) complexity of the investment, (5) estimated time required for a return on capital, (6) type of technology to be utilised, (7) commitment to reinvestment of profits, (8) volume of goods or services to be produced, and (9) the creation of production lines. Using these criteria, the Angola National Private Investment Agency may offer an extraordinary tax incentive for investments perceived as highly relevant for the country's strategic development, creating at least 500 jobs, contributing to a major boost in technological innovation and scientific research, and with exports that could exceed USD50 million and inputs valued at above USD50 million. The actual incentives available include import rights, deferral of tax payments, accelerated amortisation and depreciation, tax payment deductions, exemptions and credits.

Most of the projects in the energy sector have been greenfield investments; hence, these have been offered a variety of incentives. In the cases of the Biocom, Angola LNG and Hydro Chikapa 1 projects, the government deliberately promoted cleaner technologies in the form of hardware and machinery through exempting all equipment for constructing these plants from taxes and important duties. Most importantly, in the case of Angola LNG project, tax and import duty exemptions of all plant material facilitated pollution abatement, and assisted in creating 'pollution halos' by halting the rampant pollution that resulted from gas-flaring.

Third, the government harmonises its domestic laws with international laws, and domesticates international regimes aimed at facilitating international transfer of technology, including ESTs. Angola is a party to

the United Nations Framework Convention on Climate Change (UNFCCC) of 1992³² and ratified the Kyoto Protocol of 1997 in May 2007. In terms of these agreements, Angola has qualified for securing carbon credits from the Clean Development Mechanism.

As a result, two key studies were conducted in 2006 and 2007, assessing the eligibility of the Angola LNG Project for carbon credits. In December 2007, Sonagas (a subsidiary of Sonangol) presented the project during the proceedings of COP13 in Bali, Indonesia. In November 2008, *Banco Espírito Santo Angola* confirmed its interest in buying carbon credits that result from this project, through a letter of intention. In 2010 Angola established a Designated National Authority through Decree No. 2/10. To adhere to the Clean Development Mechanism requirements, at the end of August 2011 all supporting project documents were lodged with the Clean Development Mechanism, and the validation process commenced on 10 November 2011 with the publication of the Angola LNG Project details on the UNFCCC website.

In addition, the Angolan government has deployed its international relations apparatus to engage with international finance institutions, such as the World Bank and the African Development Bank, to facilitate IFDI carrying ESTs. Angola is a member of the World Bank's Global Gas-Flaring Reduction Partnership (GGFRP), and its interactions with this institution were of prime importance in designing the Angola LNG Project. In October 2005, October 2006 and February 2007, the GGFRP funded several conferences and presentations to raise awareness about the Angola LNG Project. Thus through deploying international relations, the GGFRP managed to finance activities that led to the realisation of the Angola LNG Project – a project that deals with the huge problem of pollution resulting from gas-flaring. Because Angola has good relations with and is eligible for support from the World Bank, the country also voluntarily made use of the World Bank and the International Finance Corporation's policies and guidelines to conduct environmental impact assessments for the Angola LNG project. As explained by an Angola LNG Project official, assimilating these 'international environmental guidelines on environmental impact assessments helped to enhance the project's appeal to international stakeholders' (interview with Angola LNG Official, 21 July 2014).

IFDI to the energy sector and the types of EST transferred

Another key research finding is that the three-pronged approach of the Angolan government has directed IFDI to transfer of ESTs mainly in the form of hardware, in particular machinery and equipment necessary for production. As an official from the Ministry of Petroleum said in an interview on 14 July 2014:

Our greatest benefit from these direct investments comes from the machinery and equipment that we receive from investors ... which enables us to immediately exploit the energy sources and also deliver energy services to consumers. This machinery should be viewed as very important, because it is key to production.

Indeed, most of the energy projects carried out in the energy sector have been greenfield investments that demand investments in new machinery and equipment for plants. Because Angola does not have the technological capabilities to manufacture energy sector machinery and equipment locally, the country has been dependent on technology transfer from abroad. In an interview on 14 July 2014, an official from the Ministry of Petroleum stated:

We, like many developing countries, are still importing or buying basic things, because we do not have the industry to manufacture products locally. We buy and import electric bulbs at the moment; think of a time when we will be able to manufacture components for a power plant or an oil-rig.

My research showed that new machinery and equipment constituting the plant for Hydro Chikapa 1, Angola LNG and the Biocom project were transferred from Russia, Europe and America, and Brazil respectively.

Generally, hardware transferred to Angola through FDI inflows can be considered to be ESTs because it is new and therefore enables cleaner production. Furthermore, the plant for the Angola LNG Project reduced pollution that arose from gas-flaring, hence facilitating the creation of 'pollution halos'. The transfer of this new technology, never used in Angola before, has enabled the country to leapfrog to new frontiers of LNG and bio-energy technologies.

The transfer of hardware, especially machinery and equipment to harness renewable energy, is another novel area where ESTs are being transferred through inflow of FDI. This hardware includes machinery and equipment for wind and solar energy. As an official from the Ministry of Energy and Water stated in an interview on 14 July 2014:

We have announced a public-private partnership to construct Angola's first 100MW wind park at Tômbwa in the Namibe Province. Our hope is that we will get partners who have modern technology and are willing to share the technologies with us. So far, we are convinced that wind and solar [energy] are the way to go forward, but without the appropriate technology we can't follow this desired route.

Recently the government awarded a tender to develop the wind-energy and solar-radiation resource map of Angola to a Spanish firm, Ereda. Ereda is also obliged to transmit soft technologies to local Angolans during this mapping phase. Likewise, direct investments into photovoltaic energy have been on the increase, especially in the form of off-grid small-scale solutions that target rural public facilities such as clinics and hospitals. The UK-based Fortune CP, for example, has been involved in implementing solar-power systems in collaboration with the Ministry of Health in ten rural clinics in Huila Province.

Besides transfer of ESTs in the form of hardware, IFDI to Angola's energy sector has also transferred ESTs in the form of know-how, especially people-embodied know-how. ESTs in the form of knowledge on safety, health and enhanced environmental practices were passed on to local staff who participated in the environmental impact assessment process for the Angola LNG and Biocom projects. Similarly, training given by Brazilian experts to Angolans employed in the Biocom bio-energy project transferred environmental best practices for sugarcane production and environmentally-friendly agricultural activities. In the Angola LNG Project, locals have been trained in methods to conserve biodiversity, especially marine animals such as sea turtles, which otherwise would have been adversely affected by the construction of gas plant and pipelines. The transfer of ESTs through training in environmental best practices also indirectly leads to the transfer of paper-embodied ESTs. However, the capacity of IFDI to transfer paper-embodied ESTs is limited because Angola is a Portuguese-speaking country, whereas some investors in the energy sector speak English, Spanish or Mandarin.

Although I found evidence for transfer of ESTs in the form of hardware and know-how, I could not find evidence that any capacity transfer has taken place. In other words, I found no proof that the transfer of ESTs in the form of 'know-why' technology has taken place. As an official from the Ministry of Energy and Water said in an interview on 14 July 2014:

Our main problem has been to ensure that we have qualified Angolans at the helm of these energy sector projects in contrast to the current situation where most of the senior managers and engineers are foreign expatriates. Educating our people is important, but we need to institute and enforce the policies that promote foreigners to train locals. This is a rather difficult task.

This means that the transfer of ESTs to Angola has not yet built the capacities and capabilities of Angolans to independently create and design new and locally adapted environmentally friendly best practices. The local capacity to adapt, adopt and transform the acquired hardware technologies remains limited.

FDI inflow to the energy sector and the transfer of ESTs to the broader economy

Another research finding is that whilst FDI inflows to the energy sector have transferred ESTs, especially hardware in greenfield investments, such transfers have been limited to this sector and have not had a wider impact on the overall Angolan economy. This was explained in an interview on 14 July 2014 by a Ministry of Environment official:

Whilst we are making great strides in transforming our economic activities so that they do not harm the environment, some sectors have been very successful whilst others have not. For example, I would say all new projects in the energy sector have had the benefit of the best existing technologies. However, old projects remain unchanged and polluting. Furthermore, we still have environmentally-harmful technologies and practices in the agricultural and other sectors. Therefore, we need to analyse these issues much more holistically.

From these comments it is clear that IFDI to Angola's energy sector has not comprehensively transformed either the energy sector or other sectors of the Angolan economy, in terms of the deployment of ESTs and practices. What is apparent is that there are pockets of environmentally-sound projects that coexist with environmentally-degrading enterprises within the energy sector, and uncertainty about what is transpiring in other sectors. Currently, the amendment of outdated legislation and statutes, such as those governing the power subsector, seems to be the Angolan government's main plan for forward movement.

Discussion

The objective of this research was to explore whether increased FDI inflows to Angola's energy sector have successfully transferred ESTs. I also wanted to examine the types of technology transferred. My main findings were that Angola has attracted increased IFDI to its energy sector, especially since 2004, and these inflows have indeed transferred ESTs. Pivotal to promoting the transfer of ESTs through IFDI are actions by the government, which has created institutional structures and policy frameworks that promote EST-carrying FDI.

My findings illustrate four types of institutions that essentially direct IFDI to transfer ESTs. First, certain state-owned enterprises partner with foreign investors and advance national interests in these investments, for example by ensuring adherence with sustainable development imperatives. Second, law-making institutions – such as the National Assembly – draw up domestic legislation, and harmonise and domesticate international regimes. Third, government institutions provide oversight for policymakers, the legislature and other relevant bodies. In Angola's energy sector, this role is fulfilled by line ministries such as the Ministry of Petroleum and the Ministry of Energy and Water. Fourth, certain state institutions build relations and interact with international actors, with the aim of attracting FDI inflow and promoting the transfer of ESTs. The primary feature that is apparent from analysing this institutional architecture is that the transfer of ESTs through IFDI does not occur automatically, but can be achieved through deliberate intervention by government. Furthermore, like other studies³³, my research highlights the importance of institutions and policies. My approach departs from other studies by stressing the central role of governments in promoting EST-carrying IFDI through the deployment of international-relations apparatuses, and through the domestication of global regimes.

Based on the findings of this study, it transpires that there are two types of policy that essentially direct FDI inflows to transmit EST. The first type is explicit policies: specific policies and provisions for IFDI that carries ESTs, such as environmental legislation and EST-incentivised programmes. The second type is implicit policies: these policies do not make direct provision for FDI or ESTs, but their implementation directly affects the transfer of ESTs through IFDI.

Table 3: Types of environmentally sound technologies transferred through inward foreign direct investment to Angola's energy sector

Capital goods and equipment	Skills and know-How	Knowledge and expertise ('know-why')
These take the form of hardware, especially machinery and equipment transferred in all greenfield energy-sector projects. These are new, clean, less-polluting technologies, and they also facilitate technology leapfrogging.	This occurs especially through people-embodied practices, transferred in the training of Angolans inside and outside the country, as well as new knowledge being transferred in renewables and alternative energy sources. However, transfer of paper-embodied ESTs and practices is limited by language barriers.	The limited availability or lack of Angolans at managerial and technical levels constrains the transfer of know-why ESTs. Also, the lack of manufacturing capability limits the country's capacity to transform acquired technologies to a level where they can be environmentally friendly.

Source: Author's compilation

Key: EST = environmentally sound technology

Implicit policies include human resource issues, such as policies on training of locals – the implementation of which results in transfer of ESTs in the form of people and paper-embodied know-how through IFDI. Through these policies, the state has managed to create a favourable or conducive environment for IFDI that carries ESTs.

My research findings furthermore show that although IFDI does transfer ESTs in Angola's energy sector, the inflows do not uniformly transfer all types of EST. Some ESTs are easily transferrable and are indeed transferred, whilst others are not, as shown in Table 3.

The main type of ESTs transferred take the form of capital goods. Most of the machinery and equipment being transferred are essential for production. Achanda and Gosch³⁴ state that 'the flow of capital goods and services adds to the production capacity of the transferee'. However, because the incoming machinery and equipment are modern, the whole country benefits from much more efficient and cleaner production.

The transfer of skills and know-how for environmental management has also occurred, especially people-embodied know-how, which seems to be more easily transmitted than paper-embodied know-how. The problem of passing on ESTs in the form of paper-embodied know-how can be attributed to language barriers that exist between Angolans and foreign investors. Moreover, the transfer of knowledge and expertise for innovation or know-why is rather limited. My findings on transferrable technologies that are easily diffused through IFDI are similar to those of other studies¹⁹.

The limited transfer of know-why ESTs seems closely linked to Angola's technological capability. Generally, the country's lack of endogenous technological capability hinders its ability to modify systems and to adapt, adopt and modify externally acquired technologies. With low-level technological capacity, it even becomes more difficult to modify the acquired technologies to be environmentally friendly. Thus the country needs to build its endogenous technological capability, in particular manufacturing capabilities that would enhance its capacity to manufacture or transform transferred technologies. The limited impact of EST-carrying IFDI in brownfield investments in the energy sector, as well as in the broader economy, might suggest that policies on FDI as well as sector-specific and national policies should be strengthened. I recommend there should be closer integration of FDI policies and institutions with the national system of innovation and educational framework.

Conclusion

In this study, I examined whether IFDI into Angola's energy sector has transferred ESTs. I concluded that the active involvement of the Angolan government in creating policy frameworks and institutional structures, and in deploying international relations, has facilitated IFDI carrying ESTs to the country's energy sector. This finding suggests that countries can generally utilise sovereignty principles to attract FDI that transfers ESTs. Furthermore, FDI recipient countries should build their endogenous technological capability, which would enable those countries to adopt, adapt and transform externally acquired technologies to be environmentally friendly. This research is among the few Africa-

focused studies that provide empirical evidence to policymakers and negotiators on FDI inflows and the transfer of EST. I recommend that further research be conducted to explore this subject area, perhaps using different countries and economic sectors as case studies.

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