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FDI-facilitated Development: The Case of the Natural Gas Industry of Trinidad and Tobago

Lou Anne A. Barclay

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FDI-FACILITATED DEVELOPMENT: THE CASE OF THE
NATURAL GAS INDUSTRY OF TRINIDAD AND TOBAGO

Lou Anne A. Barclay*

Abstract

Since the last decade, governments in less-developed countries have increasingly viewed Foreign Direct Investment (FDI), as directed by the multinational enterprise (MNE), as a catalyst for economic growth and transformation. Indeed, the literature argues that FDI-assisted development occurs when a less-developed country assimilates, adapts and diffuses the positive externalities arising from the interaction of the MNE’s ownership advantages with its locational attributes (e.g., Dunning 1981, 1988). This paper, however, posits that FDI-facilitated development is not an effortless process. It only occurs when host developing-country governments implements selective intervention policies that are aimed at increasing indigenous technological capabilities (e.g., Lall 1996, 1997). This paper explores this issue by examining the experience of Trinidad and Tobago, a recipient of substantial FDI inflows in its natural gas industry for the last decade. This paper clearly shows that FDI-assisted development only occurs when governments in less-developed economies pursue credible, selective intervention policies.

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1.0. INTRODUCTION

A little more than twenty years ago, governments in less-developed countries viewed the multinational enterprise (MNE) as part of their ‘development problem.’ Today, these governments perceive MNEs as catalysts for economic development and transformation. Hence, since the mid-1980s, governments in less-developed countries have increasingly adopted legislation favourable to foreign direct investment (FDI) (UNCTAD 2002: 7). The embracing of multinational enterprises by developing countries is largely a result of the official abandonment of traditional development strategies such as import-substitution and the adoption of an orthodoxy of export-led development that is heavily dependent on the foreign investor.

This FDI-assisted development allegedly results in economic development and transformation. The literature argues that FDI-assisted development occurs when a less-developed country assimilates, adapts and diffuses the positive externalities or spillovers, which arise from the interaction of the MNE’s ownership advantages with its locational attributes (Dunning 1981, 1988; Narula 1996). This paper argues, however, that the FDI-facilitated development is not an effortless process. It only occurs when host developing-country governments implement selective intervention policies aimed at increasing indigenous technological capabilities (Lall 1996, 1997).

This paper explores this issue by examining the experience of Trinidad and Tobago, which has been a recipient of substantial FDI inflows in its natural gas industry over the last decade. The paper is organised as follows: Section 2 presents the analytical framework, arguing the importance of the use of selective intervention policies for FDI-facilitated development. Section 3 reviews the history of the country’s relationship with FDI. In Section 4, we attempt to ascertain how successful the government has been in using the foreign investor to enhance its indigenous technological capabilities. This section is based on interviews held with policy makers and executives of firms operating in the natural gas industry of Trinidad and Tobago. The final section presents the conclusion.
2.0 FDI-FACILITATED DEVELOPMENT AND DEVELOPING COUNTRIES

The notion that FDI facilitates economic growth and transformation in less-developed countries has sound theoretical underpinnings. More than half a century ago, Lewis (1950) postulated industrialisation as directed by the foreign investor to be the solution to the intractable economic problems confronting the Caribbean region. Indeed, Lewis noted that the key to successful industrialisation lies in the “wooing and fawning” of established foreign capitalists to invest in operations in the Caribbean (Lewis 1950: 871-872). He believed that these foreign capitalists would combine their ownership-specific advantages with the region’s locational attributes. Lewis envisaged that foreign capital inflows would have an accelerator effect on these economies. “They will increase the level of national income, which will result in an increase in national savings. These savings will then be used by nationals who having learnt the ‘tricks of the trade,’ will engage in industrial activity themselves” (ibid: 872-873).

Later theories also embraced the notion that foreign investment facilitates economic development. However, they adopted the perspective that economic growth was stage-based and evolutionary in nature. The most notable include the Investment Development Path, which was initially advanced by Dunning (1981, 1988) and later refined by Tolentino (1993) and Narula (1996), and Ozawa’s (1992) “dynamic paradigm for MNE-assisted development.” A recurring theme in these theories is the dynamic interaction between the ownership-specific advantages of the MNE and the locational attributes of the host developing country. It is this activity that propels the less-developed economy to a higher stage of development.

The dynamic interaction between the ownership-specific advantages of the MNE and the location-bound attributes of the host developing economy may result in externalities or productivity spillovers. These productivity spillovers, which range from the increased productivity of local firms, worker training, industry linkages and market access (e.g., Rodriguez-Clare 1994; Blomstrom and Kokko 1998; Blomstrom, Kokko and Zejan 2000), facilitate the upgrading of the locational attributes of the host developing country. Indeed, the catalytic effect of spillovers may be strong enough to eventually propel the domestic firms into driving the MNEs out of the host economy (Markusen and Venables 1999).

Nonetheless, the notion of productivity spillovers arising from the multinational corporations’ activities in developing countries is not without controversy. Blomstrom, Kokko and Zejan (2000) concede that spillovers vary between countries and industries, and are likely to depend on the level of local capabilities and competition. Others argue that they are only beneficial to host developing countries that have attained a minimum threshold of development (De Mello
1997; Borensztein et al. 1998). Other researchers posit that while spillovers associated with FDI are supported by anecdotal evidence from several countries, their existence and magnitude are difficult to establish empirically (e.g., Kugler 2000; Hanson 2001). Moreover, Hanson (2001) argues that when the MNEs are high-productivity firms, which pay relatively high wages, their presence depresses the productivity of local firms by possibly driving them to less profitable market segments. Thus, in many instances, FDI-facilitated development may not enhance the welfare of the host developing country.

Nonetheless, it is argued that the positive externalities, which arise from the dynamic interaction between the ownership-specific advantages of the MNE and the location-bound attributes of the host developing economy, occur when host developing-country governments implement selective intervention policies that are aimed at increasing indigenous technological capabilities. It seems that selective intervention policies enhance the absorptive capacity of the less-developed countries allowing them to capture the spillovers arising from the MNE’s activities. Indeed, several researchers argue that the existence of market failure in less-developed countries requires the implementation of both functional and selective intervention policies (Lall 1994, 1996, 1997; Stiglitz 1996; Wint 1998; Jomo 2001). Functional policies are those that correct generic market failure without favouring any specific activity over the other. Conversely, selective intervention policies favour specific activities or groups of activities in order to correct specific market failures or externalities that could result in the sub-optimal allocation of resources.

It appears that the FDI-facilitated development process is faced with potential market failures, which provides a critical rationale for the use of selective intervention policies. These policies do not replace the market, but complement it. For example, Stiglitz (1996) and Lall (1997) cite the market failures arising in capital markets and from sources such as the externalities stemming from industrial and technological activities, information market deficiencies, the need to coordinate interlinked investment decisions, risky and unpredictable learning processes, and institutions gaps. Lall (1997) emphasises that these market failures call for selective intervention policies rather than functional ones because externalities and learning processes are likely to differ between activities hence, their “exploitation or remedying” is likely to require differing intervention policies aimed at different circumstances (ibid: 408). Lall further argues that it is mainly the more demanding technologies and activities that must be mastered if a country is to progressively deepen the range and complexity of its industrialisation process, which requires the use of selective intervention policies (Lall 1996, 1997).

The response of MNEs to these selective intervention policies is likely to depend on whether they perceive them to be credible (where policy credibility is defined as binding commitments made by government on which firms could rely as strategic planning assumptions -Murtha and
Lenway, 1994). Policy credibility plays a crucial role in determining whether or not a host government’s industrial strategies truly influence a MNE’s corporate behaviour in the host environment. Indeed, Murtha and Lenway (1994) argue that the MNE “will not enter into a process of mutual strategic adaptation unless it is assured that the governments can and will implement consistent policies overtime” (ibid: 127).

Empirical evidence supports the argument that FDI-facilitated development is welfare enhancing to the host developing countries. Indeed, there are frequently cited examples of spillovers occurring in less-developed countries, notably the East Asian NICs (e.g., Rasiah 1995; Hobday 1995). For example, Hobday (1995) notes the catalytic effect that the initial arm’s length contractual arrangements between foreign and local firms had on the development of the electronics industry in East Asia (South Korea, Taiwan, Hong Kong and Singapore). The domestic firms initially provided subcontracting services to the MNEs, however, within four decades, some had progressed to the export marketing of their own brand of electronic products. The initial spillovers in worker training that occurred in these countries resulted in a ‘virtuous circle’ of deepening capabilities in process and production technology, the development of domestic supplier firms, the stimulation of agglomeration economies, and the creation of final goods producers. This process occurred in an environment where the governments efficiently implemented selective intervention policies in product and capital markets, as well as in factors markets such as education, technology, information and institutional development (e.g., Stiglitz 1996; Lall 1997).

Thus, it seems that FDI-facilitated development occurs when the host country manages to capture the spillovers arising from the MNE’s operations in its economy. The empirical evidence suggests that this happens when host governments create an environment that promotes technological learning. To this end, they implement credible, selective intervention policies to compensate for the market failures occurring in product and factor markets.

However, the type, sequencing and consistency of these selective intervention policies are critical to the creation of this learning environment. Indeed, it is important that policy makers emphasise a long-term perspective that focuses on the underlying processes that sustain the competitiveness of the local firm. This entails a focus on ‘policy dynamics’, that is the interaction between policies and the behaviour of the economic actors they are designed to affect (Mytelka 2000). Such a focus obliges policy makers to take into consideration two issues: the competitive conditions existing across and within industries overtime, and the habits and practices of economic actors within these industries with respect to competition and innovation. This perspective allows for systemic thinking, consistency of policy and long-term goal setting, which makes it possible to formulate and implement selective intervention policies, and to sequence these policies in a manner that is tailored to local circumstances.
This paper seeks to examine the extent to which FDI-facilitated development has occurred in the natural gas industry of Trinidad and Tobago. The following section begins this analysis by exploring the history of the country’s relationship with FDI.
3.0 THE HISTORY OF FDI-FACILITATED DEVELOPMENT IN TRINIDAD AND TOBAGO

FDI has always played a strategic role in the economic development of Trinidad and Tobago. However, its importance has varied overtime. Indeed, three distinct phases could be discerned in the history of the country’s relationship with the foreign investor. The first phase occurred in the immediate post independence period, 1958-1973, when Trinidad and Tobago implemented two industrialisation strategies. The first strategy, which was pursued from the late 1950s to early 1960s, had its roots in Arthur Lewis’s thesis for the industrialisation of the Caribbean (Lewis 1950). The second, the import-substitution model imported from the Latin American theorists, was grafted onto the Lewis model in response to the serious balance of payments problems experienced in the early 1960s. Both of these strategies emphasised FDI as the primary vehicle for economic development. Hence, during this period, the foreign investor was identified as the main agent that would ‘transport’ industrialisation to the country (e.g., Farrell 1980). Thus, the government sought to create an environment in which foreign capital would flourish. To this end, it invested heavily in infrastructural development (roads, electricity, transport, water and industrial estates); provided generous fiscal and financial incentives; and created an institutional framework for industrialisation, which included the establishment of organisations such as the Investment Development Corporation, the Caribbean Industrial Research Institute and the Bureau of Standards.

However, by the early 1970s, it became patently clear that a strategy of passive reliance on foreign investment does not result in economic transformation. During this period, the foreign investor dominated the manufacturing sector with concentration ratios as high as 90 percent in industries such as food, drink and tobacco (Farrell 1979). Yet, the government made little attempt to design and implement intervention policies that would augment the modest capabilities (managerial and technological) of the existing domestic firms. Further, little efforts were made to use the foreign investor in this regard or even integrate its operations within the extant institutional framework for industrialisation. The failure of these industrialisation strategies had dire economic and social consequences: By 1973, the Trinidadian economy was in the throes of an economic crisis. The numbers unemployed leapt from 10.6 percent to the labour force in 1965 to 17 percent by 1970. The fiscal surplus of 1965 quickly dwindled to a deficit and remained so until the end of 1976. The current account of the balance of payments was also in a state of chronic deficit, and in 1973 the foreign exchange reserves were the equivalent of a mere three weeks of imports (Barclay 1990: Table 4.1). Not surprisingly, at this time there was widespread social and political discontent.
In the post 1973 era, in a complete reversal from its earlier approaches to foreign investment, the government became prime mover in the economy. Its policy, however, was not to imply that FDI was unwelcome but that (i) certain areas of the economy were to be reserved for national effort; (ii) certain key sectors were not to be subject to 100 percent foreign ownership and control; and (iii) foreign enterprises must be good, corporate citizens. (Government of Trinidad and Tobago 1972: 5). At this time, as the Trinidad government was reducing its reliance on the foreign investor, events were occurring in the world economy which proved to be fortuitously beneficial for the country. The unprecedented increases in oil prices in 1973 to 1974 and again in 1979 to 1980 were matched by significant discoveries of oil off Trinidad’s east coast. The years 1973 to 1982 were indeed halcyon days for this country. Its gross domestic product increased six-fold from US$ 1,309 million in 1973 to US$ 8,140 million in 1982. Per capita income soared from US$ 1,190 in 1973 to an astonishing US$ 6,450 in 1982. Foreign exchange reserves leapt from a mere US$ 47 million in 1973 to a phenomenal US$ 3,080 million in 1982 (World Bank 1994: 672-3).

Awash with oil windfalls, the government as prime mover in the economy, sought to expand the social and economic infrastructure. An important component of the economic infrastructure was its focus on the establishment of a foundation for industries that were intensive in their use of natural gas. As Table 1 demonstrates, the government developed five gas-based projects. These gas-based activities were all export oriented. Moreover, all were located on the government-built, industrial estate, the Point Lisas Industrial Estate, designed to provide for the infrastructural needs of the new industries. This 1000-hectare industrial estate is located 25 miles south of the capital city. It has well-developed road networks; a captive port that has specialised installations for the bulk loading of anhydrous ammonia, methanol, urea and direct reduced iron; excellent telecommunications services; and is fed with natural gas from two pipelines.
Table 1: The ownership structure and organisational arrangements of companies in the natural gas industry as at 1985.

<table>
<thead>
<tr>
<th>Company</th>
<th>Ownership Status</th>
<th>Start-up Year</th>
<th>Costs</th>
<th>Organisational Arrangements</th>
<th>Permanent Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Iron &amp; Steel Company of T &amp;T (ISCOTT)</td>
<td>100% GOTT</td>
<td>1980</td>
<td>US$ 350 million</td>
<td>Locally run up to 1985</td>
<td>1,200</td>
</tr>
<tr>
<td>Trinidad and Tobago Nitrogen Company</td>
<td>51% GOTT 49% W. R. Grace</td>
<td>1977</td>
<td>US$ 111.4 million</td>
<td>Management and marketing contract with W. R. Grace</td>
<td>90</td>
</tr>
<tr>
<td>(TRINGEN1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilisers of Trinidad and Tobago</td>
<td>51% GOTT 49% Amoco</td>
<td>1982</td>
<td>US$ 350 million</td>
<td>Management and marketing contract with Amoco</td>
<td>270</td>
</tr>
<tr>
<td>(FERTRIN)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago Methanol Company</td>
<td>100% GOTT</td>
<td>1984</td>
<td>US$ 179.2 million</td>
<td>Management contract with National Energy Corporation, a government energy company</td>
<td>190</td>
</tr>
<tr>
<td>(TTMC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago Urea Company</td>
<td>100% GOTT</td>
<td>1984</td>
<td>US$ 117.1 million</td>
<td>Management contract with FERTIN, Marketing contract with Agrico Chemicals (US Company)</td>
<td>NA</td>
</tr>
<tr>
<td>(TTUC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Farrell (1987)

Notes: GOTT = Government of Trinidad and Tobago

The oil boom years were a golden opportunity for Trinidad and Tobago to ensure that its foreign investors enhanced the country’s indigenous technological capabilities. However, this was not done. In fact, there seemed to be little attempt at formulating and implementing functional and selective intervention policies for such a purpose. Several factors have been identified as contributing to this failure. The first reason lies in the inefficiencies of the institutions involved in industrial planning and implementation during this period. Indeed, an ad hoc body, the Coordinating Task Force (CTF) with a meagre complement of five staff members and a five-member board, was created to carry out the planning and implementation of the five industrial projects. Apart from the organisational inefficiency arising from the small size of such an important body, there was little coordination between the CTF and the existing institutional apparatus for industrialisation. In consequence, the extant institutions mandated to promote industrial activity in the country, namely the Industrial Development Corporation and Development Finance Corporation, persisted in nurturing the development of import-
substituting activities while at the official level, an export-oriented, gas-intensive strategy was being pursued. An examination of the firms that benefited from their concessions during this period revealed that more than 50 percent were producers of consumer durables (Barclay 1990). More interestingly, however, is the failure of these institutions to actively promote the development of local firms that provided support services to the foreign firms in the natural gas industry, or were engaged in downstream activities of this industry.

Further, there was no interaction between the R&D institutions and the foreign firms operating in the gas intensive industries. Trinidad and Tobago, at that time, boasted a technological network consisting of two institutions: the Caribbean Industrial Research Institute (CARIRI) and the National Institute for Higher Education (NIHERST). However, most of the industrial research conducted by CARIRI during this period was the provision of testing and information services for the agro industry. Similarly, NIHERST’s emphasis on science and technology was limited to small-scale research exercises in animal feed and plant breeding which it sponsored (Barclay 1990).

The possibilities existed for the foreign investor to enhance the country’s indigenous technological capabilities during the project cycle phase of the gas-based projects. However, this was not done. While it seemed that the planners were aware of technology policy issues and the significance of what happened during the project planning stages for the resolution of these issues, they failed to devise a detailed, comprehensive approach to technology policy planning. For example, the available evidence suggests that the planners were well aware of technology policy problems such as the importance of locals acquiring the technical skills to operate the facilities. Yet no intervention policies seeking to develop requisite worker skills were devised. Indeed, neither the local university nor the local technical and vocational institutes offered special training programmes for this industry. Most of the workers employed in the new process industries, notably methanol and ammonia, were drawn from the oil industry and the US-owned fertiliser company, Federation Chemicals that was operating in Trinidad at that time.

Further, there appeared to be little interest in related issues, such as how the execution of these projects could play a role in building the country’s technological capabilities. Little attempt was made to carefully define the areas in which such capability needed to be built over the long term as well as the specific technologies that the foreign firms could contribute. In addition, the planners displayed interest in identifying and acquiring technologies in the project cycle phase as opposed to post start-up. For example, local firms were allied with foreign consulting companies for purposes of undertaking project management type work. However, these efforts were not part of a detailed, comprehensive plan to identify and extract all learning that was possible during the project cycle phase, or to systematically develop local capabilities to the fullest extent through spread effects and supplier linkages.
Unfortunately, the gas-based projects did not achieve much success from the outset. There are several reasons for this. First, the forecasts on which the investment decisions were made proved to be inaccurate. This was clearly seen in the case of the ammonia project where the actual prices were much weaker than the forecasted prices. Additionally, the steel plant experienced a series of difficulties, including an inability after more than three years to produce required levels of design capacity; technical inefficiencies in terms of plant operations - including poor maintenance of machinery and equipment - and substantial time and cost overruns, with the plant coming on stream a year after completion date. Further, its steel imports to US were subjected to anti-dumping charges. As a result, these plants all failed to meet their financial expectations (Farrell, 1987).

By 1983, the country had fallen into a recession that lasted for seven years. The GDP in 1990 was approximately 20 percent less than that of 1982. The country’s foreign exchange reserves plummeted from US$ 3,080 million in 1982 to a mere US$ 492 million in 1990. Additionally, in 1990, the country’s external debt rose to an astronomical US$ 2,508 million (World Bank 1994: 672-4). This economic situation was caused by the collapse of the international oil market, the decline in domestic oil production, and economic mismanagement (Auty and Gelb 1986; Ramsaran 1993).

Thus, in 1989, the government of Trinidad and Tobago was compelled to approach the international lending agencies for financing. As part of its loan conditionalities, it agreed to implement stabilisation and structural adjustment programmes. Under these programmes, the government in a complete volte-face, liberalised trade and foreign exchange markets; divested state assets - including the newer enterprises in the natural gas sector - and implemented policies to attract foreign investment. The state no longer assumed an active role in the economic development of the country. Rather, its role was redefined as one of policy maker and regulator. The task of economic transformation was left to the private sector. At present, Trinidad and Tobago is at the third phase of its relationship with the foreign investor. It is presently described as one of the most sought-out locations for energy-related activities in the Western hemisphere. International investors are being encouraged to acquire state owned energy-based industries or establish greenfield investment (Renwick 1995: 7). FDI inflows have been increasing since the mid 1980s, soaring to US$ 1 billion in 1990 and declining slightly to US$ 835 billion in 2001. Indeed, in 1999, this country ranked second in the Transnationale Index\textsuperscript{a} for developing countries (UNCTAD 2002). It presently has a total of eighteen foreign companies involved in primary production in its natural gas industry (See Table 2).
Table 2: Companies in the Natural Gas Sector of Trinidad and Tobago, 2003.

<table>
<thead>
<tr>
<th>Company</th>
<th>Start-up year</th>
<th>Original ownership</th>
<th>Current Ownership</th>
<th>Rated Capacity</th>
<th>Number of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydro Agri Trinidad</td>
<td>1959</td>
<td>WR Grace</td>
<td>Norsk Hydro (1992)</td>
<td>227,000 mt/y</td>
<td>272</td>
</tr>
<tr>
<td>Trinidad Nitrogen (Trigen 1)</td>
<td>1977</td>
<td>GOTT, WR Grace</td>
<td>GOTT, Norsk Hydro (1992)</td>
<td>500,000 mt/y</td>
<td>N. A.</td>
</tr>
<tr>
<td>Tringen II</td>
<td>1988</td>
<td>GOTT, WR Grace</td>
<td>Norsk Hydro (1992)</td>
<td>454,000 mt/y</td>
<td>N. A.</td>
</tr>
<tr>
<td>PCS Nitrogen II</td>
<td>1984</td>
<td>GOTT, Amoco</td>
<td>PCS (1995)</td>
<td>450,000 mt/y</td>
<td>300</td>
</tr>
<tr>
<td>PCS Nitrogen 111</td>
<td>1996</td>
<td>PCS</td>
<td>PCS</td>
<td>250,000 mt/y</td>
<td></td>
</tr>
<tr>
<td>PCS Nitrogen IV</td>
<td>1998</td>
<td>PCS</td>
<td>PCS</td>
<td>650,000 mt/y</td>
<td>150</td>
</tr>
<tr>
<td>Farmland/Miss Chem</td>
<td>1998</td>
<td>Farmland, Miss Chem</td>
<td>Farmland, Miss Chem</td>
<td>690,000 mt/y</td>
<td>80</td>
</tr>
<tr>
<td>Granular Urea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methanol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago Methanol Company I</td>
<td>1984</td>
<td>GOTT, Ferrostaal AG, Helm</td>
<td>Methanol Holdings Trinidad Ltd., CL Financial, Ferrostaal AG, and Helm AG (1996)</td>
<td>460,000 mt/y</td>
<td>80</td>
</tr>
<tr>
<td>Trinidad and Tobago Methanol Company II</td>
<td>1996</td>
<td>GOTT, Ferrostaal AG, Helm AG.</td>
<td>CL Financial, Ferrostaal AG, Helm AG and Methanol Holdings Trinidad Ltd.</td>
<td>550,000 mt/y</td>
<td>100</td>
</tr>
<tr>
<td>Methanol IV Company</td>
<td>1998</td>
<td>Clico Energy, Ferrostaal AG and Helm AG.</td>
<td>CL Financial and Ferrostaal AG.</td>
<td>550,000 mt/y</td>
<td>80</td>
</tr>
<tr>
<td>Titan Methanol</td>
<td>2000</td>
<td>Beacon Energy, Amoco, MG Methanol</td>
<td>Methanex, bpTT, JP Morgan Chase</td>
<td>860,000 mt/y</td>
<td>100</td>
</tr>
<tr>
<td>Methyl Tertiary Butyl Ether (MTBE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PETROTRIN MTBE</td>
<td>1997</td>
<td>PETROTRIN MTBE</td>
<td>PETROTRIN MTBE</td>
<td>365,000 mt/y</td>
<td>N. A.</td>
</tr>
</tbody>
</table>

Direct reduced iron, steel billets and wire rods
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Year</th>
<th>Company Description</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caribbean Ispat Ltd.</td>
<td>1980</td>
<td>Iron and Steel Company of Trinidad and Tobago</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ispat International N.V. (1994)</td>
<td>Billets: 700,000 mt/y Wire rods: 600,000 mt/y</td>
</tr>
<tr>
<td>Ispat DRI</td>
<td>1999</td>
<td>Ispat International N.V.</td>
<td>DRI pellets: 800,000 mt/y</td>
</tr>
<tr>
<td></td>
<td></td>
<td>744</td>
<td></td>
</tr>
<tr>
<td>Propane, Butane and Natural Gasolene</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phoenix Park Gas Processors Ltd.</td>
<td>1991</td>
<td>Natural Gas Company of Trinidad and Tobago, Conoco and PanWest</td>
<td>Natural Gas Company of Trinidad and Tobago, Conoco, PanWest and Methanol Holdings Trinidad Ltd. (1996)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>700,000 mmcf/d</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Liquefied Natural Gas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlantic LNG Company of Trinidad and Tobago</td>
<td>1999</td>
<td>Amoco, British Gas International, Cabot LNG, National Gas Company of Trinidad and Tobago</td>
<td>bpTT, BG International, Tractabel, National Gas Company of Trinidad and Tobago</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LNG: 3 mil. mcf/d NGL (natural gas liquids) 6,000 bdp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>Atlantic LNG 2/3 Company of Trinidad and Tobago Unlimited</td>
<td>2002 (train 2) 2003 (train 3)</td>
<td>bpTT, BG International, Repsol</td>
<td>bpTT, BG International, Repsol</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LNG: (for each plant) 3.3 mil. mncf/d NGL (for each plant) 12,000 bdp</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>300</td>
</tr>
</tbody>
</table>

Notes:
1. PCS is the Petrochemical Company of Saskatchewan, Canada.
2. Methanol Holdings Trinidad Ltd. is a holding company that was formed to consolidate the shareholding and management of Trinidad and Tobago Methanol Company I & II, Caribbean Methanol Company and Methanol IV Company. The Methanol Holding Trinidad Ltd is a subsidiary of the Trinidadian-owned conglomerate, CL Financial.
3. GOTT is Government of Trinidad and Tobago.
4. PETROTRIN (Petroleum Company of Trinidad and Tobago Limited) is the state-owned oil company of Trinidad and Tobago.
A pertinent question at this stage is: How has the government used the recent wave of foreign direct investment in its natural gas industry to upgrade the country’s technological capability? This paper attempts to find answers to this question by examining the following issues:

1. The government’s targeted investment promotion strategy, specifically the criteria it uses to select and attract foreign investors and the role it envisages these firms should play in enhancing the development of its indigenous technological capability;

2. The state-owned institutional apparatus created for capability building (managerial, technical and scientific) in this industry, and its relationship with foreign firms; and

The growth of downstream and supporting firms that are locally owned, and the manner in which the state and foreign firms have strengthened their capabilities (technological, managerial and marketing).

The analysis of the above issues will be done for the petrochemical and Liquefied Natural Gas (LNG) companies. However, special emphasis will be placed on two firms that are dynamic players in the industry. One is BP Trinidad and Tobago (bpTT), a member of the BP group of companies, which is one of the largest petroleum and petrochemical organisations in the world. This company, together with the Canadian methanol marketing firm, Methanex, and the US investment company, JP Morgan Chase, owns one of the world’s largest methanol plants in Trinidad and Tobago (Titan Methanol, of which bpTT owns 15 percent of the equity). BpTT also holds 35 percent of the equity in another methanol plant, Atlas Methanol, which is presently under construction. When this plant - with the capacity to produce 500,000 metric tonnes of methanol per day - comes on stream in early 2004, it will be largest methanol plant in the world. bpTT also owns 34 percent of Atlantic LNG train 1, and 42.5 percent of Atlantic LNG train 2 and 3.

The other firm studied is the locally owned conglomerate, CL Financial, which together with several foreign companies, owns and operates four of the five methanol plants and one of the nine ammonia plants in the country (See Table 2).
4.0 GOVERNMENT TARGETED INVESTMENT PROMOTION STRATEGY FOR THE NATURAL GAS SECTOR

4.1 Targeting Foreign Firms to the Natural Gas Sector

It is interesting to note that none of the state organisations involved in formulating and implementing policy for the natural gas industry during the oil boom years are currently operating in this capacity. At present, there are four state bodies responsible for formulating and implementing policy for all aspects of the value chain of the gas industry in Trinidad and Tobago. The first is the Natural Gas Export Task Force, created in 2002, which is a sub-committee of the Energy Committee chaired by the Prime Minister. The main objectives of the Natural Gas Task Export Force are to create policies that relate to the export of large amounts of natural gas. Its responsibilities include the LNG projects, the gas pipelines to the Caribbean and the possible introduction of new gas technologies, such as gas-to-liquids and gas-to-methanol-to-olefins into Trinidad. The second institution is the Ministry of Energy, which has the specific responsibility of granting licenses for oil and gas exploration. The third is the Tourism and Industrial Development Corporation (TIDCO). TIDCO, which was created in 1994 from the merger of the Industrial Development Corporation, the Export Development Corporation, and the Tourism Development Association, and plays an indirect role in the promotion of the gas industry. While it does not assume the role of coordinator of the investment promotion activity for this industry as outlined in UNCTAD (2002: 231), it processes applications for the investment incentives offered to the foreign investors in the gas industry. Finally, the National Gas Company (NGC) was created in 1975 with the initial mandate of being the main state institution responsible for the purchase, transportation and sale of natural gas. At present, its mandate has been extended to include the targeted promotion of the gas industry to the foreign investor.

The NGC implements four distinct approaches in its targeted promotion of this industry. First, it pursues a targeted marketing approach that is project specific. The company short-lists firms that have expressed interest in projects developed by its Business Development division. Two types of firms are prioritised: ‘Market Leaders’ and ‘Aggressors.’ The latter are described as innovative small firms that are rapidly revolutionising the industry. The second element of the NGC’s promotional strategy is described by one senior executive as being low-cost but effective. It involves the senior executives delivering papers at important international conferences. In so doing, they promote the country’s natural gas industry. However, the company’s promotional efforts have gone beyond mere conference attendance. Since 1994, the
NGC, together with the Institute of Gas Technology, has hosted six international conferences. Attendees generally include the major players in the industry. The third prong of the company’s promotion strategy involves the producers that are already operating in the country. These producers are actively encouraged to support the company’s marketing efforts. This strategy has proven to be fruitful. Two companies, Farmland and Cabot, were encouraged by the construction firm, Kellogg to set up operations in the country. The fourth strategy used by the company is to advertise in major industry journals.

However, some of the recent investments in the gas sector were made without the NGC’s initiatives. Some producers that operate in the upstream end of this industry have now become involved in downstream activities, i.e., methanol and ammonia production. Indeed, bpTT has adopted an aggressive corporate strategy in Trinidad by becoming involved in not only oil and gas exploration, but also methanol production. As previously mentioned, it is presently a shareholder of Titan Methanol and holds one-third of the equity in a second methanol plant, Atlas Methanol. EOG Resources, a former subsidiary of Enron, is also involved in both upstream and downstream activities. It is a shareholder of the ammonia company, Caribbean Nitrogen Company (See Table 2).

These foreign firms enjoy a fairly standardised package of investment incentives. The government offers tax holidays of a maximum of ten years to highly capital-intensive enterprises, which are those with a capital investment of a minimum of US$ 8 million. In addition, the country offers import duty concessions on plant, equipment, raw material and intermediate goods. Further, capital-intensive enterprises are also exempted from value added taxes. The firms also enjoy free repatriation of profits and dividends. Moreover, enterprises are granted an initial allowance of 50 percent of their capital cost of plant and machinery. Finally, Trinidad enjoys double taxation treaties with Canada, Germany, United Kingdom and the US (Hamel-Smith and Company, n.d.).

Although policy makers interviewed maintained that no special incentives are given to selected foreign firms in the natural gas industry, it seems that there is some subjectivity employed in the provision of investment incentives. Research revealed that one firm enjoyed a 10-year tax holiday, another 7 years, and some just 5 years. It is also interesting to note that the sole locally owned company operating in this industry initially experienced difficulties in obtaining these investment incentives. The policy reasoning behind this seemed to be that since the state-owned methanol company was not benefiting from any investment incentives, the locally owned company should also not receive them. Further research was unable to discern the rationale behind the variation in the investment incentive package enjoyed by the firms operating in this industry.
However, all of the firms operating in this industry enjoy the innovative gas-pricing regime adopted by the NGC since 1989. The NGC offers a gas pricing system that is market oriented. The price of gas offered to the firms varies with the market price for its product. Thus, when the product market price is depressed, the natural gas price automatically declines and vice versa (Barclay 2000). This gas-pricing regime has been especially beneficial to the ammonia and methanol producers. The innovative gas pricing regime allowing these producers to earn profits even in depressed market conditions.

4.2 Government’s attempts to promote FDI-facilitated development through its targeted investment promotion activity

While the government appears to have a clear strategy for attracting targeted firms to its natural gas sector, it does not appear to have clearly articulated policies for the role that these firms could and will play in enhancing the country’s technological capabilities. There are two relevant sets of policies in this regard. The first entails policies on local content requirements. Policies on local content requirements have traditionally been used, with minimum success, (e.g., Battat et al. 1996) to improve the indigenous technological capabilities of firms in developing countries. However, recent rulings from the World Trade Organisation (WTO) call for their elimination.

4.2.1. Local content requirements in the natural gas industry of Trinidad and Tobago

It is only within the last decade that Trinidad and Tobago began to actively impose local content requirements on foreign firms operating in its natural gas industry. This policy has been implemented on a case-by-case basis and is included in the contract that each foreign firm signs before commencing its operations. As a result, it is difficult to discern how the government defines local content, how it is measured and what specific activities attract local content requirements. Moreover, there does not seem to be any state-appointed body that monitors the foreign firm’s adherence to local content requirements on an on-going basis.

Policy makers reveal that local content concerns were primarily addressed during the construction phase of the LNG and methanol projects. The LNG project consists of four phases; the first was completed in 1999, the second in 2002, the third will be completed in 2003 while the fourth is presently under construction. Research was unable to reveal the precise local content requirements imposed on this project. Early research found that one of the conditions for the development of the first LNG phase was that the foreign firms spend US$ 100 million on the services of the local companies (Barclay 2000: 178). However, one policy maker recently estimated that the local content actually achieved might have averaged US$ 25 to 33 million. This is for an investment that costs more than US$ 1 billion. Interestingly, it appears that the
local content derived during the construction of the four methanol plants was greater than that of the LNG project in terms of both the percentage value (it is estimated to range from 33 to 35% of contractor costs) and the sophistication of activities undertaken. It appears that the involvement of the local partner, CL Financial, may have played a decisive role in ensuring the increased volume and greater technological sophistication of the activities performed by locally owned firms.

Yet policy makers expressed dissatisfaction with the foreign firms’ adherence to their local content contractual obligations. Several state that local suppliers only perform low to medium technology activities such as fabrication and civil works during the construction phase of the projects. Others also state that the penalties imposed for non-compliance are far too low. However, in the present WTO-inspired trading environment, policy makers in Trinidad, in line with trade in this direction in other countries, are addressing this issue by attempting to increase the capabilities of the local engineering and construction firms (see Battat et al. (1996) for a discussion of successful attempts made by South East Asian countries in this regard). Indeed, it seems that plans are afoot to enhance the capabilities of local firms not only at the civil engineering stage, but also inter alia at the pre- and post- construction stage. This issue will be discussed at greater length in a subsequent section.

4.2.2 Financial contributions for human resource development and the foreign firms
The second set of selective intervention policies implemented by the government involves the use of moral persuasion to solicit financial contributions from foreign firms for the government’s human resource development programmes. Indeed, since the mid 1990s, foreign and some local firms operating in Trinidad’s natural gas industry have been asked to make financial contributions to national human resource development. These contributions go to the recently created, National Skills Centre (NESC) and its counterpart organisation, the Trinidad and Tobago Institute of Technology (TTIT). Some firms such as Atlantic LNG, Methanol Holdings, together with the National Gas Company and the state owned oil company, Petroleum Company of Trinidad and Tobago Limited (PETROTRIN), initially funded the operations of the NESC (Energy Correspondent 2002a). Subsequent contributions have come from the more recent entrants into this industry. These firms are asked to contribute 0.5 percent of their recurrent costs to training. The older companies still make annual contributions to NESC/TTIT.

The foreign firms have not limited their contribution to the nation’s human resource development to finance. Some firms, notably bpTT, have voluntarily provided equipment and conducted training at TTIT. In other instances, the general managers sit on the board of TTIT. Further, some actively participate in its curriculum development. Moreover, most of these firms employ the students of this institution under their apprenticeship programmes.
Interestingly, the legal basis for soliciting such financial contributions from these firms is questionable. It appears that to date the government has not devised a comprehensive plan for securing this funding. In consequence, some foreign firms perceive these contributions to be a tax, which does not have any legal standing since it was not passed by an act of parliament. Hence, one foreign firm has refused to make this payment, with potentially contagious effects on this behaviour on other firms in the industry.

4.3 The Institutional Apparatus Created for Capability Building in Trinidad and Tobago.

The institutional network for capability building consists of a small number of state owned companies. These are the National Energy Skills Centre (NESC), Trinidad and Tobago Institute of Technology (TTIT), the Caribbean Industrial Research Institute (CARIRI) and the Engineering Institute.

4.3.1 Building Technical and Managerial Capabilities: The National Energy Skills Centre and the Trinidad and Tobago Institute of Technology

In its attempts at enhancing the quality, and increasing the quantum of skills developed for the natural gas industry, the government of Trinidad and Tobago created two new training institutes. These are the National Energy Skills Centre (NESC) and the Trinidad and Tobago Institute of Technology (TTIT). In so doing, policy makers by-passed the existing education institutions that were established to fulfil such a function. They further implied that these institutes, namely the engineering department of the University of the West Indies as well as the two technical and one vocational institute in the country, were unable to address the critical skill shortage existing in the natural gas industry in a timely and efficient manner.

The NESC is a non-profit foundation - incorporated in 1997 - that seeks to address the training and human resource needs of the energy and industrial sectors of Trinidad and Tobago. The organisation is a partnership between the primary producers in the energy industry (oil and gas) and the government. Its initial focus was on addressing the deficiencies that existed in the quality and quantity of craftsmen required for plant construction and maintenance. The NESC subsequently sought to relieve the anticipated shortage of skilled personnel required to operate and maintain the plants that were being constructed in this industry. It thus established the TTIT in 2001. The focus of the TTIT is on skills development at the middle and upper levels of the industry, including engineering technicians, operators, engineering technologists, engineers, supervisors and middle managers. It presently has an enrolment of more than 1,200 students.
The TITT operates along the lines of a corporate university, utilising industry-experienced faculty, emphasising hands-on learning based on industry-relevant curricula and implementing a flexible programme schedule. The institute offers a one-year Certificate course in Process Operations, a two-year Diploma in Technology in the industrial engineering disciplines, and a four-year Bachelor of Applied Technology. The NESC/TTIT programmes are audited, certified and accredited by external partners.

As noted in the previous section, all of the firms studied make financial contributions to the NESC and they have intensively used the training programmes offered by the TITT. In addition, these firms have also attempted to enhance the skills of their local workforce by offering comprehensive training programmes, which are conducted locally and abroad. In the latter case, some companies offer inter-site training at their sister companies, while others send workers to specialised tertiary institutions for the oil and gas industry such as Honeywell Training School, the Development Institute in Texas or Southern Methodist University.

It is noteworthy that the courses offered by these companies as well as those that are offered by the TITT are aimed at developing the skills needed to manage and operate process plants such as ammonia, methanol and LNG. However, Trinidad and Tobago already possesses a cadre of workers who have the capability of operating and managing these process plants. Indeed, many of the industry’s present technical and professional personnel are graduates of the apprenticeship programmes offered by oil multinationals, Shell and Texaco, which formerly operated in Trinidad and Tobago (Energy Correspondent 2002b). Moreover, several of these personnel introduced comprehensive training programmes at the petrochemical firms when they were still state owned (Barclay 2000). Hence, in this respect, the TTIT and the foreign firms are not extending the range of technical and managerial capabilities that exist in the natural gas industry of Trinidad and Tobago.

However, the range of activities carried out in Trinidad’s energy sector is much greater than operating and managing process plants. The increase in investments in the natural gas industry has been accompanied by a surge in gas and oil exploration. Thus, the development of skills in marine, exploration and production technologies urgently needs to be addressed (Energy Correspondent 2002a). Further, the country needs to develop the capabilities to carry out activities both at the pre-construction phase such as plant and engineering design (equipment selection and specification, use of advanced simulation and optimisation design software); planning and managing large scale projects during the Engineering, Procurement and Construction (EPC) phase; and at the post-construction phase including retrofit design (for plant upgrade in terms of increased productivity, de-bottlenecking and trouble shooting); and international commodity marketing and shipping logistics (Furlonge 2002). It is these skills that are critically needed for the successful long-term development of the industry.
Indeed, the foreign firms in tandem with the TTIT are developing what has been described as a “static technological capability” in the natural gas industry. These are the skills required for the maintenance of a given system. The nationals possess the technologies that permit them to successfully carry out certain routine tasks, in a more or less fixed fashion and with more or less given equipment. They are not developing a “dynamic technological capability”, which consists of the skills needed for the long-term development of the industry. The nationals do not possess the complex set of technologies (identified above) that are needed to run the industry successfully overtime, innovating when necessary to solve its problems (Farrell 1979).

It is thus ironic that the country appears to be losing critical capabilities in petrochemical marketing. Trinidad has developed a nascent ability to market petrochemicals. Locals performed this function at the former state-owned petrochemical companies. However, when the Petrochemical Chemical Company of Saskatchewan (PCS) acquired the privatised ammonia and urea companies from its first owner, Arcardian Company in 1995, it moved the marketing activities to its sister company, PCS Sales. Some of the nationals, who worked in this department, were also relocated to this company in Chicago, but several were made redundant.

Conversely, the corporate strategy of the locally owned firm, CL Financial, which acquired the privatised methanol company in 1996, was starkly different. The marketing department of the former state owned company was transferred to the newly created company, Methanol Holdings. This department presently supervises the marketing and distribution of methanol produced in the company’s four plants. It uses the US firm, Southern Chemical Company to market its product in US, and the German company, Helm to market it in Europe. However, critical decisions such as where and how the product is to be shipped and marketed are made in Trinidad.

4.3.2 Building industrial research capabilities in the natural gas industry

The science and technology institutional network established by the government of Trinidad and Tobago consists of two institutions: the Caribbean Industrial Research Institute (CARIRI) and the Engineering Institute of the Faculty of Engineering at the local university, the University of the West Indies.

As discussed in an earlier section, the CARIRI was established in 1970 to provide technological services to industry. In fulfilling this mandate, CARIRI’s cadre of 100 employees offers services in the areas of Industrial Materials, Chemistry and Petroleum, Food and Biotechnology, Technical Information and Environmental Management. However, the main service that CARIRI provides to the firms in the natural gas sector is the testing of natural gas and industrial materials. The institute is equipped with a modern laboratory accredited by the United Kingdom Accreditation Services for this purpose.
The recent increase in plant construction in the natural gas industry has had a positive impact on
the diversity of testing activities that CARIRI has performed over the last five years. It has *inter
alia* undertaken the metallurgic testing for all materials used in the construction of the LNG
plants, tested and certified the materials used in the construction of the methanol and ammonia
plants, and tested the quality of the gas in the petrochemical plants. While most of the firms
studied were satisfied with the quality of the services provided by CARIRI, several complained
about the timeliness of the service. On the other hand, policy makers voiced concerns about the
limited range of services provided by this research institute, which has been in operations for the
past three decades.

It seems that CARIRI has been beset by problems of funding. Since 1986, the institute has
increasingly been required to become self-financing. Given the small size of the domestic market**, the institution evidently experiences great difficulties in finding funding for its
operation costs. As a result, CARIRI is unable to hire and retain qualified and experienced staff
since its salary levels are considerably lower than those of industry. Not surprisingly, staff levels
are presently one-half of what they were in 1984. In addition, the institute is unable to pay for
specialised skills in areas such as metallurgy. Further, it is unable to purchase state-of-the art
equipment. Indeed, bpTT voluntarily purchased the equipment CARIRI uses to analyse the
quality of gas used in the LNG plants. bpTT willingly made this investment because of the
difficulties in transporting the gas overseas and the frequency with which these tests need to be
conducted.

Evidently, inadequate financial and human resources have limited the range and complexity of
services that CARIRI could offer to the foreign and local firms operating in the natural gas
industry. Given the increasing proclivity of foreign firms to locate their higher value-added
activities such as research and development in advanced, developed countries, which possess
*inter alia* the requisite science and technology infrastructure (e.g., Bellak 2001), the
government’s present posture towards financing the operations of CARIRI appears to be short-
sighted. Unless this institute is provided with the requisite funding, it will continue to be
relegated to performing relatively low-value, low-technology activities such as testing. While it
has been ably assisted by foreign firms, notably bpTT in this regard, it has been unable to
upgrade the range and complexity of services it could provide these firms.

The other agency in Trinidad and Tobago’s scientific and technological network is the
Engineering Institute. This institute was established in 1994 with initial funding from the NGC
(Gasco News, December 1994:5). The Engineering Institute aims to be a formal link between
the Faculty of Engineering at the University of the West Indies and the industrial sectors. Its
objectives are to direct the Faculty, its personnel and equipment to industry-related research and
development, and training projects.
An examination of the research and development conducted by the Institute showed that only one of its eight departments, the department of Chemical Engineering, undertook research that was relevant to the needs of the natural gas industry. Further, the majority of the Institute’s listed clients were drawn from the non-gas sector and local, regional and international development institutes. Only three of its thirty-three listed clients operated in the natural gas industry; these were the NGC, the Point Lisas Port Development Company Limited and the Caribbean Methanol Company. Thus, not surprisingly, none of the foreign firms studied used the services of the Engineering Institute. More importantly, it seems that the Institute suffers from problems of visibility since few of the managers interviewed were aware of its existence.

The foregoing analysis illustrates the level of “technological underdevelopment” of the science and technology infrastructure in Trinidad and Tobago. Its R&D institutes not only suffered from a lack of visibility but also from a critical lack of funding. This technological underdevelopment is aggravated by the apparent inability of these institutions to capture the benefits of economies of scale. As noted earlier, CARIRI is responsible for the provision of a wide variety of services. However, it is questionable whether CARIRI with a staff of just twenty-five professionals could perform all these services with efficacy. A serious problem confronting CARIRI is its inability to devote that critical mass of personnel working with the best equipment available, to conduct in-depth research activity. Further, CARIRI and the Engineering Institute appear to make no attempts to generate synergies by undertaking joint research. Despite the spatial proximity of these two institutes, which are both located on the campus of the local university, they do not appear to enjoy any agglomeration benefits such as access to trained personnel or state-of-the-art equipment.

This situation is compounded by the nature of the activities carried out in the gas industry of Trinidad and Tobago. The foreign firms operating in the country are involved in the relatively low R&D intensive segment of the industry. The technologies used for the production of petrochemicals (ammonia, methanol and to some extent, LNG) are relatively mature, well known and standardised. As Narula (2002) notes, competition in these process industries, which are producing commodities, is based more on price and economies of scale. Profitability is highly dependent on cost of inputs, in this case, natural gas, and the firms’ proximity to the source of inputs. The more research intensive activities of the petrochemical industry including: the generation of new products and processes; the development of new components to be used in petrochemical plants; and the generation of new uses for existing petrochemical products (e.g., DeCastro 1979; Chesnais and Kim 2000) are carried out by the chemical and engineering companies in industrialised countries.

The only research activity undertaken by firms in this country is the tailoring of the licensed technology and the plant to make them more compatible to local conditions. It seems that CL
Financial is actively engaged in this process. Its engineers are involved at the start of the project, working with the British engineering and construction company, Davy Corporation, and the US construction firm, Kellogg Brown & Root. They incorporate those safety and operability elements in the firm’s methanol plants, which demonstrably have worked well in the Trinidadian environment. This competence, acquired over the last ten years, has significantly enhanced the capabilities of the local firm. However, it has not been transformed into an industry-wide capability. There are two reasons for this. First, the other methanol plants - Titan Methanol and Atlas Methanol use a different process technology from the plants owned by CL Financial. These facilities employ the low-pressure process technology licensed from the German firm, Lurgi Oel Gas Chemie GmbH, while the plants owned by CL Financial use the licensed ICI low-pressure process technology. The second point relates to the level of technological underdevelopment of the local science and technological institutions. As noted earlier, these institutions have limited links with firms operating in this industry. As a result, they are totally left out of this process of technological adaptation. They are thus unable to capture and disseminate the positive externalities arising from the CL Financial’s activities.

4.4 The growth of local downstream and supporting firms in the natural gas industry

4.4.1 The growth of local firms involved in further downstream activity in Trinidad and Tobago

As was discussed in Section 3, during the oil boom years the policy makers made little attempts to stimulate the development of domestic firms involved in further downstream activity in the natural gas industry. This failure has had lasting consequences on the industry. The present structure of the industry consists of eight primary downstream firms producing ammonia, methanol and LNG. In the liquefaction process of LNG production, and in the liquids removal process of gas processing done by Phoenix Park Gas Processors Limited, two natural gas liquids: propane and butane are produced. These natural gas liquids, together with the three identified above, are exported. However, as Table 3 shows, a wide range of products could be made from these petrochemicals. Nonetheless, further downstream activity in the petrochemical industry of Trinidad and Tobago is negligible. There is only one firm involved in the downstream processing of methanol produced in CL Financial’s plants. This is the state-owned oil company, the Petroleum Company of Trinidad and Tobago Limited (Petrotrin), which began the production of methyl tertiary butyl ether (MTBE) in 1997.

Several factors limit the further development of the downstream industry in the country. The first is the costs involved. The petrochemical industry is characterised by large, lumpy
investments with long gestation periods. Moreover, the majority of the costs are incurred at the start of the project planning and plant construction. This limits the extent to which small domestic firms can participate in the industry (Mytelka 1979). Further, in some cases, economic considerations weigh against the local development of certain types of downstream activity. For example, the production of caprolactam – used for the manufacturing of nylon – is usually made from more than one major primary product (ammonia and cyclohexane); the latter product is not produced locally. The investor will thus have to import cyclohexane, which could affect the viability of the investment. In addition, in the case of ethylene, which is a critical building block chemical, there is an insufficient quantity of ethane produced locally for a world-scale, economically sized plant. Finally, the corporate strategy of the foreign firms operating in this industry limits the development of further downstream activity. The primary motive for foreign petrochemical firms locating production in Trinidad is its competitively priced natural gas. These firms are producing bulk commodities for which they are able to achieve economies of scale in shipping. However, it is difficult for them to achieve economies of scale in the shipment of certain secondary products. It is cheaper to produce these downstream products closer to their end-consumer market or in other processing facilities (Furlonge 2002: 14).

Given the above, it is unsurprising that both the local and foreign investor are not actively engaged in further downstream activity in Trinidad and Tobago. Several commentators note that this activity will only emerge if the government assumes a more proactive role in its development (e.g., Furlonge 2002). It was suggested that the government should modify its existing investment incentive programme to better target foreign firms to these activities. In addition, it is believed that the government could catalyse the growth of these activities by making equity investments. Indeed, the emergence of the primary petrochemical industry was a result of such investments. Further, hopes are being pinned on the introduction of an ethylene plant in the country, which would foster the further growth of the local plastic industry (See footnote 16).
### Table 3 Further Downstream Petrochemical Products and their Applications

<table>
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<tr>
<th>Source</th>
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<th>Primary Product</th>
<th>Secondary Derivative</th>
<th>Applications</th>
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</thead>
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<td>Ammonia</td>
<td>Ammonia Nitrate</td>
<td>Fertilizer</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Urea, Fertilizer, intermediate in Pharmaceuticals</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Urea formaldehyde – plugs, sockets, tableware, adhesives, coatings</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Melamine-formaldehyde, Tableware, buttons, adhesives, marine plywood</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Caprolactam, Nylon – carpets, textiles, tyres</td>
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<td></td>
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<td>Formaldehyde, Resins, adhesives, pharmaceuticals</td>
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<td>Acetic Acid, Vinyl Acetate – Flooring, paint, ink, solvents, pharmaceuticals,</td>
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<td></td>
<td></td>
<td></td>
<td>film, cellulose acetate fibres</td>
</tr>
<tr>
<td>Ethane Ethylene</td>
<td>Polyethylene</td>
<td></td>
<td></td>
<td>Packaging, toys, film, bottles, cans</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>PVC, Pipes, flooring, upholstery</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Styrene, Rubber, polystyrene – packaging, appliance casting, CDs, toys, furniture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Vinyl Acetate, Paints, adhesives, film, flooring</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ethylene Oxide, Paints, detergents, textiles, disinfectants</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Ethylene Glycol, Fibres, film, antifreeze</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Methyl Methacrylate, Glass substitute, TV screens, coatings</td>
</tr>
<tr>
<td>Natural Gas Liquids (PPGPL/ALNG)</td>
<td>Propane</td>
<td>Propylene</td>
<td>Polypropylene</td>
<td>Packaging, appliance casting, toys, furniture</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Acrylonitrile, Acrylic fibres, rubber, appliance casting</td>
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<td>Isopropyl Alcohol, Solvent, pharmaceuticals, cosmetics</td>
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<td></td>
<td></td>
<td></td>
<td>Acetone, Epoxy resin-coating, adhesives, polycarbonates – CDs, appliances, signs</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Propylene Oxide, Polyurethane foam, detergents</td>
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<td></td>
<td></td>
<td></td>
<td>Propylene Glycol, Polyester resins, brake fluid, pharmaceuticals</td>
</tr>
<tr>
<td>Butane Butylene</td>
<td>Butadiene</td>
<td></td>
<td></td>
<td>Rubber, tyre, carpets, nylon fibres</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Maleic Anhydride, Polyester resins – boat hulls, automotive parts, putty, lubricating oil additive, insecticides</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Methyl Ethyl Ketone, Lacquers – automobiles, appliances</td>
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</tbody>
</table>

Source: Furlonge (2002: Table 1).
4.4.2 Firms that provide support services to the natural gas industry

Despite the dearth of government incentives to foster the development of local firms that provide support services to the primary producers in the natural gas industry, a small number of these firms have emerged, nevertheless. The Point Lisas Industrial Estate houses roughly seventy-five such firms. The services offered by these companies range from the provision of instrumentation for the maintenance and repair of electronic equipment to janitorial services. However, research revealed that there is a group of companies that provide support services to the primary petrochemical firms on an ongoing basis. This study will examine four of these firms: two of which are engineering firms and the others, managers and operators of process plants.

The engineering firms have been operating in Trinidad and Tobago for the past thirty years. One is a mechanical engineering company, with a staff of 300, of whom two hundred are craftsmen. This firm offers low-tier project management services. Its core activities include the design, fabrication and installation of storage tanks, pressure vessels, structural steel and piping. It is also involved in fabrication and laying of sub terrain and undersea pipelines, and the installation of process plants. Conversely, the other firm boasts a staff complement of 350 workers; 70 percent of whom are engineers, technicians and craftsmen. This structural engineering company specialises in the design, fabrication and erection of steel structures and other structural components.

By contrast, the other two firms studied are of a more recent vintage. Interestingly, the impetus for their development came from executives at the local firm, CL Financial. They actively encouraged the development of the first locally owned company in the country that provides plant management services to firms in the petrochemical industry. The firm, Process Plant Services Company, was established in 1992 and it initially operated and managed all of the CL Financial’s methanol plants. With a staff of seventy-five, it now operates and manages the Titan Methanol plant. The second firm, which is a joint venture between CL Financial and a local company, was incorporated in 1999. This company, Industrial Plant Services Limited, has a staff of three hundred and forty-four. It offers a range of services to potential clients, including project management, pre-feasibility studies, front-end engineering, and plant commissioning. The company presently manages and operates all the petrochemical plants owned by CL Financial in Trinidad and Tobago.

4.4.3 The role of the state and foreign firms in the growth of the supporting firms

It is noteworthy that these firms receive little support from the government. The only incentive provided to local support firms has been the general investment incentive regime – an
environment enjoyed by all local manufacturing enterprises, for instance duty-free concessions on imported capital equipment. With the liberalisation of trade in the early 1990s, this incentive is now of limited importance to the local firms. It is also interesting to note that these firms do not enjoy the range of investment incentives that are offered to the foreign primary petrochemical producers. This lack of government support is surprising given the strategic role that the engineering industry plays in the industrial development of the country.

The local support firms also receive very little assistance (technical and managerial) from the foreign primary petrochemical producers. Rather, it is foreign construction and engineering firms operating in the country that provide them with some support. The local engineering companies are involved in the construction and maintenance of process plants. During the construction process, they appear to form loose strategic alliances with foreign construction and engineering firms with the objective of securing technological expertise for activities in which they are deficient. For example, one local mechanical engineering firm formed an alliance with a foreign firm during the construction of the three LNG plants. It wanted to access the specialised technology needed for pipe and equipment installation. In another instance, the aim was to gain vital project management capabilities. Similarly, there seem to be informal arrangements for the training of workers in new techniques. The mechanical engineering firm benefited from a welding programme launched by the US construction firm, Bechtel during the construction of the ammonia plant.

The local firms receive practically no assistance with product diversification from foreign firms. The only case mentioned was that of bpTT, which contracted one of the firms studied to construct and install a marine platform. This activity, which is new to the firm, was traditionally subcontracted to foreign firms. Indeed, bpTT appeared to have paid a 10 percent premium to use the services of a local firm.

Likewise, the engineering firms appeared to receive limited support from foreign firms in enhancing their capabilities in plant maintenance. Only one primary petrochemical producer, PCS Nitrogen provides training related to safety and the repair of machinery to local firms on a continuous basis. It is also noteworthy that the local support firms are only involved in the routine maintenance of plant and equipment. The more specialised maintenance activities are performed by foreign equipment vendors.

Nonetheless, some of the primary petrochemical producers appear to be internalising the maintenance function. Indeed, certain activities such as the maintenance of electrical and instrumentation equipment are already being performed in-house. Moreover, one firm, Atlantic LNG, has developed a specially trained “maintenance in-house team”. The workers of this team receive training abroad, for example, at the equipment supplier, General Electric’s plant in Italy.
In other cases, the primary petrochemical producers use the services offered by the local companies that specialise in the operation and management of process plants. Evidently, these activities potentially limit the range of services that the primary petrochemical producers would offer to the local support firms.

However, policy makers now appear to recognise the importance of stimulating the development of local support firms. As previously mentioned, policy makers are reviewing the operations of their local content requirement policy. Policy makers state that the concept of local content is now being broadened to include pre-construction, construction and post-construction activities. In addition, they appear to be presently engaged in preliminary discussions with various professional engineering associations, with the aim of devising policies that would enhance the capabilities of the local engineering firms. In a similar vein, the NGC is attempting to stimulate the development of these firms by example. It is presently fabricating and installing a marine platform. It believes that this activity will have a demonstration effect on the local support firms. These policies and activities are very much at an embryonic stage. It is thus difficult to assess how effective they will be in enhancing the capabilities of the local support firms.
5.0 CONCLUSIONS

FDI inflows in Trinidad’s natural gas sector have had a tremendous impact on its economy. During the years 1997 to 2001, the energy sector (oil and natural gas) accounted for 25 percent of the country’s GDP, 90 percent of its export earnings, and 46 percent of its investment. Further, in 2001, the natural gas sector alone contributed to more than 60 percent of government’s energy revenues (Energy Correspondent, 2002c).

However, as the foregoing analysis has demonstrated, the foreign investor has played virtually no role in enhancing the country’s indigenous technological capability. The foreign investor’s contribution has been mainly limited to training nationals in the operations and maintenance of the process plants. It has not been fully involved in the development of a deeper and wider range of technical skills or enhancing the capabilities of the local downstream and supporting firms. Yet, its failure to play a greater role in the development of the country’s indigenous technological capability lies with the state. Since the mid-1980s, inspired by the World Bank and International Monetary Fund orthodoxy, the government’s philosophy is that its role in development is merely one of facilitating the development process. The task of economic development and transformation has been left to the private sector, mainly the foreign firms. Indeed, in instances where the government has implemented policies aimed at deepening indigenous capabilities, notably in training and the implementation of a local content requirement policy, its efforts were not part of a well-thought plan for the long-term development of indigenous technological capabilities in the natural gas industry. In consequence, it seems that the foreign firms did not perceive these policies to be credible with the resultant effect on domestic technological capability building.

However, as several researchers posit the FDI-facilitated development process faces important market failures, which calls for the use of selective, rather than solely functional intervention policies (e.g., Lall 1997). Hence, there is urgent need for the Trinidadian government to employ selective intervention policies to compensate for the market failures occurring in factor markets and from sources such as the externalities arising from industrial and technological activities, and risky learning processes and institutional gaps. Indeed, the government’s inability to devise and implement selective intervention policies in these areas has resulted in locals possessing only static technological capabilities; the underdevelopment of the local downstream and supporting firms; the weaknesses in the local science and technological institutional apparatus; and the paucity of linkages existing between the scientific and technological infrastructure and the economic actors in this industry.
In addition, the government’s emphasis on only developing export-oriented, primary activities in its petrochemical industry is short sighted. The long-term viability and competitiveness of this industry requires the presence of vertically integrated petrochemical firms, producing not only primary products but also intermediate and final ones, for which there is a strong internal and external demand. Further, these firms need to be involved not merely in mastering process technology, but also systemically deepening the range of technological capabilities to include the development of indigenous R&D capabilities. It is noteworthy that in latecomer countries, notably Korea, where the industry has developed to this extent, the government has played a strategic and pro-active role in its development (Chesnais and Kim 2000).

The post 1980 surge in FDI in Trinidad’s natural gas industry has indeed provided the country with a second opportunity to achieve economic transformation. However, as this paper shows, the FDI-facilitated development of this country cannot be left solely to foreign firms. The government clearly needs to reassess its role in this development process. The importance of its implementing selective intervention policies to catalyse FDI-facilitated development cannot be overemphasised.
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# 2001-1  Firm Size, Technological Capabilities and Market-Oriented Policies in Mauritius By Ganeshan Wignaraja, February 2001
This paper uses the definition of indigenous technological capabilities advanced by Lall (1992). Lall defines technological capabilities as those capabilities developed at the firm level (investment – pre-investment and project execution capabilities; production – process, product and industrial engineering; and the linkages firms make with external agents such as suppliers and subcontractors) as well as at the national level. Lall posits that national level capabilities are derived from capabilities in the provision of physical investment - plant, equipment and financial resources; human capital as well as the technological effort made by firms in their attempts to assimilate and improve upon technology. These capabilities interact with the incentives provided by government where incentives are classified as arising from the macroeconomic environment, e.g., the signals arising from macroeconomic stability; competition, which includes the international competition from imports, FDI or export activity; and from the factor markets. Lall argues that incentives and capabilities are realised within an institutional framework. Thus, he posits that efficient legal, industrial, training and financial institutions promote the development of indigenous technological capabilities.

There is an ongoing debate on the efficacy of using selective and functional intervention policies to promote FDI-facilitated development. This controversy stems from the differing interpretations of the reasons for the phenomenal success of the South East Asian Newly Industrialised Countries. See Lall (1994, 1996, 1997), Stiglitz (1996) for some of the arguments in support of selective intervention policies. Also, see World Bank (1993) for arguments supporting the use of only functional intervention policies. Finally, see the work of researchers such as Balassa (1982) for arguments against the use of any intervention policies.

See Mytelka (2000) for an excellent analysis of how policy dynamics have shaped innovation, and ultimately, the competitiveness of developing-country firms in the machine tool industry of Taiwan and India, the telecommunications and petrochemical industry of Brazil and Korea, and the application of biotechnology to the pharmaceutical industry of India and Taiwan.

It is interesting to note that several researchers have identified the failure of foreign investors to transfer the “tricks of trade” as postulated by one of the policy makers, Arthur Lewis, to be one of the major factors contributing to the lack of success of the industrialisation strategies pursued by Trinidad and Tobago during this era. For an interesting discussion on this issue see Farrell (1980).

The creation of the Point Lisas Industrial Estate dates back to the early initiatives of the South Trinidad Chamber of Industry and Commerce, which sought to develop an industrial port that would be a magnet for proposed, export-oriented industries. The Chamber managed to convince the government to conduct a detailed study of the possibilities of establishing such an industrial port. A consultant study, commissioned by the government in 1965, recommended Point Lisas as the site for these new industries. It had a large flat area that was fully owned by the state-owned sugar company; it was also free of housing and commercial properties; and possessed a coastline that was suitable for the creation of a deep-water harbour (Saidwan 2002). In the late 1970s, this site proved to be the ideal location for the government’s establishment of an industrial estate to house its new export-oriented, gas-intensive industries.

The CTF was also responsible for the coordination of other projects that were undertaken or being considered during this time. These included cement expansion, furfural, power plant installation, the development of water supply systems, Point Lisas Marine Facilites, Point Lisas Industrial Estate, Liquified Natural Gas, Refractory Brick, Palletising Operations, Paper and Pulp, Development of Short Term Building Programmes, National Agro-Chemicals Limited, Apprenticeship Scheme for O’Level Graduates, Brighton Industrial Estate, and the Stockpiling of Critical Commodities. See Farrell (1987).

These were the two main institutions for industrialisation that were operating during this period. The Industrial Development Corporation, which was created in 1958, was the principal agency charged with the responsibility of administrating the government’s system of incentives, assisting industrialists in utilising incentives, and in general, stimulating, facilitating and undertaking the development of industry in Trinidad and Tobago. The Development Finance Corporation, which was established in 1970, had its principal objective promoting the economic development of the country by financing domestic enterprises.

This discussion draws heavily on the work of Farrell (1987).
The planning agency for the gas industries forecasted that ammonia prices would be US$ 235 in 1981, increase by 42% in 1981-1985 and 20% thereafter to arrive at US$ 310 in 1990. However, the actual price of ammonia ranged between US$ 150 to US$ 185 in 1981 and declined to US$ 120 to US 145 in 1983 (Barclay 1990).

The Transnationality Index has been devised by UNCTAD to measure the transnationalisation of economic activity of host economies in real terms, taking into consideration both the production potential created through inward FDI and the results of this investment. This index is based on two FDI variables (FDI inflows as a percentage of gross fixed capital formation and FDI inward stock as a percentage of GDP) and two variables related to foreign firms’ operations in the host country (value added by foreign affiliates as a percentage of GDP and employment by foreign affiliates as a percentage of total employment). See UNCTAD (2002).

BP Trinidad and Tobago was formed from the 1998 merger of BP and Amoco. The latter company, which was a subsidiary of the Amoco International group, operated in Trinidad and Tobago since the early 1960s. Following the merger, the company became BP Amoco, and subsequently, BP Trinidad and Tobago.

In 1979, the Coordinating Task Force was transformed into the National Energy Corporation. Until 1991, this institution was responsible for planning and implementing policy for the natural gas industry. It also managed the then state owned methanol and ammonia companies. In 1991, the National Energy Corporation was merged with the National Gas Corporation, and given the responsibility of managing the infrastructure of the Point Lisas Industrial Estate. However, in 1998, this merger was dissolved, with the National Energy Corporation emerging as an independent subsidiary engaged solely in the management of the estate and marine infrastructure of the Pont Lisas Industrial Estate.

There appears to have been a team of officials drawn from the various government ministries, the NGC and the Technical Advisory Group, which monitored the local content requirements for the LNG project. However, this team has since been disbanded.

The exception in this case is bpTT, which introduced a postgraduate course in geosciences at the local university in 2002. It also provides academic and financial support to local Ph. D. students who are pursuing degrees in chemistry and geosciences.

The population of Trinidad and Tobago is 1.6 million and the entire Anglophone Caribbean is 5.5 million. However, since Trinidad has the largest industrial sector in the region, it is the Trinidadian market that is of importance to CARIRI.

Girvan (1979) defines technological underdevelopment as a general weakness and lack of development of the local science and technological institutions in developing countries. This is manifested by their lack of integration with the local socio-economic system, especially the productive system.

The completion of the four LNG trains will result in Trinidad having sufficient ethane to support an economically sized cracker. In anticipation of this, the NGC has implemented an ethylene strategy. This strategy seeks to stimulate the interests of local industry in a proposed ethane plant. The NGC is presently coordinating its promotional activities with those of the local investment promotion agency, TIDCO. The objective here is “sensitive, develop and expand the local plastics industry along the lines of the resins targeted for production locally, even ahead of the actual cracker implementation” (Baisden 2000: 6).

The engineering industry is the locus of certain critical technologies, the mastery of which permits the development of the kind of generalised technological capability a country needs in order to produce a wide range of goods. This industry is one of the most heterogeneous branches of manufacturing. It embraces several separate sectors, which produce tools for all branches of the economy, plant and equipment for use within the industries themselves (bearings, electrical equipment, instruments, etc.) and durable consumer goods (refrigerators, cars, etc.).

Unfortunately, despite the growing importance of the natural sector to the economy, the official statistical agency (Central Statistical Office) does not give accurate disaggregated data on the economic performance of the natural sector alone.