

Management of Energy Resources for National Development – Looking at the Trinidad & Tobago Model Anthony E. Paul and Atiba Phillips

Background

The unpublished essay that follows was prepared in 2005, to help inform the ongoing discussion in Trinidad and Tobago (T&T) on how to best use the development of recently discovered, large natural gas fields for national sustainable development. Although issues in T&T have progressed since, the context then is familiar to countries where oil and natural gas are being discovered in abundance) as is the case in Africa, so the original essay is produced intact, in the hope that it might help with ongoing discussions in new producer countries. However, we have added a brief epilogue to illustrate how some of the recommendations were either implemented or not, along with and some of the consequences. These examples are very limited, as this is not the primary intent of this chapter.

The purpose of the Chapter is to illustrate how lessons learnt from one boom in production and prices in an extractive industry within a single location might be applied to a second such boom, in just over 25 years, in that same industry and location, to increase the benefits from the extracted resource and support sustainable development. Given the nature of the extractives industry and the state of development of T&T at the time of the report, the findings and recommendations might be applied to other resource rich countries that are experiencing similar booms at this time. With luck, these new producers, learning from the lessons of T&T, and others will be able, not just to emulate T&T, but to surpass it in the level of value retention from the resources and in creating sustainable economies.

This essay built on previous work done by Anthony E. Paul and which is included in the Vision 2020 for the T&T Energy sector (2004), some of which was subsequently included in the National Development Plan for T&T (2007). We have added a brief Epilogue with select examples of the current state of T&T, looking at instances of the application and non-application of the recommended initiatives made in the essay and some of the outcomes.

Approach

In this essay we take the case of the small twin-island developing nation of Trinidad and Tobago, and trace the story of this nation's energy sector through the period 1972 to 2005. The saga of this period tells a tale of energy-based boom and bust and then boom again all within a very short timeframe, with significant impact on the economic and social life of the nation as a whole.

We then try to understand the underlying reasons for the downturn in the economy, which occurred after the boom of the seventies and use that experience to distill certain key deficiencies in the economic activity set of the time. Recognizing that the country is again experiencing an energy-driven period of buoyancy, we ask the question, "What lessons can be learnt now toward the achievement of more sustainable development?"

To this end we look at the models that have been put forward in the past for the economic development in the Caribbean; we look at their underlying assumptions and the outcomes, which they have intended vs. what has actually been observed. The assumptions of these models are then

contrasted with the attributes of the current economic environment towards the establishment of a more appropriate frame of analysis

We examine also the experiences of other nations both in the past and who presently are experiencing success in navigating the global economic landscape and suggest a new model framework which we propose can guide developing nations towards the ideal of sustainable economic growth. The framework promotes the use of the productive (energy) sector to build local capability in human resources, enterprises, and capital markets by investing in innovation systems and technology infrastructure buttressed by an enabling policy environment emphasizing local content and the creation of a learning environment.

Having introduced the concept we then relate it to specific Trinidad and Tobago institutions both in commercial and factor markets (e.g. education, R&D etc), and put forward specific policy and tactical recommendations, which fall out of the overall framework. These recommendations take the form of targeted market and non-market actions, which can be immediately taken to improve that country's ability to use its current windfalls from the energy sector to diversify its economy and pave the way toward sustainable development.

Executive Summary

Many developing countries possess a primary export industry, which disproportionately contributes to their GDP and national wealth. Examples of these include the oil industry in Venezuela, precious minerals in Angola, columbite-tantalite (coltan) in the Congo, natural gas in Trinidad and Tobago, among others. Furthermore, these industries are many times based on non-renewable natural resources, which will only sustain the economies linked to them, for a finite period, as technological substitutes advance and reserves dwindle.

The heightened activity throughout the value chain within these sectors in recent times has increased levels of revenue growth for producer countries and has provided a window of opportunity through which local capability can develop. However, a prototypical feature of these economies is their unstable nature due to dependence on fluctuating world commodity prices, changes in preferential market access arrangements, depleting reserves and a host of other possible market structure shocks. These changes invariably have detrimental social and economic affects for the nations and societies in question.

In this context, the central concerns of this paper are:

1. How can developing economies with characteristic flagship primary export industries enhance their sustainability and diversify their economies?
2. How can these countries/economies capture more of the value that they create, in a manner that allows them to diversify and sustain their economies?

The text illustrates, within the context of the energy-based economy of Trinidad and Tobago, that economic activity, including schemes of attracting FDI, must be orchestrated in a coordinated and targeted manner towards the goals of developing indigenous strategic and technological *human resource capability*, the engendering of *local ownership and control* of the nation's economic and productive assets as well as the engendering of a *learning environment*.

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In this light, a framework of analysis is suggested which can guide developing nations towards the ideal of sustainable economic growth. The framework promotes the building of local capability in human resources, enterprises, and capital markets by increasing equity participation in global businesses operating locally, by investing in innovation systems and technology infrastructure and enhancing the policy environment to emphasize local content and the creation of a learning environment.

A key finding in the text, as a subset of engendering a learning environment, is the imperative of market awareness and ability of the local productive system to innovate. More than relating innovation capacity to “the formal activity being undertaken by the R&D system and science base” or the “ability of a productive system to learn”, we suggest further that for a production system to be truly innovative it must possess a deep understanding of the market(s) into which it sells its product/service. We posit that it is only through this knowledge that true innovation can occur, in response to the dynamic and ever present need to better satisfy intermediate and final ‘consumers’.

The text also introduces into the discussion the concept of ‘innovation chains’ and ‘innovation systems’; a concept which disaggregates economic activity into its component parts – e.g. education, research, technology development, product development, production, *and marketing* (for the production chain) - emphasizing that the success of the system depends on the creation of greater linkages between the traditionally distinct economic institutions, mainly through policy arrangements, which will result in the desired outcomes of creativity, innovation and entrepreneurship, through worker training, market knowledge and technology transfer.

We conclude, in summary, with certain key action items which we think can move developing nations closer toward the ideal of sustainable development:

- Develop and institute credible local content policies describing how local value-added is defined and measured, what specific activities it is apply, also explaining the monitoring mechanisms in place as well as the penalties for non-compliance
- Develop more thoughtful policies and strategic criteria for choosing partner companies as well as for encouraging local businesses so as to engender market and technology pull effects as well as deep synergistic linkages throughout the economy
- Enter into deep equity arrangements with external partners so that technology and business know-how can be transferred
- Augment to the local skill base, through a coordinated program of attracting skilled expatriate nationals to local opportunities in business and technology

The Iconic Case of Trinidad and Tobago

We have chosen to use as an example the case of Trinidad and Tobago for several reasons:

1. Trinidad and Tobago exhibits the characteristic profile of a post colonial developing country which relies heavily on a single export facing industry to make the major contribution to national wealth and GDP.

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2. It's dominant productive sector is natural resource based and has been subject to the fluctuations and vagaries of the world market over the last 30 years which has thrown the host economy into prototypical booms and slumps
3. Trinidad and Tobago's energy sector is foreign investor-led and thus much of the value and returns created by the sector does not remain in-country.
4. The local skill base has mainly been developed in the operational and maintenance (low-value added) aspects of the sector, while the strategic managerial, marketing and technology aspects have been provided by external partners.

Thus, in this essay we trace the story of this small twin-island developing nation's energy sector through the period 1972 to present.

The Trinidad and Tobago Energy Economy

In 1973/74 and again in 1979/80 world oil prices increased to unprecedented levels. This fact, coupled with unprecedented oil-finds of the south east coast of Trinidad had a profound impact on the Trinidad and Tobago economy. The Gross Domestic Product increased six-fold from US \$1,309 million to US \$8,140 over the period 1973 to 1982 and foreign currency reserves also jumped from US \$47 million to more than US \$3 billion.

The government of the day invested heavily in laying certain types physical of infrastructure including electricity, water, roads transport and, most notably the Point Lisas Industrial Estates which it used to found a number of energy-intensive downstream industries among them urea, steel, fertilizer, methanol and ammonia.

The energy-based projects however, did not perform as anticipated. In the case of ammonia for example, actual prices turned out to be much weaker than predicted, and thus returns on those investments under-performed all forecasts. Also in the case of steel, due to a number of other factors, including technical inefficiency, substantial cost overruns and an anti-dumping charge from America, the iron and steel plant ran into significant financial difficulties.

By 1990 energy prices had reversed their upward spike and the country's GDP had decreased by 20% from 1982 levels. The external debt rose to over US \$2 billion and foreign reserves plummeted to US \$492 million (from over US \$3 billion in 1982). With a serious balance of payments crisis on its hands, the government was forced to turn to the World Bank for help. The country even endured an unprecedented attempted political coup in that year, 1990, a testament to the political and social tensions brought about by the economic hardship of the time. The country's former dependency on the buoyancy of the world oil market, its inability to diversify the economy and limited strategic investment in its human capital, had become its undoing.

The Theories Underpinning the Energy Economy

The economic and industrial development of the Caribbean, particularly Trinidad and Tobago, has been influenced by two main schools of economic thought:

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1. Noted economist and Nobel Prize winner **Arthur Lewis** put forward the model of '**Export-led Industrialisation by Invitation**' for Caribbean territories
2. Historian, Economist and former Prime Minister, **Eric Williams** pursued his '**Point Lisas Model**' for the development of Trinidad and Tobago

The Arthur Lewis Model

The tenets of the Arthur Lewis model are as follows:

- Given the inability of agriculture to sustain high levels of employment in the region, industrialization was needed, **complementarily**, to achieve 'full employment'
- Domestic and regional markets were too small in populous and the level of domestic savings not sufficient for investment at the level needed to resolve the unemployment problem through industrialisation. Therefore foreign investment would be required to provide access to foreign markets and to fill the domestic capital resource gap.
- Caribbean capitalists were regarded as 'risk averse', preferring the distributive trades and protected agricultural production over manufacturing production, especially for export. In order to develop the industrial sector, there was a need to invite foreign industrialists to teach Caribbean capitalists the 'tricks of the trade'.

The Point Lisas Model

The model rests on the same basic principles of the Arthur Lewis' model, but with some notable distinctions. This model called for:

- State led investment vs. foreign based capital
- Quick monetarization of energy assets through large-scale conversion into early stage primary products. (e.g. natural gas to methanol)
- Created out of an assumption of surplus capital and an *unlimited natural resources* rather than unlimited labour

The Models in Practice

While both models assume the transfer of technology and business know-how – the 'tricks of the trade' – they both fell short of devising a specific process by which this knowledge transfer would be achieved – resulting in a lack of local innovation capacity, and limited strategic business and technology skill being developed regionally

A Closer Look at T&T

While there was significant investment in the nation's infrastructure and physical economic assets the government did not emphasize and ensure at the time, the concomitant deepening of the

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nation's strategic-managerial and technological capability in its precious human resource asset. The energy sector therefore attracted the existing re-deployable high-value human resources away from other non-energy sectors and the lack of significant new investment in skill development meant that the energy boom had a strangling effect in terms of the upgrading of other sectors of the economy and ironically further entrenched the economy's umbilical dependency on petroleum.

Additionally, the lack of re-investment in a critical mass of in-country strategic and high-level managerial skill in-country had the follow on affect of effectively relinquishing functional control and ownership of the country's most productive assets into foreign hands. Weak policy frameworks around technology and skill transfer also prevented significant high-level skills from being built in the energy sector and then eventually disseminated to other parts of the economy.

In parallel it must be taken into consideration that foreign firms have tendencies that are not necessarily in the best interest of their less-developed host country partners. Foreign firms are predisposed to accessing international suppliers of inputs and services with whom they are familiar rather than creating excessive domestic linkages. This import-intensity of foreign owned firms can many times lead to balance of payments problems for the host nation (Mytelka 2003).

Foreign owned firms also have a tendency to conduct the more knowledge intensive activities at "head office" (in the developed country), shifting only highly capital-intensive, relatively low skilled/value-added, commodity-type activities to their operations in less-developed regions.

Trinidad and Tobago Today

Currently, world economic conditions once again, are playing to the favor of the twin island nation of Trinidad and Tobago. Geo-political tensions in the Middle East, an increased energy appetite in the northern developed countries, political instability in Venezuela and a host of other factors, have once again conspired to bring energy prices to their highest levels in history. In tandem, there have been unprecedented finds of, this time, natural gas and consequential inflows of foreign direct investment into the petroleum sector of Trinidad and Tobago. During the years 1996 to 2001, oil and natural gas accounted for 23 percent of the country's GDP, 53 percent of its export earnings, and 84.3 percent of its Foreign Direct Investment. The contribution of natural gas sector to the government's energy revenues had overtaken that of oil for the first time by 2002 (Center for Energy Enterprise Development - CEED: 2003).

*T&T at a Glance**

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Economy

- GDP / capita = US \$8,500, inflation = 3.5%
- Energy exports = 53% of T&T exports
- Petroleum sector (1996-2001) represents 23% of GDP
- 84.3% of FDI is energy related
- Need to reduce GNP / GDP gap – currently only 15% local participation in upstream energy business (2002)

Trinidad investment

- Significant increase in gas and oil production set to drive massive investment by the large energy companies in high spend areas
- bpTT plans to spend US\$2.7bn on upstream activities over next 5 years (almost one third of T&T's 2001 GDP)
- Great opportunities for local operators to capture new business
- Projected levels of growth must translate to the expansion, diversification and long-term development of the country

Resources

- 5th largest gas producer in the world with gas reserves of 70 trillion cubic feet and sales of 500,000 barrels of oil equivalent per day
- 2002 –supplied 68% of US LNG imports
- World's largest producer of ammonia and methanol
- Projected energy growth set to be almost quadruple that experienced in the 1970s
- Need to expand into value added energy projects
- "The future is so bright you need shades" – Minister of Energy, Hon. Eric Williams

Social

- 'Vision 2020' goal to attain 'developed' country status by 2020
- Revenue from energy sector to be used to improve employment, education, health, housing & nutritional levels
- 4% of T&T employment is in the energy sector, yet it accounts for 23% of GDP

Confidential - Centre for Energy Enterprise Development (CEED)

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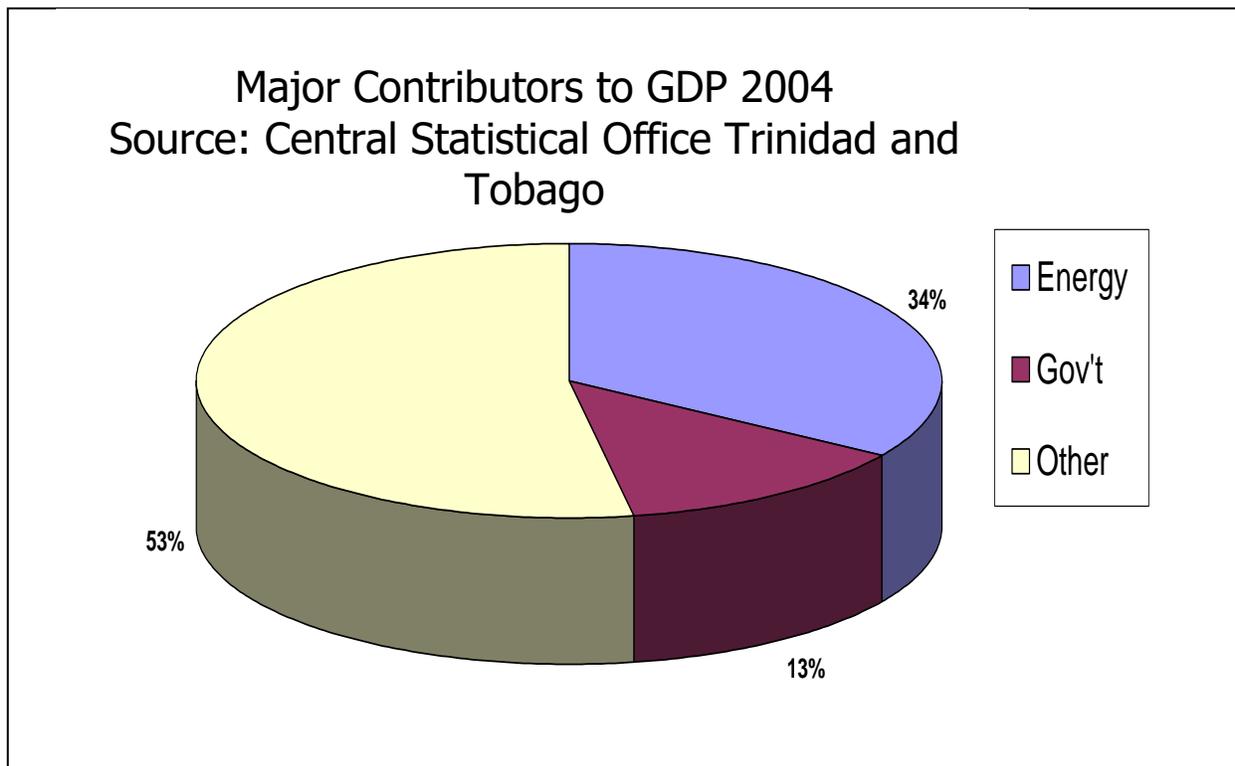
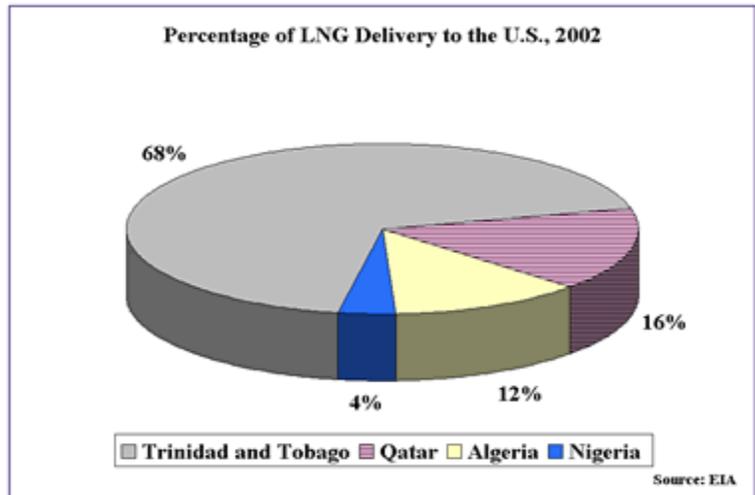
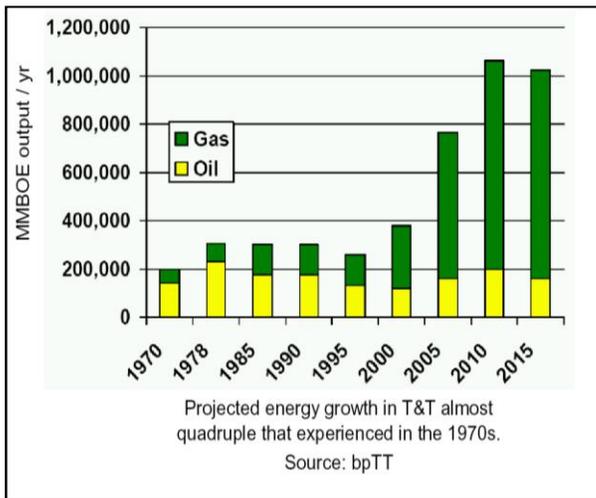
Trinidad and Tobago's Second Chance

Despite the country's increasingly enviable macro-economic performance, FDI in this sector has played only a small role in contributing to the stock of strategic and technological human resource skills in the country. These have generally, once again, been limited to the acquisition of operation and maintenance skills. It has not been fully involved in the transfer of industrial R&D that would lead to meaningful product and process innovation.

Particular characteristic points of concern follow:

- Energy is still by far the single major single productive sector of the economy.
- The sector is now engaged in industries which extract large volumes of the natural resource at high rates but yield minimum value. This because the return to economic activity early in the value chain (primary extraction) is much lower and creates fewer economic linkages than does the higher value-added activity further down the value chain (e.g. the creation of final products such as plastics or manufactured products)
- This sector is also referred to as the 'offshore' sector as it's major investors and earnings originate and are thus remitted to foreign-based entities
- The sector is responsible for at least 53% of total exports (2004) but accounts for only 4% of total employment

Indicators of the Performance Significance of the Gas Economy of Trinidad and Tobago



Trinidad and Tobago must note that the foundation of its economy is pinned on a non-renewable resource, which at current production-to-reserve levels will be depleted in approximately 50 years. As the knowledge-intensity of production continues to increase dramatically throughout all sectors,

all around the world, investments will be needed not only in R&D but also in other intangibles such as intellectual property infrastructure, marketing, finance engineering, training, and strategic business decision skill capacity as these come to play a greater role in the production of goods and services over time.

The country has thus a window of opportunity to make the adjustments and investments necessary to avoid a second and possibly more disastrous downturn in its economy due to changing fortunes in its main productive (energy) sector.

Defining a New Outcome

In order to define a new vision for Trinidad and Tobago, we feel it may be instructive to look case scenarios of other countries that have brought themselves out of factor driven “plantation” economies into knowledge-based societies, taking note of the processes and guiding principles that they have employed to get there. To this end we look briefly at two examples; the “Asian Tigers” and the Asian model, as well as a more recent example of record-breaking development in the little nation of Qatar.

South Asia

“Hobay (1995) notes the catalytic effect that the initial arms length contractual arrangements between foreign and local firms had on the electronics industry in East Asia (South Korea, Taiwan, Hong Kong, Singapore). The domestic forms initially provided subcontracting services to the MNE, however, within forty years some had progressed to the export marketing of their own brand of electronics. The initial training of workers resulted in the “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 good producers*. This process occurred in an environment where government efficiently implemented *selective intervention policies in product and capital markets*, as well as in factor markets such as *education, technology, information and institutional development*.”

Qatar (www.qatargas.com.qa)

“Little noticed, Qatar has reversed the typical role of the producer country, which simply opens its territory to oil companies to explore, and takes a cut of whatever they find.

Not only does Qatar own the majority share of each LNG joint venture, but it will also own delivery ships and stakes in import terminals in Europe and the United States. The arrangement allows Qataris to profit from processes and sales far beyond its borders, elbowing into a business that was once the sole province of big oil.

"There's no doubt it is unique," says Harms. "Their logic is pretty sound. It is to *participate in every part of the value chain*."

Having highlighted these iconic examples and the core principles that are leading to increased economic prosperity for these nations, we turn now to a more in depth focus on a country that is

already at what we consider the “goal state” – Finland. We examine their competitive characteristics, comparing Trinidad and Tobago on key factors/indices.

Why Finland?

Finland is a small country of approximately 5 million people and with no significant endowment of natural resources, but is ranked No.1 on the World Economic Forum’s Growth Competitive and Business Competitive Indices for 3 out of the last 4 years. Finland is now internationally recognized as the most competitive nation in the world.

The Business Competitiveness Index

The BCI uses microeconomic indicators to measure the "set of institutions, markets structures and economic policies, supportive of high current levels of prosperity, referring mainly to an economy's effective utilization of its current stock of resources."

It examines the conditions that support a high level of sustainable productivity and prosperity, measured by GDP per capita. The Index thus assesses the current productive potential of countries, looking at areas that affect the business environment, such as university-industry research collaboration, foreign technology licensing, government procurement of advanced technology, R&D spending the availability of venture capital, the intensity of local competition and the quality and quantity of local suppliers.

The following table presents selected countries and their ranking on the Business Competitive Index for 2001. Two of the sub-indices are presented, one focusing on company sophistication and the other on quality of national business environment.

Business Competitive Index:
(Selected Countries 2001)

| Country | Composite Ranking | Operations and Strategy | Quality of the National Business Environment |
|---------------------|-------------------|-------------------------|--|
| Finland | 1 | -- | -- |
| Singapore | 10 | 15 | 9 |
| Hong Kong | 18 | 21 | 16 |
| Norway | 19 | 20 | 19 |
| New Zealand | 20 | 19 | 20 |
| Chile | 29 | 30 | 28 |
| Trinidad and Tobago | 34 | 27 | 37 |
| Malaysia | 37 | 37 | 38 |
| Uruguay | 46 | 48 | 45 |
| Costa Rica | 50 | 34 | 52 |

We now compare the 2001 rankings with the 2004 rankings to give an indication of trends. Thus the following table presents selected countries, and their ranking on the Business Competitive Index for 2004 with similar sub-indices included.

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Business Competitive Index:
 (Selected Countries 2004)

| <u>Country</u> | <u>Business Competitive Ranking(2004)</u> | <u>Operations and Strategy Ranking</u> | <u>Quality of the National Business Environment Ranking</u> |
|----------------------------|---|--|---|
| Finland | 2 | 7 | 1 |
| Singapore | 10 | 13 | 8 |
| Hong Kong | 11 | 15 | 10 |
| New Zealand | 18 | 20 | 15 |
| Norway | 20 | 23 | 14 |
| Malaysia | 23 | 28 | 23 |
| Chile | 29 | 33 | 29 |
| Costa Rica | 48 | 35 | 50 |
| Trinidad and Tobago | 59 | 55 | 62 |
| Uruguay | 71 | 75 | 69 |

Source: Business Competitiveness Report
 Published by the World Economic Forum

The Growth Competitiveness Index

The GCI

(Selected Countries 2001 – 2004)

| <u>Country</u> | <u>(2004)</u> | <u>(2003)</u> | <u>(2002)</u> | <u>(2001)</u> |
|----------------------------|---------------|---------------|---------------|---------------|
| Finland | 1 | 1 | 1 | 2 |
| Singapore | 7 | 6 | 6 | 4 |
| Norway | 6 | 9 | 9 | 6 |
| Hong Kong | 11 | 15 | 10 | 13 |
| New Zealand | 18 | 14 | 14 | 10 |
| Chile | 22 | 28 | 26 | 27 |
| Malaysia | 31 | 29 | 27 | 30 |
| Costa Rica | 50 | 51 | 49 | 35 |
| Trinidad and Tobago | 51 | 49 | 47 | 38 |
| Uruguay | 55 | 50 | 48 | 46 |

GCI Sub Indices

(Selected Countries 2003)

| <u>Country</u> | <u>Growth Competitive Index Ranking</u> | <u>Macroeconomic Environment Index Ranking</u> | <u>Public Institution Index Ranking</u> | <u>Technology Index Ranking</u> |
|----------------------------|---|--|---|---------------------------------|
| Finland | 1 | 2 | 2 | 2 |
| Singapore | 6 | 1 | 6 | 12 |
| Norway | 9 | 4 | 16 | 13 |
| New Zealand | 14 | 13 | 5 | 23 |
| Hong Kong | 15 | 15 | 10 | 37 |
| Chile | 28 | 35 | 19 | 31 |
| Malaysia | 29 | 27 | 34 | 20 |
| Trinidad and Tobago | 49 | 47 | 56 | 47 |
| Uruguay | 50 | 89 | 29 | 51 |
| Costa Rica | 51 | 63 | 49 | 46 |

Source: Global Competitiveness Report
 Published by the World Economic Forum

A comparison of comparative advantages of Finland vis-à-vis Trinidad and Tobago:

| Notable Competitive Advantages (Finland) | Notable Competitive Disadvantages (Trinidad and Tobago) |
|---|---|
| <u>Research & Education:</u> <ul style="list-style-type: none"> • High level of Tertiary Enrollment • University/industry research collaboration • High Company Spending on Research and Development | <u>Research & Education:</u> <ul style="list-style-type: none"> • Low level of Tertiary Enrollment • Lack of university/industry research collaboration • Company spending on research and development insufficient |
| <u>Technology & Innovation:</u> <ul style="list-style-type: none"> • Technological sophistication • Firm-level technology absorption • Capacity for innovation • Internet access in schools | <u>Technology & Innovation</u> <ul style="list-style-type: none"> • Shallow Firm-level technology absorption • Poor technological readiness • Prevalence of foreign technology licensing • Limited internet access in schools |
| <u>Company Operations & Strategy:</u> <ul style="list-style-type: none"> • Broad value chain presence • Production process sophistication | <u>Company Operations & Strategy</u> <ul style="list-style-type: none"> • Narrow value chain presence • Nature of competitive advantage – factor driven economy |

See Appendix for “National competitiveness balance sheets” for Trinidad and Tobago and Finland for 2002-4.

A New Mandate for Trinidad and Tobago

The vision is to build a cadre of skilled managers, entrepreneurs and technologists who can participate at all business levels and better organize the local industrial sector to execute locally initially in the productive sector where there is the biggest immediate return. The challenge will then be to ensure that these skills are then transferred across all sectors and eventually to the international market such that revenue streams begin to occur which are diverse and independent of the initial “cash crop” activity within the economy.

However, based on the experience of the Trinidad and Tobago energy sector, we have found that in order to promote sustainability and to capture value locally, economic activity must be coordinated to promote:

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- *Local ownership and equity* - promoting greater local stakes in assets and profits; greater wealth distribution; movement from savings to investment culture.
- *Local control and decision making* - promoting greater local control over country's productive assets; development of high value, transferable skills and services for global competitiveness and sustainability
- *The creation of a continuous learning environment* – promoting greater transfer of technology leading to more and more relevant innovation in both products and markets

In order to achieve this mandate, Trinidad and Tobago must strategically invest in the development of its:

- *Human Resource capability* in technology and strategic business
- *Enterprise and Institutional capacity* in the private and state sectors
- *Capital market / financing & investment capability*

In pursuance of this mandate we put forward the following framework which we suggest can guide developing nations toward the ideal of sustainable economic development.

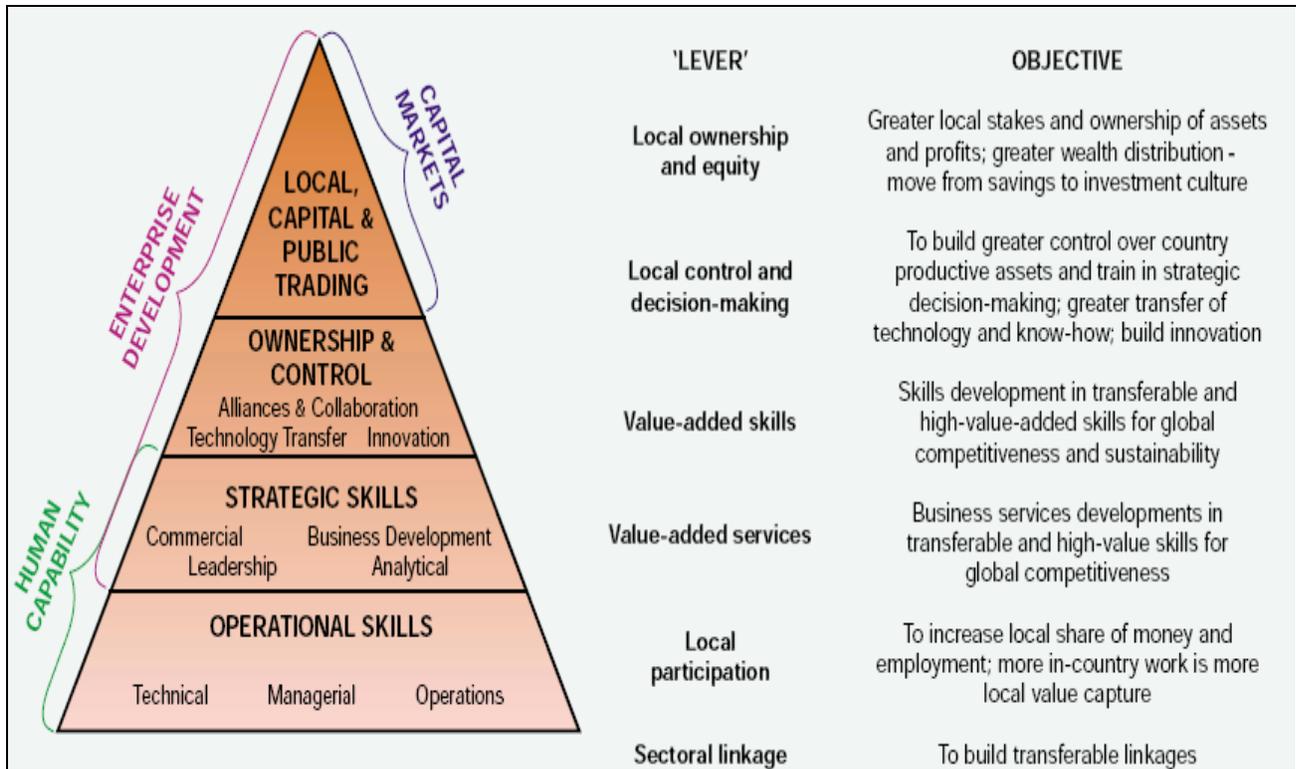
The Suggested Development Framework

The idea of the framework is to promote the building of local capability in businesses, personnel and capital markets by investing in systems and infrastructure which are relevant to the current stage development of the host economy. It consists of the following parts:

- *Human capability development* — increasing local participation in industry by building relevant and transferable skills and knowledge.
- *Enterprise development* — building tools, processes, strategic business and technological capability that positions local businesses to grow and become competitive in the global marketplace.
- *Capital market development* — creating a financial environment conducive to business development and broad local participation in the industry.

The framework for sustainability is a series of building blocks. The technical and operational skills lead to the business being developed within the home country, which in turn leads to the development of higher value-added skills. These then enable ownership and control, which act as the catalyst for the creation of local firms of the size to influence the development of financial and capital markets.

Apart from local financing, at the top of the framework pyramid is public trading. In addition to creating access to capital markets and aiding wealth creation, the growth of local capital markets local will also encourage transparency and good governance in domestic institutions as they are placed under greater regulatory and public scrutiny.



To achieve these ambitious goals Government must involve itself in deep discussions involving a broad range of potential stakeholders in participatory agenda-setting processes that builds bridges and brokers partnerships across all actors in the system. It must foster local buy-in to a process of change, facilitating coordination and collaboration amongst clients and suppliers and seek coherence in the setting of policy parameters within which innovation and development related decisions are taken (Mytelka 2003).

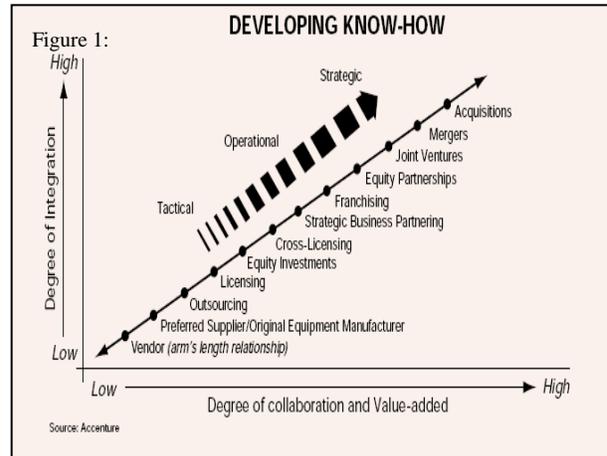
To implement the framework in the context of our prototypical (esp. post colonial) developing economy, the following four enabling levers are necessary:

- Increasing Equity Participation in Global Business
- Investments in 'Innovation Systems'
 - Investments in Skills development
 - The Quality of the Business Environment
- Investments in Technology Infrastructure
- Enhancing the Policy and Legal Framework

Implementing the Framework: Equity Participation

Transitioning a traditionally less-developed economy and society forward into one which is based on innovation, will entail the adoption of “more productive company strategies require more highly skilled people, better information, more efficient government processes, improved infrastructure better suppliers more advanced research institutions and more intense competitive pressure, among other things.” (Martin 2003)

To carry out this transition, lesser-developed regions would be well advised to employ the world-class resources in the international marketplace to their advantage. This can be achieved through specific partnerships with international and organizations adept in the experience and skill sets being sought. As the diagram shows at all levels of this value chain the developing country must seek to forge deep *equity* relationships in this process of alliance (rather than simpler distribution type arrangements) for there to be the optimal transfer of ideas and technology necessary to bolster indigenous human resource and institutional capability.



This concept of growing managerial and technological capability through acquisition /merger /joint venture etc. is a well understood and practiced concept in business. Cisco for e.g., has grown to be one of the largest and technologically advanced companies in the world through their very focused strategy of acquiring and assimilating promising smaller firms, which possess advanced technological and /or managerial competencies relevant to Cisco’s strategic objectives.

Implementing the Framework: Innovation Systems

The National System of Innovation (NSI) approach is a helpful framework for understanding the process of knowledge creation, transfer, adaptation, and monetization occurring within a country. In this framework the components of economic activity are identified and disaggregated. This gives a clear and consistent look into the functional roles and activities played by different parts of the economy as well as their relationships to one another. (See diagram for the ‘Production Innovation Chain’). In this framework, innovation success depends on the closeness of interaction between the economic institutions which carry out these functions and cohesiveness of the norms and policy arrangements which define and enhance their relationship.

The application of this framework to a country is useful in identifying the systemic failures that hamper the ability of an industry or productive system, to learn, adapt and generate innovation and wealth. Public policy can then be applied to correct for such systemic failures (Mani 2004) and be used as a tool to bring greater streamline to the process of economic value creation.

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Two main views of national innovation systems prevail however. One is a more narrow view which focuses on the science and technology infrastructure and synergies and the economy’s ability to leverage said infrastructure to produce innovative products, processes and services. The other focuses more on the ability of the productive system as a whole to learn and adapt to changing market and economic conditions and remain relevant and in step with the wider economic system.

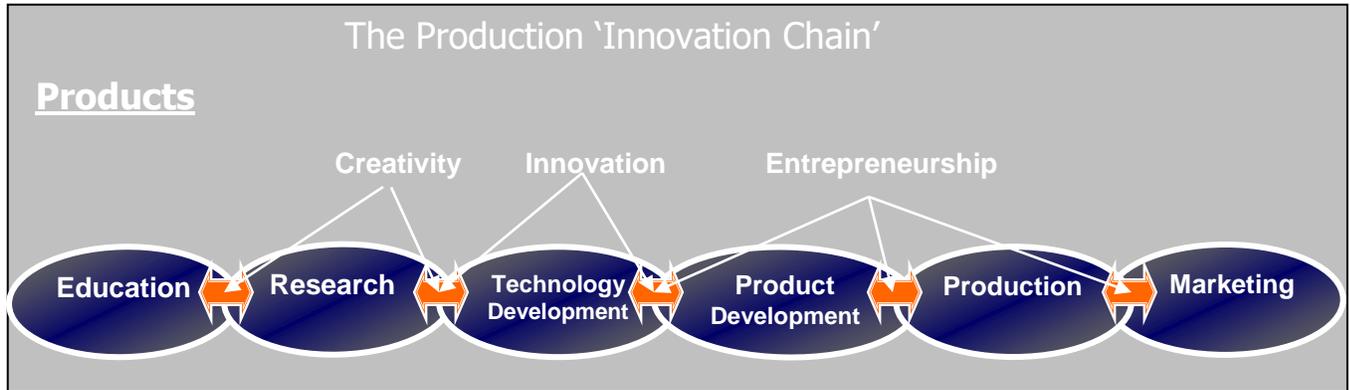
| Approaches | Scope and Emphasis |
|--|---|
| Narrow Definition of NSI (eg Nelson 1993) | This analysis emphasizes the impact that national technology policy has on firms innovative behaviour. Innovative behaviour being measured in terms of the level of formal activity being undertaken by the R&D system and science base. So the narrow definition of NSI includes organizations and institutions involved in searching and exploring, such as R&D departments, technological institutes and Universities. |
| Broad Definition of NSI (eg Lundvall 1992) | This puts the emphasis on learning rather than on the creation of knowledge itself implying that the competitiveness of an individual firms and entire systems of innovation reflect the ability to learn. The new trends in production and in the labour market, which are increasingly knowledge based, means that knowledge building and learning are becoming more and more crucial for economic growth and competitiveness. It is also argued that learning especially new skills and competencies is essentially a collective and interactive process which cannot flourish in a purely market economy. Hence the emphasis in this approach is more on the efficacy of the networks of firms and how they undertake innovative activity than on formal activities related to the R&D system and science base. |

Sources: Mytelka and Smith(2001); Tomlinson (2001)

More than relating innovation capacity to “the formal activity being undertaken by the R&D system and science base” or the “ability of a productive system to learn” however, we suggest that for a production system to be truly innovative it must possess a deep understanding of the market(s) into which it sells its product/service. We suggest further that it is only through this knowledge that true innovation can occur in response to the dynamic and ever present need to better satisfy market actors in basic response to the foundational capitalistic competitive drivers of increasing profits or market share.

It is in this context that we present the following visualization of a ‘Production Chain’ including the post-production dynamic of ‘marketing’ in which we include activities such as distribution and logistics, wholesaling/retailing, consumer financing, communications and branding etc.

The Production ‘Innovation Chain’:



The innovation systems approach helps us to understand the linkages between commercial markets and factor markets such as education and R&D. Through this approach it can be seen that the principles and understandings delivered through formal education must be applied to delving into new yet relevant areas of research. The goal of this research must be to develop new technologies, forms of organisation, processes or products which can be taken to market. Products, services or processes must then be produced in light of prevailing and forecasted market conditions, giving consideration to production costs, user acceptance and value delivery.

Thus we have a coherent system of innovation; from education to post-consumption activity.

The key to this framework is the creation of linkages between traditionally distinct economic institutions which result in the desired outcomes of creativity, innovation and entrepreneurship. These concepts are both overlapping and interrelated. We suggest here that “creativity” occurs as a result of the understanding and tools given through education, the focused study of a particular area of research, and the active attempt to bring about new technologies, processes or methods of organization. “Innovation” is the taking of research and new or existing technologies and applying them to the creation of new products that may be offered to a market. And finally “entrepreneurship” is the harnessing of new technologies into products that are market relevant and organizing their production and delivery on a scale and in a manner which is relevant to an identified market opportunity.

When applied in a country context, we can identify those parts of the innovation system that are either present, underdeveloped or absent. We can then assess the importance of each element to overall country sustainable development and prioritise, through policy and government spending, those aspects most critical and in need of immediate as well as long-term attention.

Aside from the identification of innovation chain elements that are either absent or underdeveloped within a country, it must be noted that the innovation chain concept, and innovation systems analysis, is not limited to the realm of production. Specifically we expand the concept and approach of innovation systems to encompass the “set of mechanisms institutions and technologies that facilitate trade”. These are market elements that affect the *environment* in which goods and services are traded. The market elements referred to here include for eg:

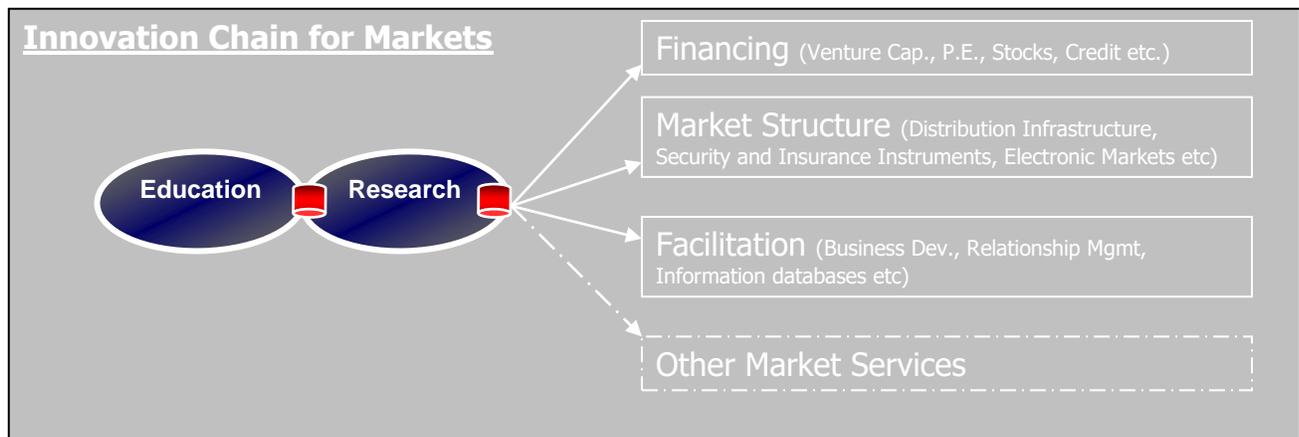
- *Financing Elements*– the ability of firms to access the capital needed to provide services to the market and the availability of financing to the enable or catalyse the rate of consumption by consumers.

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- *Market Structure' Elements* –the physical (or virtual) ability of customers to access desired products as well as the amount of risk assumed in engaging in market activity
- *Facilitation Elements* – those structural or institutional mechanisms which make it easier for individuals or firms to participate in market activity, e.g. information databases, chambers of commerce, investment promotion companies etc.

As argued earlier, innovation can take place with respect to these and a host of other strictly non-production functions, and the mapping of these (and other) market elements constitutes an 'innovation chain' for *markets*. It is in fact true that innovations in these (market environment / market structure) realms may well bring more value to the producer and to the market itself than is possible through product or process innovation.

The Innovation chain for Markets:



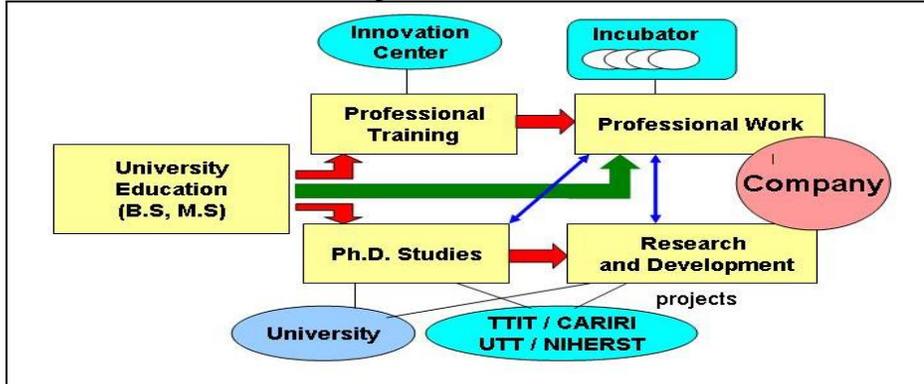
Developing nations in particular seem to be underserved in their human and institutional capacity to innovate in these fundamental market realms. Arguably, this is an under-exploited area of innovation possibility which developing nation would do well to focus in on with respect of their value and wealth generation efforts into the future.

Implementing the Framework: Innovation Systems > Skills Development

To achieve the goal of fostering a cadre of successful innovative domestic companies, the broadening and deepening of the skill sets of the indigenous workforce into areas of endeavor that formerly constituted the sole domain of the MNC will be required. Functions such as business development, commercial analysis, strategy, market analysis, political risk analysis, negotiation, mergers and acquisitions, financial trading and knowledge management must now be carried out in local educational and innovation-hybrid institutions. This so that domestic firms can be supplied with the range of human resource skills-sets necessary to fuel market activity along all aspects of the industry value chain; from incorporation to long-term asset management.

The following diagram shows an expanded view of some of the linkages in the human resource development chain. It illuminates the various routes through which human resources may become available to firms and institutions which carry out commercial activity.

The Human Resource Development Chain:



It is imperative that developing nations look closer at their human resource development infrastructure to determine those areas in which they are deficient, and or those private-public linkages which they have yet remained unexploited. The national human resource must be the cornerstone of any serious and holistic program of sustainable development; human resource capacity development must be given the highest priority by host governments.

In pursuance of this goal however, many governments have attempted to use a push strategy in their education and skills development initiatives; i.e. they have sponsored foreign-based scholarships initiatives as well as mass public programs of training that, while good-intentioned have not been truly relevant to the country's current state of economic development or to their strategic priorities for development going forward. As such these push strategies have invariably resulted in the crippling phenomena of 'brain drain' as graduates find their skill-sets a mis-match to the opportunities and priorities of the local economy. Thus they seek employment in other territories better able to accept and reward their new found competencies.

We advocate therefore pull strategies, in which the proscribed training and development activities are directly related to current and anticipated market opportunities as well as country development priorities.

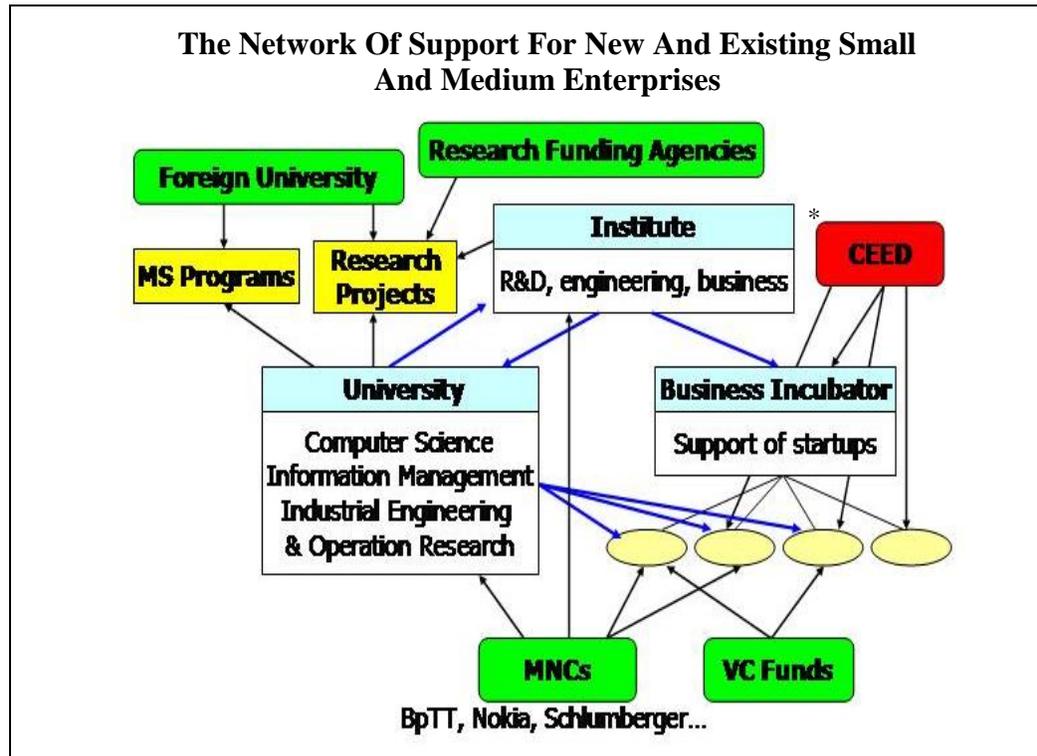
The Quality of the Business Environment

Factors such as the state of cluster development, the availability of business financing, the extent of bureaucratic red tape (in management culture as well as in Government), the extent of unionization and labour relations, as well as the independence of the judiciary, all affect the ability of productive sector to efficiency carry on the business of wealth generation.

In addition to these macro elements, there are other more micro business support elements that can significantly affect the ability of small and medium sized firms to survive and thrive in the modern global economy. Especially in developing economies, accurate and timely information on current and planned activity and on the potential for increasing the national share of value-added is crucial. Businesses must be fed with the best-trained minds and bodies and have access to one or more *Enterprise Development Centers* which would provide such businesses with the advice and consulting services needed to allow them to upgrade business models to meet MNC contractor requirements

and otherwise international standards. It would also provide them access to the tools and incentives necessary to encourage innovation, foster new thinking and bolster overall industry competitiveness.

The following diagram shows a cross-section of some of the various institutions (from educational to funding) which are connected to and in support of startup companies as well as small and medium enterprises:



*CEED stands for the proposed Centre for Energy Enterprise Development which would provide information and consulting services to Small and Medium Enterprises in the Energy Sector.

Implementing the Framework: Technology Infrastructure

Pulling information from the National competitiveness balance sheets for Trinidad and Tobago and Finland for 2002/3 specifically in the area of technology, the following table gives a broad comparison between the two countries on key areas.

It is clear that one of the important levers that Finland has used to elevate itself to the competitive elite in the world is a large investment in integrating the latest technology and methods into every aspect of its economy and value chain. These are some of the aspects in which Finland has invested toward becoming a more robust society and conversely they are also the aspects in which Trinidad and Tobago's developing economy, despite its windfall of energy earnings, remains notably weak.

In order to build its technology infrastructure, the following are some of the measures that should be set as metrics to gauge the success of any program of infrastructural development:

- Growth in R&D investments
- Human resource development leading to increases in the supply of business and technical professionals through enhanced educational, research and product development institutes.
- Updating of patenting legislation and an increase in indigenous patenting activity
- The growth of knowledge intensive industries and an increase in Hi tech exports
- Specific policy support for growth of sustainable local business
- Government R&D Labs and Institutes linked to both Public and Private enterprise
- Financial incentives and schemes for local generation of technology
- Increased venture capital availability and venture creation vehicles

| Finland | | Trinidad & Tobago | |
|---------|--|-------------------|---|
| | Technology | | Technology |
| 3.01 | Technological sophistication.....1 | 3.13 | Quality of competition in the ISP sector.....100 |
| 3.02 | Firm-level technology absorption.....1 | 4.22 | Tertiary enrollment.....85 |
| 3.08 | University/industry research collaboration.....1 | 3.16 | Laws relating to ICT.....79 |
| 3.16 | Laws relating to ICT.....1 | 3.12 | Internet access in schools.....78 |
| 3.18 | Tertiary enrollment.....1 | 3.14 | Government prioritization of ICT.....72 |
| 3.12 | Internet access in schools.....1 | 3.15 | Government success in ICT promotion.....70 |
| 3.06 | Company spending on research and development.....2 | 3.01 | Technological readiness.....62 |
| 3.14 | Government prioritization of ICT.....3 | 3.06 | Company spending on research and development.....61 |
| 3.21 | Internet hosts, 2002.....3 | 3.02 | Firm-level technology absorption.....54 |
| 3.15 | Government success in ICT promotion.....5 | 3.08 | University/industry research collaboration.....54 |
| 3.17 | Utility patents, 2002.....7 | 3.18 | Cellular telephones, 2003.....54 |
| 3.20 | Internet users, 2002.....7 | 3.19 | Internet users, 2003.....52 |
| 3.19 | Cellular telephones, 2002.....10 | 3.21 | Personal computers, 2003.....52 |
| | | 3.03 | Prevalence of foreign technology licensing.....51 |

Implementing the Framework: Policy Enhancements

Here we suggest some high level and preliminary actions which are designed to begin developing nations along the path of sustainable development.

- Develop and institute credible local content policies (esp. in the dominant sector) describing how local value-added is defined and measured, what specific activities it is apply, also explaining the monitoring mechanisms in place as well as the penalties for non-compliance
- Be more strategic about the type of businesses we invite to operate nationally and the way those business are guided to interact with the local economy
- Develop more thoughtful policies and strategic criteria for choosing partner companies as well as for encouraging local businesses so as to engender market and technology pull effects as well as deep synergistic linkages throughout the economy
- Enter into deep equity arrangements with external partners so that technology and business know-how can be transferred

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- Seek to create pull effects rather than the push effects both in terms of the creation of markets and with respect to production and supply.
- Augment to the local skill base, through a coordinated program of attracting skilled expatriate nationals to local opportunities in business and technology
- Conduct an innovation systems analysis of the local economy to identify those parts of the component innovation chains system that are either underdeveloped or absent. These must then be prioritized in-terms of their possible contribution to country sustainable development and then addressed through policy arrangements and government spending and guided partnerships with the private sector.

It is clear that one of the important levers that Finland has used to elevate itself to the competitive elite in the world is a large investment in integrating the latest technology and methods into every aspect of its economy and value chain. These are some of the aspects in which Finland has invested toward becoming a more robust society and conversely they are also the aspects in which Trinidad and Tobago's developing economy, despite its windfall of energy earnings, remains notably weak.

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- Specific policy support for growth of sustainable local business
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Conclusion

Developing nations must move away from the present mode of engendering “static technological capability” which is the minimum requirement for the maintenance of a given productive system, with existing given equipment and technology. They must seek to develop a “dynamic technological capability” which assures the long-term development of the industry by giving nationals the complex set of skills and tools necessary to run the industry successfully over time and to innovate when necessary to overcome specific problems as they arise.

Host governments cannot rely on the schemes of attracting FDI alone to bring about “productivity spillovers” (i.e. worker training, knowledge transfer and market access) and other positive externalities as extolled in theory. Developing countries must see it within their ability and mandate, to *choose* international companies as partners in a mutually beneficial and balanced processes of development and profit-making. This ability becomes credible when developing countries recognize the value their country(ies) bring to the MNC's global business.

Trinidad and Tobago, for e.g., is the 5th largest LNG exporter in the world and provides 70% of the LNG intake of the US. Trinidad and Tobago has an opportunity to choose partners who will move

away from the traditional model and require that more of the energy business be done locally, particularly head office functions, such as business development, analysis, commercial strategy, customer relations, markets, political risk, negotiating, mergers and acquisitions, trading and knowledge management. Trinidad and Tobago would therefore have access to world-class business methodologies and personnel development, technologies and processes. These businesses, in turn, will develop and spawn local suppliers and contractors at a similar level, encouraging local businesses to develop their services to international specifications.

As argued by Barclay (2003) they must enact *credible selective intervention* policies; i.e. policies which seek to create an environment which identifies opportunities, mechanisms for implementation and promotes, indigenous technological and strategic business acumen in the host country. However, the response by Multi-National Enterprises (MNE's) to intervention policies is likely to depend on whether or not they are perceived as credible, i.e. "they are seen as binding commitments made by host governments on which firms can rely on as strategic planning assumptions. The MNE will not enter into a process of mutual strategic adaptation unless it is assured that the government can and will implement consistent policies over time"

Another shift in emphasis which is necessary to achieve the goal of sustainability is the move away from the focus on the upgrading of the individual firm or entity within the sector, toward the looking upon upgrading as process of innovation across the sector as a whole. Individual domestic firms cannot compete on their own in the global economy; they must be supported by a dynamic and upgraded sectoral innovation support structure. Additionally, there must be efforts to upgrade *across* sectors, actively using the innovations and systemic improvements in the energy sector to provide linkages and enhancements to other sectors thus achieving the goal of economic diversification.

Trinidad and Tobago's changing objective is now not only to increase GDP but also to reduce dependency on oil and gas. The strategy suggested is one which is designed to create a diversified economy with increased purchasing power parity, greater equity in wealth distribution, a world-class workforce and a dynamic inshore economy satisfying local demand and exporting its surpluses.

Summary Points

- Post-colonial developing countries esp. those in the Caribbean have always produced great quantities of wealth from natural resources - first in agriculture, then minerals, then services (tourism). All revenue generating activity based on natural endowments.
- Almost exclusively, this wealth and natural resources have been developed through reliance on an external (big brother) investor.
- The foreign companies in question came with all of the business elements in-house; (i.e. markets and marketing, financing, business know-how and relationships).
- In the new economy however, many of these are disaggregated commodity services which can be sourced from one of a number of competing service providers on the international market. As a matter of operating protocol though, critical elements of business know-how are still usually kept in-house within the multi-national.

- There is now the growing ability of host countries to build indigenous business know-how by:
 - Increasing their equity stake in global business operating locally, and thus have access to world-class methods and technology through participating at senior management and Board level positions within those companies.
 - Re-organising the education system (including R&D) to increase the provision of technology and strategic market skills thereby better equipping the local workforce to take up the challenge of achieving sustainable growth

From Theory to Practice: Specific Tactical Recommendations for the Case of Trinidad and Tobago

Overall Underlying Policy Framework:

1. Make learning and innovation among the explicit goals of FDI promotion policies.
2. Implement a credible, transparent and consistently enforced system of laws, policies and taxation regimes which send clear signals to all existing and potential investors, which take a long-term view of the development of Trinidad and Tobago.
3. Formalize and enforce an overall framework and policy for local content, describing what defines local value-add, how it is measured, what specific activities attract a local value-add minimums and how adherence to the policy will be monitored with clear penalties for non-compliance.
4. Upgrade domestic intellectual property legislation/enforcement and encourage increased knowledge creation and patenting behaviour

Education /Research and Development:

1. Adequately fund local research institutes to enable them to afford the equipment and human resources needed to carry out a broader range of higher value added services to industry firms, both local and foreign and as such begin to build a reputation of world class centers of research excellence (esp. in oil and gas).
2. Increase the interaction and linkages between these R&D institutions (eg. CARIRI, TTTT, NIHERST, UTT and UWI) and the energy and technology based commercial sectors, through initiatives which would encourage students and faculty of the engineering, technological and business schools to do research and projects based on the local energy industry. These initiatives must be given high visibility in the business sector and act as part of an overall integrated national innovation plan in which every effort is made to seek out synergies and co-ordinate research in a systematic and directed manner, taking advantage of agglomeration benefits as they accrue.
3. Ensure that the training curriculum of the energy and technology training institutions addresses critical current shortfalls of leadership, strategic business and technological capability. Possible new areas of focus include marine management and shipping logistics, exploration and production, engineering design simulation software, international commodity marketing and planning, managing large scale projects and financial trading.

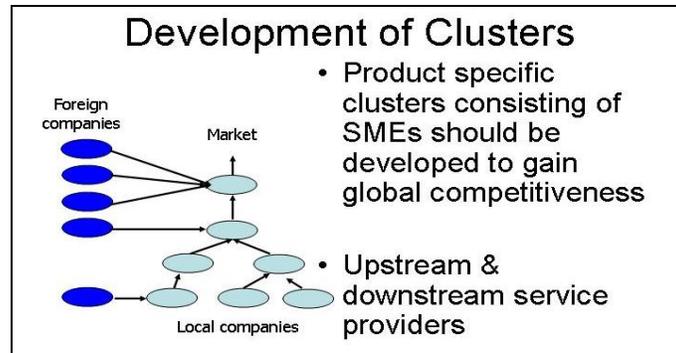
Technological Development / Product Development:

1. Ensure that the foreign investor who comes into Trinidad and Tobago enhances the indigenous technology capability by devising a detailed and comprehensive plan which addresses the capabilities needed to be developed over the long term, as well as specific technologies that the foreign firm may contribute. These must be implemented to systematically develop local capabilities to the fullest extent through spread effects and supplier linkages (Barclay 2003).
2. Encourage identification and exploitation of synergies, business opportunities and benefits from large use of computing power in the upstream services sector, one of the biggest users of computing power in the world. Operators and their suppliers should be required to build the digital infrastructure to support their work with local suppliers, using open standards and formats that enable other businesses and sectors to leverage the network to support the country's ongoing transformation to a digital economy

Inaugurate a Center for Energy Enterprise Development (CEED) which will supply small and medium enterprises with accurate and timely information and metrics on current and planned activity in the sector and on the potential for increasing the national share of value-added. They should provide consulting services assist domestic firm in upgrading business models to meet MNE contractor requirements and supply the advice and tools needed to encourage innovation, foster new thinking and bolster overall industry competitiveness. Energy businesses are currently unable to access the support resources provided by state business development agencies (BDC and TIDCO), since energy businesses are excluded from their client portfolio

Production and Financing:

1. Establish a trading marketplace and trading floor for LNG, methanol & ammonia — creating a Trinidad and Tobago Gas Exchange with a minimum of 50% level of local ownership and which enables the development of the capital market and technology base.
2. Act strategically concerning the types of technology and equipment is used in plant and operational processes. This would allow the local industry to understand the new technology and over time be able to localize its equipment and technology to local conditions. The learnings would be applicable industry-wide and updating training could be organized in-country.
3. Develop industry clusters in specific strategic areas, which allow agglomeration synergies to occur. These clusters can act as the drivers and beneficiaries of R&D initiatives, the combined scale can service larger contracts both at locally and internationally, and there are also training and workforce synergies which can be derived.



4. Devise a comprehensive plan for receiving finance and in-kind donations from foreign companies which are directed at labour force upgrading (eg. NESC, TTTT etc), so that companies do not regard these as an unsolicited tax and thus refuse to contribute to these schemes (Barclay 2003).
5. Consider a regime of incentives to existing and new local firms which recognizes the strategic role that local private equity plays in the industrial and sustainable development.
6. Increase public ownership and access to energy businesses by enabling local investment in the sector through amendment Pension fund and Venture Capital Acts which currently prevent investment in the local energy sector. These are critical elements that could impact significantly on the growth of the local capital market. Local investment in long-term projects, rather than funds languishing in overseas reserves, could provide the country with a much-needed boost to the development of its capital market. Additionally, a reduction in the Central Bank reserve requirement (currently at 14%), could free funds that can be used for local energy sector investment. Heritage fund –strategic investment, including energy sector – making US\$ available for locals to utilize at low rates.

Epilogue

The strategic approach recommended in this essay considered the characteristics of operations along the entire oil and natural gas value chain, in the light of T&T's then vision of becoming a developed nation by 2020. By identifying those industry activities that used and/or allowed for the development, within T&T, of the characteristics that define a developed nation, T&T was able to determine the overlap between what the country desires and what the industry provides.

The resource development approach recognized the relative importance of the three factors of production (capital, labour and resources) and especially the value of knowledge skills and the capture, aggregation and subsequent strategic deployment of capital, in support of those skills. Means were found to maximize the impact of the relevant industry activities within the country and recommendations made to put the appropriate policies and regulatory framework in place to ensure that these would be implemented.

The recommendations of this essay built upon the Report of the Energy Sub-Committee for T&T's Vision 2020 (2004), the subsequent "Energy Framework for Action – Vision 2020 (2005) and aligns with the subsequent

“Draft National Plan for T&T” (2007)¹.

With changing circumstances in the political leadership of T&T, different priorities within government and variable application of policy, some of the recommendations were followed more robustly than others, with mixed results in terms of attainment of the potential benefits.

A major success came in 2013, when T&T was designated by the World Economic Forum as the first developing country to become an innovation driven economy. This follows a series of deliberate policy decisions and investment in human and technology capacity enhancement, utilizing the revenue and experience acquired from a very successful period of oil and natural gas development.

T&T’s well established tradition of pursuit of excellence in education through ready access, quality educational institutions and systems was enhanced during the period of the natural gas boom and extended to reach the evolving world of high technology and innovation. The National Energy Skills Centre, UWI School of Business, University of Trinidad and Tobago (the vision of which is to provide education for a future world) and others were established, first to meet the needs of the growing energy sector, which had the financial capacity to fund their initial construction and operations, and then extended to other sectors of the economy.

The Evolving TecKnologies and Enterprise Development Company Limited (eTeck) was given a mandate to, among other things, develop innovative businesses and build technology parks to support these along with the main campus of the University of T&T. Its Taman Park Brochure opens with the statement –

A new era is beginning. An era in which economies are built around knowledge, and innovation powers success. An era driven by the energy of new ideas, new connections, and the vital power of collaboration. An era in which industry and technology cross-pollinate, and the barriers to commerce disappear. A new era that’s beginning at the centre of the Americas, in Trinidad & Tobago’s Tamana Intech Park.

Tamana Intech Park is developed by e teck—a state enterprise company created by the Ministry of Trade and Industry to diversify Trinidad & Tobago’s national economy. e teck is developing enterprises and services that are economically sustainable, technology driven, environmentally accountable, community oriented and knowledge-based, acting always in the national interest.

1

<http://www.transforme.gov.tt/sites/default/files/library/documents/Vision%202020%20Draft%20National%20Strategic%20Plan%20Trinidad%20and%20Tobago.pdf>

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