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**GOVERNING TECHNOLOGICAL
CHANGE AND THE PARADOX OF
COMPETITIVENESS: AN ANALYSIS OF
STATE CAPACITY IN SCIENCE,
TECHNOLOGY AND INNOVATION
POLICIES IN TRINIDAD AND TOBAGO**

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Thesis submitted in fulfilment of the degree of Doctor of Philosophy in
International Development

2017

Department of Development Studies
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DECLARATION

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ABSTRACT

This thesis investigates the evolution of state capacities in science, technology and innovation (ST&I) policies in a small developing country. It empirically examines the minutiae of interactions among various actors and agencies in this domain, with in-depth case analysis of Trinidad and Tobago (T&T) during 2002 and 2015. Data were collected from forty-eight interviews with university researchers, state officials, industry, and donors, in addition to archival and secondary documentation. Findings show an uneven distribution of ideas, information, knowledge inputs, technical capabilities, and organisational power. Detailed historical analysis reveals changing state-society configurations according to social, political and economic developments. I thus conceptualise these asymmetric and dynamic relations across organisational units as ‘networks of power’.

Compared to the early 1970s, the state, pressured by anti-colonial mobilisations, created new institutions and fostered developmental coalitions comprising state and private enterprises, high-skilled researchers and multilateral agencies to successfully promote technologies in agriculture, telecommunications, energy, and steel. Its ability to design and implement ST&I policies is currently constrained by informal relationships, ethnic considerations, powerful sectoral interests, a fragmented institutional apparatus, intense clientelism, and the formal requirements of multilateral bodies. Taking a long-term horizon to improve technological capabilities, allocate to productive firms, coordinate agents, and deploy appropriate fiscal instruments is thus stymied.

This analysis reveals a paradox: after thirty years of market-friendly policies, why has the country not improved its overall technological performance? Consequently, it was found that both innovation systems and ‘good governance’ frameworks do not endogenise the interplay of domestic and international forces in the national political economy that give rise to *structural, technical* and *socio-political* (STP) imbalances. I propose a novel approach – the Developmental Governance Capability Framework (DCGF) – that incorporates these dimensions to help reformulate ST&I interventions aligned to broad-based developmental aims, and considers the complex political processes associated with effecting new developmental coalitions.

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DEDICATION

I dedicate this work to my mother, Michelle, and to the memory of my late niece,
Karimah.

To my intellectual forebears, the late Lloyd Algernon Best, Trevor Farrell, and Norman P.
Girvan, from whose work I have benefitted a great deal and inspired my commitment to
Caribbean development.

And to all my teachers and mentors.

ACKNOWLEDGMENTS

In every academic venture, there are always numerous individuals and organisations without whom the outcome could not have been achieved. Expressing thanks to all those who have been helpful is often an understatement of their true contribution. I first wish to give thanks to my supervisor, who has truly offered wisdom and exercised a great deal of patience and support over these past years.

For me, this effort is a lifelong learning experience to this point, as I have been inspired and supported directly and indirectly by my many teachers over the years, starting from Arima West, and Queen's Royal College (*magnum est!*) to the University of the West Indies, as well as mentors along the way, timely supporters, and friends and loved ones on this journey.

To my mother in particular who has always believed in me, despite circumstances that may have befallen us as a family and individually. I owe a debt of gratitude to my cousin Ryan, my aunt Marcia, sister Kizzy and other siblings, and the rest of my family, who all believed in me, and were supportive of my academic pursuits.

To my sponsors, the Government of Trinidad and Tobago, who upon behalf of taxpayers supported my time in the UK, as well as the permanent secretaries and administrative support officers at the Scholarships and Advanced Training Division, and at the Trinidad and Tobago High Commission in London, I offer heartfelt appreciation.

My friends, in particular, Jeanelle, Teocah, Renee, Geneve, Nicole, Colin, Cara, Weslee, Janelle, Karyse, Rebecca, Jevon, and Danielle, were all very supportive and encouraging at different times. Gillian and Stacy have remained an important source of wisdom and inspiration, and offered practical support at times. In December 2015 and November 2016, I found myself in difficulty and many persons, who were mere strangers rallied to support me, including Shelly, Ryan, Yansie, and Nicola, I am very grateful for their backing and encouragement during that time and thereafter.

To my colleagues at SOAS, in the UK, and further afield, who provided great listening ears, and gave useful feedback on my academic presentations.

Indeed, the research conducted profited a great deal from the forty-seven individuals and their organisations that were interviewed in the course of my fieldwork from September 2014 to 2015. In addition, the staff at the libraries at the Ministry of Planning, the University of the West Indies, and Senate House, where I visited was of great help. A number of friends were also helpful during my time in Trinidad, all of whom I cannot name for reasons of space, but who know themselves.

I also owe a debt of gratitude to my friends in the UK, lecturers and colleagues in Newcastle in particular (a place I will never forget) who started me on this journey, and provided solace and allowed to be myself at times, when I just did not want to think about the PhD. You are all champions!

ACRONYMS

ALJGSB	Arthur Lok Jack Graduate School of Business
AMCHAMTT	American Chamber of Commerce Trinidad and Tobago
CARICOM	Caribbean Community and Common Market
CARIRI	Caribbean Industrial Research Institute
COSTAATT	College of Science Technology and Applied Arts of Trinidad and Tobago
CCI	Council for Competitiveness and Innovation
CRU	Cocoa Research Unit
DGCF	Developmental Governance Capability Framework
EC	European Commission
ECLAC	Economic Commission for Latin America and the Caribbean
EU	European Union
GCI	Global Competitiveness Index
ICTA	Imperial College of Tropical Agriculture
IDB	Inter-American Development Bank
IFF	Innovation Financing Facility
IFIs	International Financial Institutions
IMF	International Monetary Fund
ISCOTT	Iron and Steel Company of Trinidad and Tobago
MDGs	Millennium Development Goals
MLAs	Multilateral Lending Agencies
MST	Ministry of Science and Technology
MSTTE	Ministry of Science Technology and Tertiary Education
MPE	Ministry of Planning and the Economy
MPSD	Ministry of Planning and Sustainable Development

MTI	Ministry of Trade and Industry
MTPF	Medium Term Policy Framework
NAR	National Alliance for Reconstruction
NCOSTI	National Council on Science Technology and Innovation
NDP	National Development Plan
NIE	New Institutional Economics
NIHERST	National Institute of Higher Education Research in Science and Technology
NIP	National Innovation Policy
NIS	National Innovation Systems
PNM	People's National Movement
PP	People's Partnership
R&D	Research and Development
RDF	Research and Development Fund
SEPPD	Socio-economic Policy Planning Division
S&T	Science and Technology
SSTI	Sub-committee on Science Technology and Innovation
ST&I	Science Technology and Innovation
T&T	Trinidad and Tobago
TTCIC	Trinidad and Tobago Chamber of Industry and Commerce
TTMA	Trinidad and Tobago Manufacturers' Association
UNC	United National Congress
UNDP	United Nations Development Programme
UTT	University of Trinidad and Tobago
UWI	University of the West Indies

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PREFACE

In 2012, I encountered a real-life puzzle. At that time, based on my own interest, I went to work as a graduate employee at the Ministry of Planning and the Economy - its name has been changed both before that time, and when I left later that year. The portfolio changes has been as a result of political motivations. I wanted to contribute to making Trinidad and Tobago a better society, and I thought that ‘innovation’ and ‘creativity’ within a policy setting had something to do with that. While I didn’t come into the role there by chance; I was as a graduate employee assigned to this department because of my national scholarship obligations and asked to assist a new agency by the minister at the time. Starting off, my exact role was still very fuzzy. I was supposed to contribute to the “innovation” and “competitiveness” aspect of a new agency known as the Council for Competitiveness and Innovation (CCI). I was asked to become the first employee of the agency dedicated to this new mandate, for which the minister had previously served as Chairman. I would operate under the newly assigned Executive Director, whose salary was funded by the Inter-American Development Bank (IDB) and who was supposedly chosen by the high-level officials of the ministry.

In fact, the agency was a relatively new one, but its actual position in the structure of government seemed fluid or perhaps not yet well-defined or operationalised. We were therefore operating on the fly so to speak, to come up with new projects and ideas with the Executive Director who just completed a research consultancy on the ‘national innovation system’ that had been funded by the IDB. It should be known that this agency was set up since November 2011 and had a functioning board, or at least the Board periodically met to discuss proposals and issues related to their mandate. After more than a year of its existence, they had done very little, and were not engaged in much real activity towards achieving their purpose (though this was still very uncertain for many of them). Their role was advisory, and so initially they were not seen to have an active operational mandate, but that soon changed with my and the new Executive Director’s re-assignment. All political manoeuvrings, as it were, in one way or another. After a few weeks, I found myself sunk, trying to figure out what to do, and someone with an active imagination and stickler to try to make a contribution, though it was really an unformed role; no structure actually suited me well.

In the coming months, I found myself thinking about a new pet project that the Minister asked the CCI to execute, i.e. an ‘innovation financing facility’ which became a nationwide grant competition known today as *idea to innovation*. I started using my skills, researching online, reviewing government documents and attending meetings of the board to work out what could be done. I was asked to make presentations with very little guidance on what this project would look like. The Board members also started making decisions on what external agencies they could hire to support its execution. Other people were eventually co-opted including the Chief Executive of the Caribbean Research and Industrial Institute (CARIRI) and a high-level planner at the Ministry of Trade and Industry who started attending meetings to discuss plans and obstacles for

‘doing business’. I gathered that many of them being from the business sector were concerned about reducing so-called obstacles of doing business, while the Minister seemed obsessed with the idea of improving the country’s competitiveness. Both of these agendas for them coincided quite well.

It was not until the project started taking form, I had to engage with a number of internal and external parties, having to act as a networker and liaison to see through its implementation. I engaged with a number of state entities to get advice and follow-up on execution, internal staff at the ministry to get support to procuring items through the bureaucratic machinery, and even legal advice from the internal State Counsel and to draw up contracts, as well as the Intellectual Property Office and the events management company which we eventually hired to conceptualise the whole range of marketing and promotional activities, and conceptual design for implementing the project. But all this while I wondered apart from not fully understanding their role, the Board did not seem to understand the innovation concept or how policy at the governmental level was formulated. This is despite their many years of combined experience of engaging with government, but supposedly they had connections or ways of getting around the system to get things done. Their role was to scale up their collective effectiveness in performing this role on behalf of the business community to be more successful at innovation, and become a globally competitive force.

After leaving the ministry later that year, and entering a postgraduate programme to study innovation and entrepreneurship, things appeared a lot more complicated than I could make complete sense of at that time. I then became exposed to appropriate conceptual tools, through extensive reading and drawing inferences from the research conducted over the last four years, in particular the last three during which I undertook this doctoral project. My naivety at the time of becoming frustrated with a lack of systems, support, and knowledge about how to implement the particular project, and in particular how policy was meant to work have been clarified through this doctoral project.

I was frustrated thinking about this situation and have been challenged on a personal level in terms of my level of comfort as a citizen of Trinidad and Tobago, and intellectually after experiencing some time living abroad these past years growing wearier while understanding the long-term view of development.

Indeed the story has not yet been told. The work of scholars like Lloyd Best, Norman Girvan, Trevor Farrell, Ha-joon Chang, Martin Bell, especially Mushtaq Khan, among others helped me on this journey. I began wondering why institutions seemed dysfunctional and why was the development situation in the Caribbean, particularly Trinidad and Tobago, did not appear to advance beyond the few goods the country exported. Despite the intellectual talents and ‘educated workforce’ you would read in reports describing our situation. But eventually I came to know institutions not as fossilised relics as Best, Girvan and their followers would suggest, but as dynamic creatures of their environment at the nexus of their social relations, the underlying production system with informal features, especially in developing countries, that

underpin such interactions, even if outcomes may seem ‘sup-optimal’ or there may be little perceived progress.

My engagement with Gillian Marcelle, an academic herself and fellow Trinidad and Tobago national, during my time before the start of my doctoral studies was instrumental as she helped shaped some of my initial ideas first at the meeting of minds called the ‘Caribbean Convois’ that was held in Tobago in March 2012 hosted by the Lloyd Best Institute of the West Indies, and later in her role as a consultant with the CCI.

It is then that the beginnings of the intellectual conception of this project, given its many transformations and re-orientations over the past three years that led me to this point. My supervisor may not believe this, but his own work, encouraging words and immense patience and relentless support have been very influential and appreciated in shaping my ideas, my own philosophical approach, and my preferred academic positionality as a young political economist. The vibrant, radical environment at SOAS, even for aspects of its exclusivity certainly also offered fertile ground for such exploration and taking this project forward to its present state. The journey now starts.

Figure 1.1 Map of Trinidad and Tobago

Source: Ezillon.com (2009)



CHAPTER 1 - INTRODUCTION

1.1 Background and Context

Since the global financial crisis erupted almost a decade ago, policy makers, the academic community and popular media alike are increasingly concerned about the economic prospects of developing countries. At the coalface of present low commodity prices, diminished living standards, and massive unemployment and inequality, the search for technical and increasingly political solutions seem all the more urgent (World Bank, 2017). Technological progress and productivity growth in many Global south countries, especially in Latin America, Africa and the Caribbean has been somewhat lacklustre and characterised by immense sectoral heterogeneity over recent history (Cathles and Pangerl, 2016; Lee, Juma and Mathews, 2014; Stallings, 2016; Vries, Timmer and Vries, 2015). An intense debate has therefore ensued among development scholars about the important lessons for developing countries from this lingering crisis, reigniting reflections about the role of the state in the development process, given past policy failures, theoretical reformulations, and recent experience (Centeno, Kohli and Yashar, 2017; Chang, 2011; Fine, Saraswati and Tavasci, 2013; Lazonick and Sun, 2016; Leach, 2016; Mazzucato, 2013; Teichman, 2016; Wade, 2010; World Bank, 2017; for a more mainstream view of the state, Cimoli, Dosi and Stiglitz, 2009; and Fukuyama, 2014). However approaches to understanding state-society relations and state intervention in technology-capitalist accumulation are varied and raise important questions. These viewpoints also engender consequences for politics and society. In many instances, these considerations are rhetorical, and not necessarily in response to nuanced empirical evidence and in-depth historical knowledge.

According to Melissa Leach, ‘changing relationships between the state, markets are part and parcel of these political dynamics’ and at the heart of development concerns (Leach, 2016, p. 2). This renewed focus on the state’s role (not to be seen as empirically distinct but as part of complex social dynamics – see chapter 2) comes after the legacy of the last three decades (World Bank, 2017). In an effort to reset the growth process after debt crises during the 1980s – the so-called ‘lost decade’ – structural adjustment and macro-economic stabilisation policies were undertaken by governments, under the supervision of the international financial institutions (IFIs) (Chang, 2015; Kiely, 1998). These ‘right’ policies dubbed the Washington consensus, emphasised free trade, low inflation, floating exchange rates, openness to foreign capital, tight fiscal regimes, and limited government to ‘set the framework conditions’, among others (Saad Filho, 2005). These measures were also deemed sufficient to bring about the flurry of technological change (Taylor, 2016). Policymakers and mainstream economists were of the view that this would induce domestic firms to become more competitive, reduce unproductive rent-seeking, and ensure cutting-edge technologies would be efficiently acquired (Gore, 2000; Khan, 2007). In consequence, this ‘paradigm’ transformed the state, effectively circumscribing its capabilities in pursuing and achieving broad developmental objectives (Fine and Saad Filho, 2014), as well as giving rise to a heterogeneity of actors with different interests and political sway (Leach, 2016).

In 2000, at the time when the millennium declaration was adopted by United Nations member states that set in motion the pursuit of the Millennium Development Goals (MDGs), S&T were not explicitly incorporated. Developing countries instead focused specifically on improvements in healthcare, education, environmental sustainability, poverty elimination and a number of noteworthy welfare-promoting activities. This triggered immense debate in the international development community,

about ways of satisfying these goals that can facilitate greater prosperity, thereby uplifting populations in the Global South from their multiple deprivations (Teichman, 2016).

Observers believed that the MDGs attempted to promote social transformation without engaging with the productive sectors of the economy, and specifically how ST&I and development knowledge from these countries themselves could contribute towards their achievement (Bell, 2009; Chang, 2013; Mackintosh, Chataway and Wuyts, 2007). Soon after, there was some respite though intellectual debate launched by a group of scholars to correct this oversight about the lack of explicit attention to S&T issues in the MDGs. Their main argument was that S&T resources, in particular research and development (R&D) need to be ramped up, and institutions in developed countries needed to re-orient their activities to suit the needs of the Global South (Juma *et al.*, 2001).

The UN responded by setting up a sub-committee coordinated by Calestous Juma of Harvard University, and Lee Yee-Cheong of the World Federation of Engineering Organisations, Paris of the wider task force directed by Columbia University economist Jeffrey Sachs. It included participation of prominent Western and Global South scientists and scholars, the majority from North American and European institutions that produced a report as part of the Millennium Project on the virtues of ST&I for development policy (Juma and Yee-Cheong, 2005). Notwithstanding minor shifts in analytical and policy content, the group failed to engage with the specific political and institutional realities of developing countries, outside of them a destination for increased investment, the lack of political will or good governance, and improved international cooperation, government beyond public goods provider (e.g. education and infrastructure). They did not address the explicit mechanisms of power relations that underpin the division of labour and resources in S&T, and linked to the history of international cooperation of S&T for development, nor did they address the peculiar concerns of small developing economies.

The recommendations on infrastructure provision, accountability and transparency, restructuring institutional mandates (Juma and Yee-Cheong, 2005, p. 177–181), all align with the ascendant institutional arguments and frameworks related to ‘good governance’ and national innovation systems (World Bank, 2010; for a critique, see Kiely, 1998).

On a substantial level, one critic even noted that specific attention needed to go beyond R&D investment, which has been entangled in decades-long debates and consider the changing trends in understanding the contribution of building innovation capabilities (Bell, 2009). This ST&I policy add-on to the MDGs was welcome, but historical experience reveals the intense debates on S&T cooperation with developing countries. In the 1960s, short and medium term efforts by developed countries in specific areas have had only minimal impact on developing domestic capabilities in Southern countries, triggering intense conflicts and competing priorities at the global, institutional and local levels (Rittberger, 1982; Sagasti, 2005). A recent study noted that little has changed since (Arroio, 2012). According to Arroio (2012), even though international donors’ current aid policies give some explicit focus to ST&I, especially agricultural research activities, they still do not appear to provide the space for a reciprocal dialogue with developing countries, that will ensure that their funds and programmes meet or reflect the latter’s needs (ibid.). These well-intentioned efforts to mainstream ST&I in global development debates fail to acknowledge that the ‘the dynamics of technological change involve complex and power-laden processes that can move in assorted, and often contradictory, directions’ (Leach, Sumner and Waldman, 2008, p. 728). They essentially expunge these political concerns from policy discussion and analysis, and accordingly do not critically interface with the distributive effects from a reconfigured state over the past three decades (Cerny, 1997).

The foregoing discussion highlights a major shortcoming and the intellectual lacuna of ST&I policy research, especially as it relates to developing countries, which appears to lack a critical, reflexive scholarship (Morlacchi and Martin, 2009), which is only emerging (Delvenne and Thoreau, 2016; Flanagan and Uyerra, 2016; Taylor, 2016). Consequently, in his classification of the various approaches taken by innovation scholars, Ball (1995, cited in Molarchi and Martin, 2009, p. 259) argues that policy is both ‘de-politicised and thoroughly technicised’. It constitutes a form of technical rationality that ‘rests upon an uncritical acceptance of moral and political consensus, in which debates and conflicts which link policies to values and morals are displaced by bland rationalist empiricism’ (*ibid.*, p. 259). In contrast, in seminal work on evolutionary economics, policy changes in democratic contexts occur based on the influence of formal institutions and social agency of actors in various spheres to reflect evolving value systems (Nelson and Winter, 2009). Nelson and Winter (2009, p. 232) note that

Public policies may reflect not changes in objective conditions but shifts in values, or understanding. Change over time in the relative power of different interests and groups within society likely will pull changes in policy in their wake. This underscores the point that in developed countries, demands and social conflicts for democratic institutions and direct political interventions have led to high levels of technological accumulation (Smits, Kuhlmann and Shapira, 2010).

In comparison, policy and economic strategies in developing countries are in part driven and mediated through patron-client politics and hierarchical modes of operation that may differ from the Weberian state structures (Khan, 2005). To further delineate these contexts, Dasandi and Esteve (2017) attempt a typology of political-bureaucratic that varies across the separation-autonomy spectrum¹. They postulate four types of

¹ According to Dasandi and Esteve (2017, p. 3): ‘the difference between separation and autonomy is that the former refers to the types of functions politicians and bureaucrats perform, and the latter refers to how bureaucrats can perform the functions they have been assigned’.

interactions: collaborative, representing low role separation between political and bureaucratic elites, with high levels of bureaucratic autonomy (as in developmental states). Second, collusive relations are characterised by a close relationship between bureaucratic and political elites where bureaucratic autonomy is low and a low degree of separation. Then, an intrusive arrangement, which has higher degree of separation between political and administrative realms and oriented towards the rule of law usually in once-colonised democracies. Finally, the integrated model has clear role separation between politicians and bureaucrats and high bureaucratic autonomy (Dasandi and Esteve, 2017). These configurations add to the on-going debate surrounding the nonlinear relations between whether the level of democracy and integration of countries and institutions into a world of unbridled markets directly correlate with technological progress and development (Bishop, 2016; Kiely, 1998; Khan, 2005; Taylor, 2016). As will be shown throughout this thesis, these issues and features of society have a complex, dialectical relationship to technological development.

This thesis is thus concerned with a particular puzzle surrounding the nonlinear aspects of state-society relations and technological change, in particular regarding state capacities and its evolution relative to ST&I policies. Despite years of cumulative reforms, why a country, such as Trinidad and Tobago (T&T) has not achieved greater competitiveness on the basis of technological development? For instance, T&T graduated to high-income status in per capita terms in 2006 according to World Bank classifications. Also in 2011, the country was taken off the Organisation of Economic Cooperation and Development (OECD) Development Assistance Committee List (DAC)² (OECD, 2011).

² The country still however receives bi-lateral funding through the European Development Fund (EDF) of the European Union set up for African Caribbean and Pacific (ACP) countries, who are ex-colonies of European powers, within the CARIFORUM group i.e. member states of the regional grouping the Caribbean Common Market (CARICOM), plus the Dominican Republic.

In 2013, the country was classed as an ‘innovation-driven’ economy by the World Economic Forum (Schwab, 2013), but with its static factor-driven comparative advantage in petroleum and natural gas. This situation has thus given rise to an interesting paradox in the case of T&T: despite high per capita income, years of market reforms and relative improvements in governance, it has not entered into new product spaces (Guinet, 2014).

This paradox appears to suggest the level of national income and degree of market openness have little to do with progress in innovation capacity and S&T performance (Taylor, 2016). Some mainstream economists and political scientists argue that market reforms were not fully implemented and call for additional reforms which it is hoped would stimulate technological progress (for a critique, see Radosevic, 2009). In the case of T&T, certain authors attribute lack of progress to social and ethnic cleavages, and fear of electoral loss by leaders (Ann Marie Bissessar, 2003; Mottley, 2008a; World Bank, 2005). The evidence is that market-conforming reforms further reinforced deindustrialisation, lowered levels of technology production and capability development and did not create new comparative advantages (Barclay, 2004, 2007; Boodraj, 1995; Ramsaran, 2004). The explanation may come down to social factors, government-business-society interactions, and strategies of political mobilisation, including ethnic-based politics and clientelism, prevalent in T&T that have limited the effects of certain ST&I policies. But again, this is not well parsed out in the literature. More than that, a neglect of those specific contingent factors and their influence on policy-making has been a particular shortcoming of Washington and post-Washington consensus models of policy-making as they are believed to be one-size-fits-all or formulaic (Gore, 2000; Chang, 2011; Van Waeyenberge and Fine, 2011). Ultimately, mainstream economic perspectives tend to have an instrumentalist and narrow view of politics and democracy (Kiely, 1998). These views claim that they have the same effect on technological

development regardless of the social relations and configuration of power in a particular context and across time (Breznitz and Ornston, 2016; Khan, 2013; Taylor, 2016).

This study will seek to ‘bring politics back’ to investigate and appropriately examine the institutional context of the ST&I and technological change as arenas of political contestation and negotiation among various actors and embedded interests (Bastos and Cooper, 1995b; Bell, 2009; Breznitz and Ornston, 2016; Cooper, 1972; Doner, Hicken and Ritchie, 2009; Girvan, 1989; Khan, 2013; Leach, 2016; Saha, 2016). Specifically, to investigate this nexus and interrelationships, it is geared towards tracing the historical evolution, contemporary nature and process dynamics of state capacity, and the distribution of power in the political economy over the post-independence period of a small developing country. It attempts to examine the techno-economic outcomes and anomalies that have emerged in the country through an extensive historical analysis. Particular attention is given to the intervening years from the early 2000s when two science technology and innovation (ST&I) policies were elaborated under different political administrations in T&T.

T&T is an resource-rich small island nation of 1.4 million inhabitants comprising a diverse cultural and ethnic mix of people of East Indian heritage accounting for 35.4%, African heritage accounting for 34.2%, and ‘mixed’ 22.8%, with other minority groups (Caucasian, Syrian/ Lebanese, Chinese, Portuguese, and ‘other’) about 1.4% and ‘unstated’ groups numbering 6.2% of the total population (Central Statistical Office, 2012). The twin-island nation is situated in the southernmost Caribbean Sea, northeast of the South American continent east of the Venezuelan coastline (see chapter 2 for more in-depth historical and political account of its development experience and implications of geo-political position). At independence, in 1962 the country’s leaders adopted the Westminster form of parliamentary democracy. The independent country is also a

founding member of the Caribbean Community and Common Market (CARICOM), which was formed on August 1, 1973 by the signing of the Treaty of Chaguaramas in Trinidad. As part of this grouping, T&T enjoys trading benefits such as a common external tariff with 14 other member states³ all bordering the Caribbean Sea.

Specifically, the thesis concerns how the state and its critical agencies have transitioned over the post-independence period to manage and promote ST&I policies. The most recent ST&I policies drafted in 2004 and 2015 were specifically aimed at achieving greater competitiveness, appropriating greater spending in R&D, generating increased S&T activities, and overall improvements in innovation performance. Finally, the investigation addresses the thorny question of how do these agencies comprising the state actually interact with a number of domestic and ‘external’ actors to articulate their interests, and contribute to the policy-making process, and what do these dynamics imply for implementation and governance over time. The thesis therefore poses the following primary research question:

How have state capabilities in formulating ST&I policies evolved during the post-independence period in T&T?

Subsequently, it addresses the supplementary concerns:

- 1) How do relevant state agencies and other interests interact in designing and implementing ST&I policies?
- 2) What are the institutional and political factors that shape these exchanges, and implications thereof?

³ They include: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago.

The study analyses the main research question in Chapter 3. This chapter shows contrary to earlier dependency treatments that the configurations of state-society exchanges are complex and dynamic. ST&I institutional development was not fixed, but has shifted from asymmetric metropolitan-colonial relations that reified the plantation sector to increased attempts to build relevant institutions albeit with lingering external influence. It was essential to demonstrate the nature of the T&T colonial society and the place of ST&I within institutional arrangements from that time to understand its contemporary manifestations. The first supplementary question is then addressed in chapter 4 in relation to the 2004 and 2015 ST&I draft strategies and the process of formulation at the organisational level and across organisations. Both policies were driven by a market-friendly logic to promote competitiveness as a whole, though the latter policy gave more emphasis to firm-level and sectoral activities. All the while state intervention is circumscribed.

Subsequently, chapters 3 and 5 illustrate the implications of historical and contemporary institutional arrangements and inter-organisational conflicts based on social, economic and political phenomena. The state's ability to design and implement ST&I policies is currently constrained by informal relationships, ethnic considerations, powerful sectoral interests, a fragmented institutional apparatus, intense clientelism and the formal requirements of multilateral bodies. The analysis therefore aims to cover specific concerns that existing literature on the political economy of development, governance and ST&I policy has not adequately addressed. In consequence, state capacity is therefore not determined by the size of the polity (see chapter 2 for a review and critique of this literature), or autonomy of bureaucrats, but by the dynamic relations of domestic and international actors and events that influence policy decisions and techno-

economic outcomes. The subsequent section undertakes a brief historical survey of literature that conjoins these areas.

1.2 Literature survey

After the Second World War a period well-known for the emergence of development economics as a discipline, technological change and industrialisation were major concerns for academics. Raul Prebisch, then head of the Economic Commission of Latin America (ECLA), claimed that the division of labour and terms of trade favoured industrialised economies where the majority of manufactures were generated, compared to primary products in which Latin American countries specialised (Prebisch, 1950). Technological dependence was said to have set in as a result where resources gained from primary exports in developing countries were used for imports of manufactured and capital goods at the expense of development of local skills, institutions and industrial capabilities (Cardoso and Faletto, 1979). The lack of entrepreneurial capabilities was also deemed an important source of development problems for poorer countries that resulted in unbalanced growth (Hirschman, 1958). In this scenario, declining terms of trade where exports could not yield sufficient foreign exchange to purchase imports were of increasing concern. Developing countries were often price-takers and driven by demand for energy and raw materials in the industrialised world. Other dependency theorists in the Caribbean area also noticed similar patterns in small economies, that were mono-culture and unable to advance structural changes to achieve higher standards of living, even with self-determination (Best and Levitt, 1969; Girvan and Girvan, 1973). Initial policy conclusions from the structuralist and dependency analyses were pessimistic about the possibility of industrialisation.

In this scenario, the government's role was to provide infrastructure, incentives and basic research (Sagasti, 1973). It required a shift towards new analytical grounds for the value of increased exports and capital inflows in sectors with constraints (Chenery, 1975). It was later believed to achieve economic and social changes in these countries that institutions and policies around science and technology (S&T) needed and this formed an important part of the United Nations work in the so-called Second Development Decade starting in the 1970s (Singer and Cooper, 1970). The answer at that time seemed to be: import technologies, increase spending on S&T activities, or redirect systems of technological production in advanced countries to the needs of poorer states (*ibid.* – similar concerns to the ST&I aspects of the MDGs, as mentioned above). It was proposed at that time that the S&T concerns could be further assuaged with the transfers of financial capital and technical assistance to developing countries (Bell, 2009).

Moreover, the inter-sectoral differences in productivity by the application of technologies embodied in capital formed the basis of Arthur Lewis' two-sector model (Lewis, 1954). Though Lewis' thesis did not neglect the agriculture sector and the historical role it played in the technological development of several advanced countries, he believed that technological change could be induced more readily in the industrial sector (Farrell, 1980; Ranis, 2004). His short-hand for what became learning by doing (Arrow, 1971), was 'learning the tricks of the trade' from foreign investors and other migrant skills that could in conditions of scarcity could help labour-surplus countries deepen their growth process (Lewis, 1954). In this sense, development economists that were influenced by Lewis formed the view that technological solutions imported from abroad would complete the transition from agrarian economies to higher value manufacturing economies.

The policy response was then to promote an industrial sector based on inward flows of technology and supply foreign transnationals with subsidies to incentivise their production (Fei and Ranis, 1974; Pack and Saggi, 1997). Lewis's ideas also had influence further afield across Asia and Africa, and the technology transfer model was further promoted at the United Nations Conference on Trade and Development (UNCTAD) which advocated change in the international dimensions of the transfer, including costs, technical arrangements, information, and their underlying power dynamics among countries (Omer, Soubra and Konde, 2000). An alternative policy approach widely pursued throughout Latin America was import substituting industrialisation that encouraged domestic producers through subsidies and high tariffs on imports to manufacture some capital goods (Bértola and Ocampo, 2012; Hirschman, 1968). Though productive capabilities were gradually achieved in some Latin American economies, they were not pressured to upgrade their technologies and their domestic markets remained underdeveloped. The cost of technologies became too prohibitive and stymied the development of technological capabilities more broadly.

At this time, development economists interested in S&T took a very critical view of the prevailing international order and trajectories of technology that appeared to leave poorer countries behind. Their institutions and productive systems just did not appear suitable to fully absorb S&T or create their own internal dynamic that could make effective use of available technological resources (Cooper, 1972; Stewart, 1972). It was believed that the organisation of power may have also been inimical to changes that S&T would bring about. This remained the case even up to the 1970s when the so-called 'white magic' i.e. Northern technology was an essential input to rapidly develop these countries' manufacturing sectors and the economy as a whole (Girvan, 1978).

By this point, a number of new industrialising countries were showing increased capacity to overtake the Western industrial powers in some key technologies (Pack and Westphal, 1986). South Korea, the province of Taiwan, Hong Kong and Singapore, known as the East Asian ‘Tigers’, followed the path of Japan in technological upgrading and export promotion utilising high levels of protectionism (Kiely, 1998). They represented in earnest different models in technology development, with commonalities in strong state policy, interaction with international networks of buyers and suppliers, their exploitation of reverse engineering (Kim and Nelson, 2000). On their heels were left a number of Latin American and African countries that showed little sign of growth beyond traditional sectors based on absorptive capacity or indigenous innovation (Bastos and Cooper, 1995; Jerven, 2015; Stallings, 2016). This was despite changes in the global economy with increases in commodity prices and the assertive stance taken by the Organisation of Petroleum Exporting Economies (OPEC) during the 1970s to ensure their members had greater control over their destiny (Buzdugan and Payne, 2016)

However, studies emerging from the late 1970s led by Southern scholars, showed differences in productivity and technological mastery among firms that shifted focus from dependence to understand the technological processes and dynamic gains (Katz, 1980, 1984; Lall, 1987). These studies represented greater dynamism in analysis focussed at the sectoral, and some cases the plant or firm level, to understand the processes by which firms develop their own technological solutions. Simultaneously, a similar research programme was underway on Caribbean firms and industries (DeCastro *et al.*, 1985; Girvan, 1983; Girvan and Marcelle, 1990; Odle, 1985). These earlier critics of the structural condition of these small countries adjusted their analyses, while suggesting that the main technological conditions to be overcome were technological dependence, technological underdevelopment and technological dysfunctionality (Girvan, 1979),

drawing on their earlier intellectual moorings. These authors nevertheless maintained their focus on political economy aspects of technological change and integrated such concerns in their analysis from the outset (Fransman and King, 1984; Girvan, 1983). The major outcome was to understand the underlying factors of (non)innovative performance of firms and sectors within various contexts towards ultimately proposing measures that would make effective use of resource endowments, while generating employment, improving economic performance, and society-wide transformation. Thus, these endeavours were meant to produce policy measures and changes that can address the enduring developmental problem of backwardness in ST&I.

This approach became an important part of negotiations at UNCTAD to help increase their technological stock and bargaining position of developing countries vis-à-vis technology suppliers, leading to the calls for a New International Economic Order (NIEO) (Girvan, 2006). However, advanced countries were not inclined to give up their dominant position, utilising a number of tactics and strategies (Sagasti, 2005). The specific concerns and conditions of developing countries however over the years found their voice at UNCTAD, but this period was marked by major global shifts and many of the intended gains did not materialise (Girvan, 2006; Karshenas, 2016). In addition, the simple technology transfer model also appeared to be losing steam with the experience of newly industrialising countries (Dahlman, 2007; Dahlman, Ross-Larson and Westphal, 1987). This period was also characterised by movement towards increased national ownership of raw material production and channels of distribution, though the supply chains for technologies were still resident abroad (Barclay, 2015b; Stewart, 1982;).

However, some scholars claimed that the import-substitution industrialisation would not entirely fulfil the requirements of developing countries, especially those specialising in raw materials and agricultural commodities (Farrell, 1979; Fransman and

King, 1984). Small developing countries too had the added concern of exploit external markets and limited bargaining power as their domestic demand and transaction volumes were far too small (Farrell, 1979b; Girvan, 1983). But a policy perched solely upon ‘technological transfer’ and national ownership would not suffice, without simultaneous procurement of the tools, skills and institutional arrangements for the development of technological capabilities and exporting product markets (Bértola and Ocampo, 2012; Farrell, 1979a). This period however emboldened national populations to demand the creation of national institutions and offered much hope to develop knowledge base, relevant infrastructure aligned to shifting the productive structure of these less advanced economies (Cooper, 1980; Bell, 2009). Enduring institutional and political investment in the predominant ISI project, along with forces in the world economy, both nevertheless limited their effects on technological development (Bell and Pavitt, 1993; Perez, 2003).

Increased external pressures on developing countries at that time increased the prospects of economic instability triggering a debt crisis in many developing countries at the beginning of the 1980s. The material and social consequences of the debt crisis and drastic change in economic conditions ushered in new development thinking associated with the Washington-based international lending agencies, namely the World Bank, International Monetary Fund (IMF) and to a lesser extent the Inter-American Development Bank (IDB). All of these agencies proceeded to offer loans and adjustment packages to developing countries to promote macro-economic stability, and by consequence encourage an ‘implicit’ policy with wide-ranging and uncertain technological effects (Narula, 2014). The basis was the ‘neoclassical synthesis’ that dictated that markets were the best way to organise economies and government intervention was only required to provide a minimal regulatory framework to improve social ties, information flows and poor-performing institutions (Fine and Saad-Filho,

2016; Lapavitsas, 2005). This approach coincided with a shift to pure macro-economic objectives of technology policy among advanced and industrialising countries as a means to achieve technological dominance as compared to military concerns just after the Second World War (Mowery, 1994). In other words, as states transformed their approach to intervention with markets and firms at the centre, growth would be restored and markets would function well enough to deliver the appropriate technological gains. This had profound effects on how state-society relations evolved in relation to financial markets. The new policy imperatives ushered in a period of 'new' growth in some poorer countries based on existing comparative advantages, such as commodities seemingly that were already capital intensive (Kiely, 2005). On the other hand, larger middle income countries which experienced sustained growth and sectoral expansions, especially China which did not follow the new 'rules of the game' (Kaplinsky and Messner, 2008; Radosevic, 2009; Saad-Filho, 2014).

Even as some developing economies experiencing growth without productivity-enhancing structural changes, a competing model was emerging, based on evolutionary economics and institutional theory, known as the National Innovation Systems (NIS) (Freeman, 1987; Lundvall, 2010). Led by the OECD and Northern based scholars, the NIS was initially centred on the successful industrialisation of Northeast Asian countries which possessed strong linkages among firms, international networks, demand in foreign markets, institutions, and their productive sector (Freeman, 1987; Lundvall, 2007; Sharif, 2006). At the top of the hierarchy with mature 'systems' in terms of performance remained the United States, Nordic regions, East Asia, then the intermediate NISs like Israel, Ireland and the so-called BRICS (Brazil, Russia, India, China and latterly South Africa) (Brezntiz, 2007; Cassiolato and Vitorino, 2011; Nelson, 1993; Taylor, 2016). As a result, this construct has been used to both prescribe ideal-type institutional changes,

evaluate policy interventions, and determine a country's innovation performance often based on patent citations and R&D expenditure (Fu, Pietrobelli and Soete, 2011; Lee, 2013a; for a critique, see Bell, 2009; Bell and Figueiredo, 2012).

Problems emerged as the empirical realities of developing countries often contrasted with the advanced industrialised countries where it shows technological capabilities accumulate over time (Bell and Pavitt, 1993; Ritchie, 2005). They also vary with their political, economic and social structures that stimulate or hamper structural changes in a developing country, even if some countries attempted to adopt similar institutional forms (Khan, 2010b). Property rights structures may also evolve with and become more affordable in later stages the industrialisation process (Chang, 2011). Earlier insights by development economists working on technology policy were also ignored altogether (Cooper, 1972; Girvan, 1979; Herrera, 1972; Stewart, 1982). These institutional features were not necessarily seen as variable from the region to region, given their structural position, independent of those countries after which the NIS was modelled, rendering the framework of limited relevance (Delvenne and Thoreau, 2016). Society, the nature of the state, and politics were equally taken as given variables, across context and time (Bell, 2009; Girvan, 1983; Jessop, 2015; Migdal, 1988). NIS thus explained these anomalies by suggesting that myriad weaknesses in institutional systems were prevalent in less developed regions, and these had to be dealt with in order to improve S&T performance and capabilities (Cimoli and Dosi, 1995; Lee, Juma and Mathews, 2014).

Despite these apparent weaknesses, the approach along with its overarching governance model has been adopted and widely disseminated throughout the developing world as an analytical and prescriptive tool that seeks to help developing countries adjust their systems to become better innovators (Lundvall, 2007; World Bank, 2010). In

addition, institutional economics has been the predominant theory used to understand how political and economic institutions, including formal and informal mechanisms, matter in governing resources for economic development (North, 1990). The World Bank, IDB and UNCTAD, and a lesser extent the IMF, have all come to adopt the NIS in their operations and policy advice agendas with similar strands of knowledge, varying emphases and interpretations (North, 1990; for a discussion on the continuities with NIS, see Edquist, 1997; Nelson and Nelson, 2002) . Recognising that developing country innovation systems, almost in ahistorical analysis were different and evolved along different lines much more attention was paid to governance and policy design (Chaminade and Padilla Pérez, 2016). This has been done at the expense of explicit analysis of state-society interactions as a purposeful determinant of ST&I policy and economic outcomes. To a large degree, both the NIS and market-driven models have been additive and mutually reinforcing assigning emphasis for circumscribed state intervention to address institutional deficiencies from the imaginary norm, as a way to reverse underdevelopment.

The foregoing section offered a brief overview of the debates in the development and innovation literatures regarding policy for technological change. Much more in-depth analysis of their cleavages, main arguments, and origins will take place in the next chapter, and policy implications of these institutional theories will be critically examined thereafter. These policy and empirical starting points give insight into the thinking of economic development centred on the idea of ‘state capabilities’ and its complex relationship to technological change and development. It is an effort in more interdisciplinary understanding of these dynamics (Jessop, 2015). This research attempts to unpick some of the latter theoretical offerings and propose new pathways by building on a political economy reading of institutions and technological change in line with an

embedded state-in-society approach. Much of the large body of literature on technological change tends to gloss over important political and social characteristics of small developing countries in particular (Briguglio, 1995), by either extending empirical insights of large cross-country econometric studies to small ones (see chapter 2 for a methodological critique of these small studies), often considered ‘anomalies’ or ‘outliers’ but nevertheless deriving policy implications therefrom, or ignoring them altogether (Veenendaal and Corbett, 2014). The rest of the chapter will outline and discuss the research design and methodological procedures, present the main argument, contribution and structure of the thesis that aim to achieve a more satisfactory understanding and answers to the research questions.

1.3 Research design and methodology

The main unit of analysis of the study is the state embedded with other actors in the policy system and society in a developing country (Centeno, Kohli and Yashar, 2017; Jessop, 2015; Kiely, 1998; Migdal, 1988; Mitchell, 1991). According to Migdal, state capabilities include the ‘capabilities to penetrate society, regulate social relationships, extract resources and appropriate or use resources in determined ways’ (Migdal, 1988, p. 4). More recently, Centeno et al. (2017, p. 6) further denote state capacity across four dimensions:

the ability of the state to achieve its own identified goals (implementation), the ability of the state to achieve an ideal set of goals usually determined by an outside party (scope), the ability of a state to impel citizens and other states to do what they may not have done otherwise (relational power), and the organizational competence of the civil servants (quality of bureaucracy).

Rather than a focus on state strength or weakness that can descend into tautology, this research takes a more nuanced approach that aims ‘to investigate the scope for variability in state capacities by policy area, over time, and in specific conjunctures’ (Jessop, 2015).

It delves into understand how politics affect the emergence of coalitions of state and other social actors, the extent of ability to mobilise them, distribute and utilise resources, develop technical capabilities and priorities, instil an overarching vision, and organise the ST&I bureaucracy over time in the context of contradictory forces and power relations.

In this way one could test those particular state capacities with respect to which policy fields and economic sectors are effective in promoting economic performance and over what spatiotemporal horizons of action and in what circumstances they can do so (Jessop, 2015, p. 46).

In developing countries, these capacities are uneven across policy fields and it is important to understand why this may be so (Centeno, Kohli and Yashar, 2017). In particular, regarding ST&I policy, this study has decomposed the policy sub-system as constituting social actors such as bureaucrats, politicians, research scientists and engineers, industry officials, policy advisors, and representatives of multilateral lending agencies that have had greater prominence in policy making since the period of structural adjustment in the late 1980s.

These actors, organisations and coalitions were identified based on the innovation literature (Patel and Pavitt, 1994), and insights of Haggard's methodology (1990), though important modifications of the latter, as detailed by Davies (2014) are utilised. Haggard (1990) notes that policies have distributional effects around which groups, including politicians, ruling parties, sectoral representatives and coalitions of interests mobilise to advance their divergent interests. By deductively identifying the interests of sectors, one can assess the impact of their political capabilities in constraining or enabling the ability of state actors to pursue certain policy objectives. Davies (2014) further suggests that normative claims by sectoral interests and actors are not themselves value-free and without ontological presuppositions. Therefore, they must be contextualised to arrive at the meaning of various truth claims. As such,

Where experts seek to hide or forget such presuppositions, or deny normative or political dimensions of their actions, this type of excavation acquires a critical dimension in its own right that, like genealogy, brings to light the fluidity, politics and contingency of taken-for-granted types of truth (Davies, 2014, p. 12)

It is thus about breathing life into research participants' subjective views based on historical and contextual grounding with the aid of relevant theory –the starting point of which is a sociological framework (Khan, 2010) . Following the identification of institutional actors, the study specifies the incentives, symbolic identities and material conditions that shape the strategies of these diverse actors (Jessop, 2015). In sum, Davies (2014, p. 23), suggests that adopting a sociological perspective in analysing a critical phenomenon is 'to assume that the causes and meanings of these events are to be found in socio-economic structures, institutions, inequalities and power dynamics'.

As 'a creative process of insight and discovery taking place within a well-established structure of scientific inquiry', social research in large respect is deployed based upon 'logics of enquiry' (King, Keohane and Verba, 1994, p. 12; Hakim, 2000). Jessop (2015) further offers a taxonomy of institutional perspectives, two of which are important for this study: the institutional approach that examines particular institutions, their forms, assemblages, histories, orders and the design of governance arrangements. Second, agent-centred institutionalism evinces how social forces create history, specific institutional arrangements, including actors' interests, identities, resources and orientations, and unearths the scope for deliberate context-relevant action (Jessop, 2015a). Together, this approach goes beyond standard institutional analyses that focus on cognitive abilities and performative roles of rational agents (North, 1990). It instead embraces a heterodox approach, likened to Khan's political settlements (2010), that enables

a more complex analysis, which may put apparently statements about the state into a more comprehensive analytical schema that reveals how the truth value of observations and statements depends on the contexts in which they are made (Jessop, 2015, p. 7).

Based on Migdal's definition above, the focus here is on activities related to designing policy instruments, allocating/obtaining resources, the dynamics of social relations over time, and their implications for present public action. The study thus stays close to the empirical data in analysing these activities and their potential effects and trade-offs based on historical and institutional analysis, thereby enabling the explanation and prediction of phenomena (Frankfort-Nachmias and Nachmias, 1996).

Insufficient attention has been paid to the actual interactions of ST&I actors in a developing country setting, or particularly the 'networks of power' among these multiple actors beyond the state-business binary or the harmonious 'interactive learning' position of NIS scholars (Lundvall, 2010; Lundvall and Johnson, 1994). Thus, how these coalitions are formed, the nature of their relationships, and the process of engagement within the specific institutional environment have been analysed here (see chapter 4). The intensity of interactions and varying influence in ST&I policy making, which can vary from low, moderate, to strong holding power depending on the interest, purpose of interaction, and agency involved (see figure 2.1, in chapter 2). When contextually and historically grounded, these power plays can bring about diverse possibilities and outcomes which will be explained in later chapters (chapter 3, 4 and 5). This 'bounded system' of the study thus comprises different configurations that are qualitatively derived regarding the trajectory of institutional capabilities and their contingent effects (Simons, 2009). All these elements are starting points for that have guided the conduct of this research.

To interrogate how governance or state capabilities have been developed over time in the management of STI policies, ‘such questions deal with the operational links needing to be traces over time, rather than frequencies or incidence’ in other research designs (Yin, 2009, p. 9). According to Hakim (2000) the rigour and contextual focus of case study research permits a thorough overview of a phenomenon and wider causal processes. Other methodologists suggest that ‘knowledge of reality is as a result of social conditioning and cannot be understood independently of the social actors involved in the knowledge derivation process’ (Saunders, Lewis and Thornhill, 2009, p. 115). As such, both practical and subjective considerations were weighed to arrive at fit for purpose strategy (Seale *et al.*, 2006). Therefore, the case study with the aid of a combined institutional and agent-centred approach was the primary research method. According to Yin (2009, p. 4) ‘the case study method allows investigators to retain the holistic and meaningful characteristics of real-life events’. In brief, ‘case studies involve capturing multiple perspectives which are rooted in a specific setting and provide detailed understanding which is holistic and contextualised’ (Ritchie and Lewis, 2003, p. 75).

It must be noted that the conclusions of qualitative research based upon a particular approach proffers that possibilities exist for revision of findings and particular attention to the audience (Seale, 1999). As such, the data gathered was reported in descriptive manner, where themes were drawn based upon the analytical framework outlined in chapter 2. The patterns that emerged among the institutional arrangements, actors and systems of engagement and policy processes were illuminated. Based on the foregoing approach and analytic technique, interpretative logics and lenses were employed to arrive at a systematic empirical understanding (Creswell, 2012). In this respect, the process of gathering evidence from the ‘private’ process of policy-making that highlight the behaviour of policy actors in institutional settings can contribute to

theoretical outcomes (Evera, 1997). Ultimately, case studies assist in developing theory inductively from a variety of data sources (Eisenhardt, 1989; George and Bennett, 2005; Yin, 2009). Thus, a new theoretical departure in the form of the Developmental Governance Capability Framework (DGCF) (see chapter 5),

From this perspective, the representative sampling model based on practicalities starts from the ‘bottom up’ to incorporate ‘general structures rather than single social practices’ (Gobo, 2004, p. 423). Two comprehensive ST&I policy drafts were selected as the basis of analysis from the early 2000s when the process of policy development began to 2015 when the National Innovation Policy (NIP) was drafted, within the context of the economic development strategies of the People’s National Movement (PNM) and the People’s Partnership⁴ (PP) administrations respectively. Additionally, a total number of 47 semi-structured interviews were conducted with key informants and elite participants of the identified groups and agencies over the period January to June 2015 (see Appendix 3). These interests were identified through a purposive snowball sampling, and latterly through referrals by key informants. Potential respondents were first contacted from September to December 2014, to allow sufficient time to consider the interview request and scheduling of appointments. An interview protocol was drawn up based on the extensive literature review previously done, and questions germane to each group were outlined, allowing for spontaneous feedback and elaboration during interview sessions (see Appendix 2). Interviewees were sent a research protocol outlining the aims and guidelines of the research sample of a few questions (see Appendix 1), but not the complete guide to trigger their interest and offer an outline of the research. After several

⁴ The PP was a coalition of parties and civic interests, including the main party, the United National Congress (UNC), the National Joint Action Committee, the Congress of the People, and the Movement for Social Justice.

follow-ups with some of them, and in some cases preliminary meetings, interviews were scheduled.

The study has used several sources of primary and secondary data: government and donor policy documents, elite interviews and historical information gathered at government and university libraries. Visits were also later made to libraries at public agencies and university where repositories for archival data were held, and collected, which formed the bedrock of the historical analysis. In cases where high-level decision makers of the organisation were unavailable, lower level staff members with relevant seniority and experience in a few instances were interviewed (George and Bennett, 2005). Informed consent was also sought from participants beforehand (see Appendix 1), while in-person interviews were recorded appropriately, and relevant notes taken for others' whose preference was not to go on record.

Given that no systematic study of this policy process currently exists, much of the analysis and interviewing was novel, providing useful historical and contemporary background. This was supported in some cases with documentary evidence for verification or to help reconstruct the sequence of events in a more wholesome fashion. Given the potential professional or other risks as well as sensitivity associated with reporting of data in a small society like T&T, to allow for consistency, and to maintain interviewees' privacy, results (see chapter 4) are shared anonymously. Reference is only to the respondent's general area of responsibility or position, like 'state official', 'senior bureaucrat' or 'donor representative'.

Likewise, comprehensive data treatment was carried out to ensure the validity of findings and conclusion drawing from the data. To draw appropriate conclusions and causal inferences on the policies, the method of process-tracing was conducted based on informant testimonies that elucidated the theoretical framework and historical conditions

of the policies over a long period (Vera, 1997). Both elite interviews and documentary analysis provide the basis for process tracing procedure. The method of process-tracing thus

attempts to trace the links between possible causes and observed outcomes. In process- tracing, the researcher examines histories, archival documents, interview transcripts, and other sources to see whether the causal process a theory hypothesizes or implies in a case is in fact evident in the sequence and values of the intervening variables in that case (George and Bennett, 2005, p. 6).

This methodological procedure helped identify the process through which initial conditions passed through and was translated into outcomes, which ensured rigour in the case study analysis (Vera, 1997). These data points trace the activities that led to the present policy agenda (drafted under both political administrations) as well as the emergence / non-emergence of policy coalitions and the exercise of power in the process, and ultimately indicative inferences related to such outcomes.

There were some limits to the data gathering process as key officials and informants were unwilling to provide information, both on participants in the official policy consultation exercises and draft policy documents prepared by the agency responsible for national S&T policy – the National Institute of Higher Education in Research, Science and Technology (NIHERST). However, this limitation was overcome by an appropriate involvement of a number of interviewees, including some other experts who were at the margins of the policy process and supplemented by archival and relevant policy documentation. In this manner, process tracing with the aid of historical data and analysis helped reveal certain casual relations among the process of policy and actors / state agencies' capacity through policy iterations (see chapter 4). Archival data not only provided the context for the policy making activities but also offered important insights into technological projects, the source of technical advice, and institutional changes over

the years. The result is a mapping of the various leading actors, groups and entities in the governance process contributing to ST&I policy design and implementation conceived as ‘networks of power’ (see chapters 2 and 5).

In the final analysis, Khan (2010) suggests that the analysis of development has paid scant attention to the critical issue of relative power of organisations within that society which ultimately affects and is affected by how different rules are enforced. Findings were hence developed based on meaning-making of actors’ recollection of events, interpreting, identifying regularities and patterns in the data, along with the identification of causal flows, inferences and potential propositions for further analysis and elaboration (Silverman, 2013). This process of pattern-matching followed the propositions laid out in the theoretical framework (Yin, 2009) to determine the nexus between the evolution and change in governance capabilities as influenced by the bargaining power and demands apparent in the processes of policy formulation.

Based upon a historical and contemporary assessment, this overarching methodological process provided an effective basis for the project’s findings and their analysis. In this sense, case studies provide a richly detailed ‘portrait’ of particular social phenomena that refine knowledge, and causal processes that are observed based upon previous accounts (Hakim, 2000, p. 60). It was equally important to focus on the minutiae and concrete details of events and processes that played out in order to uncover genuine depth of analysis and understanding (Silverman, 2013). As such it responds to the caution against standard institutional analysis and methodological problems that arise regarding the direction of causality, misreading of empirical evidence where observations made based on expected or known variables in other contexts applied to new ones, or a ‘compression of history’ that generates confirmation bias in certain studies about developing countries (Khan, 2012b; Jerven, 2015). In consequence, the study thus goes

further to understand the influence of structures and configurations which are created and reproduced through interaction of the actors, and representatives of organisations within a dynamic institutional environment.

1.4 Contribution

This research process adopted a state-in-society relational approach given the institutional context, social and economic structure of a small developing country. The study contributes to an under-studied area which can be termed the ‘political economy of technological change’ (Bastos and Cooper, 1995b; Bell, 2009; Fransman, 1984) in the broad field of development studies. By advancing a political economy perspective, it seeks to explain the complex relationship between technological outcomes, policy making, socio-political configurations through history in a developing country (for e.g. Velasco, 2015). The operationalised framework demonstrates the exchanges among the state and several non-state actors involved in policy making and implementation processes define the scope for state action (Jessop, 2015). These agents are either fully or partially embedded in the polity through informal and formal political and economic relations with the state – e.g. transnational enterprises, business groups, scientists/engineers, and international organisations. However, it eschews globalisation discourses about state weakness or irrelevance, or a de-materialised and de-contextualised understanding of institutional change, for more contingent, historically grounded, process oriented view, and their effects (Arora, Romijn and Caniëls, 2013; Gray, 2016; Jessop, 2015; Khan, 2010b; Migdal, 1988; Wade, 2014).

This was accomplished by introducing the concept of ‘networks of power’ to describe these dynamic relationships. In addition, the study theorises and extends existing analyses on the role of transnational elements (Hickey *et al.*, 2015), intermediaries such

as industry associations (Watkins *et al.*, 2015), experts and universities in the governance structure and policy making processes of developing countries (Sagasti, 2013). The concept also incorporates dynamism by identifying specific social structures based upon ethnicity and social kinship ties that are linked to contests for economic and political power. Political competition in the country on the one hand depends on political parties or office holders mobilising particular social identities among the population who have their own material concerns, and more or less marginalised in the formal policy process. Political parties and capitalists are mutually dependent; the latter's productive power and profitability requires state incentives or investment. The resulting rules of engagement have however not favoured technological development in the current period.

In the policy process, these groups possess and exercise varying degrees of authority as determined by access and informal relationships, the 'networks of power' through the emergence and formation of coalitions that can indirectly shape policy preferences of government officials. From this perspective, the dissemination of 'development knowledge' to local actors and policy making entities from multilateral lending agencies is more pronounced, and has material properties and economic effects (Girvan, 2007). The transfer of donor resources to government bodies and non-state actors in institutional formation and policies occupy an important aspect of this process (Hickey *et al.*, 2015). One of the paradoxes that this brings light to is the fact that political actions are personalistic that has a logic of its own to maintain patronage systems, but this interacts with other variables, such as formal requirements of donors and complex interactions, and may be insufficient by itself to explain ST&I policy outcomes, such as appropriate financing mechanisms for firms that may draw upon donors' knowledge. Additionally, while this state support of projects with the appropriate capabilities can prove determinative in some instances, the overall economic structure and efficacy of

overarching frame of reference of policy makers, and the inadequacies of the policy model in use (for e.g. innovation systems or import substitution; see chapter 2 for a critique of NIS) can help determine the level of technological dynamism at a micro level (chapter five gives a more detailed discussion of implications).

The historical evidence illustrates that successful examples of R&D projects were initiated and even produced but did not stand to be diffused or create sufficient market demand (chapter 3 shows this in the context of the agriculture, telecommunications, natural gas and steel industry). This was either due to outright intervention by external, internal struggles and withdrawal of support, policy shifts, changes in political and economic conditions, and in some cases ‘benign neglect’ of the value of these innovations. The experience of the late 1980s proved definitive in terms of policy shifts to macro-economic concerns, and generates the second paradox whereby after three decades of such market-promoting policies have had limited effects on stimulating new technology-intensive growth sectors. It is because in part that market liberalising policies aim to impersonally re-direct resources and transform state capacities, in particular away from so-called ‘picking winners’, with less emphasis on state coordination and collective action, to cross-sectoral horizontal policies.

In the process, they have created more complex, hidden and intense forms of clientelism. Pre-1980s coalitions were disbanded or undermined, and the state pursued other objectives that also had widespread economic and social effects linked to the under-development and under-utilisation of ST&I infrastructure and institutions. They also entrenched dependence on external funding and sources of knowledge, as local actors may have been deemed less capable by state and donor elites to execute certain policy actions. During this period, international actors came to exercise greater influence on policy-making, in which ST&I was not a specific focus, as opposed to developing or

reconfiguring appropriate state capacities for developmental coalition-building purposes. These experiences suggest that ST&I policy concerns, even when deliberate or latent, need to be much more contextualised rather than based one-size-fits-all governance arrangements that view society as a black box, or assessed on necessarily a homogenous criteria and capabilities, with little attention to their political implications and histories.

The distributional effects are thus instigated by the pursuit of various goals, the exercise of organisational power, and the interactive nature of the policy environment. These relationships are evinced by various unsuccessful efforts at forming coalitions and effective information channels since the 1990s to the present – under Vision 2020 (People’s National Movement – PNM regime) and the Medium Term Policy Framework (2010 to 2015 under the People’s Partnership) (see chapters 3 and 4). Equally, the production and exchange of knowledge also matters which may structure the relational dynamics differently among participants and organisations. Knowledge production in this respect is dominated by the IDB and its agents. These effects can be directly and indirectly determined in the policy inputs and the associated transfers from political office holders or donors, but not always noticeable, except through practices such as hiring and appointments to relevant state bodies and overall institutional design.

This thesis therefore argues that there are socio-political, technical and structural contradictions of ST&I policy processes encapsulated as an analytical framework for understanding T&T’s experience, have been hitherto not well accounted for within extant frameworks and analyses. These rigidities are endogenous to development processes. Unlike the NIS and mainstream institutional theories, the proposed Developmental Governance Capability Framework (DGCF) does not tend to equilibrium across time, but generates a dynamic analysis of institutional paths and possibilities (see chapter 5 for an elaboration). The DGCF approach offers analytical tools to understanding the processes,

capabilities, and resource mobilisation efforts among the bureaucratic, political, knowledge and productive systems aimed at driving the development process over the long-term in T&T. They consider the specific possibilities of integrating ST&I policy process with broad-based developmental goals that require democratic input. The thesis shows that future public action can nevertheless be guided by historical experiences and institutional configurations so designed or modified over time, and may in fact require social mobilisations and new coalitions among interested social actors to promote governance capabilities and re-defined interventions.

1.5 Organisation of thesis

The thesis is structured in such a way to respond to the research questions indicated above, and progressively take account of the historical and contemporary evolution of state capabilities in ST&I policy. It thus develops the argument and novel pathways over five subsequent chapters following the introduction. Chapter *two* assesses the relevant theoretical literature, namely institutional economics and innovation systems, size and state capacity and outlines the contours of a ‘political economy approach to technological change in developing countries’. It offers a relevant analytical device in ‘networks of power’ given the prevailing configuration in the ST&I domain. Chapter *three* offers an historical analysis of the country’s development experience linked to the evolution of state-society relations and impact on its institutional development and techno-economic outcomes. It highlights these dimensions to understand the organization of S&T, and emergence of S&T institutions in the national polity. Chapter *four* critically evaluates two specific policies formulated between 2002 to 2007 and 2010 to 2015 in T&T. It analyses the critical conjunctures and institutional context of policy design based on the analytical tool proposed in chapter 2. Chapter *five* contains a discussion of the

findings and elaborates the DGCF heuristic for STI-oriented development strategies.

Chapter *six* summarises the thesis, its limitations, suggests pathways for future research.

CHAPTER 2 – STATE CAPACITY, POLITICS AND TECHNOLOGICAL CHANGE: A THEORETICAL FRAMEWORK

‘Technological determinism is contradicted by a great deal of historical evidence that the character and direction both of scientific progress, and of technological change, are to a large extent socially conditioned. Major influences have been the structure of power and the objectives of the powerful, within and between nations: the resource endowments of dominant nations, war, general political and social choices, as well as (apparent) serendipity. Hence, we share the view that technological change should be seen as a social process, whose relationship with social change is one of continuous and dialectical interaction. A minimum requirement of the analysis of this process is a framework that identifies the principal actors or forces involved in TC and the relationships among them’ (Girvan, 1989, p. 113).

2.1 Introduction

This chapter undertakes a more in-depth exposition of the relevant theoretical debates and insights, and attempts to excavate a political economy perspective of ‘state capabilities’ as an area of inquiry. It seeks to demonstrate its usefulness in the ST&I policy realm as a variable in developing countries that evolves over time relative to technological changes and social transformations. Each section contains a brief discussion of the principal concepts used in the study and their definitions – transaction costs and institutions, economic smallness and vulnerability, state capacity, coalitions, and innovation, as they have emerged in the literature. This contextualises and clarifies these issues to understand their currency, related debates in relation to overall aims of the study i.e. to understand the dynamics of state governance and its effects on technological progress over time, and vice versa.

First, it reviews the new institutional economics literature, and assesses its shortcomings relative to analysing dynamic social organisation in developing countries. It proceeds by examining the innovation systems model, formulated in the 1980s as the popular ‘institutional’ construct to devise ST&I policy in both developed and developing

countries. It moves to assess the state capacity in relation to small societies drawing upon mainstream literatures on innovation governance, economic vulnerability and development. A methodological critique of this literature is then proffered. Subsequently, it offers a political economy perspective to the dynamics of state capabilities perched primarily on the state-society relational and the political settlements framework as a relevant theoretical departure from mainstream analysis of institutions and governance structures.

Moreover, it expands upon political settlements approach to suit the realities of small, open and highly contested political environments. The chapter ends with an analytical model: ‘networks of power’ to understand the variegated and multi-actor nature of ST&I policy processes, and the dynamics of social relations in a contemporary developing country. With this in mind, this concept looks specifically at the power of the state over time in relation to other factors, including technological accumulation and agents across national institutions, and the international political economy that influence the state’s ability to develop a broad-based productive economy.

2.2 New Institutional Economics and its successors: an assessment

This first section summarises the key concepts of ‘transaction costs’ and ‘institutions’ from the work of new institutional economics in the tradition of Douglass North and his followers. These constructs have had implications for understanding the state and the evolution of institutions over time. This branch of social science literature emerged in the 1970s to explain the relative economic position of countries over different periods of time which can be termed the ‘first generation of new institutional economic’ (NE1) models. With structural development economics approaching its so-called impasse (Tucker, 1999), North was well situated to extend on mainstream growth theory, which

up to that point regarded savings, resource endowments, capital investment as the causes of growth with technological progress viewed as an exogenous factor. In effect, North became the doyen of this school of modern institutional theory of economics.

His preoccupation however was not about the so-called developing world, but centred on reinvigorating analysis on the dramatic rise of Europe as a the centre of world development (North and Thomas, 1973). Despite this obvious limitation, they suggested that the causes of growth that Solow and others identified i.e. education, capital and savings do not represent the fundamental causes of growth but ‘are growth’ (North and Thomas, 1973, p. 2). Scarcity, competition and methodological individualism were however retained from the earlier neoclassical approaches to growth. In his NIE1 formulation, North accorded ‘institutions’ as the missing element, and the main causal variable in performance of economies over different periods of history (North, 1987, 1994). Using a positivist method to trace economic history and understand why some countries became rich compared to others, North identifies the costs of transactions as a reasonable cause for investment decisions to enact new institutions (North, 1987; North and Thomas, 1973).

Following Ronald Coase, the emergence of efficient markets is only believed possible with the absence of transaction costs – which are identifiable as all the costs incurred from the functioning of an economy. Further delimited, they

are the costs of specifying and enforcing the contracts that underlie exchange and therefore comprise all the costs of political and economic organisation that permit economies to capture the gains from trade (North, 1984, p. 7).

In this sense, the economic system primarily comprises markets and individual actors engaging in different types of transactions. In such a situation individuals trading professional skills such as lawyers, doctors and accounting are costs associated with the efficient running of markets. North estimated that in 1970, the costs of such transactions

were between 45 and 50 per cent of gross national product (GNP) in the United States and in other advanced economies (North, 1984, 1987). Institutions were considered the structural properties that permit or constrain such transactions occurring, among principals and agents (North, 1984). From this perspective, North defined institutions as

the humanly devised constraints that structure human interaction. They are made up of formal constraints (e.g., rules, laws, constitutions), informal constraints (e.g., norms of behaviour, conventions, self-imposed codes of conduct), and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies (North, 1990, p. 3).

Williamson further identifies a number of costs associated with exchanging information and producing a good or service, including the intermediate and auxiliary activities that are involved in production and exchange (Williamson, 1979). The contract drawn up is the tool for facilitating transactions and ensuring the appropriate governance framework for economic activity. Institutions are thus a hierarchical formation of human interaction (North, 1984).

Fundamentally, in North's analysis, the political and economic institutions that are consonant with a market economy are seen as critical to technological and economic development. In this way, property rights are deemed the most important economic institution in market exchange and productive activities, underlying the entry and enforcement of contracts among participating individuals (North, 1984). North, however, separates the legal, political and economic aspects of markets as a way of defining the costs of exchange within particular institutions. These rights conferred on the individual are based on assets or opportunities which can be exploited and exchanged to generate income. Bargaining among individuals and enforcement regarding an institution in a particular society occurs at pareto optimal levels as agents negotiate changes to institutions (and side payments) to achieve the best possible outcomes for society (North,

1989). As such, such rights provide the incentives for individuals to engage in production and innovative activity. Individual entrepreneurs thus depend on secure property rights as benefits are to be distributed according to one's effort (Acemoglu, Johnson and Robinson, 2005; North, 1995). Property rights are equally the legal articulation of the agreement defined by the political system that can be determined when conflicts occur, and these rights are protected by juridical system (North, 1994).

Therefore, property rights based on a transaction cost analysis may lessen the possibilities of conflict, and induce cooperation among agents towards more efficient and economical means of exchange (Williamson, 1985, 1994). As the economy grows, institutions also evolve as a result of entrepreneurial and individual decisions that alter the underlying contracts, and set new property rights in their place. Individual perceptions or 'mental models' are critical to navigating these transactions and thus aggregate to have wider economic effects, including increased competition. Incomplete information and the 'bounded' rational nature of human beings as seen in their mental maps of the social world, or cognitive abilities, is what makes institutions necessary and costly (North, 1995). This principally engenders North's ideas about instrumental learning and the cognitive abilities of individuals as the basis of institutional evolution in a given economy over time (North, 1994). Thus,

mental models are the internal representations that individual cognitive systems create to interpret the environment; institutions are the external (to the mind) mechanisms individuals create to structure and order the environment (North, 1994, p. 363).

When these mental maps in turn shift, more complex contracting relations are formed where impersonal systems of exchange, formal rules and property rights become endemic, and evolve in a given society to generate better economic performance. In firms, individual entrepreneurs will therefore use and generate the most efficient technologies

necessary for production whose products can be traded without hindrance across geographical boundaries. Individuals are said to make the best decisions about production in their allocation of resources to achieve pareto optimal outcomes.

These formative insights enabled North and others to develop an explanation of the performance of economies and the behaviour of economic and political agents that influence economic growth and development. The ‘second generation of NIE models’ (NIE2) started from the early 1990s with the publication of his magnum opus *Institutions, Institutional Change and Economic Performance* giving more explicit attention to the situation of developing countries (North, 1990). The economic problem of scarcity, the need for market-derived prices, and competition in efficient markets are the main organising principles of North’s theory of institutional change (North, 1995). Relatedly, the efficient markets hypothesis based on price signals associated with neoclassical economic theory forms the basis of North’s assessment of economic developments across time and space. The route to Western-styled economic development is can therefore be driven by enforceable and secure property rights such as ‘formal contracts, bonding of participants, guarantees, brand names, elaborate monitoring systems, and effective enforcement mechanisms’ (North, 1995). This resembles in part the Rostowian view of economic modernisation as a staged process through which all countries eventually pass (Rostow, 1959; for a comparison with market-friendly approaches, see Kiely, 2005).

There are two levels of analysis in North’s approach, namely the formal contract-type or rules aspect, and the informal aspect, such as modes of behaviour and culture also understood by individuals’ mental capacities (Nabli and Nugent, 1989; North, 1995). Since developing countries lack the requisite property rights and advanced mental models, they are deemed poor performers. They engage in inefficient and unproductive

practices that do not bring about prosperity (Acemoglu, Johnson and Robinson, 2001; North, 1990). The approach was thus primarily concerned with how institutions emerged in different societies, using advanced industrialised countries as an ideal-type, and their effects on the mode of capital accumulation driven by technological progress across countries.

Consistent with these early insights, from the early 2000s, others followed suit devising a third generation of new institutional economic models (NIE3) by creatively using historical data to explain how different types of institutions emerged and become entrenched in now developing countries. Daron Acemoglu, Simon Johnson, and James Robinson in a celebrated paper, take this argument to the historical origins of colonialism and the presence of property rights defined by different colonial regimes (Acemoglu, Johnson and Robinson, 2001). In essence, countries' development was determined based on colonialists' settlement patterns which resulted in growth-enhancing property rights or wealth extraction. Taken a step further, this formulation offered an explanation of the long run effects of political and economic institutions on technological improvement and productivity in countries where Europeans settled (Acemoglu, Johnson and Robinson, 2005). When countries became independent the types of institutions that emerged were as a result of these settler relations that encouraged certain types of productive activities, and affected the emergence of market economies.

The presence of markets endowed with property rights and effective representative politics therefore encourage the adoption of efficient technologies, individual entrepreneurship, and long-run prosperity (Acemoglu and Robinson, 2012). Similarly, North and Wallis (1994) explained that the interaction between technological change and institutions. Over time, as technology improves and new production

possibilities are achieved, costs need to be reduced as much as possible (North, 1995; North and Wallis, 1994). Additionally, costs associated with the increased hierarchisation of organisations are believed to be an impediment on economic growth, productivity (or the gains from trade) and social welfare (Acemoglu, Johnson and Robinson, 2005; North, 1990; North and Wallis, 1994). From this perspective, essentially only the fittest market actors survive and can benefit from monopolistic advantages (Schumpeter, 1934), which are critical for future research and development investment.

The argument is further developed along political lines. In effect, it comes down to political choices and the preferences of leaders with power in different societies (Acemoglu and Robinson, 2000). In this model, incumbent elites are faced with a dilemma: whether to adopt efficient and growth-promoting institutions and technologies, or not. It is for fear of losing economic and social power that elites decide not to invest in or utilise the most advanced technologies or undertaking opportunity-generating ventures (Acemoglu and Robinson, 2006; Solimano and Avanzini, 2012). The preferences of the politically powerful matter in the type of market institutions and arrangements that are put in place to ensure the adoption of new technologies have a positive effect. Once again they suggest that capitalism was more successful, for example in Europe compared to the Soviet Union because land owners were freer to operate due to the credible threat of expropriation by the Soviet state (Acemoglu and Robinson, 2000). In monarchies, for example, it is less likely that such countries would adopt economic strategies where their interest in maintaining political power is challenged irrespective of the loss of economic rents. In consequence, one set of interests had more to lose given the structure of power in the particular polity. For them, it thus followed that the type of political regime mattered for growth strategies and their success.

In contrast, democracies with a modern market system are able to provide the *right* kind of incentives that spur institutional changes and favour new technologies, because a fairer distribution of economic advantages is achieved by both the politically powerful and the working population who had the franchise at the time (Acemoglu and Robinson, 2006; Aghion, Alesina and Trebbi, 2008). After the fundamental establishment of democratic institutions and political checks and balances on government, merchants and other capitalists were able to act as a counterbalance to European states, and demand changes to secure property rights across the Western hemisphere (Acemoglu, Johnson and Robinson, 2005). Mokyr (1992, 1996) therefore summarises the ingredients of economic growth as free markets that offer opportunities for specialisation, law and order, allocative efficiency, trust, as well as those that gave rise to productivity growth and prosperity. For this to happen, formal political institutions must fulfil their role in providing the conditions for actors to operate seamlessly and to increase wealth. Any disruptions to the democratic political norm create conditions in which firms suffer and the ease of trade and profit-making cease to have cumulative positive effects on society. If backward institutions persist, then the buck stops with the oligarchical elites who distort the equilibrium, and resist appropriate institutional changes (Acemoglu, Johnson and Robinson, 2005).

In relation to in developing countries, to what extent these theoretical insights offer an understanding of technological catch-up and growth? In this regard, Juma (2016, p. 13) is definitive: ‘The developing world has the potential to access more scientific and technical knowledge than the more advanced countries had in their earlier stages of industrialisation’. Adopting a similar interpretative framework of analysis to Acemoglu et al., he further suggests that political leadership is at the centre of technological expansion, underpinned by democratic accountability, transparency and citizen participation based

on sound advice (Juma, 2016). Thus, a ‘good’ set of institutions is equivalent to what Acemoglu and Johnson (2012) call ‘inclusive’ institutions in a democratic context which most advanced economies in Northern, Western Europe and North America adopted. By contrast, most developing countries primarily located in sub-equatorial hemisphere in Latin America and Sub-Saharan Africa carry ‘extractive’ institutions which elites use to profit from society. In this manner, Aghion et al., (2008) find that the further away a country is from the technology frontier, democracy is more inhibiting for competition and technological innovation. Thus, those who support certain incumbent technologies can use government power to resist innovations (Mokyr, 1992). Similar arguments have been advanced to explain the so-called technological backwardness in Latin American countries, where the economic and power structure encourage rent-seeking impulses and domestic conflicts (Cimoli and Rovira, 2008; Taylor, 2016).

In contrast, utilising a ‘neo-developmental’ state theory Breznitz (2007) contends that policy elites in Israel, Taiwan, and Finland, were able to determine the direction of science and technology-based industrial development. These studies emphasise that the structural conditions of global production provide constraints and opportunities for some countries with different political institutions and decisive policy champions. Diverging somewhat from the mainstream literature that emphasise free markets, and the relationship between political institutions and technological innovation, Breznitz nevertheless purports that corruption and political contestation appear harmful to innovation (Breznitz and Ornston, 2016). Despite the fact that in some East Asian countries corruption was rife but did not undermine technological development process (Khan, 2004b). Breznitz and Ornston further argue that these countries progressed due to ‘peripheral’ bureaucratic agencies with small budgets that limited rent-seeking

opportunities and political conflicts to promote innovation in IT sectors (Breznitz and Ornston, 2012a; Taylor, 2016).

The counterfactual is suggested that so-called political interference increases as agencies become more prominent or increased innovation budgets are created. The type of political regime in the newly industrialised countries mattered. Underpinning these formal state institutions is the adequate level of *de jure* power in a democratic society to direct economic activities towards more productive and innovative outcomes (Acemoglu and Robinson, 2012). For Juma (2016) policy making needs to account for what is termed ‘inclusive innovation’, in which capacity building, private sector partnerships, management of intellectual property, all of which can spur the socio-cultural transformation. First acknowledging the inadequacy of free market, democracy and certain institutional arguments, Taylor (2016) posits that rather formidable and credible external threats obliged elites to create and invest institutions that are seen as menacing to their interests. Rather, it was ‘creative insecurity’ that creates the right competitive environment in which external threats outweigh internal struggles and thus encourages greater internal harmony to invest in technological progress (Taylor, 2016).

In this framework, competitive pressures between developing countries and other societies may offer opportunities for the former to ‘open up’ to induce new organisational models and productive activities. The capacity for developing countries to make the transition, or not, to open market competition can be therefore contingent upon changing conditions and the behaviour of a number of entities. Among them include institutional or policy experimentation, importing institutional models, international pressures, inducing use of technologies especially mobile communications, new joint arrangements with multinational enterprises (Breznitz and Ornston, 2012, 2016; North, 2007).

Successive theoretical formulations of the NIE appear to stay true to neoclassical roots of competition, efficiency, individual rationality, connected to idealised and partial perspectives about politics and the state (Gray, 2016). These NIE models present a circular argument about the possibility of economic modernisation in developing countries – one that sees them moving towards open markets - superficially engaging critically with their diverse historical and social situations (Kiely, 2005). It starts by considering developing countries as ahistorical ‘natural states’ juxtaposed to advanced countries – as if institutions of colonialism, nationalism, marketisation had not occurred, or were themselves not embedded transformative vehicles of power relations over space, time and stages of development. Even Acemoglu et al.’s theory about colonial settlement is solely about property rights, and not about the effects on social interaction and state formation (Khan, 2012a). The state receives very little historical analysis in these formulations, supplanted by ‘institutions’ aligned to markets deemed sufficient to allocate resources, promote competition, and trigger technological development. Technological change in this view is about getting the politics right as opposed to understanding the politics and social relations that underpin developmental processes. The chapter next interrogates the ideas of ST&I and unpicks the dominant vision of technology promotion in the ‘innovation systems’ school, as well as continuities and differences with North’s institutional analysis.

2.3 Innovation systems in developing countries: the limits of conventional analysis

This section focuses on the historical rise of the innovation systems concept as a tool of analysis and of development policy more recently. In classical economic thought,

the importance of scientific knowledge and technological resources were acknowledged as important for creating wealth and driving productivity. Karl Marx, Joseph Schumpeter and Friedrich List all expressed interest and views on the relation between science and capitalism writ large. In Marx's view, scientific discoveries were linked to the production process, whereby science formed a fundamental basis of technological change within a capitalist economy (Cooper, 1972c; Rosenberg, 1982). Marx recognised that the productive power of labour and the productivity gains made therefrom created compulsions for a distinctive and dynamic form of capitalism to emerge. The social relations between labour and capitalist production led to the emergence of new capitalist class structures. According to Marx and Engels:

the bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together (Marx and Engels, 1988, p. 65 [1848]).

The use of machines in factories and manufacturing processes created this link and produced the ink dye and paved the way for the chemical sciences. The demands of capitalists also shaped the scientific trajectory where new skills were developed and the division of labour became more streamlined (Cooper, 1972). Friedrich List's writings support this view. As such the power of science took on particular characteristics in the capitalist economy:

There scarcely exists a manufacturing business which has no relation to physics, mechanics, chemistry, mathematics or to the art of design, etc. No progress, no new discoveries and inventions can be made in these sciences by which a hundred industries and processes could not be improved or altered. In the manufacturing State, therefore, sciences and arts must necessarily become popular (List, 2001, p. 162 [1841])

Subsequently, Joseph Schumpeter considered the father of evolutionary economics asserted the process of technological process as discontinuous and leading to gales of 'creative destruction' with multiple equilibria (Schumpeter, 2013 [1919]). In this sense,

science does not follow a linear progression where investment in basic research leads automatically to technological development (Mowery, 1994; Rosenberg and Kline, 1986). In many instances new technologies precede new scientific discoveries or the production of new technical knowledge. Thus, scientific advance is not by itself a sufficient condition for productivity growth, nor is the converse true, that resource productivity is the only necessary factor in the emergence of capitalist institutions (Rosenberg, 1982). In sum, the relationship between science and industry was indeed dialectical and clearly shown in the rise of capitalism in the 19th century Britain (Rosenberg, 1974). These insights imputed models of the innovation process based on competition among interlinked forces.

Despite these important insights made by political economists and economic historians, much of the post-war investment concentrated on promoting scientific research in universities and government laboratories, increasing the supply of skilled human resources, with some funding for major R&D programmes in companies based on a linear conceptualisation (Rothwell, 1994). This in effect constituted a supply-side approach to public policy for innovation, especially in advanced nations (Mowery, 1994). The investment in basic research argument took on new dimensions, where one scholar posits that the 'economic value' of scientific research comes about when the knowledge output can be applied to a practical problem (Nelson, 1959). Nelson further argues that productive firms hardly expend resources on research since the private benefit does not outweigh the positive social effects. In fact, the main objective of basic research is to generate models and theoretical explanations of natural reality (Pavitt, 1998).

In addition, serendipity in the process of scientific enquiry can lead to new knowledge. As a consequence, science came to be viewed as a public good that is non-

excludable and non-rivalrous. These insights led to changes in the institutional arrangements that undergird ST&I policy during the 1970s, with the advent of Ministries of Science and Technology throughout the developing world (Bell, 2009). The policy direction that has produced the emphasis on university research however has led to the over-production of patents, and less focus on the uses of science and its links to industry and societal value (Caraça, Lundvall and Mendonça, 2009). The resulting mismatch between basic scientific exploration and the needs of the economy and industry further entrenched political divisions, ideological stances and the rule-making activities of governments. In the 1980s, these contradictions were expressed and emphasised in smaller budgets, state withdrawal in aspects of the scientific enterprise (Partha and David, 1994). Such debates occurred in the United States, which already had a well advanced scientific community, and close linkages between science and industry and further spread to other regions (Mowery, 1994). Based on this brief historical account, the advancement of science and industry are essentially linked to the demands of industry, on-going economic and demographic changes a society is experiencing at any period of time (Pavitt, 1998).

With the ascent of new capitalist states in East Asia in late 20th century, new conceptualisations of technological progress were proffered based the building up of capabilities in the use and transformation of new technologies (Hobday, 1995; Kim and Nelson, 2000). The innovation systems approach was therefore modelled after the East Asian experience. Scholars recognised the increased linkages and interactions among public and private actors and institutions in the innovation process (Edquist, 1997; Freeman, 1987; Lundvall, 2010 [1992]). The ‘innovation systems’ proposition (see Box 1 for definitions) started from the experience of industrialised nations in Europe, and the fast industrialising East Asian states, in particular Japan.

During the 1950s, Japan was overtaking the United States in the production of new technologies, especially electronics, facilitated by adaptive production and managerial systems (Andreoni, 2016). According to Freeman (1987), the main components of an innovation system included a strong state, educational and training systems, sophisticated financial capital, and a host of other institutional and political arrangements. They were all critical to enable a well-functioning system that generated new technologies; a proposition that shed light on what was going wrong in other slowing advanced economies in Europe (and far worse the developing world). A series of case studies on innovation systems in the advanced economies proliferated to illustrate the mature systems (Western Europe, United States, and now East Asia), compared to those with linkage problems and underdeveloped educational, research and development (R&D), and financial systems (Latin America and parts of South Asia) (Nelson, 1993). It was then the role of policy to strengthen the linkages of the overall system to improve the quality of interactions in the innovation process in these laggards (Lundvall and Borrás, 2005). In the former, strong policy measures and incentive mechanisms were also in place to allow the commercialisation of new technologies, their so-called international diffusion. This created the conditions for knowledge flows among various institutions to stimulate ‘interactive learning’ between producers and users of knowledge, and a more effective innovation process (Lundvall, 2010).

Box 2.1 National innovation systems: definitions

Author / year	Definitions
Freeman (1987)	‘the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies.’
Lundvall (1992)	‘the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state.’
Nelson, (1993)	‘a set of institutions whose interactions determine the innovative performance ... of national firms.’
Patel and Pavitt (1994)	‘the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country.’
Nelson and Rosenberg, (1993)	‘The set of institutions whose interactions determine the innovative performance of national firms’
Edquist and Lundvall, (1993)	‘The national system of innovation is constituted by the institutions and economic structures affecting the rate and direction of technological change in the society’
Niosi et al. (1993)	‘A national system of innovation is the system of interacting private and public firms (either large or small), universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, in as much as the goal of the interaction is the development, protection, financing or regulation of new science and technology’
Metcalf (1995)	‘that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies.’

Compiled from (OECD, 1997, p. 10)

In essence, the framework developed from combined theoretical starting points in evolutionary theory of the firm (Nelson and Winter, 2009) and later aligned to institutional economics (Nelson, 2002; North and Wallis, 1994). Nelson (2002, p. 19) recently declared the meeting points of both disciplines:

There certainly are strong natural affinities, in the form of common core assumptions and perceptions, between institutional economists, at least those in the school of North, and modern evolutionary economists. There also are very strong reasons more generally why they should join forces.

Edquist (1997) also indicated the organisational features of innovation systems, which represent formal structures, including technical universities, industrial research institutes, and R&D departments in large firms, consulting agencies, patent offices, technological service institutes, and other bridging organisations. In addition, markets which have strong property rights reduce uncertainty by providing information, manage conflicts and cooperation and provide incentives (Edquist, 1997, p. 51). From this angle, the interplay of institutional, economic and technological factors creates continuities that determine the progress along particular technological paths (Cimoli and Dosi, 1995).

In this regard, innovation systems represented the mechanism to justify improved investments in R&D and patenting by firms and countries, which were the main measures to understand the rate of innovative performance and competitiveness of economies (Nelson, 1993). Linked specifically to the logic of evolutionary economics, it was equally the justification for designing policy instruments where firms' investment activities were path dependent. Evolutionary economists were therefore of the view that given the very uneven and uncertain nature of the innovation process policy-making needed to be adaptive to changing environmental conditions (Metcalf, 1995). The institutional failures and parlous conditions of developing countries, innovation systems were therefore weak and prone to under-perform (Chaminade and Padilla Pérez, 2016; Lundvall, 2007;

Lundvall *et al.*, 2011; World Bank, 2010). The widespread popularity of the approach and its acceptance in influential policy circles of the World Bank, UNCTAD, EU and OECD (Lundvall, 2007; Mytelka and Smith, 2002; Sharif, 2006) create sufficient impetus for developing country policy makers to imitate an array of institutions and invest in infrastructure along these lines (as their advanced counterparts had done before them).

In contrast, some innovation systems theorists thus hope to counter the ‘institutions rule’ hypothesis by replacing it with technologically determinist view, but ironically reproduce it by emphasising patents as a source of competitive performance (e.g. Lee, 2013). Overall, in this framework, institutions co-evolve with technologies and industries in a self-reinforcing manner to advance economic growth (Dosi, Freeman and Fabiani, 1994; Nelson, 2002). Likewise, innovation policy constitute a mix of policy instruments and strategic decisions that enforce formal institutions, such as science-industry relationships, promote education and training, intellectual property rights, and foster industrial networks and clusters (Chaminade and Edquist, 2010; Fagerberg, 2016). This has often been seen a supply-focused view of innovation, and has been criticised for not identifying which are the ‘right’ set of institutions, or the correct form and function these institutions need to take to achieve their objectives of stimulating innovation and changes in the economic system as a whole (Andreoni, 2016; Taylor, 2016).

Moreover, at the firm level, technological capability refers to the ability to effectively use knowledge to solve problems that require different skills (Farrell, 1979b; Pavitt, 1998). It was believed that it was due to trial and error in the firm and with external actors and institutions that technological capabilities, distinct from the skills applied and experience in the use of technologies accumulated (Bell and Pavitt, 1993; Lall, 1992). In late-developing countries, however, their characteristics transposed a new

understanding of technological diffusion by creatively incorporating existing knowledge, with their own internal capacities and networks in the wider domestic and international system. Through the adoption of technologies, institutional changes and investment catch that latecomer countries could build their absorptive capacity, and improve productivity (Perez and Soete, 1988). In another sense, the demands on innovative practice have created compulsions for the search of new knowledge in industry, based on local knowledge situated in dynamic, less formal social spaces not close to the technological frontier.

Innovation systems in developing countries were generally not ‘mature’ and predisposed by prevalent systemic failures, capacity constraints and institutional failures which account for their poor innovative performance and lack of competitiveness compared to advanced countries (Chaminade and Padilla-Perez, 2016; Lee, Juma and Mathews, 2014; Lundvall *et al.*, 2011; World Bank, 2010; for a more critical account, see Kuhlmann and Ordóñez-Matamoros, 2016). By adopting institutional systems and designing policy instruments based upon a systemic rationale, innovation scholars argued that more productive outcomes would result (Klein Woolthuis, Lankhuizen and Gilsing, 2005; Smits, Kuhlmann and Shapira, 2010). Such observations were based upon measures of R&D productivity, patents and intensity of interactions and overall aggregate outputs. These failures originate in both structural and functional aspects of their innovation systems, creating bottlenecks that retard innovation processes (Chaminade and Edquist, 2010; Hekkert *et al.*, 2007). To counter these challenges, (Borrás and Edquist, 2013) suggest that selecting the ‘right’ policy instruments for the context-specific failures can address the low level of innovation intensities or stimulate productive capabilities to develop innovations. Thus, these instruments can in fact appeal to functions of innovation systems regarding (1) management of interfaces, (2) (de)construction and organizing

(innovation) systems, (3) providing a platform for learning and experimenting, (4) providing an infrastructure for strategic intelligence and (5) stimulating demand articulation, strategy and vision development (Smits and Kuhlmann, 2004).

It is at this point the technological and institutional causes seemed to occupy similar, if not equal positions in the explanation of economic growth across countries (for example, see Kuhlmann and Ordóñez-Matamoros, 2016). At the expense of epistemological and ontological diversity, the marriage between innovation systems and institutional economics represented a cogent rationale for implicitly patterning developing countries against their advanced counterparts. The innovation systems approach however limits the kind of analysis and marginalises important insight on the political economy of development that elucidated how global structures converge with local dynamics to produce underdevelopment (Cooper, 1972). They have indeed created significant problems and contradictions for policy makers and critical governance agencies (Delvenne and Thoreau, 2016; Kuhlmann and Ordóñez-Matamoros, 2016; Marcelle, 2017).

According to one critic, Northern scholars may not always capture these nuances and experiences inspiring an all-encompassing definition relative to the Global South:

Innovation is an intentional process of generating, acquiring and applying knowledge aimed at producing economic and/or social value. In developing countries, this process typically takes place through the unfolding over time of a wide variety of learning and capability-building processes, rather than through the mastery of science and technological knowledge. Innovation is an investment effort in which knowledge, financial capital and other resources including cultural and social capital are deployed over time to create value. Deftly undertaken innovation can lead to the transformation of systems, values and culture as well as the production of new and/or improved products or processes (Marcelle, 2017, p. 2).

This definition pointed to the learning and capability transforming processes that underpinned the application of technologies in diverse environments. Moreover, the historical uniqueness and structural position of the Global South was glossed over in the NIS and the contradictions of ‘innovation systems’ paradigm even dominated analyses calling for a ‘southern framework of analysis’ (Delvenne and Thoreau, 2016). Attempts to modify the framework to include a structural-dependent relationship, and learning perspective have reproduced similar findings where developing countries start from a deficit position that have limited policy insights (Arocena and Sutz, 2000; Cassiolato, Lastres and Maciel, 2003; Chaminade and Padilla Pérez, 2016; Fagerberg, 2016; Lee, Juma and Mathews, 2014; for a critique, see Taylor, 2016). As a result, it gives importance to policy rationales that suggest that structural shifts may occur in the economy based on a technocratic assumption that the successful implementation of policy and institutional reconfigurations, improvements in productivity and technological capabilities over time.

To consider the experience of developing countries, Sagasti (2013) provides a useful periodisation to understand the evolution of practice of ST&I policies in Latin America that serves as a useful heuristic:

- a. An initial ‘science push’ stage, which lasted from the early 1950s to the late 1960s.
- b. A transfer of technology regulation stage, which started at the end of the 1960s and extended through the 1970s.
- c. A systems approach and policy instruments stage that began in the early 1970s and lasted through the mid-1980s.

- d. An economic adjustment and policy reform stage that started with the Latin American debt crisis of the early 1980s, covered the lost decade of the 1980s, and waned in the mid-1990s.
- e. A systems of innovation and competitiveness stage that began at the end of the 1990s and extended into the 21st century (Sagasti, 2013, p. 380).

At different time periods, the influence of various actors, the orientation of the state and the content of the policy varied from laissez-faire policy emphasising basic research and S&T infrastructure, to more explicit state planning to regulate technology flows, to implicit S&T policy, and a network approach aligned to competitiveness and macro-economic policy (Alcorta and Peres, 1998; Cimoli and Katz, 2003). Thus, contemporary developing countries have been unable to meet the standards set by fast-industrialising countries, which reflect the stickiness of their institutions. As a consequence, good governance becomes a cure-all for the weaknesses in these countries (Altenburg, 2009; Fagerberg and Srholec, 2008).

According to this perspective, development is seen as a technical matter of fixing the policy ‘instruments’ and failures to compete, and not related to the wider political and social processes of change (Fine and Saad Filho, 2014; Khan, 2013; Velasco, 2015; Weber and Truffer, 2017). The complex nature of the relationships among firms and their environment and their internal capacities are lost in the innovation systems approach (Marcelle, 2016). More than that, an understanding of the relationship among the state, its historical evolution, and relations with other social actors, are characterised in zero-sum terms as opposed to a dynamic process over periods of time. The state has more or less disappeared from the analysis, or taken for granted as developing countries are treated as if institutional arrangements already existed (Girvan, Gomes and Sangster, 1983; Mazzucato, 2016). Improving capabilities are seen to be specific to firms, and are not

seen as part of a wider sphere of social and power relations that are constitutive of process of technological change (see chapter 5). Neither the innovation systems nor the neoclassical institutional theory have incorporated a dynamic view of institutions and their power relations within the society, with wider structural dynamics of production or interrelations at the international level (Andreoni, 2014; Gray, 2016; Kiely, 1998; Weber and Truffer, 2017; Velasco, 2015).

2.4 Towards a political economy approach of technological change and governance

The theoretical approach employed here to understand the processes and mechanisms that underpin the accumulation of technological capabilities specifies the changing relationships and balance of power among several actors involved in the policy process and economic system. Girvan (1979, p. 2) long identified as the major determinant of technological change and its socio-economic effects as the ‘nature of power relations in a given society’. Missing from the conventional analysis of technology and institutional development, proposed by North and innovation theorists, Girvan and colleagues (1983, p.19) are a perspective on:

the relationships that must exist between technology, power relations, and economic organisation, and the way in which these condition the socio-economic effects of that result from the adoption of specific technologies.

Likewise, other observers have noted that

Technology and technological change are not autonomous forces exerting uni-directional effects on society and neither are they neutral. The widespread belief to the contrary stems, perhaps from the mistaken view that sees technology as the mere application of science, and scientific progress itself as the result of the sudden flash of insights of the Great Thinkers transcending existing social and theoretical circumstances. The recognition however, that science and technology interact with important ways and that both are intimately affected by the prevailing social, political, theoretical and economic circumstances has extremely

important implications for the way in which we examine technology and technological change (Fransman, 1984, p. 11).

This insight is critical for the present task of studying the ways state capacities can influence development processes, and how conceptually state led processes are analysed in a specific context and unfold over time to encourage certain forms of S&T activity.

In contrast, in a popular article Perez (1985) posits that so-called transition from one technological cycle to another is accompanied by a socio-institutional transformation that appears to be deliberately carried out by social actors. In this formulation, Perez seeks to outline a somewhat gradual process of change underpinned primarily by technological and organisational factors where shifts occur driven by technological changes, unlike Girvan and colleagues. Thus, Perez simplistically concludes that ‘[y]et inertial forces make the socio-institutional framework more resistant to change and rather slow to adapt to new conditions, except under critical pressure’ (Pérez, 2007). This interpretation largely remains a technological determinist view and underplays the role of social forces in the process of technological change, as it does not analyse the specific configurations of the social system through history linked to the technological outcome, which can have a two-way causal relationship. It thus has been seen as leaving a major gap in theoretical understanding of the political and institutional context of technological aspects of development (Bell, 2009), deemed appropriately as the ‘political economy of technological change in development’ (Cooper, 1972; Fransman, 1984). The proposed view advanced here is one that gives greater attention to the social, political and institutional dynamics and drivers of such techno-economic outcomes that have sparsely been addressed in development studies with reference to small developing states.

Such a perspective should indeed be understood based on the specific realities and contexts in which policies are devised and institutions are created and are made to work over time. In small developing states, the nexus of power among personalistic politics,

informal patron-client ties, and institutions have peculiar characteristics and effects (Khan, 2010b; Veenendaal, 2015). Unlike the small European states with socially embedded, responsive and strategic political institutions that transcend narrow political party considerations that contributed to their relative success in specific economic arenas (Katzenstein, 1985; Ornston, 2012), small former colonies in peripheral regions are organised differently in political terms (Baldacchino, 1993). The literature on adaptive capacity and relative success of small European states and other territories given their ability to respond proactively to technological imperatives is well known (Breznitz and Ornston, 2016; Fagerberg, Mowery and Verspagen, 2009; Ornston, 2012). These studies are usually display ‘success stories’, while paying glib attention to the historical contexts of less successful cases (UNCTAD, 2015).

For this reason, this study is concerned with the institutional and political arrangements in small peripheral regions over different periods of time, in particular how the balance of power among the social forces impinging upon state policy changes relative to the S&T system, economic and political developments. In general terms, public policy can be defined as ‘the set of techniques by which governmental authorities wield their power in attempting to ensure support and effect (or prevent) social change’ (Vedung, 2011, p. 21). Oftentimes, public policy reforms are designed in an abstract manner or relative to the successful cases, such as East Asian states that possess certain characteristics high level bureaucratic competence, autonomy of the state from private interests and so on (Evans, 2012). It was claimed that such an approach was coupled with wider financial and macroeconomic reforms encapsulated under the framework of the Washington consensus. However, it was realised that all these reforms in effect paradoxically required greater state intervention (Fine and Saad Filho, 2014) and undeniably transformed the state to respond to market compulsions (Kiely, 2005).

The approach thus attempts to establish a different set of modalities to understand how technological and institutional outcomes within the state in relation to other social actors, and institutional capabilities that are derived from the political context are realised.

Understanding that these dynamics are not necessarily consistent over time bears important implications, and has been a concern since the heyday of development studies, especially when S&T were seen as vital to development processes (Cooper, 1972; Girvan, 1979a; Fransman, 1984). Cooper (1972) and Farrell (1982) acknowledged that the specific structure of production and social systems condition how technologies and institutions evolve, and can have varying socio-economic effects; in fact they may well be an outcome of social and economic conditions that prevail in a society. Thus, the existing institutional apparatus and their productive impacts are reflective of the scientific and technological capability and vice versa. In other words the existing threshold of ‘skills, knowledge, and experience of local personnel, organised in institutions’ become the result of, and result in the level of productive use of technologies, its ability to modify and adapt to specific purposes, to initiate new techniques based on existing production, or to organise new productive systems (Girvan, Gomes and Sangster, 1983, emphasis in the original).

A case in point is the construction of the national innovation policy (NIP) in Cyprus where the politics of this small society, its specific institutional set-up, and geopolitical relationship at the periphery of Europe have played a role in lacklustre ST&I performance (Hadjimanolis and Dickson, 2001). The authors note that ‘strong men’ and interest groups managed to effectively influence the policy formation process in a disproportionate manner by utilising informal lobbying. These intense relations mattered for directing certain policy outcomes in their favour at the expense of wider long-term considerations. Similarly in small Central American states, there is strong competition

among policy makers and ministerial staff for funding which has led to weak commitment and coordination among vital agencies (Padilla-Pérez and Gaudin, 2014). On the one hand, the views of Cypriot policy makers diverged from those of owner-managers of firms. The authors conclude that 'it is not a lack of ability on behalf of the civil servants, but rather a matter of conflicting, embedded interests and political considerations which put constraints on NIP implementation' (Hadjimanolis and Dickson, 2001, p. 816). The question of the changing role of the state and its capacity in such an environment is critical to understand the political economy conditions for (un)successful implementation of ST&I policy. The market friendly policies that were instituted by the country during its accession to Europe provoked these forces could not be easily disciplined by state prerogatives (Hadjimanolis and Dickson, 2001). This leads us to consider how the current discourse on neoliberal governance has circumscribed state power (Khan, 2007) and what are some relevant characteristics of states in developing countries.

Adopting the premise that developing countries are qualitatively different in political, economic and social dimensions, though connected by historical processes of capitalist expansion, we can begin to put things into better perspective. Migdal (1988) offered a description the state in several developing countries in the post-war era as deeply interlinked with social actors in various productive and other spheres in a web-like configuration. In the same vein, Jessop (2015) describes the capitalist state as a 'special kind of social relation'. It constitutes

a complex ensemble (or, as some scholars put it, assemblage) of institutions, organizations, and interactions involved in the exercise of political leadership and in the implementation of decisions that are, in principle, collectively binding on its political subjects (Jessop, 2015, p. 16).

In developing countries, deeply informal characteristics make social control important for the state, which can have many centres of power preventing steadfast pursuit and

effective implementation of policies (Migdal, 1988). Migdal classifies states along a continuum of weak and strong. Fragmentation in the state is a reflection of the compulsion of competing interests in the society which in turn can reinforce the lack of state cohesiveness (Migdal, 1988).

Other authors believed that these emerging states could simply imitate the institutional forms of developed nations to advance technologically, but this led to significant failures, as their social political contexts were organised differently (for a mainstream view, see Levy, 2014; for a heterodox critique, see Chang, 2011; Centeno, Kohli and Yashar, 2017). Empirical observations of these current developing states and their differences across contemporary African, Latin American, and Caribbean contexts have however led to other interpretations. These regions became more embedded with international market forces that have created difficulties for institutions to adapt to competitive conditions (Mytelka, 1993). The earlier attempts at industrialisation have also been severely reversed and with it the material gains and social legitimacy that supported state power. For example, advanced countries are said to have more formal state-society relations and a more diversified capitalist sector and attendant formal supporting institutions, compared to the contemporary Global South (Khan, 2013). This divergence of performance was based on ideas linked to late development (Abramovitz, 1986), and that suggested that different institutions through time were equipped with social capabilities.

This reconfiguration of the state over the last thirty years has added to worries of permanent de-industrialisation. The ideological heuristic was concerned with better allocative function of markets to make markets more efficient, termed 'market-enhancing governance' (Khan, 2008). However, given global rules implemented to bring about

macroeconomic stability through structural adjustment and largely transform the state maintaining an active role in promoting competitiveness (Cerny, 1997; Davies, 2014). Such policy prescriptions have been based on abstract reasoning and historical conjectures inherent in neoclassical economic theory, thereby the specific orientation of institutions and their informal enforcement mechanisms in developing countries. In these circumstances the state requires new purpose and impetus (Wade, 2014). As such, the institutional context and political capabilities that facilitated the emergence of ‘developmental states’ in North and East Asia are not present in some late developers. Given the historical evidence of industrialisation and successful development, the state maintains an important but the context for development in the 21st century has dramatically changed.

In these societies where ‘the rules of the game’ are patently different and are not consistent with the stylised facts of the industrialised world purported by NIE and some NIS scholars, important historical and political nuances can be glossed over, and institutional dynamics mischaracterised (UNCTAD, 2015). A reconceptualisation of state capacity is required based on these empirical insights and theoretical advances. This paper thus utilises the concepts of policy or governance capabilities (interchanged with state capabilities or capacity) to describe the institutional and political conditions to design, implement and enforce policies. In this way,

the ability of the political system to decide or compromise on the best approach to technological and economic development, or to distinguish between what is ‘desirable’ and what is ‘feasible’ through the processes of policy debate and interest coordination (both within bureaucracy and political institutions and between public and private actors) (Karo and Kattel, 2014, p. 84).

Such an approach emphasises an experimental approach to governance regimes that seeks to improve state and administrative capacities to pursue growth strategies and implement developmental interventions that address structural constraints and enhance technological

capabilities in private sector firms (Khan, 2012a). These efforts require instigating the formation of institutional arrangements between public and private actors in pursuit of productivity improvements and broader developmental goals. This type of growth-enhancing governance approach thus focuses on incremental changes to improve institutional capacities to implement reforms and new policy instruments and ensure that firms' efforts align sufficiently with overall development strategy (Khan, 2012a). It departs somewhat from market-conforming policy initiatives that have to date proven detrimental to developmental efforts. These arrangements also address the need to 'learn' in government to experiment and adapt to changing circumstances based on contextual factors (Girvan, 2007).

In this way, we deviate from normative claims in the institutional economics literature to consider how institutions interact with the political economy to produce particular economic and distributive outcomes. Configurations of power, which are historically rooted and shaped by politics, can be evident at both at the societal level, across industries, within organisational settings, or across institutional boundaries (Khan, 2010b; Ngo, 2016); and they ultimately influence how policy decisions are made, and various incentives therefrom are effectively appropriated. As a consequence, it goes beyond the market-state dichotomy, while acknowledging the need to ensure that state investment is channelled towards productive enterprises and broader developmental objectives are achieved through transformation of productive systems (Mazzucato and Semieniuk, 2017). This temporally bounded and dynamic approach is understood in relative terms to other institutional outcomes.

To arrive at necessarily deeper level of analysis to understand how the state and political actions affect such processes, a critical review was conducted above of the

relevant institutional theories that have sought to explain these complex relationships. Recognition of the fact that power relations affect and are affected by the fruits of technological activity (Girvan, 1979; Fransman, 1984) gives the state and politics a role in a defined context and political praxis. In addition, the concept of state as a relational and embedded concept matters for discerning the direction and political authority of various actors and their effects on outcomes (Khan, 2010b). In development studies, different conceptualisations of the power of the state, and of institutions in particular, and their functions in different policy spheres, from embedded autonomy in so-called developmental states, to more powerful forces, such as those in Western Europe and the like have been proffered (Amsden, 1989; Breznitz, 2007; Katzenstein, 1985; Wade, 1990).

The concept of ‘political settlement’ as proposed by Mushtaq Khan thus helps to arrive at a more contemporary and empirically grounded formulation of the state in developing countries. According to Khan (2010), a political settlement describes

an interdependent combination of a structure of power and institutions at the level of a society that is mutually ‘compatible’ and also ‘sustainable’ in terms of economic and political viability...[this] combination of institutions and organizations can reproduce itself over time. Once a reproducible social order emerges, the relative power of different organizations is relatively stable and evolves along stable paths. The macro-level political economy can help to explain a fundamentally important observation: particular formal institutions appear to perform differently across countries and over time (Khan, 2010b, p. 20)

It critically addresses the many anomalous cases of developing economies to give greater attention to the functioning of the state and the distribution of power among actors in a society. Khan further argues that the distribution of benefits supported by a country’s institutions is consistent with the distribution of power in society and the economic and political outcomes of these institutions are sustainable over time (Khan, 2010b). The structure of politics and rent-seeking activities are invariably linked to demands for

redistributive benefits from societal groups. From this perspective the general outcome is that politics in a developing country is personalised, based on fostering coalitions of the powerful who are offered access to rents on a privileged basis and establishes a more or less sustainable ruling coalition.

These coalitions, primarily the ruling elite, can have a set of different characteristics and alignments based on the structure of the economy, power relations and society. Khan (2010b, p. 20) further classifies these arrangements based on whether 'holding power' which is defined as 'the ability for groups to how long a particular organisation can hold out in actual or potential conflicts against other organisations or the state', is based on formal institutions or whether formal institutions are conducive of growth or not. In advanced economies, the distribution of power reflects the income-generating capacity of elite groups and the ability to affect the necessary formal institutions, known capitalist political settlements. They usually have Weberian structures or what Dasandi and Esteve (2017) view as an integrated model where there is a clear separation between politicians and bureaucrats with high level of bureaucratic autonomy. Nevertheless, rents in such economies are based on formal rights and privileges and application of impersonal rules. Meanwhile, in many developing societies there are clientelist political settlements where rule following is constrained by personal power ranging from military rule to clientelistic party competition. In this system, bargains are based upon informal relationships and institutional mechanisms that evolve over time (Khan, 2010b).

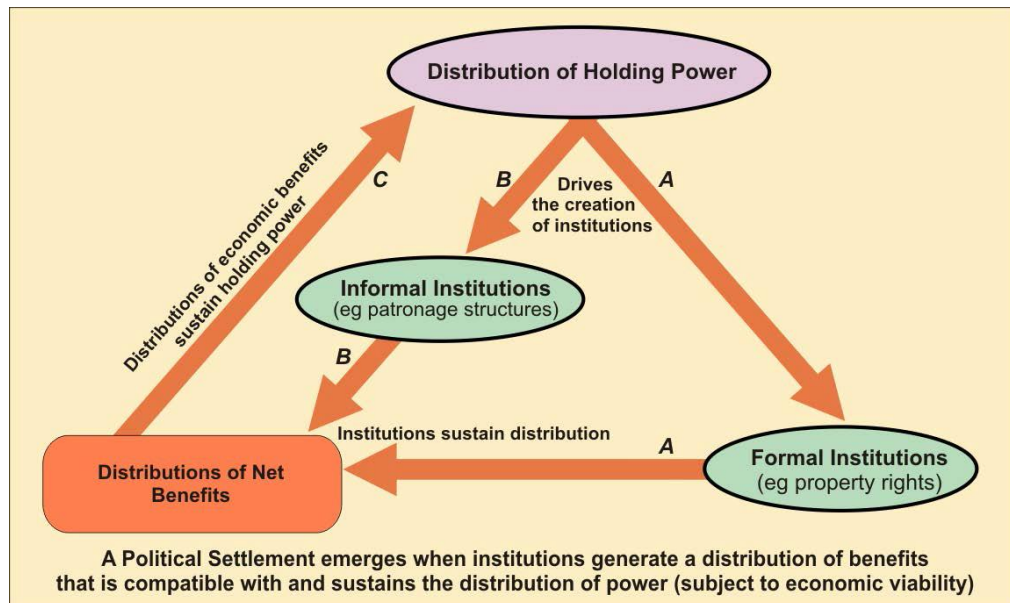
In this sense, rents refer to the incomes generated both by the official state policies, in addition to their informal or extra-legal aspects of these policies, including taxes and subsidies, resource allocations like land or natural resources, create

employment in public organisations, or institute regulations that levy costs and benefits on different social groups (Khan, 2000; Gray and Whitfield, 2014; Ngo, 2016). In orthodox analysis, rent-seeking is damaging for efficiency, growth and productivity (Chaudhry and Garner, 2007; Krueger, 1974). While rents in developing countries are often off-budget claims provided by political elites can also operate as subsidies, or in the case of developed countries are legalised instruments (Gray and Whitfield, 2014). Rent-seeking activities are part of both to processes and outcomes in this type of analysis, and can be important for growth, political stability, technological upgrading and innovation (Chang, Cheema and Mises, 2002; Khan and Kwame Sundaram, 2000; Ngo, 2016). Ngo further (2016, p. 1046) posits that

the configuration of rent management, is defined as the ways in which politics, institutions, and the market structure of an industry are organised and how they incentivise and compel rent-receiving firms to upgrade.

However, as some scholars have shown state created rents are critical for firms in new industries develop and to compensate for limited or no profitability during early years (Chang, Cheema and Mises, 2002; Ngo, 2016). As a result, without appropriate state intervention to support firms in late developers, higher levels of productive capability, investments and technological learning than can promote employment creation and broad based developmental outcomes cannot be achieved.

Figure 2.1 - The two-way relationship between power and institutions



Source: (Khan 2010b: Figure 7, p. 25)

Figure 2.1 is the depiction of how institutions are meant to operate and actually do in developing countries, mediated by inform patronage structures along B, while along A the distribution of power determines the creation of institutions, their evolution and effects on society. The distribution of benefits along C is sustainable over time to represent the balance of social forces or the ‘political settlement’.

Moreover, attempts at promoting broader based development outcomes reflect the nuances within the social and economic spheres of a specific political context. The distribution of power and technical capabilities across organisations that constitute the political settlement bear out particular implications for the implementation of technology policy and programming (Khan, 2013) . As such, the informal connections that are established between the ruling political elites and capitalists and their representative organisations allow for the allocation of rents and deal-making based on forms of patronage or quid pro quo arrangements. Given the structure of small developing economies, the existing organisations can be quite heterogeneous and their technological

capabilities vary according to the sector they belong to, given a very small number of competitive organisations in existence. Their ability to lobby for specific policy outcomes and their influence in the policy process is therefore dependent on their economic and political power drawn in part from their symbolic resources and connections to the ruling coalition (Khan, 2010b; Khan and Kwame Sundaram, 2000; Migdal, 1988). In the area of ST&I policy, the key governance agencies can be spread across different parts of government, and their level of technical capabilities to enforce particular policy goals are in turn constrained by these relationships. For instance, business associations have grown in influence and can have varying levels of effectiveness in facilitating or delaying certain policy changes (Watkins *et al.*, 2015). In some instances, potentially high-impact ST&I policies are not successful, and incremental policy change is required given the position these agencies may occupy in the public bureaucracy and their openness to intense political lobbying by powerful interests (Breznitz and Ornston, 2016).

As a result, state institutions are required to invest in building more effective governance capabilities to address its structural deficiencies, clientelistic features, and the insufficiency of market mechanisms to bring about economy-wide technological progress. In such contexts, structural limitations are entrenched; the need to address market failures must take account of the power constellations of institutions which impinge upon overall lacklustre institutional performance. Moreover, since formal institutions are not principally where power is exercised in developing countries, agency is primarily structured around informal institutions or ‘clientelist’ organisations such as political parties (Khan, 2010b). These patron-client networks, namely informal relationships or organisations that comprise individuals holding varying degrees of power are likely to provide the institutional setting within which credible commitment problems to invest in ST&I can be addressed in an environment where formal institutions i.e. property rights

are absent or unenforceable (Khan, 2010b). Factions within the society can be structured in terms of religion, tribe, caste or ideology, or be large or small, centralised or fragmented, with strong or weak patrons (Migdal, 1988). In this scenario ‘holding power’ is:

a function of a number of characteristics of an organization, including its economic capability to sustain itself during conflicts, its capability to mobilize supporters to be able to absorb costs and its ability to mobilize prevalent ideologies and symbols of legitimacy to consolidate its mobilization and keep its members committed (*ibid.*, p. 20).

The political settlements approach indeed acknowledges other key variables such as power distribution, informality, and patron-client networks which emerge within societies and influence the likely success of policies.

However there are some potential weaknesses of the political settlements framework, as it attempts to proffer generalisations across developing countries. In this formulation, informal institutions regulate the flow of benefits and power dynamics across sectors and domains, but the main tenets may also not account for radical changes or more fundamental transformations necessary for embedding democratic traditions in development processes. It may thus only be consistent with incremental reforms (Khan, 2012a). Other political economists also suggest that such a perspective may be guilty of ‘methodological nationalism’ and not take into account international capitalist structures and processes that interact with both domestic political developments and policy choices (Marois and Pradella, 2015; Pradella, 2014). As Kiely (1996, p. 82) puts it:

Late developers face enormous constraints, both in developing effective producers that can compete with foreign capital in their domestic economy, and in breaking into export markets and thereby competing in the world economy.

Political settlements studies also take a neutral stance on IFIs, in particular their political, even interventionist role in re-shaping the political economies of developing countries,

and even redistributing rents from the advanced world (see chapter 5 on the extension of the framework), thereby neglecting the uneven forces of the international political economy. Another problematic area in the approach is that institutional arrangements result from a ‘political equilibrium’ at the national level and not adequately attend to the multifarious and contradictory effects of exogenous shocks, international forces or internal political struggles that generate social disequilibria and profound institutional dynamics over different periods of time in particular contexts.

In this regard, institutions are dichotomously explained as informal institutions versus formal arrangements, the former more prevalent in developing countries and the latter in advanced economies. Political scientists have suggested that the formal institutions when transplanted can serve as effective mechanisms for authoritarian type of democratic rule in instances of deep ethnic and ethnic cleavages (Meighoo, 2012; Girvan, 2015). Less effort is made to understand instances of effective overlap when the mechanisms are not easily separable or apart from informal enforcement as quotidian ways of engagement and pre-existing informal networks that influence or block policy processes. Informal institutions become very influential on economic and political outcomes whereas the interaction between formal and informal matter – even at least to provide the legitimate backdrop from which certain actions can be taken or give the pretence of legitimacy in some circumstances. However, apart from linking informal institutional arrangements to outcomes, process dynamics are also equally important, especially for explaining incipient policy regimes or ‘stop and go’ policy cycles that have not been well advanced, as a result of which the outcomes are uncertain and cannot be pre-determined.

Finally it would have drawn from both historical and empirical work from several developing countries, the theory may not cope well with the nature of insertion into, and complex relations of small developing countries with global economic structures (M. Bishop, 2015). In particular, it does not consider the unequal relations between countries in the control of resources, metropolitan monopoly over setting prices and partly determining the value of exports, control over the terms of acquisition of technologies. The level of capabilities available to a small country may also be constrained due to a lack of agglomeration economies (Farrell, 1979b, 1982; Lee and Smith, 2010; Marcelle, 2009). Such contexts are often left completely out of the analysis or are clumped with larger countries without any attention to the lessons that can be drawn as well as their peculiar circumstances (Kattel, 2009; Roolaht, 2012; Veenendaal and Corbett, 2014).

2.5 State capacity, power and economic structure: does size really matter?

Small states and their capacity to survive and function has been a concern, especially in the post-WWII era when many new states achieved independence (Emmanuel, 1976). The smallness of economies and nation-states has conventionally been a concern in international relations. One important contribution notes that:

A small state is more vulnerable to pressure, more likely to give under stress, more limited in respect of the political options open to it and subject to a tighter connection between domestic and external affairs. In other words the smaller the human and material resources of a state the greater are the difficulties it must surmount if it is to maintain any valid political options at all and, in consequence, the smaller the state the less viable it is as a genuinely independent member of the international community (Vital, 1967, p. 3).

In classical neo-realist terms, a small state was defined as

[one] limited [in] capacity to: (1) influence the security interests of, or directly threaten, a great power; and (2) defend itself against an attack by an equally motivated great power (Keohane, 1969 cited in Elman, 1995, p. 174).

As such, from a military perspective, some small territories have been unable to assert or manoeuvre adequately to avoid external attack (Commonwealth Secretariat, 1985). In some instances, their own internal divisions have rendered them more vulnerable to external threat. A number of small states were victims of military attack, including Cyprus (1974), the Falklands/Malvinas (1982) Grenada (1983) (Espindola, 1987).

For many of these small states, the 1950s and 60s signalled a period in which early nationalist leaders championed sovereignty both among domestic interests and in the international arena. On this issue, in retrospect, Lewis (2012) has questioned the Westphalian and Euro-centric narrative of sovereignty, which to him cannot be easily applied to these polities, especially in terms relevant for advancing an approach that secures their long-term economic prospects. The scholar further notes that it serves as a further constraint on their ability to meaningfully pursue development strategies suitable for their circumstances (Lewis, 2012). For this reason, at the time of the Cold War, evidence suggests that several small states used their 'small status' to annex to larger ones as a leveraging mechanism to garner much needed material resources and benefits for their economic development. Some authors believed that strategy contributed to their further dependence on the benevolence of richer countries (Clapham, 1999). This 'dependence' has in part come from their colonial legacies and paths to decolonisation, especially in the case of island states, which have left them reliant to a certain extent on metropolitan sources for their survival, especially through trade linkages (Baldacchino, 1993).

From this backdrop, smallness is usually defined in terms of population size; land mass, resources (human and material); or per capita income or gross domestic product

(GDP). However, there is no consensual metric used to determine size of countries or economies. (Kuznets, 1963) first identified a small economy as one with a population of 10 million inhabitants or less. Following this characterisation, (Demas, 1965) proposed a definition based upon a population of five million and a land area of ten to twenty thousand square miles. In addition, he noted that economic structure was in large measure a characteristic of small sized economies that helped determine growth potential (*ibid.*). As a proxy of capital stock, (Jalan, 1982) suggested a small economy possessed a population below five million, arable land area below twenty five thousand square kilometres, and national income below US\$2 billion. Since these early contributions, there have been a number of further attempts that deem small economies based on a composite set of indicators i.e. population, land area and total income assigning weights to each measure (Crowards, 2002). In more simplistic terms, Streeten (1993, p. 197) acknowledges that these variables do not consistently hold up, and argues that ‘we know a [small] country when we see it’. Thus, in relative terms a small state can be identified based on its position in the international system and the specific characteristics under examination (Sutton and Payne, 1993).

To avert focussing on population constraints, the Commonwealth Secretariat decided to identify the following economic characteristics: limited domestic opportunities for export, leading to openness and susceptibility to adverse exogenous shocks; a narrow resource base leading to monoculture production, export concentration and dependence on a few markets; shortage of sophisticated skills and high per capita costs in public administration; and greater vulnerability to natural disasters and greater reliance on development assistance and various preferential agreements (Commonwealth Secretariat, 1985; Snorrason, 2012). From this angle, (Demas, 1965) has explicitly linked economic size to the nature of dependent development based on unequal economic relations with

metropolitan countries. Conversely, challenges with reference to transport costs, communications and remoteness have come to be associated with small island states (Sutton, 2011). Based on a number of studies, one should note that size does not impede growth (Armstrong and Read, 1998; Easterly and Kraay, 2000) but can influence the course and pattern of development in particular ways (Farrell, 1982). In this respect, the country's size is less determinate as compared to the size of the potential market available to it perhaps through export of goods and services. (Best, 1972) questions Demas' earlier perspective on long-term growth to suggest that size does not determine survivability, nor does it necessary relate to a mode of dependence as policy may change the terms of engagement. In this sense, longer run changes in these counties are cumulative episodes of coherent measures that support a developmental trajectory. Ultimately, political economists argue that smallness is a condition of history, geopolitical situation, level of development and is relative to other nation-states across space and time (Campling, 2006; Lee and Smith, 2010).

Moreover, economic vulnerability is defined as 'the increased proneness of certain economies to downside risks to growth' (Cordina, 2004, p. 36). In this sense, vulnerability is not synonymous to weakness (Bishop, 2012), though observers often treat size as a determinate / objective variable related to economic performance, which may have a self-fulfilling effect on policies and strategies of political entrepreneurs and economic agents (Baldacchino and Bertram, 2009; Sen, 2013). Though the literature suggests that small size has not necessarily been a binding constraint on growth in per capita terms (Armstrong and Read, 1998; Ruprah, Melgarejo and Sierra, 2014), the vulnerability discourse has disproportionately influenced global and national policy postures in these states (Baldacchino and Bertram, 2009). The lack of analytical consensus has also added to this imbroglio. For example, in one study of 'small country

innovation systems' (Edquist and Hommen, 2009), its authors treat on equal terms countries as diverse in Asia (Taiwan, Singapore, Hong Kong, South Korea) and Europe (Sweden, Finland, Norway, Ireland, the Netherlands) ranging from 4.8 million of 49 million. They interpret the term 'small country' rather sloppily (Roolaht, 2012). Comparatively, in reference to Caribbean countries which may vary in degrees of smallness from 'micro' to small, in terms of population size from 46,000 (St. Kitts and Nevis) and 2.7 million (Jamaica) to level of development and ethnic make-up, an IDB report claims:

In the Caribbean, very high debt to GDP levels, scant economies of scale, weak diversification, high vulnerability to trade shocks, and weak overall competitiveness—partly due to high labor, financing, and energy costs, but also to weak institutions and a complex business climate—have induced low productivity levels (Dohnert, Crespi and Maffioli, 2017, p. 137).

This lack of conceptual clarity and arbitrary use of 'smallness' (Sutton, 2011) in reference to a myriad number of states has major drawbacks, especially in comparatively assessing small countries' innovative performance (Roolaht, 2012). In sum, size is rather a matter of 'spatio-temporal context' that evoke asymmetric relations, rather than an immutable constraint on the nation-state; it increasingly becomes a negligible for innovation and economic performance at advanced levels of development (Kattel, 2009; Ruprah, Melgarejo and Sierra, 2014).

The pattern of development that a small state adopts or is led into are particularly interesting for this discussion; it is not a *fait accompli* but can be a product not merely of small size in scale economic terms, but are germane to policy decisions, productive factors, including the level of technology, and to its trading relationship with specific markets and the world (Farrell, 1982). In addition, coordination failures and credible commitment challenges can be equally prevalent in small states as they persist in larger

‘more autonomous’ territories (Sen, 2013). The question remains, under what conditions do smallness, social forces and external exigencies create pathways in which technology policy can be critical for development, especially given the dynamic shifts underway? Overall, state capacity to implement relevant policies in small developing countries must therefore consider other factors beyond size, including domestic politics, industrial structure, initial conditions, structural constraints that shape policy choices, in turn determined by the relative ‘holding power’ among various groups and players in the society (Khan, 2013). The direction and rate of innovation in small country can be mediated by a number of factors including poverty, challenging social systems, ethnic divisions, as well as under-resourced institutions (Farrell, 1982). The domestic and the international political economy in small states are closely intertwined and thus cannot be analytically separated nor can they be addressed in deterministic terms.

It is notable that larger-sized developing countries are also under pressure from external shocks (Liou and Ding, 2004), including military invasion and rule, for instance Pakistan (Khan, 2014), as well as suffer from geopolitical threats during industrialisation (Doner, Ritchie and Slater, 2005). Vulnerability must therefore be problematised theoretically, considered contingent, and a result of more complex relations of intervening political, historical and economic factors (Bishop, 2012; Campling, 2006). In this regard, the literature has proffered a number of problematic assumptions, associated with large panel datasets and econometric modelling techniques. The parameters for considering an economy ‘small’ or ‘vulnerable’ are not clearly delineated, conditions and consequences are conflated, and the associations and causal relationships between small size and other variables have been muddled. These methodological approaches employed selectively consider and prioritise some variables over others, based on synchronic correlational analysis, and sometimes with missing data points for some countries. Such studies

inconclusively compare *a priori* the importance of smallness as a causal factor in the lack of development and technological progress.

A methodological critique: small states, institutions and technological change

Studies conducted to measure the supposed ‘vulnerability’ of small states primarily use statistical techniques, based on limited available data related to governance and economic performance in small states (Briguglio, 1995, 1998; Easterly and Kraay, 2000). They often attempt to correlate smallness to growth experiences, as opposed to analytically technological capabilities and institutional development for example.

Notwithstanding Briguglio (1995, p. 1616) posits that many of these economies may not possess an indigenous capability to innovate due to ‘a high degree of dependence on imported technologies, since small size inhibits the development of endogenous technology’. These analyses are often based on synchronic and static measures across a panel data set with measures selected often at random or based on available data convenient for use by econometricians (Bishop, 2012). As a result a number of vulnerability indices have been constructed primarily premised initially upon five variables: smallness, economic openness, an export-driven economy, and dependence on strategic imports, insularity and remoteness (Briguglio, 1995). They attempt to show that their constraints are direct causal enumerations to growth. They tend to become highly teleological about the constraints facing small states which are deemed to face myriad challenges given their position in the international system (Bishop, Heron and Payne, 2012; Bishop, 2015a).

In studies of innovation, often small states are deliberately excluded from sample sizes as they are viewed as ‘outsiders’ (for example Taylor, 2016; for a critique, see

Veenendaal and Corbett, 2014). Earlier studies by a group of Caribbean scholars question the notion of small size and survivability based largely on qualitative considerations (Best, 1971; Farrell, 1979b, 1982; Girvan, 1983). Best (1971, p. 30) was unwilling to accept this teleology and asked the following question: not there be ‘a path of innovation which may lead to the fullest transformation of a small economy?’ As a response therefore the perceived impediments to transform of certain economies were down to the character of economic institutions and policy, certain attitudes and technology (Girvan and Girvan, 1973). However case studies on innovation have shown a different picture where firms in developing countries are able to experiment and strategically invest in innovation over time (Girvan and Marcelle, 1990; Boodraj, 1995).

In Mauritius, it was equally shown that the country has developed technological capabilities in low technology sectors such as garments. One explanation proffered is that Mauritius’s ‘government and business have worked together closely to shape the way Mauritius engages with the global economy’ (Brautigam, 2005, p. 64). Based on a contrived technology index, a comparison was made between small firms and large firms showed that the latter possess more sophisticated engineering process capabilities, quality management systems, more export-orientation and international standards certification (Wignaraja, 2002). In this context, continued active state intervention and a phased approach to trade liberalisation were key factors in the Mauritius’ successful economic performance. No privatisations were carried out during its structural adjustment, while new state-owned enterprises were created (Brautigam, 2005; Wignaraja, 2002). This example demonstrates in part the limitation of economic arguments that due to small size economies should open up their tradable sectors liberally and allow market forces to dominate (for instance Briguglio, 2014).

The so-called vulnerability argument amounts to conclusions that promote Ricardian comparative advantage and an unjustified assumption that large size by itself creates competitive advantages. For instance, Trinidad and Tobago and Costa Rica both small states in relative terms, have had very different experiences in attempts to boost technological development (Mytelka and Barclay, 2004). Costa Rica had more relative success due to the investment of a global technology firm, Intel, and its ability to export other medical equipment globally. Both countries have been able to develop internationally competitive sectors in hydrocarbons and medical equipment but have found it difficult to integrate the off-shore aspects of their economy where transnationals reside with upgrading the local resources and capabilities. This is largely due to policy and political variables (Barclay, 2015a; Giuliani, 2008). Internal market size and the lack of economies of scale do not provide a sufficient answer to the technological intensity of production in an economy (Farrell, 1982; Balzacchino, 1993). These constraints represent in part the difficulties in terms of the constrained negotiating power of small state political leaders and bureaucrats, the mode of insertion into, and the implications of decisions of larger states and private corporations in the international political economy.

Moreover, based on a qualitative study, Philpot and colleagues (2015) have found that the concept vulnerability remains ambiguous, and not necessarily polar opposite to ‘resilience’. For certain small island communities, their perception of economic and political occurrences infers certain levels of vulnerability coexist alongside strategies for inducing resilience⁵. This is because conditions vary and are constantly changing in people’s circumstances. In this sense, the authors posit that vulnerability can also result from policy measures to enhance resilience and vice versa (Philpot, Gray and Stead,

⁵This refers to capacity to overcome the challenges provoked by smallness by generating new economic sectors and creating conditions whereby these threats are minimised to allow economic prosperity.

2015). These authors posit that vulnerability cannot be only exclusively applied to small islands but is also relevant to larger developed and developing states. Take Bangladesh and Pakistan for example, their conditions of vulnerability arose due to military intervention, political occurrences and external aid that circumscribed their development path (Khan, 2014). In addition, observers posit that these developmental states emerged as result of systemic vulnerabilities i.e. to pressures exerted by a combination of internal factors and exogenous shocks (Doner, Ritchie and Slater, 2005). Their prognosis changed when elites were forced to regard long-term development as a necessary route to meet present needs and overcome difficulties. This outlook provoked the creation of institutions and policies that improved the social and economic conditions of these societies (Doner, Hicken and Ritchie, 2009). These compulsions resulted from sources of vulnerabilities even for these large industrialised economies characterised by political and social forces, than the mere size of the population or economic output.

Though there may be vested political and academic interest among mainstream scholars and policymakers in these territories in proposing and maintaining policy conclusions associated with the vulnerability thesis. Indeed, vulnerability to external conditions has been linked to the effects of Western European capitalism:

the vulnerability of national economies to external shocks is also by no means a new phenomenon of the last decade or two, even though the liberalisation of capital markets and international flows of trade and investment combined with computerisation and new telecommunications networks may have increased this vulnerability. Small and distant nations were already affected by shocks from the City of London under the Gold Standard and the Popular Front Government in France suffered just as severely from the 'flight of capital' in the 1930s as the Socialist government of France in the 1980s (Freeman, 1995, p. 21).

In a study of growth on mainly large African states, Jerven (2015, p. 91) concludes that 'for policy purposes it is better to think of African states as fragile and vulnerable to

economic downturns and temporary fluctuations'. In addition, it demonstrates that small states in fact may not be as vulnerable as other least-developed countries, and that vulnerability can be a more wide-ranging concept related to countries unequal position in the global trading system and their middle- income status in terms of development (Liou and Ding, 2004; Lee and Smith, 2010). These observations were not made solely based on the relative size of their economies but emerged as a result of other variables linked to the history of policy action and institutional performance in these countries, and ostensibly exacerbated by actions taken towards structural adjustment and opening up to global market forces from the 1980s onwards.

In consequence, the vulnerability thesis in development studies has had limited engagement with the innovation literature, especially in relation to small developing countries. Notwithstanding its approach when considering the implications for innovation performance appears incomplete at best, inaccurate at worst for their inherent neoclassical assumptions. This may be because of the perceived analytical device and heavy reliance on statistical methods employed closely attaches vulnerability and limited capacity for innovation (Briguglio, 1995). Perhaps, because it has been loaded with a “disarming discourse” (Baldacchino, 2006), and “plagued by a lack of cumulative insights and coherent debate” (Steinmetz and Wivel, 2010, p. 4) there are yet no conclusive justifications for such a position. Relatedly, many of the studies which emphasize innovation as an analytical concept in small states are based upon European cases which are contextually, historically and institutionally different (Katzenstein, 1985; Ornston, 2012).

Even those that seek to address innovation in small developing are skewed by drawing heavily upon the good governance literature (Briguglio, 2014) and the need for

high level capacities which are likely to be absent in small developing countries (Nurse, 2007; Roolaht, 2012). As a result, they seem to suggest that the institutional preconditions are present in these contexts (Girvan, 1983), without even engaging with the political specificities and historical experiences of these countries. Using alternative methods, mainly case studies, authors have suggested that the deployment of R&D activity is not the only source of innovative activity (Bell and Pavitt, 1997; Bell, 2009; Girvan and Marcelle, 1990, 2017). While arguing that in some cases, R&D costs may be beyond the resources of small developing states, resulting in misleading policy conclusions, technological activity in these states particularly include technological adaptation, imitation, modification, as well as engineering and design (Girvan, Gomes and Sangster, 1983; Hadjimanolis and Dickson, 2001; Kattel, 2009).

Given the foregoing discussion, this thesis proposes that the vulnerability of small states is a material, inherent or objective condition relative to a country's size. Rather it can be the result of confluence of historical, social, political, and economic drivers and processes as well as the nature of countries' insertion into the global capitalist system. Vulnerability researchers conflate causality with consequence. The level of state capacity is also affected by the interests that are dominant in a particular collective spatio-temporal context and combine to create material advantages for those dominant groups that may influence elements and seize opportunities accordingly (Jessop, 2015). From this angle, small states may making progress in terms of innovation in relate a matter of selecting the appropriate combination of activities, problem areas, institutional arrangements that can bring about the best use of local resources, satisfactorily meet domestic need and development of local capabilities (Girvan, Gomes and Sangster, 1983; Farrell, 1984).

It is likely that these new allocations or changes may be contested by groups and entail important costs of change (Khan, 2010). Smallness is a mediating variable, when combined with other material and symbolic considerations can have diverse effects dependent upon the context of the issue under consideration. For example, participation in international trade or diplomatic efforts may be different in relation to a country's existing level of development and/ or industrialisation. Such effects cannot be seen *a priori* as a pathological condition that inhibit successful policy response to external phenomena or efforts in technological development without appropriate analysis of the contingent factors and theoretical scope. Studying small developing states as a specific category can provide important insights into their nuanced experiences at the nexus of the politics and technology. These shortcomings give rise to the need for further extensions of the state-society relational dynamics which are encapsulated below in the conceptual device of 'networks of power' and developmental coalitions.

2.6 Networks of power and developmental coalitions

More variegated and complex nature of the relations among the political forces that comprise ST&I institutional environments in developing countries therefore needs to be considered. In this framework several governing agencies and interests compete for rents in a small developing state. It is critical to examine the minutiae of these interactions and their effects on state capabilities, and vice versa over different time periods. These exchanges occur among myriad agents across institutional boundaries beyond the traditional state-business dichotomy (Leach, 2016) known in earlier formulations of the developmental state and even more contemporary industrial policy analyses (Amsden, 1989; Andreoni, 2016; Evans, 2012; Sen and Velde, 2009; Wade, 1990; Whitfield *et al.*,

2015). Much greater heterogeneity has been known in the period of the last three decades under market-driven governance, but also due to a more analytical focus on innovation processes and institutional settings (Leach, 2016; Mytelka and Smith, 2002; Watkins *et al.*, 2015). The institutional complexity of the state and society became more pronounced over the preceding forty years when the policy and conceptual shift from government to governance was made, reflecting more focus on networked, multi-level forms of coordination and authority (Jessop, 2015). This was particularly witnessed in several advanced countries, especially the United States, Germany and to a lesser degree, Japan, which developed distinctive mechanisms to put industrial policy into force through decentralised formal organisations across the state and other entities (Andreoni, 2016; Mazzucato, 2013). Even in advanced countries, the market-led approach to governance in some so-called advanced countries have unleashed contradictions and coordination problems in respect of innovation policy (OECD, 2005).

While market-oriented governance reforms exacerbated already weak state institutions, it has equally modified the balance of forces, emboldening certain sectoral interests resulting in unpredictable economic performance. Attempts to standardise governance procedures and institutions across the developed and developing world have resulted in perverse outcomes for growth and development in peripheral regions (Andrews, 2008; Chang, 2011; Grindle, 2004). Similarly, institutional gap in ST&I have been bridged (Castelacci and Natera, 2015), but have not resulted in improved innovation performance or technological development in many Global South countries (Kiely, 2015; Kuhlmann and Ordóñez-Matamoros, 2016; Stallings, 2016). Instead, innovation and technological capabilities have concentrated in some emerging countries that have followed distinct and heterodox policy paths (Fu, Pietrobelli and Soete, 2011; Kiely, 2015). This mismatch between institutional transplantation and techno-economic

outcomes has certainly created the need for reconsidering the causes of institutional and structural constraints, while paying greater attention to their underlying contradictions.

The governance problem is not one of setting ‘cooperation’ or ‘coordination’ right as an objective of ST&I policy, but of the uncertain and tricky areas of interrogating the nature of politics and policy simultaneously (Jessop, 2015). It therefore requires an examination in tandem of the fuzzy area between the macro-level of political activity and the organisational level that have important overlaps but also distinct institutional characteristics. The main constituencies in ST&I policy include the university and research community, training institutions, research and technology organisations, the industrial sectors, the state system, and increasingly intermediaries like industry groups, and factions of the wider society (Patel and Pavitt, 1994; Edquist, 1997; Watkins *et al.*, 2015). Further defined, Girvan *et al* (1983, p. 54) noted that

the actors in the decision-making process include the managerial and technical staff of central government departments, divisions and other specialised agencies, statutory boards state enterprises and other para-statal organisations; personnel in private sector organisations, such as contractors and consulting engineers used in design and construction of projects; personnel in international ‘aid’ and financial agencies, and foreign technical assistance personnel.

Therefore, a host of public, private and hybrid organisations comprise the ST&I policy domain. The relations among the scientific community, industrial sectors and state architecture are thus not necessarily symbiotic, and not channelled through highly impersonal bureaucratic structures, or Weberian governance systems (Dasandi and Esteve, 2017; Khan, 2010b). The degree of influence of any of these actors is not straightforward and is conditioned by historical factors (UNCTAD, 2015). In the context of onerous liberal market-oriented reforms, these interactions have evolved in a highly particularistic and informal manner which can result in contestation among actors; where for example sections of the science community or private interests may gain benefits,

while other productive endeavours are neglected (Arora, Romijn and Caniëls, 2013; Scoones, 2005). These configurations also reflect the highly political nature of S&T governance and its dynamic mechanisms expressed in relation to different issues across institutional contexts (Borrás, 2012).

Moreover, different types of rents (Ngo, 2016), and the heterogeneity of actors in a specific policy locus help determine the nature of rent-seeking activities, the conditions under which rents are sought as well as the possible outcomes from the process of engagement among the range of identified actors (Leach, 2016; Lucas, 1997). This focus on process features instead of necessarily establishing causal links to outcomes from the political settlement extends the PS framework in a more dynamic way and is the basis of the analysis in what follows. In ST&I policy, the uneven and particularistic linkages that are fostered across institutional structures – the state, via political or bureaucratic elites, business groups and industrial researchers - matter in how the capitalist process unfolds and how governance of relevant policies can engender diverse outcomes.

Following Jessop (2015), these complex interactions occur not only in a hierarchical or top-down manner as the original work on political settlements (Khan 2010) suggests, but through increasingly multi-faceted networks.

However, the level of social control the state exercises can be very weak and based on patronage structures, including symbolic and cultural factors such as ethnicity and ethnic alliances that structure the allocation of benefits, such as scholarships cultural recognition, public sector jobs and contracts and political representation (Migdal, 1988; Wilson, 2012, p. 7). Politically connected firms can exact resources from the ruling elite due to the promise of electoral (and financial) support along ethnic lines, their control of certain economic resources, and their ability to mobilise others in the community to

challenge proposed changes to the status quo (Khan, 1998). Their stranglehold on rents often forms part of their own survival strategies and depends on the level of ethnic heterogeneity and political competition to legitimise the state's efforts at redistributing, constructing and exchanging rights to meet certain broader developmental goals (Khan, 2010; Migdal, 1988; Wilson, 2012).

The diverse actors and agencies in the network exercise varying levels of influence across local, transnational and national contexts simultaneously, which are further constrained by the nature and quality of usually informal relations within the organisational setting. The rules of engagement therefore often are not only subject to high-level regulations set by multilateral lending agencies, but are interact with the local modus operandi across networks (Hout, 2012; also see chapter chapter 4). Policy entrepreneurs and other bureaucratic agents may have some greater degree of constrained than previously thought as process legitimacy is based on their practical knowledge of the social context. In addition, though they may seek to openly follow conditions set or frameworks that are embedded in the support regimes, their control over the process is both contingent upon the relative power they can mobilise and their knowledge of how things work. Technical knowledge is therefore insufficient for bureaucrats to exercise mobilising capacity of agents and is often tied to the rent management mechanisms that are in force (Khan, 2013). More specifically, members and supporters of the ruling coalition use informal lobbying to access such rents and to subvert or manipulate the formal role of the agency.

As a result, the degree of policy effectiveness is naturally beset by collective action problems, creating 'networks of power' that exist along organisational spaces. Networks of power thus describe *the unevenness in acquiring legitimacy, knowledge,*

articulating interests and organizational power, and deploying capabilities among heterogeneous actors in the political economy represented by various sectoral or institutional domains, including technology, production process, bureaucratic arrangements. The structural complexity that emerges is such that it is still based on clientelism, informal mechanisms as well as formal arrangement that with policy intervention can offset transition costs (Khan, 1995). Notwithstanding attempts at synthesising the systemic and market failure policy rationales for ST&I and industrial policy (Andreoni, 2016; Bleda and del Rio, 2013), we are nowhere closer to a comprehensive understanding of the multiple constraints that need to be tackled by endogenising the specific nature of political forces into policy processes in small developing states (see chapter 4 and 5). The empirical basis upon which these ‘failures’ were constructed and circumscribed are at best anomalous, namely the Asian tigers, and bring to the fore a number of contradictions in the current period of development (Fine and Saad Filho, 2014). Even though some historical problems may be similar, the current international economy and the nature of production arrangements are unique to the spatio-temporal context (Kiely, 2015). The specific nature of the ST&I environment in small developing countries and the distribution of power and benefits can be a lot more dynamic, unpredictable and multi-layered.

Figure 2.2 - Networks of power - institutional arrangements and governance capabilities among the relevant groups and actors in the policy system

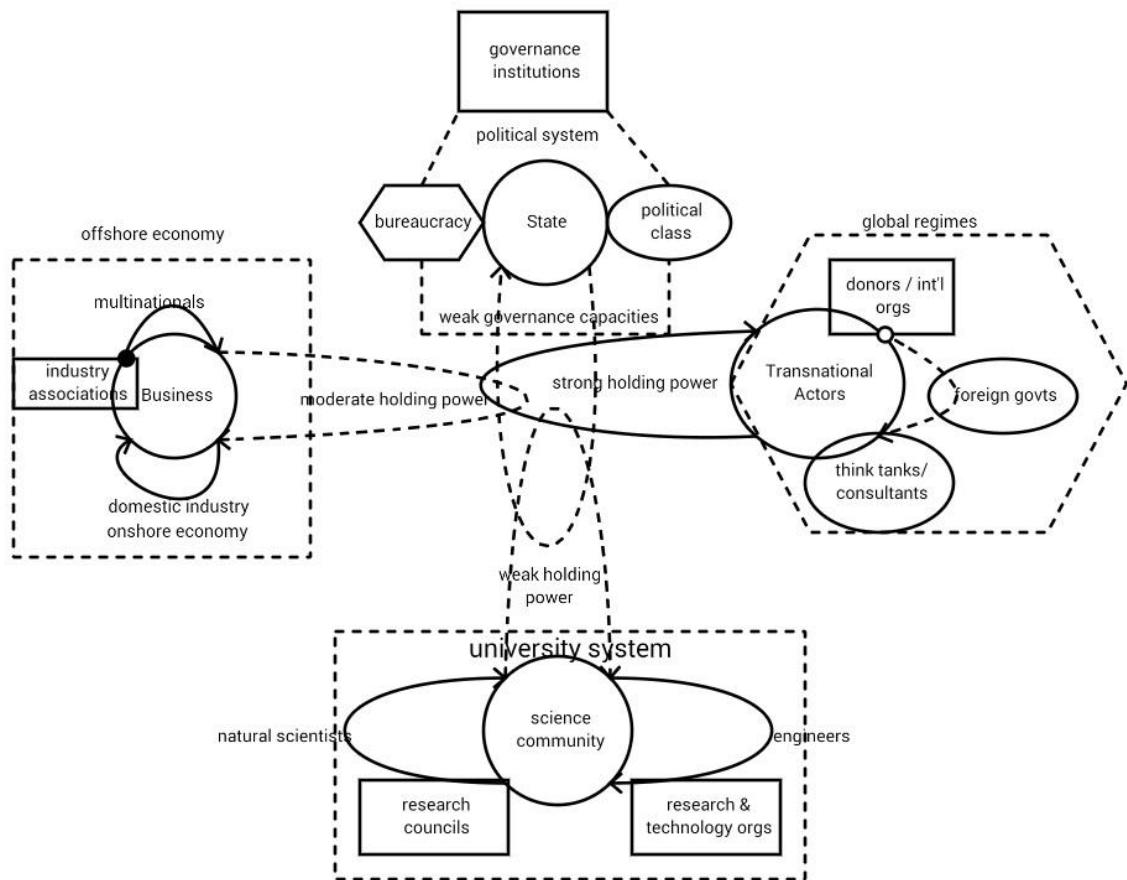


Figure 2.2 represents an archetypal depiction of the interactions among different players – the governance system, transnational actors, business sector (both domestic and foreign), and the science/ research system in an ST&I subsystem. The effects of these interactions and social relations generate the level and effectiveness of governance capabilities of state agencies in implementing broad-based ST&I policies. The configuration of actors varies according to country characteristics, productive sectors, institutional and political context and the degrees of power held by the various agents. This can be used as a way of depicting these various formations and understanding the structural, socio-political and technical rigidities that may limit technological change (see chapter 5 for elaboration of Developmental Governance Capability framework).

This dynamism characterises the extent of productive output from the application and integration of technological and scientific knowledge among industrial actors, how intermediaries support the former through intelligence gathering and policy advocacy, or not. Even external sources of financial incentives and where the state receives its finances for the formulation and implementation of policy evince changes in the political arrangements and its capability to mobilise resource for its purposes (Doner and Ross, 2000; Cassiolato, Lastres and Maciel, 2003; Hout, 2012; Watkins *et al.*, 2015). The informal and non-transparent character of these interactions and mechanisms that drive or retard institutional changes are deeply context-specific. For example, the business sector may also be unable to articulate positions on ST&I policy because of its membership or capabilities of its staff may be endowed with little experience or knowledge given the very few pockets of activity or that certain sectors may dominate, reflecting the structure and weak relations in a small developing economy (see chapter 4). In comparison, industry associations in South Africa and India have been able to effectively execute political strategies to support specific biotechnology sectors in concert with the state (Papaioannou *et al.*, 2016).

The institutional capacity of industry associations are mediated by the depth of its information-gathering and knowledge generation activities and capabilities, its insulation from government influence, which in some instances cannot be full achieved, and ability to articulate independent positions, and level of centralisation, which is also determined by the composition of its membership (Lucas, 1997). Public-funded universities can be susceptible to policy, political and intra-organisational changes and struggles; and their industrial research programs made to be dependent on patronage and bargaining (see chapter 4). Thus, researchers in developing countries can to pursue industrial-oriented research with the support and interactions between themselves and private sector groups.

The demand for knowledge among private sector groups can wane with the industrial activity when the political environment and policy impetus is weak or non-existent (Brimble and Doner, 2007; Kruss, Adeoti and Nabudere, 2012). As a result, the university and domestic research system may have limited capacity to marshal local problem solving capabilities and knowledge, can suffer from weaker institutional linkages and vulnerability towards the private sector and thus may not be able to exercise a great degree of policy influence compared to international sources of knowledge (Girvan, 2007; see chapter 5). These differential capabilities also complicate the ways in which state can provide effective leadership in a policy area in the wider public interest.

The coordinating mechanism for these linkages comes from different sources, which impact upon their effectiveness. The state can support the fostering and institutionalisation of these linkages but this depends upon how the political leaders and policy officials view the private sector (Lucas, 1997; Watkins *et al.*, 2015). In recent times with the onset of market liberalisation, multilateral lending agencies are playing an increasing role in facilitating these networks, supposedly as arbiters of knowledge of various contexts, to prevent corruption and unproductive rent-seeking (Levy, 2014; for a critique of this view, see Kiely, 2005). The multilateral organisations are usually seen as more insulated from the national environment and thus can impose its rules with greater consistency. They have become an important player in developing countries innovation programming and political economies more widely to facilitate the transition to a ‘knowledge based economy’ (Mayorga, 1997; Goel *et al.*, 2004). They serve as funding sources and institutional repositories by providing loans and grants to governments for human capital, expertise to conduct consultancies, policy formulation, and implementation in firms (Machado Arroio, 2012). Their role as influential diffusors of concepts, such as ‘innovation systems’, which has been used to design policies in both

developing and OECD countries (Mytelka and Smith, 2002; Lundvall, 2007; Edler and Fagerberg, 2017).

More widely, as knowledge generators refer to their political and institutional influence in developing countries (Toye and Toye, 2006; Girvan, 2007). From this perspective, given their significant human and material resources compared to developing countries, they can create knowledge hierarchies⁶ between themselves and their developing countries counterparts (Girvan, 2007). Instead of investing in local scientific capability they can undermine the development of such resources and the institutional compulsions to generate context-specific research and solutions to productive sector challenges and collective action. However, their policy influence must be understood in a complex way, not always directly imposing their own doctrines, but sensitive to their own internal struggles, engagement with country-level actors, bureaucratic structures, inflexible incentives, organisational cultures and practices that may not always be amenable to change (Toye and Toye, 2006; Yanguas and Hulme, 2015). In addition, depending on the policy domain and the number of other donors and the level of activity, it can create further complexity, by diluting the state's resources to engage meaningfully, or generate competition among donors to provide support which can be beneficial for the state to select among options or diversify its support arrangements. If however, there is a single dominant donor supporting ST&I policy, this can prove somewhat detrimental in the face of weak policy capacity or negotiating power caused by political / bureaucratic fragmentation and a lack of relevant policy and research skills. The incentives for pursuit of specific strategies or diverse approaches to policy making and social learning, become narrowed or limited as relevant actors demand more from this single source, possibly leading to further contestation.

As a result, this may obviate the emergence and formation of effective *developmental coalitions*, or ‘groups of actors’ that promote or impede certain types of policy reforms and instruments have been become an important analytical construct. In their view, coalitions are formal or informal groups of leaders and organisations that come together to achieve objectives they could not achieve on their own (Leftwich and Wheeler, 2011). In other words, they view developmental challenges as collective action problems when ‘when the rational pursuit of individual or narrow interests results in collective irrationality’ (Marquette, 2014, p. 13). For the purpose of this present study, coalitions are defined as institutional arrangements between public, private and non-state actors in which varying interests and degrees of power are expressed and exercised in pursuit of objectives that generate particular outcomes at points in time. These coalitions of interests may have an effect on the course of development and the implementation of policy as they engage and pursue particular objectives across class and institutional boundaries.

Developmental coalitions are thus characterised broadly of groups or classes of people along capitalist, administrative and workers or the poor that create incentives for other groups to act according to particular collective ambitions (Bresser-Pereira and Ianoni, 2015). For example, in the agricultural sector such coalitions have been known to either promote productivity improvements or block important policy changes given their divergent interests (Ruttan and Hayami, 1984; Hall, 2007). According to Pranab Bardhan:

Much depends on the nature of political competition and the context-specific and path-dependent formation of political coalitions... Institutional economics would be richer for more ... comparative historical studies rather than additional cross-country regressions (Bardhan, 2001, p. 279).

To build such coalitions may require a structural learning transition that is underpinned by productive transformations and institutional reconfigurations undertaken through

specific political and policy actions (Andreoni, 2014). Otherwise, social mobilisations of social classes and groups may trigger important changes in the state system and its political postures and substantive content of policies (see chapter 3). The likelihood of such coalitions having a developmental effect over time would require strategic coordination on the part of governance agencies, given their specific capabilities and the context of power relationships relative to other actors in the system. In a fragmented and highly politicised environment, indeed an historical outcome, the structural and productive learning efforts necessary to achieve this transition may require new types of social mobilisations across class lines, professional backgrounds, and institutional settings.

This chapter has sought to sketch a political economy approach to explain the process and mechanisms that produce socially desirable and broad-based technological outcomes. It is a reaction to the shortcomings and contradictions of the neoclassical economic theory of institutions and of the system-evolutionary institutional approach to innovation. These formulations have problematically been promoted throughout the international development community as the basis for policy interventions and understanding why developing countries' performance in ST&I have remained below expectations. But they have largely not taken the real political and social configurations of developing countries in general into account and the institutional settings of small developing states in particular. They remain ineluctably tied to the mainstream economic literature (Reinert, 2007). The growth in influence of a number of diverse players in the political environment of small developing states seem to have arisen from their size, lack of skills and material resources, as well as from the pursuit of neoliberal governance arrangements since the early 2000s.

This in effect transformed the balance of power and rearranged the objectives of the state from systemic transformation to efficiency and growth considerations (Fine and Saad Filho, 2014). Finally, policy conclusions are premised on R&D competitiveness, scientific productivity, efficiency, scarcity integral to innovation systems and good governance and less on conditions of dynamic efficiency, income distribution or the contradictory interactions between productivity gains and employment, social welfare or overall effective demand (Bell and Pavitt, 1992; Evangelista, 2017; Leach, Sumner and Waldman, 2008). Lacking therefore is a heterodox ‘Southern framework of thought’ (Delvenne and Thoreau, 2016). To achieve the social and economic objectives that create the conditions for broad-based development and more equitable structural change, deliberate political efforts must be informed by an in-depth understanding of the confluence of interests, incentives and structures consistent with each country’s specific historical, political and social struggles and their institutional contexts.

CHAPTER 3 – SCIENCE AND TECHNOLOGY, POLITICS AND INDUSTRIALISATION IN TRINIDAD AND TOBAGO: AN HISTORICAL ANALYSIS

3.1 Introduction

Chapter two has situated the main arguments and issues of the thesis in a theoretical framework, combining the nature of economic and political structures in small developing state with technological concerns. As stated above, the thesis is primarily concerned with analysing the evolution and changing dynamics of state capabilities and the effects on technological changes in T&T during the post-independence period, i.e. from the 1960s to 2015. In this regard, in the previous chapter the mainstream economic and institutional literature was assessed and found wanting in explaining the experience of small peripheral countries. As stated previously, new institutional economics drawn from the experiences of advanced economies with a methodological individualist rationale is unable to cope with structural and institutional realities of developing countries. The one-way path to development of adopting ‘first world’ institutions and correcting the politics presented within the new institutionalist theory does not resolve the paradox of high growth/income status and low technological capabilities in the current period that has prevented wider productive transformations.

Therefore, through in-depth historical analysis this chapter examines the institutional and political mechanisms and initial conditions that shape exchanges among various social actors in T&T. It aims to understand the evolution of state capacities relative to the industrialisation process and economic outcomes. Making in-depth observations about history and institutional context is essential. Likewise, despite its

claim as evolutionary theory of institutions, historical analysis in innovation systems studies has been synchronic and patchy. It starts by explicating empirical regularities of advanced economies and tries to work backwards to understand the process of institution building and policy design for fostering linkages and collective learning in developing societies. The framework's moorings create methodological difficulties that are not easily resolved by applying the framework wholesale across the developing world (Delvenne and Thoreau, 2016; Marcelle, 2017; Weber and Truffer, 2017). This kind of approach can lead to faulty and incomplete analyses and insights. As a counterbalance, the previous chapter has introduced a political economy analysis to consider the dynamics of politics and social forces seen as endogenous to development processes. It exposes several shortcomings of dominant theories in innovation and development. It thus reconstructs a heterodox perspective based on an appropriate analytical device. The next natural step is to historically link these arguments and heuristics to the social foundations of the society. This constitutes the aim of this chapter in the case of T&T starting from the colonial period up to 2015.

This chapter undertakes a theoretically informed case history of the S&T system, its institutional logics and the emergence and shifts in the balance of political forces in T&T at various conjunctures. Based on the framework outlined in Chapter two, it demonstrates to what extent driven by political external and domestic pressures by disparate networks and developmental coalitions of interests have emerged, and led to institutional changes and technological development. It also considers the overall effects of these configurations on policy and state power. As such, it attempts to open the 'black box' of the state apparatus and views development as a political process, thereby tracing mechanisms, strategies, and processes to historical techno-economic outcomes and institutional performance. It supports the empirical analysis of the contemporary period in

the next chapters insofar as one can understand the formation of the state and its mutations provoked by shifts in the distribution of power. The outcome considers the varying elements of the S&T system and policies of state, whether explicit or implicit, and the political rationales and economic effects.

3.2 Institutional and economic foundations: the colonial period

The island nation of Trinidad and Tobago is a modern politico-economic construct originating from interconnected human and material processes, namely mass migrations of people of African, Indian and Chinese, Middle Eastern and European origins to form a plantation system. The Spanish presence from 1498 in the island led to the decimation of the majority of indigenous groups referred to as ‘Caribs’ or ‘Arawaks’, with a small community with ancestral roots recognised today in a village in Eastern Trinidad (Ryan, 1972; Brereton, 2008). The island for the most part was neglected by the Spanish, since Columbus and his crew did not find any gold or precious metals and the remaining indigenous peoples were deemed an unreliable labour force (Brereton, 1981; Williams, 1962). Until 1783, when the Cedula of Population was issued by the Spanish throne, Trinidad remained largely underpopulated and remained under-developed compared to other of its colonial territories in Latin America. Meanwhile, Tobago was ceded to Britain in 1763 and was developed as a rural peasant society, in which sugar plantations were thereafter established. The island had been granted a form of colonial ‘self-rule’ led by an elected Assembly of Protestant landowners (Brereton, 2008).

In 1797, Trinidad became a Crown Colony *sui generis* much later than its neighbouring Caribbean territories (Brereton, 1979; Millette, 1970; Ryan, 1972). The two islands were nonetheless later joined together in 1889, incorporated under British rule,

with Tobago conferred the status as an administrative 'ward' of Trinidad in 1899. The Crown colony arrangement had a representative of the Queen in the person of a Governor, who in turn appointed wardens themselves exercising great influence in administering their districts (Anthony, 1987). While Trinidad was settled by the Spanish and the English; Tobago changed European powers several times from the French, Spanish, and British who were last to take political control (Braithwaite, 1953; Williams, 1962). British institutions have had the most durable effect on social life on these territories which came to known as 'colonies of conquest' as opposed to being settled by colonial authorities (Best and Levitt, 2009; Braithwaite, 1953; Meighoo, 2012) .

Their political position and dynamics have up to today created a complicated relationship between the two islands, but nevertheless entrenched certain European ideals. Each constituent group occupied a different place in plantation society; Africans as forced enslaved labour; Indians, Chinese and Madeirans as immigrant labour; and White Europeans as the planter class. Many of this latter group emigrated from other neighbouring islands in response to black uprisings in France and its colonies, and were offered generous land grants to settle on the islands under the Cedula of Population in 1783 (Braithwaite, 1953; Brereton, 1979; Ryan, 1972; Williams, 1962). This edict brought a landed, aristocratic class of French plantation owners to Trinidad who claimed to have closer, more paternalistic in their relations with the enslaved populations (Brereton, 1979).

During enslavement and later indentured servitude, the racial divisions in Trinidadian society were stark compared with Tobago, which remained relatively homogenous, with Whites wielding political and economic power, and Blacks and Indians occupying the lower rungs without the existence of any legal or political

safeguards (Brereton, 1979). Emancipation of enslaved Africans in 1834 was one step towards establishing a new social order but continuities have remained. The socio-economic order centred on the plantation-based sugar production would be dominated by these groups until pre-independence struggles sought to subvert these tendencies for the concentration of economic and social power (Best and Levitt, 1969; Brereton, 1981; Ledgister, 1998).

From the outset, its political and economic system within the British Empire was shaped by agrarian relations, primarily based on sugar production, but also cocoa, coffee, coconuts, livestock and other food crops (Kiely, 1996). This prominence of sugar and cocoa was supported first by the setting up of Botanical Gardens in Trinidad in 1818 represent a primordial source of valuable plants transferred to the colony where scientists would experiment, gather data on, and cultivate new crops for export production to other colonies or the metropole (Pemberton, 1999). The fact that the gardens were located on the Governor's premises signalled its importance in the origins of the island's political economy and the emphasis the colonial authorities would place on S&T, especially in relation to agriculture, for its imperial mission (Brockway, 1979).

As Pemberton (1999, p. 6) reports: 'the major local activity of the gardens became the distribution and sale of plants. The main items for sale included cocoa, nutmegs, coconuts, Brazil nuts and choice varieties of mango'. They also become the repository of technical knowledge for improving yields, plant selection, new techniques of cultivation, locational decisions, and investing in new varieties of sugar cane and other cash crops on the islands for the creating wealth for the planters and the metropolitan enterprise (Brockway, 1979; Pemberton, 1999). This led to the establishment of the Imperial Department of Agriculture in 1899, which had its headquarters in Barbados, but conducted

advisory work in Trinidad, given that the colony had its own cohort of scientists (Ali, 1975).

At that time, colonial forces exercised political control over the economy with the plantation viewed as the central institution of social life, which has given rise particular patterns of accumulation (Best and Levitt, 1969; Ledgister, 1998). After the Emancipation Act of 1834, even though attempts were made for transfer of power to the local White and British population, the metropolitan government as political authority would come to reflect the existing social order. French cocoa interests, English planter and coloured elements on the island however mobilised to attain greater political clout and formed the Legislative Reform Committee that functioned from 1856 up to the First World War (Ryan, 1972). At that time, the social pecking order was thus occupied at the top by commercial and property owners, salaried professionals, managers and overseers of the plantation and colonial officials (Braithwaite, 1953; Brereton, 1979; Ryan, 1972). At the lower rungs were the ex-slaves, and Indians and Chinese indentured servants. Sugar manufacturing was to a large extent control by overseas British interests and generated most of the colony's income until 1911 (Ledgister, 1998; Ryan, 1972;).

During this period, the lot of Blacks and later indentured Indian labourers was prevalently characterised by unemployment, precarious forms of work and low wages (Brereton, 1979). Former enslaved peoples of African descent rejected low wage work and were later supplanted by indentured labour, majority Indian, from 1845 to 1917 (Brereton, 2008; Ledgister, 1998). An organic association called the Trinidad Workingmen's Association (TWA) would later be formed, and led by veteran Captain Arthur A. Cipriani to contest the existing order, by educating the masses on the virtues of collective action and recruiting Blacks to become involved in the political process

(Anthony, 1987; Ryan, 1972). Added to this was the clamouring for social change through education as a result of which a new middle class emerged in the post-Emancipation period (Ledgister, 1998).

In 1921, the living and working conditions of the poor, especially returned war veterans, triggered strikes deemed menacing by merchants (Ledgister, 1998; Palmer, 2006). Led by Captain Arthur A. Cipriani, militant workers and pressure groups opted to take strike action and show their dissatisfaction. A limited franchise was subsequently permitted under a new Constitution. The first general elections under this new arrangement took place on February 7, 1925 resulting in seven members of the twenty-six member Legislative Council being elected partially reducing the role of the Governor to appoint members (Anthony, 1987; Brereton, 1981). They still represented the planter and managerial class of the colony who wanted protection from the majority of Blacks and Indians and so maintained close links to the metropolitan state. They effectively ensured the plantation system continued to generate profits (Jacobs, 1977; Ledgister, 1998).

The 1930s witnessed heightened pressure clamouring for elective political reform and improved social conditions (Kiely, 1996). Punctuated by the 1937 Butler Riots, during which countrywide labour and social unrest occurred clamouring for greater political participation towards self-government. These events further led to the Adult Franchise in April 1943, whereby individuals over the age of twenty-one were allowed to participate in general ballot which took place on July 1, 1946 (La Guerre and Girvan, 1972). Attempts by colonial legislators to lobby for the criteria for voting to remain linked to property ownership and literacy, were unsuccessful due to challenges by left-leaning political groups (Ryan, 1972). A further nine of the legislative council seats were to be contested by the entry of political parties, namely the Butler Party, the Trinidad

Labour Party, the Trade Unions Council, and the United Front, among other left-wing variants espousing socialism and improvement of the economic and social conditions of labour (Anthony, 1987; Kiely, 1996; La Guerre and Girvan, 1972). All of these political developments set the stage advanced the power of trade unions that would set the stage for full self-determination of inhabitants of the islands to exercise control over their own affairs (Kiely, 1996; Ryan, 1972).

The first petroleum finds were made in the late 19th century attracted little investment from resident merchants. It was not until 1904, that the British decided to convert the Navy from coal to oil; the military not only served as an important source of technical know-how, but also to protect commercial interests (Johnson, 1975; MacDonald, 1986). The internal combustion engine invented in the 1890s, and later the automobile encouraged full-scale drilling and production of oil. This coincided with greater demand and interest from metropolitan sources (Brereton, 1981; Mitchell, 2011). The commodity assumed increased geopolitical and economic importance to British imperial interests, when according to one government source:

In 1936 Trinidad produced over 60 per cent of the oil produced from British Empire sources, but this was only 0.92 per cent of the world's production. None the less, on account of its quality and geographical position, it is of very real significance to the Empire as a whole, and in both peace and war the Royal Navy and the Royal Air Force have a vital interest in the development and modern scientific refining of Trinidad oil (Johnson, 1975, p. 48)

Trinidad came to be seen as a reliable source of oil for the British Navy, precipitating a rapid expansion of oil production activities whereby in 1910, 30 companies received loans and other capital allocations made for production and drilling facilities (MacDonald, 1986; Mulchansingh, 1971). Infrastructural works from 1876 to 1913 in the form of construction of rail lines, pipelines, roads and port facilities were undertaken between Port-of-Spain and the oil fields in South Trinidad to serve the efficient

transportation of petroleum to British markets (Mulchansingh, 1970). In these days capital was secured from Canadian sources as resident capitalists had interests in the cocoa boom (Brereton, 1981). Besides, these initial investments propelled further drilling and the yields generated interest by British capitalists. By 1933, 50 additional companies registered to participate in the industry and increased production to 20million barrels in 1939 (Mulchansingh, 1971). By 1938, Trinidad produced between 38 and 44 per cent of British petroleum demand (Brereton, 1981; Mulchansingh, 1971).

By the early 1930s, more sophisticated scientific knowledge and technological equipment would be put to the service of the oil industry making deeper wells and more accurate discoveries possible (Brereton, 1981). The oil industry brought increased prosperity to the colony but labour in the oil fields were still facing poor working and social conditions (Kiely, 1996). The workers were being meagrely remunerated and could not advance in their positions given the policies that undermined opportunities for improved education and training (Ali, 1975; Jacobs, 1977; Johnson, 1975). In fact the two major companies declared dividends of 25 and 35 per cent in 1935-36 (Brereton, 1981). Additionally, senior administrative staff, engineers and technicians were European or American expatriates occupying high-skilled jobs (Braithwaite, 1953; Brereton, 1981; MacDonald, 1986).

The disparity of wages between skilled and unskilled workers also became a source of tension and industrial unrest; unskilled workers complained that they worked up to 90 hours weekly and being paid a paltry 70 to 80 cents per hour and had to endure squalid living conditions (Ryan, 1972, p. 48). The demands of the striking workers were for industrial and social legislation, slum clearance, adult suffrage, land settlement, better wages, trade union representation and full democracy. As a result, the combination of

increased economic costs, local clamouring and British social policy in the metropole that made recruiting international staff more difficult; concomitantly over time, some oil companies established on-the-job-training schemes and scholarships for local people (Braithwaite, 1953).

Following the setting up of botanical gardens in the early 19th century to serve the plantation and imperial interests, as mentioned above, S&T architecture was set up to serve resource exploitation based patron-client colonial relations (Harrison, 2005; Hodge, 2002). In certain instances, investments in new infrastructure and institutions for the island colonies were made after some social unrest, or based on the demand of the planter class and driven by prevailing production systems (Brockway, 1979). Joseph Chamberlain, the Secretary of State for the Colonies during the 1890s advocated a ‘new’ vision for the area based on ‘science for development’ which translated into exploiting resources, primary production, requiring alongside minor improvements in physical infrastructure, as well as the ‘the application of science to solve the many biological and technical problems of “tropical” development’ (Hodge, 2002, p. 3). These imperial tools would help improve labour efficiency and worker output, along with the state provision of rudimentary sanitation and healthcare services to combat disease. It would not be until later when clamouring for and processes of decolonisation were triggered that this would marginally change (Girvan, Gomes and Sangster, 1983; Harrison, 2005). Research and development (R&D) funding was supplied by the colonial office for agricultural activities (Ministry of External Affairs, 1979). As part of the intervention in the colonies and to expand production and reduce unemployment, scientific research was seen as important for the growth, especially in agricultural commodities, fisheries and forestry.

The basis of such an agenda was laid out in the Moyne Commission's region wide report, chaired by Lord Moyne to investigate the economic and social conditions of the West Indies after the uprisings of the late 1930s. The rise of the working-class movement in 1937 in one writer's view 'altered the orientation of British colonial policy... as nothing before it had done' (Ryan, 1972, p. 15). It stated that West Indian countries should essentially focus on their comparative advantage in agriculture, and not industry (Farrell, 1980; Ministry of External Affairs, 1979). A welfare fund intended to improve social and economic conditions was established; subsidies towards capital development and import substitution, as well as research work in agricultural techniques also took centre stage (Jeffries, 1964). Some scientists working in the metropolitan centres believed that concerns of scarcity of natural resources, and the need to optimally use and prevent wastefulness signalled the need to apply modern scientific methods to their exploitation (Hodge, 2002; Worboys, 1996). To this end, a number of technical service-oriented units within Colonial offices and departments were set up and run by local agricultural and administrative officers with links to and occasional visits of expert scientists based at British laboratories where major investigations were conducted (Worboys, 1996). These services largely aimed at supporting the wealth-generating and productive capacity of large corporates and the planter class (Jöns, 2016). In line with maintaining a modern plantation system in Trinidad, these planters made greater use of technical knowledge, production and organisational technologies (Girvan, Gomes and Sangster, 1983; Pemberton, 1999).

Additionally, the Imperial College of Tropical Agriculture (ICTA) was established in the early 1920s and was considered the 'university of the Tropics' or the 'South Kensington of the Tropics' (Worboys, 1996, p. 101; Roseboom, *et al.*, 2001). The structure of the institution was initially contested by local legislators and colonial

administrators, as the College was aimed at servicing the entire British empire, as a result of which it was instead re-purposed as a regional centre (Hodge, 2002). From 1918 to 1928, the number of scientists coming to the colonies trebled while increased fieldwork and advisory visits from 1926 -1935 by a number of British-born university researchers and teaching staff also increased (Jöns, 2016; Worboys, 1996). At this stage, ICTA was the site for research and teaching, published its own journal, and the only institution engaged in postgraduate research populated mainly of non-nationals involved breeding programmes for the major plantation crops (sugar, cacao, bananas, citrus) as well as a strong soil science programme (Hodge, 2002; Roseboom, *et al.*, 2001). The effects of these changes were especially felt on the sugar production which expanded almost two-fold at time the country's major export crop. This significant increase in yields was triggered by the consolidation of smaller estates, new cane varieties, greater use of inorganic fertilisers, better methods of land preparation, improved extraction rates and a successful campaign against the froghopper pest after 1926 (Brereton, 1981).

In contrast, cocoa witnessed a deep slump in prices from US\$23.90 to \$US9.50 from 1919 to 1921 in the context of world oversupply caused by the Great Depression (Bekele, 2004; Brereton, 1981). In an effort to stem this downward spiral, the government extended credit facilities to French creole planters who owned large estates to meet their interest payments, long-term mortgages, and to continue cultivation from 1922-1955 (Brereton, 1981). Prices fluctuated up till 1930 contributing to persistent unease among planters. By 1931, the Cocoa Research Scheme was set up under the ICTA, a five-year funding arrangement by producing colonies and chocolate manufacturers in Great Britain – to increase yields and rejuvenate the sector that had experienced serious effects from ‘witch broom’ disease (Bekele, 2004; Hodge, 2002; see chapter 4 - box 4.2 for a brief discussion on the cocoa sector development). This institution was prompted after a series

of visits by Frank Stockdale who was named Agricultural Adviser to the Colonies during the Great Depression, when at the time production across the colonial empire was affected by low prices and decreasing yields. The Cocoa Rehabilitation scheme beginning in 1940 was another intervention expected to stem this decline and certainly assisted in generating exports and employment, though cocoa's 'golden years' prior to 1920 never returned (Brereton, 1981). The ICTA for decades led significant research into new varieties, making it resistant to disease, and use of production technologies (Grivetti and Shapiro, 2009). However, the number of other scientists making visits for research purposes decreased leading up to the Second World War, and even before that paled in comparison to more established areas such as India and Canada (Jöns, 2016). Up to 1960, the major funding sources of the ICTA were private commodity interests and boards under the control of the British Colonial Office.

Additionally, government units alongside industry, especially the Imperial Department of Agriculture had already established a reputation for conducting cutting-edge research into various crops and food production activities. With the onset of the labour riots and island wide unrest in the late 1930s, augmented by a growing population, greater state intervention and coordinated efforts in public services through the various Colonial Welfare and Development Act, land reform measures, and agricultural policy centred on the application of scientific and technical knowledge (Hodge, 2002; Moore, 2016). Given all these efforts towards self-government, it became apparent that a new university – or higher education institute – was essential to bring about necessary socio-economic change. The inauguration of the University College of the West Indies was therefore held in 1948, a part of the British plan to cultivate new leaders to handle the affairs of an independent nation (Ali, 1975). Greater demand for trained professionals and

to engage with finding solutions for the process of development would be natural outflow of political decolonisation.

In the post-war period, British interests perceived independence as a gradual process and thus still maintained effective control of several institutions critical to development. For instance, in the sugar industry, by 1958, Agricultural Research Station, part of the Tate and Lyle transnational company, was considered at the time one of the most advanced in the world established and managed agricultural research centres. Its main activities were the refining process, the use of molasses, and non-food uses of saccharose (Chalmin, 1990). Chalmin (1990, p. 356) further documents that Caroni Ltd constituted a 'laboratory' where staff experimented with a number of innovations, including bulk transport and handling (1950); the industrial use of bagasse; a profit-sharing mechanism for workers (1956); the mechanisation of fieldwork and pension scheme (1963); and agricultural research where a number of cane varieties were developed. By the time of independence, its research personnel, led by Dr A. J. Vlitos departed as 'it seemed logical to transfer the main research effort to Great Britain' (*ibid.*, pp. 423). This also accompanied a shift in academic focus on the colonies as less advisory requests were made as the need for British expertise reduced (Jöns, 2016). According to one historian, it would appear that the science policy and the colonial development agenda were inextricably intertwined:

It was expected that science and scientists would be catalysts of development by discovering economic opportunities, making the tropical environment safe, solving technical problems in production, processing and distribution, directing and improving the productivity of investment, and generally demystifying the tropics and their people (Worboys, 1996, p. 108).

Notwithstanding the early makings of an S&T system, it was constrained by a focus on research activities of export crops and commodities after imperial demand,

limited skills improvement and technology transfer, and fragmented domestic control of the institutional development process. In effect, these disparities and loss of control by local authorities in the direction of S&T in the colonies, giving rise to ‘asymmetric power-relations between different parts of empire and thus confirms the existence of multiple, geographically distinct imperial knowledge networks’ (Hodge, 2002; Jöns, 2016, p. 110). This undermined any prospects of a local technological capability being developed to any great degree. Nonetheless, the existing elites and power structures benefited, especially as the locus of power was centralised in Great Britain, and became increasingly fragmented over time as more power was devolved under the colonial regime. In consequence, the institutions set up did not yet respond to the real material needs and productive challenges of the society (Girvan, Gomes and Sangster, 1983). The colonial S&T system would thus come to reflect in part the external control of resources typified by rents to plantation owners and resource extractors, and social impulses from within for greater decision-making authority, constituting a site for domestic conflict. To alleviate this situation required important political changes.

3.3 The politics of industrialisation (1958-1970)

The interwar years and the onset of the Great Depression catalysed mass mobilisation and demands from the working class and burgeoning middle class for social change creating the conditions for decolonisation in T&T. These catalytic events had fatigued colonial powers and the metropolitan economy and energised new leaders and labouring classes to pursue self-determination. The culture of top-down rule also had already been entrenched in T&T and thus policies and ideas initially flowed from that source. However ethnic and class cleavages inherited from colonialism, despite attempts

to create a form of nationalism, still protruded the politics and aspects of state-building (Girvan, 2015; Ledgister, 1998; Ryan, 1972). One of the main drivers for political independence was the thrust of industrialisation, as it was believed that manufacturing based industrialisation required foreign investment. The Pioneer Industries Ordinance of 1952 was thus passed to achieve this undertaking (Brereton, 1981; MacDonald, 1986).

Albert Gomes, minister of labour, industry and commerce in the Executive Council, an a colonial institution which Ledgister (1998, p. 104) referred to as the 'governor's coalition', was one of the main architects of the early attempts at capitalist development under a five-year economic programme from 1951 to 1955 (MacDonald, 1986). This period also paved the way for independent party politics and rivalry, as Williams berated Gomes in hindsight for the 1950 constitution:

Cipriani, Butler, Solomon – these three will go down in our history as the great trinity in our movement for self-government. Cipriani gave dignity to the barefooted man. Butler brought the inarticulate masses on a national scale on to the political stage. Solomon introduced the intellectual element and dignified the constitution reform movement by placing it in its world democratic context. ... Cipriani, Butler and Solomon laboured, each in his own way in the vineyard, only to produce the barren fruit of Albert Gomes (Williams, 1962, p. 242).

Industrial growth was experienced in this pre-independence period as the Gomes' quasi-colonial administration promoted light industries including asphalt, beer, bricks, cigarettes, cotton, textiles, glass, matches, rum, and wooden boxes (MacDonald, 1986). The country entered independence with buoyant growth with per capita GDP over 7 per cent between 1955 and 1961 (Ramsaran, 1999). Nevertheless, most profits were repatriated to the owners of these companies who resided abroad, and so had little immediate effects on local development.

. In 1956, the People's National Movement (PNM) led by the charismatic Oxford-educated Dr Eric Williams was formed. Less than a year in operation, it won the 1956

elections by winning 13 of the 25 seats and Williams was invited by the governor to become the Chief minister and form the government (Palmer, 2006). At the dawn of independence in 1962 in *The History of the People of Trinidad and Tobago*, Dr Eric Williams offered hope for a nationalist identity and pride that would ‘remove the vestiges of colonialism and change the colonial pattern and mentality in every sphere’ (Williams, 1962, p. iv). In the economy, this meant a shift from old patterns of accumulation associated with agriculture and food production (Mottley, 2008).

According to Mottley (2008, p. 10), ‘agricultural pursuits awakened colonial memories; whereas industrialisation the forbidden fruit in colonial times fired [up] nationalist aspirations’. Williams and his party set out to transform the society and economy away from agricultural production, eschewing attempts to align his party along ideological lines, which earned him staunch criticism of trade union leaders (Palmer, 2006). Instead, he sought a third way, along with his party to promote the national interest and reach out to diverse groups in the society (MacDonald, 1986). Even though the PNM had a national scope, with followers from all ethnic and class groups, it became known for its African support base, while the Democratic Labour Party’s (DLP) support base comprised primarily Indians from the South and Central sugarcane belt (Auty and Gelb, 1986; Brereton, 2008; MacDonald, 1986; Pierre, 2015).

The construction of the T&T state and its responses to external pressures or advancing objectives in international relations was conditioned by the forms of capitalism related in part to the control of the majority via British colonials and planters from abroad. Influenced in large measure by colonial strategy, much of the early discussion on industrialisation restricted the T&T colony to production of raw materials, the importation of technologies from Britain, and the minimal stimulation of local industrial capacity

(Farrell, 1980). These realities reflected the unequal development and the linkages between advanced manufacturing in the North that resulted in poor terms of trade in developing countries (Prebisch, 1950). In this context, limited emphasis was placed on building an endogenous S&T base to benefit the local population (Cooper, 1972). As a result, the connections between science, technology and the productive sector were tenuous and S&T institutions and infrastructure reflected these poor conditions (Cooper, 1972).

The lack of technical skills, significant resources, power supply and capital constituted key binding constraints on such an industrialisation effort, which bolstered their argument for 'light industries', thereby influencing the limited policy attention by colonial authorities and provoking tensions with and local trade unions and leading figures at the time (Farrell, 1980). The stark inequalities that existed in terms of science and technological (S&T) capability between developed and developing countries and the organisation of S&T activities in the latter, made a serious case for intervention, provoking the interplay of forces at the global level (Sagasti, 1980). In no other arena where such tensions were brought into relief than in the global politics surrounding issues related to S&T for development.

At independence in 1962, the Prime Minister saw the importance of international solidarity and an active foreign policy. As one of the first diplomatic overtures, three delegates from T&T participated in 1963 United Nations Conference on Science and Technology for the Benefit of Less Developed Countries, held in Geneva, Switzerland (USAID, 1963). For their part, these representatives believed there was need to conduct an assessment of relevant ST&I institutions and make training opportunities available for

nationals, especially in its mineral production sector. In this respect, the T&T three-member delegation articulated the following needs and problems:

(1) good geological coverage; (2) study of the problems of secondary oil recovery; (3) study of the uses and effects of water encountered in drilling for oil; (4) diversification of oil and mineral products; (5) low government salaries; (6) a civil service board; (7) increased attendance in 81 world conferences to keep up-to-date; and (8) educating local people in their local problems (USAID, 1963, pp. 81-82).

To this end, representatives of low and middle income countries, lacking the financial wherewithal and thus political clout, advanced the proposal for the establishment of a dedicated institution for science in service of development, which was at first rejected, and replaced by a committee on S&T by Secretary General U Thant (Brook, MacMaster and Singer, 2014). In the final analysis, it is notable that the major accomplishment of the Conference was the recognition of the importance of S&T in the policies of developing countries (Standke, 2006). The creation of UNCTAD in 1964, which became the Secretariat for the Commission on S&T for development (1993), was also testament to the efforts of developing countries for a forum to discuss their own issues, including S&T (Omer, Soubra and Konde, 2004).

Prime Minister Williams sought to integrate many of these proposals into the national economic agenda and proceeded to put a number of institutional arrangements in place. First, he set up a National Planning Commission, an autonomous planning agency under the office of the Prime Minister (Farrell, 2012). With the intellectual guidance of famed economist Professor Arthur Lewis and Mr Teodoro Moscoso of the Puerto Rican Development Agency, two five-year National Development Plans (NDPs) were devised based on a strategy that became derisively known as ‘industrialisation by invitation’ (Best, 2012). Both NDPs adopted an approach aimed at attracting foreign capital, through the legal provision of incentives, including tax holidays, duty-free import allowances, even material inputs and production facilities (Best, 2012; Lewis, 1950; MacDonald,

1986; Ryan, 1972), to be managed by the Industrial Development Corporation (IDC), inaugurated in 1959 (IDC, 1969). Meanwhile, the economy was largely controlled by external interests: the financial sector (British, Canadian and American), sugar industry (British), and petroleum sector (British and American) (Pantin, 1995). Early on, the Prime Minister and the ruling PNM committed to retaining their involvement, while further boosting industrial expansion by attracting new foreign capitalists in an effort to address the problem of labour surplus.

In 1962, the year of independence, the government introduced a number of tariffs to stimulate the local assembly of products by inviting on a first call over 300 local and foreign applicants and making it more worthwhile to import components rather than finished products (IDC, 1969; Ryan, 1983). Protections were granted to a number of segments including foodstuffs and meats, household and kitchen wares, cosmetics, footwear and garments against foreign imports (IDC, 1969). It was hoped that such measures would resolve the problem of excess labour and promote economic growth. The government nevertheless adopted an approach to industrial policy, by providing basic infrastructure, incentives and support services to industry while avoiding becoming active operators in the manufacturing industries (Government of Trinidad and Tobago, 1958), thereby strengthening of the capitalist class to grow in policy influence.

The first five-year NDP, premised on the above conditions, envisaged greater investment in manufacturing sector, research and development (R&D) by foreign transnationals that would lead to successful take-off and industrial development. The same year the ICTA, which was made the University College of the West Indies (1948), affiliated to the University of London, became the independent regional University of the West Indies in 1962. By 1963 a total of 99 'pioneer' manufacturing enterprises were in operation with capital investment of \$85million by mainly British and American capital

and directly employing 4666 people (Brereton, 1981, p. 219). However, it was soon discovered that the foreign private sector had not performed as anticipated after even being provided with generous incentives and increased dependence on foreign capital, management, technology and markets (Best, 2012).

These investments were only to be facilitated by government, and the expected spill-overs from such foreign capital, as the theory goes, would lead to improved managerial capabilities, employment and other technological spill-overs (Lewis, 1950). The projects and incentives were not directed to the domestic private sector, as they were to a certain degree left to their own devices and not actively included in the industrial policy process (Farrell, 2012; Mottley, 2008). Meanwhile, the pre-independence class structures remained intact and continued to create anxiety and tensions, especially among the labouring class and trade unions (Brereton, 1989; Kiely, 1996). Indeed, the employment and hiring practices that showed blatant discrimination towards Blacks and Indians, the two major ethnic groups from obtaining employment in areas in which they possessed the requisite training and skills, exacerbated these tensions (Camejo, 1971). Coupled to this, the number of unemployed stood at 10 per cent or 35,000 in 1967 and at 15 per cent in 1969 (IDC, 1969; Seers, 1964). Eventually, the import substituting industrialisation policy of providing facilities and incentives to industry but not as an active economic player would not meet the labour and employment needs of the country (MacDonald, 1986; Pantin, 1995; Ryan, 1971; Seers, 1964).

In the final analysis, certain ‘infant industries’, like vehicle assembly did not mature at an expected rate and acquire the capabilities to become more productive and internationally competitive operations (Bell, Ross-Larson and Westphal, 1984; DeCastro *et al.*, 1985). Indeed, the incentives provided to these new industries did not induce the process of technological upgrading as the governing bodies could not enforce

performance standards (Khan, 2010b; Jaupart, Longmore and Cazorla, 2014). Farrell, (1980, p. 100) further asserts that

The lack of sufficient skilled and professional workers and tremendous deficiencies in management and other aspects of organisational [sic] technology constitute severe bottlenecks to the employment expansion process.

Based on the activities of the IDC and the wider government, it would appear that little policy attention was given in its industrialisation thrust to the specific area of technology policy i.e. building local capabilities and technological capabilities of industrial firms receiving government subsidies and infrastructural support. This outcome appears to have two determining sources: the role of the state as facilitator, attendant limited governance capabilities due to existing powerful transnational forces working in the state, and the actual content of policies already influenced by the relative power of existing and new organisations seeking to establish manufacturing operations in T&T.

During this first decade after independence, the authoritarian tendencies of the first premier, Dr Eric Williams, became evident from this early phase of industrialisation as he dominated the PNM, and aspects of national life (Palmer, 2006; Parris, 1983; Payne and Sutton, 1984; Sebastien, 1985). One leading observer as a matter of fact referred to Williams' style of leadership as 'Doctor Politics' to describe a structure in which there is a dominant key figure, in the Prime Minister or leader of government who exercises a monopoly of power over all governance institutions and functions and around whom a form of personalistic politics converges (Best, 1969; Parris, 1983). By 1970, he would lead four ministerial departments in addition to his substantive role as Prime Minister (Palmer, 2006). The Prime Minister assumed several responsibilities and the patron-client relationship between he/his ministers and technical and bureaucratic staff was evident, sometimes becoming testy because of the political demands made (Hope, 1983). It would appear that at times Williams and the state were synonymous, and given his liberal

orientation towards industry, he was viewed more pro-capital than pro-labour (Sebastien, 1985). Nevertheless, disagreements still persist about his actual stance, though a midway between socialism and liberal capitalism has been advanced (Pierre, 2015; Ryan, 1983). He nevertheless maintained that the PNM was not communist, especially in light of the ousting of a left-leaning government in neighbouring British Guiana (Pierre, 2015).

In the early years of the PNM administration, there was significant conflict between his ministers and the civil service which had largely been brought over from the pre-independence era. To a certain extent the Prime Minister maintained the 'old order' of white predominance in the civil service and attempted to recruit new technical expertise, its complexion had to gradually change to meet the demands of the new society (Hope, 1983; Ryan, 1972). The many mandates that required rapid implementation created frustrations and an overstretched bureaucracy. The political establishment also had limited capacity to re-organise the bureaucracy, and discipline the private sector to achieve dynamic efficiency and deliver on its development plans. As Ryan (1972, pp. 351) argues:

Despite the attempt to define roles and responsibilities the administrative crisis, one of the more immediate consequences was the development of a system of personalized administration. More favoured officers began to bypass their colleagues and even their ministers (whose competence) they suspected to work directly with the Prime Minister. The elite corps of the service functioned as the personal aides of this charismatic leader.

In an effort to counteract any political fallout and the negative backlash from the trade union leadership, Dr Williams embarked upon community consultations for the Second National Development Plan (Jones and Mills, 1976). Thus, reform efforts of this early post-independence period were considered ad-hoc and sought to only marginally re-structure the administrative arm of the state (Hope, 1983). The establishment of new institutions and operating procedures did not succeed as anticipated, and many decisions

of government were marred by ‘friction, tension and suspicion’ among politicians, technical and administrative staff (Bissessar, 2015, p. 182–186). This stymied the level of decisive action the state could take in transforming the society and economy.

Other productive sectors such as agricultural commodities like sugar provided the majority of employment and required effective management to maintain its political and economic importance (St. Hill, 1970). Sugar production at this time also employed both directly and indirectly 60,000 people, including 11,097 (1965) cane farmers for a population of less than 1 million people (Sugar Manufacturers Association (of Trinidad and Tobago), 1969; Chalmin, 1990). Production activities and factories were dominated by three main manufacturers of sugar in 1969, including Caroni Limited, which was owned by Tate and Lyle, a British transnational company (Sugar Manufacturers Association (of Trinidad and Tobago), 1969). Up to 1968, the company amassed \$50 million from sale in its major export markets, including United Kingdom, United States and Canada, across the English-speaking Caribbean and the domestic market (Caroni Ltd, 1966). In 1963, failure of the main union to institute a pension plan and agreement to a wage freeze led to organising among sugar workers. Further tensions heightened and on February 21, 1965, a strike was called by sugar workers at the Ste. Madeleine factory (Kiely, 1996). By March 12, the entire sugar labour force had engaged in a complete work stoppage and the Governor-general issued a State of Emergency. This opened the way for government to lay the Industrialisation Stabilisation Bill in Parliament on March 12, which prohibited the right to strike and lock-outs in essential public services.

One report underscores that greater yields gave rise to smaller holdings and changes in tenancy of farmers and stagnant wages over this period (Haraksingh, 1988). Salaries did not keep pace with their level of productivity (Chamlin, 1990). By 1970,

there were four estates still in existence under private ownership by Tate and Lyle, with Caroni Limited, generating 90 per cent of sugar production. However, sugar production continued to increase during the 1960s, from 174.4 metric tonnes to a peak averaging 227.7 tonnes of sugar⁶. Sugar production at this time employed around 15 per cent of the population, and thus represented the mainstay of labour power (Thoumi, 1989). Sugar workers and farmers at the time led through the All Trinidad Sugar Workers' Union believed that their representatives were not seeking their best interest and this led to their participation in what would be dubbed the 1970 February Revolution (Samaroo, 2014). Labour organising among major trade unions was heightened as the major Sugar Workers' union, considered an ally, and the Oil Field Workers Trade Union, among other major unions joined forces to challenge the status quo (Kiely, 1996).

The industrialisation thrust, prominence of the oil economy, along with changes in the international commodity and political environment appeared to marginalise the agricultural sector. In this vein Crichlow (1997) reports that no longer in this part of the world, agriculture seemed to hold international attention as in the centuries. In this way, continuities associated with ethnicity and class in the colonial plantation economy came into relief, and formed a basis of inter-ethnic cleavage; people of East Indian heritage were largely employed in the agricultural sector, whereas increasingly citizens of African heritage had jobs in the petroleum industries (Ledgister, 1998). It is no wonder that economists came to describe the marginal role of Indo-Trinidadians in the economy (Dookeran, 2005; Munasinghe, 2001). But this view contrasts sharply with coalitions among sugar and oil workers in the colonial period (Edwards, 2016; Kiely, 1996). The sharp decline in sugar production and policy attention to the sector the decades post-

⁶ <http://www.undp.org.tt/TT-Today/Trinidad-Tobago-Production-of-Cement-Sugar-1960-2007.html>

independence could explain the so-called disenchantment among Indians. However, the lack of policy support and regulation of the industry meant that cane planters competed with larger companies undermined the former's profitability and capacity to improve productivity and lower costs (Chalmin, 1990). Francis (2012) also documents that the decline in the industry was brought about by a confluence of external and domestic factors and forces, namely the change in trading relations with Great Britain, and deliberate domestic policy to concentrate on the petroleum industry. However, this approach to industrialisation failed to generate indigenous technology transfer as only minor activities, especially in assembly production for export were eventually carried out in the country (DeCastro *et al.*, 1985; Farrell, 1979b).

3.4 State intervention and institutional change (1970-1983)

By the end of the 1960s, unemployment stood at 13 per cent (Pantin, 1995), indicating the failures of the first and second NDPs to promote equitable growth and broad-based development. Petroleum exploitation and refinery accounted for almost three quarters of exports, one-fifth of government revenue and 20 per cent of national output turning the economy into an oil based economy proper with limited effect on employment (Auty and Gelb, 1986). Unemployment data suggest that it had grown from 17,000 in 1956 to 60,000 in 1975 and was projected to become worse (Farrell, 1978). Black leaders at the University of the West Indies (UWI) and trade unionists started mobilising and demonstrating against the PNM administration. Social discontent among working and middle class citizens was widespread and presented the major popular challenge to the PNM administration (Parris, 1983).

In February 1970, a major domestic shock hit the political landscape of T&T. The perturbations created much disquiet throughout the country as marching and demonstrations ensued culminating in an army mutiny. 'Black Power', the refrain and of the popular movement represented for its protagonists, including the National Joint Action Committee (NJAC) and other trade unions the only challenge to a repressive economic system, which favoured capital and expatriate economic class. According to Sutton's account (1983, p. 116), NJAC produced a pamphlet prior to its coming onto the scene in 1970 that outlined the major problems in T&T:

The starting point is the economic system: "the major instrument of the oppressors in our society". This system is 'founded on the calculated dehumanization of the Black man by the White man' and is the product of centuries of exploitation. In Trinidad and Tobago the system is manifest in the dominance of the white power structure, 'the alliance of Foreign and local White capitalists' in which the local white capitalists serve as junior partners.

For the progenitors, it was an opportunity to uproot centuries' long exploitation, starting from enslavement, to the apparent continuity of colonialism, and institutional alliance of the bureaucratic state with foreign capitalist interests. Its expression took the form of mass protests, an army mutiny, and a no-vote campaign that was carried out in 1971 (Kiely, 1996), and comprised various sections of society, including university students and workers of African and Indian heritage (Meighoo, 2003).

As the government did not have the repressive power of the British state, nor were they immediately up to the task of quelling a popular uprising, prompting the government to make significant institutional and popular changes. During this time, clientistic politics evolved as Prime Minister Williams grew distrustful of the official sources of information, which led him to rely upon a 'second' Cabinet or informal group of business men and party supporters to assist the government in subverting the movement (Pantin, 1995). It was also evidenced in campaign funding offered by the Syrian business

community to the PNM for the 1976 election campaign (Samaroo, 2014). It would appear that an informal pact was entered into between the capitalist Syrian community and the PNM, where the former received state protection in exchange for political financing. The events of this period opened an opportunity for Williams to appear conciliatory and highlight a number of achievements of the ruling PNM that counteracted the laments of the protesters. However on April 20, 1970, Williams instructed the Governor General to declare a nationwide state of emergency which brought an end to the unrest (Farrell, 2012). However, these relationships did not depress growth thereafter according to NIE explanations would predict, as the economy grew by 5 per cent over the 1973-1982 period largely on account of changing demand and better terms of trade (Ramsaran, 1993).

At this juncture, political and economic reforms became necessary. It precipitated the nationalisation of a large number of entities in the oil sector, including British Petroleum assets in 1971 through a joint venture with Tesoro Oil company during this period (Julien, 2005). Williams announced a number of rents and subsidies to black-owned enterprises and community organisations, and more general reforms to the public bureaucracy (Samaroo, 2014). The state also created a number of new state-owned enterprises to manage a number of sectors of the economy. In 1975, government took majority shareholding in Caroni Limited, 51 per cent of the company and thus inherited the large labour pool of majority Indian-origin workers. The preferential trade relationship that existed with Great Britain, for over half a century was to soon come to an end which would affect the future of the industry (Francis, 2012). The sugar sector nevertheless showed some promise for agricultural research activities given previous institutional focus and investment focus by the Colonial administration as a means to

appease labour unions and the nationalist leaders, even as the sector's production decline (Carr, 1983; Chalmin, 1990).

These reforms also had the effect of increasing the wages of public sector workers and the government launched redistributive programs amounting to \$715 million (Parris, 1983). By 1973, the country witnessed its first post-independence oil boom (Sutton and Payne, 1984), which redirected attention to its petroleum and natural gas resources. This period demonstrated the catalytic role of Williams's leadership, the effects of social mobilisations on the liberal state, but also demonstrated how connected the T&T's economic fortunes were to the international economy. The socio-economic order would later be transformed into a somewhat more bifurcated and diversified system, with greater political and economic authority in the hands of middle class Blacks, Indo-Trinidadians and Chinese, and remaining White, Syrian/Lebanese and transnational elites in control of certain resources and sectors like banking and finance, trade, media (Barclay, 2004; MacDonald, 1986; Meighoo, 2008; Palmer, 2006; Pantin, 1995).

In 1973, the Israeli-Arab war and ensuing oil embargo pushed up commodity prices and improved economic conditions and revenues of the sitting PNM government to carry out its nationalisation agenda. Simultaneously, the growing clamour of developing countries for a New International Economic Order (NIEO), in which the country occupied a minimal role at an international level, compared to Jamaica and Guyana, as it contradicted the former's economic interests in greater benefits from increased oil prices. This crisis however enabled the T&T state to assert a regional position, as the government decided to make a contribution of \$150 million to support ailing Caribbean economies (Demas, 1978). At a national level, Macdonald (1986) suggests that this period saw a subordination of ethnic interests among Afro-creole and Indian creole identities to class

interests. As a whole, the agriculture industry's labour population declined from 71,800 to 49,700 from 1970 to 1975 which disproportionately affected the Indian population (Hintzen, 1985). These shifts in part were condition by the country's political economy which has been largely shaped by oil windfalls (Auty and Gelb 1986).

Similar to the industrialisation programme, a number of incentives were supplied to international capital to induce greater investment in refining and discovery of petroleum. According to Mottley (2008), the government over the period sought to attract significant investment through the establishment of several state-owned enterprises to build its capacity to exploit and monetise its petroleum, and later, gas reserves. This particular industrialisation path in the hydrocarbon and petrochemical related industries pursued by government and private sector stakeholders promoted 'high-technology' inputs, most of which had to be imported from abroad through the implantation of transnational enterprises (Best, 1976). These heavy investments by the state created a new stream of policy rents that was in part aimed at building new coalitions and helping drive a resource based industrialisation strategy. It in effect destabilised the old social order or political settlement.

During this period, up until the early 1980s public sector employment amounted to two-thirds of the total working population (Parris, 1983). However, Williams soon realised that there was a serious paucity of technical and professional skills to implement projects in many state enterprises and agencies but nevertheless pressed ahead. Institutional changes also accompanied the proliferation of training programmes and expansion of public goods provision. In this context, labour unions were able to negotiate better wages (Edwards, 2016). The PNM public investment strategy however came in for

sweeping and antagonistic criticism from the local private sector who believed the government's capacity was overstretched:

The truth is the government has, over the Plan, yielded to political pressures and allowed costs to get out of hand. It has taken up a leading position in its wages for unskilled and junior clerical grades outside of the oil and related industries. It has taken on its payroll a large number of people whom it does not have the concomitant technical, managerial or financial resources to employ efficiently. It has failed in the promises of its development programme, particularly in agriculture, housing, ports and local Government. And it has permitted itself to incur substantial over-expenditures in "crash" or "special works" programmes, sewerage and such prestige projects as BWIA (national carrier) and the Central Bank. (Trinidad and Tobago Federation of Chambers of Industry and Commerce, 1969, p. 11)

The new popular direction of the government was not to be stopped. In response, for its part, the government lambasted the private sector for its limited participation in the economy, viewing its criticisms as a red herring and hypocritical. In Williams's view the domestic private sector demonstrated reluctance to respond productively to streams of rents that were earlier offered.

The business chambers blamed negative regulations and bureaucratic hurdles for its inability to make productive investments (Government of Trinidad and Tobago, 1968). As a result, the government decided against any significant local private input, and continued to lure foreign capital and expertise for new energy-based industries. In line with its nationalisation drive, it maintained at least a 51 per cent stake in all new natural gas and heavy industrial projects (Mottley, 2008). Prime Minister Williams proceeded to improve project management and implementation capabilities through government-to-government arrangements, which would provide infrastructural works. In these plans there would be no single dominant interest apart from government (Ryan, 1983). To a certain extent these arrangements were path-dependent from the earlier period as

government looked outward to support its industrial strategy as technical capabilities were unevenly distributed in the state bureaucracy and country as a whole.

As a result, the government invested up to \$1.2 billion in public enterprises and its nationalisation agenda – a 300-fold increase in public sector participation in the economy (Farrell, 2012; Long, 1983; Mottley, 2008; Toney, 1996). It now had shareholding in agriculture, manufacturing, petroleum, media, tourism, banks, finance airlines and shipping (Farrell, 2012; Parris, 1983). To further bolster the public intervention and export promotion strategy, the National Scientific Advisory Council (NSAC) was established in 1968 to ‘survey the scientific and industrial resources of the nation and to determine its scientific and technological needs’ (National Scientific Advisory Committee, 1972, p. 1). In 1972, the National Bureau of Standards was created to set national standards on production, monitor and educate the private sector on various certifications, as well as to ensure the quality of products and chemical process in various industries. The National Council for Technology in Development (NCTD) later replaced the NSAC in January 1976 based on proposals by Prime Minister Eric Williams that:

The future development of Trinidad and Tobago will rely heavily on science and technology. Whether it is the provision of badly needed infrastructure, (water, health, service, housing, power, communications, transportation systems, etc.); whether it is the proposed development of hydrocarbon resources or their utilization; whether it is the improvement of performance of the agricultural sector, or whether it is in the deepening of certain areas of manufacturing sector (food, processing, textile, electronics, tool and die), technology in its various forms will have to be applied with efficiency and confidence (Ministry of External Affairs, 1979, p. 8).

In his budget speech in 1977, Williams again made the connection between investments in S&T and the industrial sector, based hitherto on exploitation of petroleum resources, and natural gas in particular for new industries (CARIRI, 1978). The government had long acknowledged that a national R&D programme was necessary along with other

relevant S&T efforts to advance the industrialisation and enable national institutions to have a greater role in promoting economic independence (Government of Trinidad and Tobago, 1968).

In similar reformist fashion, the PNM government appointed the Natural Gas Coordinating Task Force in 1975, which was later transformed into a formal organisation, the National Energy Corporation (NEC), in 1979 operating alongside the Natural Gas Company in 1976 (Barclay, 2004). According to Kenneth Julien in an interview, recounting the story of the gas finds:

Amoco discovered a substantial amount of oil and gas in an onshore field. At the time, oil was considered important to generating revenue while, gas was a nuisance – so the company burnt the gas. Eric Williams recognised that it was a product and directed Amoco to stop burning the gas. It became available to government at no cost offshore. The gas had to be brought onshore. The Prime Minister started NGC to bring the gas onshore and head a group to determine what could be done with the gas.

The main sectors identified for additional foreign support were ‘energy-based industries, agriculture and deepening of the manufacturing sector’ (Ministry of External Affairs, 1979). The gas was used as a driver of the Point Lisas Development project that included ammonia, urea, methanol and iron and steel downstream industries facilitated (Best, 2012).

In particular, the Iron and Steel Company of Trinidad and Tobago (ISCOTT) became emblematic of the country’s new resource-based industrialisation strategy. The company was the first state-run mini mill in a small developing country in the Western Hemisphere, like T&T utilising Direct Reduced Iron (DRI) and the MIDREX method that had been initiated in the United States. Former ISCOTT Chairman added that:

the MIDREX proposed moving away from that process - building small steel plants and they didn't need coal but gas. A new technology surfaced, using natural

gas as a reducing agent, and took iron ore (60 per cent iron, as well as oxygen) to interface with the iron ore. The result was a product that emanates 90% iron (DRI) at a reduced production scale of half a million tonnes.

ISCOTT began construction in 1979 and would provide a small range of products, namely sponge iron, billets and wire rods and became dependent on the US market for export (Auty and Gelb, 1986). ISCOTT was initiated by the NEC, wholly owned by the government, utilised the direct reduced iron (DRI) – imported technology – local engineering talent at the lower levels of technological activities and external consultants and management expertise (Farrell, 1979b; Pantin, 1987). The company also suffered organisational and operational challenges, in terms of managerial and technical capability, as analysts believed that its Chairman and senior management did not have the competence to build the company (Ramlogan, 1985). In the early stages of the company, local engineering staff was also restricted to lower level tasks and so were not offered the opportunity to build their skills. From a demand-side perspective, the company got into early difficulties with joint venture partners who were initially carded to bring markets and technical expertise for the project (Farrell, 1987).

The proposed Japanese and German partners pulled out after they disagreed on what the company should produce, colluding with each other, and decided not to fulfil their end of the bargain (Farrell, 1987). After its initial turbulent years of operation at below design capacity, increased operational costs and financial losses, ISCOTT's products were refused entry into its major market the United States (Mottley, 2008a). One study that focused on the company usefully acknowledges that: 'it is precisely because of the importance of steel industry to all countries that there is a tendency for market distortions and trade barriers to develop' (Ramlogan, 1985, p. 15). Indeed ISCOTT had great innovation potential through the acquisition of appropriate cutting edge technology from various sources, and the company's staff was soon even being promoted to higher

levels of responsibility. However, a combination of internal (low production capacity, design flaws, patron-client relationship between the Chairman and Prime Minister that bred an ineffective, technically deficient decision-making process, too short timeline to achieve and excessive focus on profitability) and external developments (rapid shift in external macro-economic conditions and demand, United States steel trade lobby) had a major part in its subsequent downfall (Farrell, 1987).

Moreover, the Williams-led government defined S&T as an important thrust in its foreign policy, evinced by the setting up of an inter-ministerial working group with the permanent secretary of the Ministry of External Affairs as its chair (Ministry of External Affairs, 1979). In its position paper at the 1979 United Nations Science and Technology for Development conference, the T&T government reported on a perennial paucity of R&D personnel, brain drain, limited funds to execute relevant projects, the overall weakness in the negotiating position of developing countries with foreign suppliers of technology (Ministry of External Affairs, 1979). The government's delegation thus called for a number of important collaborations between the developed countries and developing countries, specifically in the provision of technical information, an assessment of the international patents system, the establishment of a network of national institutions and inter-regional agencies for agriculture, re-balancing the scales in aid provision, and re-organising systems of technical support as well as international S&T agencies (Girvan, 2006).

The National Coordinating Task Force was led by the Dean of the Faculty of Engineering, Professor Kenneth Julien (Barclay, 2004), and involved a number of technocrats, key partners, such as European and Japanese technology providers, key state officials and international investors. Nevertheless, these various coalitions were

responsible for successfully initiating the natural gas and iron and steel industries in T&T. In spite of the approach, the government under Williams was able to stave off criticisms and pressures from private sector lobby groups, mobilise domestic resources, to pursue its industrial policy by adopting a long-term horizon. Given this broad mandate, according to Third NDP:

It is not enough to provide more jobs; existing jobs must also become more productive so that they support a higher standard of living. Higher productivity is a function of more investment, the discovery of new knowledge and the application of new knowledge (Government of Trinidad and Tobago, 1968, p. 4)

This acknowledgement of the need for greater alignment between an indigenous knowledge base and the productive sector hitherto did not benefit the society, as the primary source of technological activity resided with transnational companies (Barclay, 2005; Farrell, 1979b).

With great vigour, the government thus continued to establish necessary institutions that supported the small domestic private sector and the large expatriate corporations. The CARIRI was created in 1970, with the technical support and funding from the United Nations Industrial Development Organisation (UNIDO) and the United Nations Development Programme (UNDP), with autonomous policy direction of the government. CARIRI built a reputation of engaging with industrial sector and forging productive partnerships (Ali, 1993; Girvan, Gomes and Sangster, 1983). The original plan provided by the UNDP and UNIDO was dramatically altered by the government, who steered the agency towards to providing services to industry, both public enterprises and private sector (Girvan, Gomes and Sangster, 1983). Within the first five years of its operation, with an evolution from simple technical services and testing, it trebled its income (Girvan, Gomes and Sangster, 1983). Whereas the first decade of activity was concentrated in feasibility studies and other testing procedures for business, and therefore

yielded minor results (*ibid.*). During the 1980s it worked alongside the Coconut Growers' Association to design and build a coconut de-husker (Dinanath, 1987), which gained international repute.

The Exchange Control Act of 1970s also bestowed on the Central Bank at the right of approval or technology licensing agreements for the use of patents, trademarks and technical assistance (Moniquette *et al.*, 1986). The reform included the examination of the production process, the availability of local technology, the appropriateness of royalty payment thresholds, and the process of assimilation of foreign technology (Toney, 1996). Further, the government's 1977 White Paper on the National Institute of Higher Education preceded the establishment of the National Institute of Higher Education, Research in Science and Technology (NIHERST). The first Chair of this organisation, economist Frank Rampersad, was seconded by the Prime Minister as a means side-lining his influence in the state bureaucracy. During Rampersad's tenure, according to one former staffer at NIHERST, a number of agricultural studies and experiments were undertaken with scientists to promote tissue culture research, especially in cocoa and other crops but had limited input and demand from the private sector to invest and commercialise research (see chapter 4 - Box 4.2 for a snapshot on the cocoa sector development).

All of these efforts contributed to what was a more explicit approach to S&T policy integrated into the development plans of the country. In fact the entire chapter three of the third NDP was dedicated to issues related to research, science and technology and the many policy proposals that would underpin the country's agenda. From 1973 to 1982, GDP per capita and GDP growth tallied at 4 and 6 per cent respectively (Ramsaran, 1993, p. 222). However, the main challenge with respect to state-driven approach

concerned the enduring organisational power of a number of external agencies and actors in technological decision-making, a lack of home-grown capabilities (Barclay, 2004; Farrell, 1979; Girvan, Gomes and Sangster, 1983).

This slew of new institutional arrangements and state-owned ventures demonstrated a more consolidated effort by the state to coordinate activities, interests and drive technological change. During this period, the public sector attempted to exercise greater control over technological activity, increasing from 6.5 to 60 per cent of the total value of imported technologies (Long, 1983; Toney, 1996, p. 36). Attempts to hone and coordinate a local technological capability⁷ and expertise were made possible when a coalition of relevant local institutions, individual enterprises interested in developing projects come together to solve particular national economic and production problem.

By 1985, the export of sugar had become significantly curtailed due to new agreements with major exporting blocs such as the United States and the European Economic Community (EEC), ushering a new period of internal politics and the state taking on heavy debts on account of the dwindling competitiveness of sugar manufacturing (MacDonald and Demetrius, 1986). A World Bank report also deemed the sugar industry uncompetitive given the unprecedented costs of production compared to world comparator prices with grim chances of future survival (Bank, 1983). This outlook however is naïve and detached, by not paying due consideration to the political and ethnic factors ingrained in the sugar industry, prompting one commentator to view its imminent closure as an attack on the political base of the Indo-centric political party (Munasinghe,

⁷ Technological capability is defined as “the ability to harness reason and scientific know-how to solve the particular problems of a specific society” (Farrell, 1979b, p. 244).

2001). However, despite the impending impact of global politics on the sector, the sugar industry evinced tremendous signs of technological potential.

In 1982, the sugar industry and wider agricultural sector at this time recorded greater levels of diversification and employment as the slowdown in the oil sector took place (Carr, 1983; Francis, 2012). Concomitantly, a number of research initiatives were launched, mainly in sugar but in rice and other crops. In 1985, CARIRI was contracted by Caroni (1975) Limited to undertake project designs for the automation the weighing of sugar cane crops due to management concerns with falsification of weights, untimely and inaccurate data provision by producers (Tikasingsh, Cameron and Williams, 1989). A number of organisations came together to develop the Truck Scale Management System (TSMS), including a resident multidisciplinary team, a research funding institute and a local supplier (CARIRI). Technological options were determined by the team, along with relevant with software created by the company which contributed towards developing two pilots that received. The result was tested with users, including contracting firms, cane farmers while commercialisation was still being considered, attracting interest from one sugar-producing country.

While other possible uses were being explored, including proposed automation at Caroni's juice clarification, evaporation and sugar boiling and mechanisation at laboratories. Though commercialisable, with piloting, technical upgrades and testing were successfully done to determine suitability and functionality, the management decided that further trials were required delaying its deployment into the field (Tikasingsh, Cameron and Williams, 1989). In the end the final decision was taken not to optimise the design features, but the system brought overall benefits to the company. Due to overarching economic and ideological shifts, these activities appeared not to have been taken into

account and the system's many applications across several sectors as a tool in the diversification process. As a result of deliberate policy shifts, the agriculture sector declined to 3 per cent of total value added in the economy (Ramsaran, 1993).

By this account, the international capital linkages to the local S&T system, especially in agriculture came to offer fewer opportunities, as demand dried up and as new trading arrangements came into force that would define the development agenda for the subsequent three decades.

Table 3.1 Summary of S&T proposals in the three Five Year Development Plans (1958-1973)

Period of Plan	Main Issues/ Priorities	Sectors	Objectives	Key Proposals
1958-1962 Industrialisation by invitation	<p>Address the many social and economic ills: dominance of key industries, rural underdevelopment, and structural unemployment (14%).</p> <p>Emphasis placed on industrial expansion, basic research, resource exploitation, job creation, education and training, infrastructural works</p>	Agriculture, Fishing, Farming, Manufacturing Industries	<p>To create new jobs, improve productivity of resources</p> <p>To improve agricultural yields, mitigate disease and soil conservation,</p> <p>To conduct research on new crop by-products and varieties, storage techniques, irrigation and food processing</p> <p>To promote the application of technological knowledge</p>	<p>Investment in knowledge generation and training; industrial production and new production techniques in different sectors e.g. John Donaldson Institute, the Faculty of Agriculture and other research units</p> <p>Establishment of the Industrial Development Corporation responsible for industrial research</p>

<p>1964-1968</p> <p>Import substituting industrialisation with export orientation</p>	<p>Commitment to private enterprise (foreign and local) with greater partnership with government</p> <p>Greater economic independence, social transformation</p>	<p>Agriculture (fishing, husbandry, crops) and Manufacturing</p>	<p>No major changes</p>	<p>Investment of local private capital in industrial projects and research and development</p> <p>Establishment of a Productivity Centre (with technical expertise and funding from the United Nations Special Fund)</p> <p>Food Science Laboratory (Central Experimental Station)</p> <p>Construction of a College of Arts and Science</p> <p>Expansion of Vocational, Technical and Science education</p>
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<p>1969-1973</p> <p>Export-driven industrialisation under “constructive nationalism”⁸</p>	<p>Greater control/steering of economy by government</p> <p>Inappropriate technology which utilises large capital outlay without adequate labour absorption</p> <p>Failure to develop indigenous technology, utilise local raw materials and product designs for use in manufacturing</p>	<p>Same as above</p>	<ul style="list-style-type: none"> • To adapt technologies to local conditions, invest in research on natural resources, including asphalt, limestone etc. • To provide the appropriate skills development • To promote modern scientific techniques in agriculture • To develop new locally “intermediate” technologies suited to excess labour absorption • To conduct epidemiological and medical research into diseases 	<p>Education and training systems to be geared towards local-problem solving</p> <p>Creation of National Scientific Advisory Council and Bureau of Standards</p> <p>Industrial Research Institute to conduct studies in adapting technology, feasibility of projects, laboratory testing and dissemination of technological information</p> <p>Greater cooperation with international agencies, like UNDP, the S&T programme of the OAS, and the Centre for Application of S&T for the development of Latin America</p>
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(Government of Trinidad and Tobago, 1958, 1963, 1964, 1968)

⁸“Constructive nationalism” denotes a philosophy of addressing the structural problems that afflict the T&T economy by marshalling the embedded creativity of the people, endogenising the growth process, and transferring the centre of productive decision-making to local institutions.

3.5 Transforming the state: the onset of market liberalisation (1983-1993)

A developmental approach in the previous decade was buttressed by both a favourable external environment and anti-colonial social pressures that destabilised the political equilibrium heralding the pursuit of industrialisation and institutional change. The state exercised its power to mobilise resources and actors external to it to drive productive diversification. Even though well-intentioned, adequate time and capabilities did not enable its agencies to carry out these heavy industrial activities as well as meet social demands in the most effective manner possible. State patronage did not abate, but appeared to have been reoriented to improve political legitimacy of the ruling party and its leader (Parris, 1983), as well as satisfy broader and longer-term socio-economic objectives. The state equally decided to compensate for its lack of project implementation capabilities by employing external managerial skills, financing, suppliers and technologies (Girvan, Gomes and Sangster, 1983; Pantin, 1987) In fact, as Ryan (1983) notes, new forms of asymmetric relations arose in the form of government-to-government arrangements with the United States, Japan and the United Kingdom in order to undertake infrastructural works, while discouraging local contractors and private sector players. Whatever capabilities were in existence were further undermined by historical factors and shifting trade environment characterised by capitalist demands in the advanced economies, especially in the iron and steel industry.

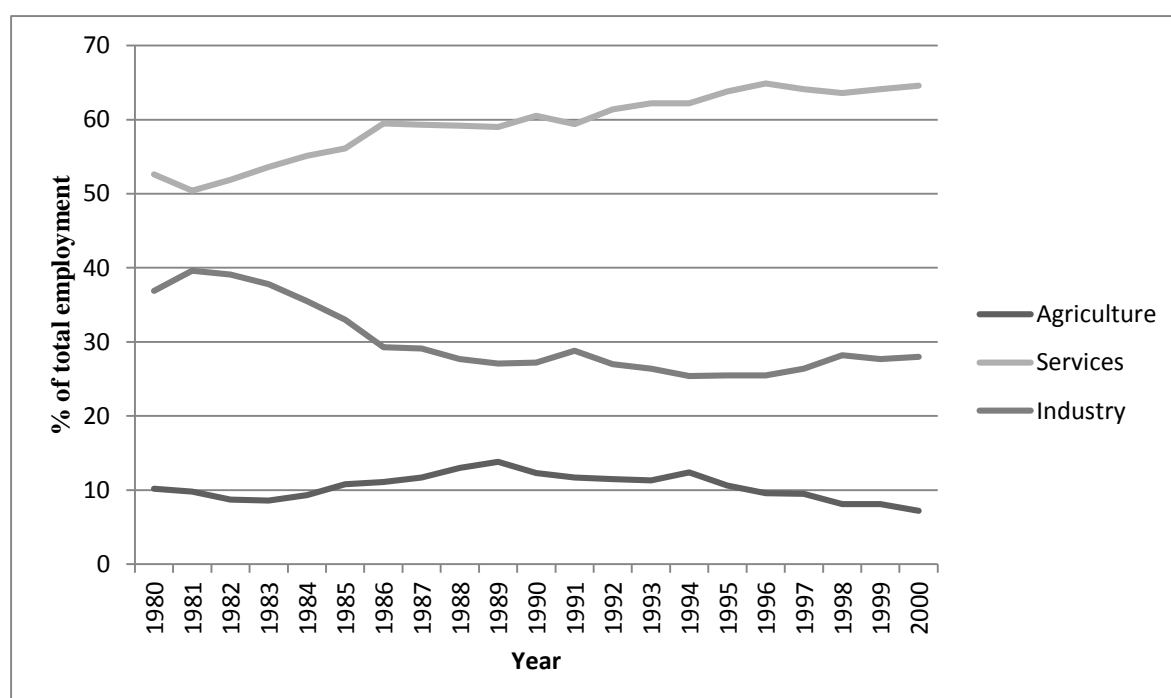
The 1980s represented an important turning point in the global political economy, exemplified by the elections of Ronald Reagan in 1980 in the United States, and Margaret Thatcher since 1979 in the United Kingdom. Their impacts on the developing world have been profound given the major debt crisis that led to shifts in macro-economic policies and international governance arrangements at the IMF, World Bank and US Treasury (Saad Filho, 2005). The earlier Keynesian policies were abandoned when as global

instability was precipitated by the Vietnam War and oil price shocks, resulting in the profit rate among US corporations declining and stagnation set in the US. These adjustments were particularly felt throughout Latin America and Eastern Europe, which employed 'shock therapy' as promulgated by global elites and the IFIs to transition to liberalised markets for global footloose capital viewed as critical for market competition (Klein, 2009; Wilson, 2014). In this period, it is more apparent the shifts in balance of power among a complex of actors, and the rapid curtailment of state capabilities to penetrate and steer society in any developmental way.

In T&T, political and economic reverberations were also experienced with the significant collapse in oil prices, growing debt amounting to US \$670 to 1,480 million from 1981-84 after massive investments in infrastructure and energy related industries (Auty and Gelb, 1986). An attendant sharp increase in interest rates, capital flight and subsequent growing unpopularity of the Eric Williams led PNM administration which had governed since independence (Auty and Gelb, 1986; Bennett, 1988). Following the demise of the PNM leader in 1981, the party appointed George Chambers as the new leader who served as Prime Minister until 1986. The PNM lost the election that year in a 33-3 distribution of electoral seats to a coalition of opposition groups forming the National Alliance for Reconstruction (NAR) which faced a worsening macro-economic situation. Kiely (1996) asserted that the electoral loss of the PNM broke patronage ties between government and conservative trade union leaders that had existed since the early 1960s. The new approach pursued by NAR was no longer based on local state control over the economic system, but based on a perceived need for access to new technologies, markets and foreign capital (Ramsaran, 1993).

At this time, the government had majority shareholding in 46 firms, with 100 per cent ownership in 35 of them, amounting to almost two-thirds of gross domestic product (La Guerre, 1994). The collapse of oil prices and turnaround in economic fortunes precipitated the appointment of William Demas, former head of the Caribbean Development Bank to oversee a committee to plan for the adjustment. According to the Demas report, the period required ‘profound adjustments by everybody in the country, public sector workers at all levels, public sector employers, housewives, farmers and indeed consumers at all levels’ (Demas *et al.*, 1984, p. 1). Indeed the economic downturn disproportionately affected youth, women and so-called unskilled workers, at an unemployment rate of 22 per cent of the total population where labour participation significantly increased in the services, agriculture and informal sectors (Rambarran, 1998; Francis, 2012).

Figure 3.1 Employment by sector (as a percentage of total employment) (1980- 2000)



Source: World Development Indicators, 2017 (<http://databank.worldbank.org>)

Figure 3.1 shows the trends in sectoral employment in agriculture, services and industry from 1980 to 2000. As seen after 1983, increases in service based employment were experienced from 53 to 60.5 per cent of total employed to 1990. In agriculture, there was a surge from 8.6 to 13 per cent in 1989, reducing negligibly to 12.6 in 1990. Conversely, industrial employment decreased rapidly from the start of the downturn in 1983 from 37.8 to 27.2 in 1990. These movements show the direct effects of macro-economic situation on the structural changes in employment after the economic contraction and the adoption of structural adjustment policies in 1987.

During this period, the telecommunications ownership changed hands towards greater share ownership by multinational Cable and Wireless. A R&D department was initiated at the Telephone Company (TELCO), with project management and engineering capabilities from the UWI. Simultaneously, the Real Time Systems Group, set up in the mid-1980s by an engineering professor St. Clair King with industrial experience, and funding support from the Organisation of American States (OAS), supported efforts at the state enterprise in acquiring and adapting digital multiplex switching systems. This group further made technological strides and created partnerships with several state enterprises in the electricity generation, energy, and steel sectors. With little or no deliberate policy framework, as these activities were largely carried out in different state agencies and under the radar, attention had been increasingly directed to external support and interests. The government instead pursued new funding schemes with the Inter-American Development Bank (IDB) and World Bank for competing research activities (Pantin, 1997). Funding support for the UWI related had been withdrawn from international partners and due to increased tensions from high-level decision makers at the university, projects were stopped among other competing priorities. As such this attempt was

scuttled by the shift in the role of the university and the disinterested state sector towards more short term capital accumulation.

Moreover, capital investments were reduced from 18.1 per cent to 4.9 per cent of GDP between 1981 and 1990 and divestment of public assets accelerated as the country's indebtedness grew (La Guerre, 1994; Ramsaran, 1993; Simmons and Andrews, 2000, p. 54). This resulted in a shift of focus from resource-based industrialisation to macroeconomic stability and recovery on account of dwindling foreign exchange reserves and deteriorating balance of payments (Best, 2012; Mottley, 2008). The government, prime mover in the economy at that time embarked upon a number of structural and administrative reforms, including the removal of quantitative controls, trade and financial liberalisation, tax reform and divestment of state assets, further buttressed by IMF standby financing package in 1987 (Artana *et al.*, 2007; Best, 2012; Downes, 1998). On the question of social welfare, from 1985 to 1990, the level of employment declined from 399,500 to 374,100 people (Downes, 1998, p. 10–11). In 1989 a further structural adjustment loan was requested from the World Bank which at this point had great amount of influence over the budgetary process (Simmons and Andrews, 2000). The increased role of the international lenders thus indicates an increased influence over the policy process and reduction of redistributive rents to the society, which one observer viewed as wasteful in the first place (Farrell, 2012).

Additionally, the government's privatisation programme included 30 state enterprises, while 12 were set for liquidation, and by 1995, several companies had either been fully or partially privatised, including the urea, methanol, the national air carrier, printing and packaging, shipping, cement and the electricity companies (Bernal and Leslie, 1999). This strategy was adopted to gain much needed foreign exchange, which by 1993 accumulated to TT\$1.36 billion, including from the initial leasing of ISCOTT to

Indian transnational steel giant ISPAT in 1989, and later sold in the early 1990s (Ramsaran, 2004; Sergeant and Forde, 1992). As a corollary, Mottley (2008, p. 28) claimed that the country's foray into iron and steel was a financial disaster; given significant investment of more than US\$1.2 billion and it recouped \$70.05 million after being privatised.

A more nuanced explanation noted both external and internal developments and agents played a critical role, like poor initial planning, an ineffective marketing strategy, incompetent management, financial crisis, and delayed production (Ramlogan, 1985). Other analysts have stressed profitability as the reasonable justification for its privatisation based on a narrow profit-loss analysis (Mottley, 2008; Farrell, 2012). Initially, planners' projected profitability after three years was too ambitious and unrealistic given the global state of the sector (Farrell, 1987). In comparison, South Korea's steel industry which started in 1968, only became successful (in terms of increasing global market share) after 20 years of operation and led eventually to the creation of a number of downstream industries (Amsden, 1989; Lee and Ki, 2017). The T&T planners therefore failed to consider the dynamic long-term multiplier effects of a steel industry, or the value of technological learning and activities involved in the exploitation of future possibilities (Barclay, 2004; Bell and Pavitt, 1992; Ramlogan, 1985). Differences in political settlement and the configuration of power reflect the varying successes between the South Korean and T&T state-owned iron and steel industries. For instance, transnationals like Korf Corporation in the United States who was a supplier of the DRI technology embedded itself in the early decision-making of ISCOTT, later sued the company for breaches, and even joined the US trade lobby to stop steel imports from T&T (Farrell, 1987; Ramlogan, 1985). It represented different

leveraging capacity by the South Korean state to negotiate trade concessions, based on market size and volume of trade (Amsden, 1989; Girvan, Gomes and Sangster, 1983).

In particular, a comprehensive training programme had formed part of the arrangement process engineers who were all from T&T migrated from other companies to be engaged in the plant operation of both the DRI and steel mill. Heavy use of local materials was also encouraged, albeit the operation was capital intensive. In addition, the venture explicitly included a number of local consultants and management experts. These efforts would have envisaged upgrading the capabilities of local producers and other talent (Ramlogan, 1985). Indeed, according to an interview with one of the supervising managers in the early days of the company, some of the top executives of the company were employed foreigners who had some experience in the industry but progressively locals were promoted to roles that required higher technological competence. The burden of responsibility therefore appeared largely due to external market forces, in particular the international recession and powerful lobbying efforts of US steel firms to the US Trade Representative office to apply anti-dumping sanctions against the company for the state's subsidisation of its operations (Ramlogan, 1985). The project was viewed as a failure of state-driven industrial policy more generally (Farrell, 2012; Mottley, 2008), and little attempt was made to restructure the company and the industry or redeploy these resources to other productive uses (Chang and Andreoni, 2016). The confluence of actors in the political economy thus came to constrain governance capabilities and the interest in long-term development agenda compared to the earlier decade.

In an attempt to avert and hopefully improve the perceived ill-fated approach of state intervention, the country's policy-makers sought to cede whatever policy autonomy it had to the IFIs (Ramsaran, 1993; Girvan, 2007), which have had important lingering

effects on future development. Overall, from 1982 to 1990, GDP per capita dropped by 5.4 per cent and the economy contracted by 4.2 per cent (Ramsaran, 1993, p. 222). This new paradigm had the effect on reconfiguring state regulatory power, while increasing pressures from economic and political party elites interested in new and traditional trading sectors towards particular policy objectives. These shifts were accompanied by the suspension of the Cost of Living Allowance for public sector workers, wage freezes, currency devaluations announced in 1988, closure of public works programmes, and massive retrenchments (Kiely, 1996). Indeed, it precipitated an era of clientelist relations and corruption allegations that was squarely centred on ethnicity and symbolic and material resources that were gained through political competition and control of the state (Wilson, 2012). The NAR was broken up in 1988, with the United Labour Front leaving the coalition and causing heightened ethnic tensions at the end of the initial adjustment period (Kiely, 1996).

The traditional capitalist elites have aligned themselves to the NAR as a means of ensuring market openness, state contracts and the like, while political party supporters were in line for favoured posts. The infighting of the NAR also led to factious resentment that gave rise to the United National Congress as the 'Indian' party (Ryan, 2007). During this period market openness did not engender, to any great degree, investments in long-term S&T development as exemplified by the abandonment of the Demas report which favoured long-term changes in the economic structure through investment R&D (Demas *et al.*, 1984). It was as a result of the move towards a 'market society' that discontent and the fallout on economic grounds that sporadic protests have erupted every so often demanding changes or redistributive actions with limited overall social transformation.

These structural changes brought about by economic liberalisation spurred social and political unrest with massive protests by workers from diverse areas as teachers, sugar farmers, and nurses and public sector workers, culminating in an insurrection staged by local Muslim fundamentalist group⁹the Jamaat al-Muslimeen led by Yasin Abu Barkr (Abdullah, 1991; Riddell, 2003). On July 27, 1990, the Islamic group comprising 113 followers of Afro-Trinidadians took up arms and headed for the capital city, taking control of the parliament, and the main television station to broadcast to the public that it had seized state power (Griffin, 1995). It was believed that their attempt was linked to discontent and the hardship that erupted due to structural adjustment and the stewardship of the NAR (Riddell, 2003). The Prime Minister and several parliamentarians were held hostage in the parliament chambers for up to six days, where the former sustained a bullet injury. This series of events triggered looting throughout the main urban centre of Port-of-Spain. One serious flaw which one analysts has attributed to its failure to gain public support was its perceived disconnect from the masses, whom it was believed had more interest in wielding the ballot as a means of expressing dismay at the political status quo (Abdullah, 1991; Collihan and Danopoulos, 1993). The extent of these events of six days were characterised by loss of life included deaths of 25 people, including law enforcement, and millions of dollars of damage to property (Griffin, 1995). Another assessment also suggests that the failure to include other ethnic groups, and the supposed political sophistication of the population created divergence from and resentment towards the Muslimeen group (Ragoonath, 1993).

⁹ A recent commission of enquiry was held into the 1990 attempted coup by the Jamaat-al-Muslimeen, twenty years affect the insurrection. Details of the report which addresses myriad factors related to its occurrence, causes, its historical significance and the readiness and response of law enforcement and the army. (Simmons *et al.*, 2014)

3.5.1 Towards an implicit ST&I policy (1993-2000)

At the time of the NAR election victory in 1986, a committee set up by the IDC comprising a number of public and private sector representatives reported that the government needed to give consideration to regulating technologies as a means to overcome the vagaries and unfairness of the international technology market (Moniquette *et al.*, 1986). It would also ensure that local entrepreneurs are effectively guided towards the pursuit of national economic policy. The predilection of both public and private organisations to the import or licensing of foreign technologies had been a problem highlighted by Caribbean scholars a few years before (Girvan, 1983). The committee drew upon experiences from a number of developing countries which had such a regime showing the positive effects on savings and the exchange rate, to make their case. It was also critically noted that the financial outflow of technological services had increased 15-fold over the period 1973-1983 (Moniquette *et al.*, 1986, p. 10). However, the Trinidad and Tobago Manufacturing Association (T&TMA), though part of the committee submitted objections to such a regulatory mechanism stating that technological control was an undesirable policy option and that there should instead be a focus on incentivising foreign investors in manufacturing, while increasing their export competitiveness and ensuring ‘some level of technological transfer’ (Trinidad and Tobago Manufacturers’ Association, 1986). The combined influence of external forces such and the resident private sector who moderately increased its political influence (see chapter 2 figure 2.2 ‘networks of power’), in the context of restrained fiscal ability to manage and governed its affairs.

Given the country's poor fiscal situation at the time, it was not envisaged that all the recommendations, including fully operationalising the institutional framework, namely a Centralised Technology Agency. Nine months later the government produced an investment policy that seriously took the manufacturers' concerns into account about encouraging foreign investment, privatisation, technological development, export promotion, thereby diluting to a large extent the regulatory mechanisms for technology imports proposed the Committee (Industrial Development Corporation, 1987). The new foreign investment approach detailed a number of contradictory measures, for example, some regulation on foreign investment in very low technology areas, while government encouraged privatisation of state assets, full foreign ownership of enterprises if the investor met certain criteria: provision of 100 per cent capital, demonstration of export capability and job creation. Though it included a section on 'Technology Transfer' that intended to regulate agreements, the principles of which were generally weak and not geared towards the development of indigenous technological capability. These discrepancies reflected the overall earlier strong message of the committee's recommendations was rejected and recommendations not subsequently given serious consideration. Perhaps it was because they were relegated to the backwater of 'old' industrial policy thinking, which in effect, made way for full-fledged open-market reforms promoted by the constellation of power concentrated in the global governance institutions and local private sector.

The policy response also appeared inadequate, as the issue was summarised as one where the lack of representation of private sector bodies in formal policy-making processes, instead of integrating S&T with development plans (Pantin, 1997). An important outcome from this realisation was the setting up the Caribbean Council for Science and Technology (CCST) held at a meeting in Kingston Jamaica of the Caribbean

Development Cooperation Committee (CDCC) supported by UN-ECLAC and UNESCO (Nurse, 2007). It became an inter-governmental body responsible for embedding, creating linkages among and implementing CARICOM member states' policies on science and technology¹⁰ (ECLAC, 2005). Since, its adoption of a regional S&T framework in 1988, it has operated in a modest way undertaking a series of policy consultations across island territories and some science education initiatives region wide (Sankat, 2005), later to be housed at the NIHERST. In the subsequent decade S&T issues at the regional level appeared to take a back burner due to lack of enthusiasm from leaders (ECLAC, 2005). As the developing world entered a period of chronic destabilisation brought on by the debt crisis that had debilitating effects on Caribbean economies leading later to a slew of structural adjustment policies shepherded by the IFIs.

The subsequent election in 1991 returned the PNM back to power with a continuation of the liberalisation policies, as growth was restored in the early part of the decade. Continuing the policy trend, with fiscal policy in place the government made an agreement with trade unions for a freeze on wages and salaries of public sector workers to prevent further retrenchments (Downes, 1998). Riddled with a significant public external debt, amounting to \$581 million the country faced important constraints in S&T investment but remained an important source of demand (Pantin, 1997). In the area of S&T, based on the Medium Term Planning Framework (MTPF) devised for the 1992-1995 period, further plans were made to conduct R&D activities in energy, agriculture and maritime with training support provided at the UWI (Pantin, 1997). There were serious contradictions in government policy, as the multilateral agencies intervened to provide support for S&T initiatives, but they discouraged direct funding from

¹⁰ <http://www.niherst.gov.tt/projects/collaboration-ccst.html>

government. The private sector was meant to take the lead as the ‘engine’ of new growth potential (Farrell, 2012). The 1995 policy paper on Science and Technology outlined a number of policy objectives including that demand for S&T must be market-driven and the expansion of educational opportunities to make technical and vocational training globally relevant. The practice during this period for T&T policymakers was driven by the idea that technology was seen as given input, and its bearing on particular economic activities were viewed as indirect and generally applied across sectors (Forsyth, 1990; Toney, 1996).

Over time the role of NIHERST has been fuzzy and while its genesis was to help coordinate research activities outside of the formal university system, it has remained marginalised and its capabilities are still nominal (Toney, 1996). It has built up some analytical capability with its periodic publication of S&T reports and sectoral analyses, but within the fragmented state system (Braveboy-Wagner and Gayle, 1997), it has duplicated efforts of agencies like the Ministry of Trade or the Central Statistical Office. Frank Rampersad, its former chair, declared that ‘the institutional paradigm that informed the NIHERST concept ... was not brought into being’ (cited in Toney, 1996, p. 25). Likewise, CARIRI on the other hand has become less focused on long-term projects and has shifted its focus to the oil and gas sector to increase its revenue generating capacity. Its role was significantly circumscribed and funding cut which disabled it from pursuing strategic projects and transformed the organisation into a lab for testing and technical services to major energy sector clients.

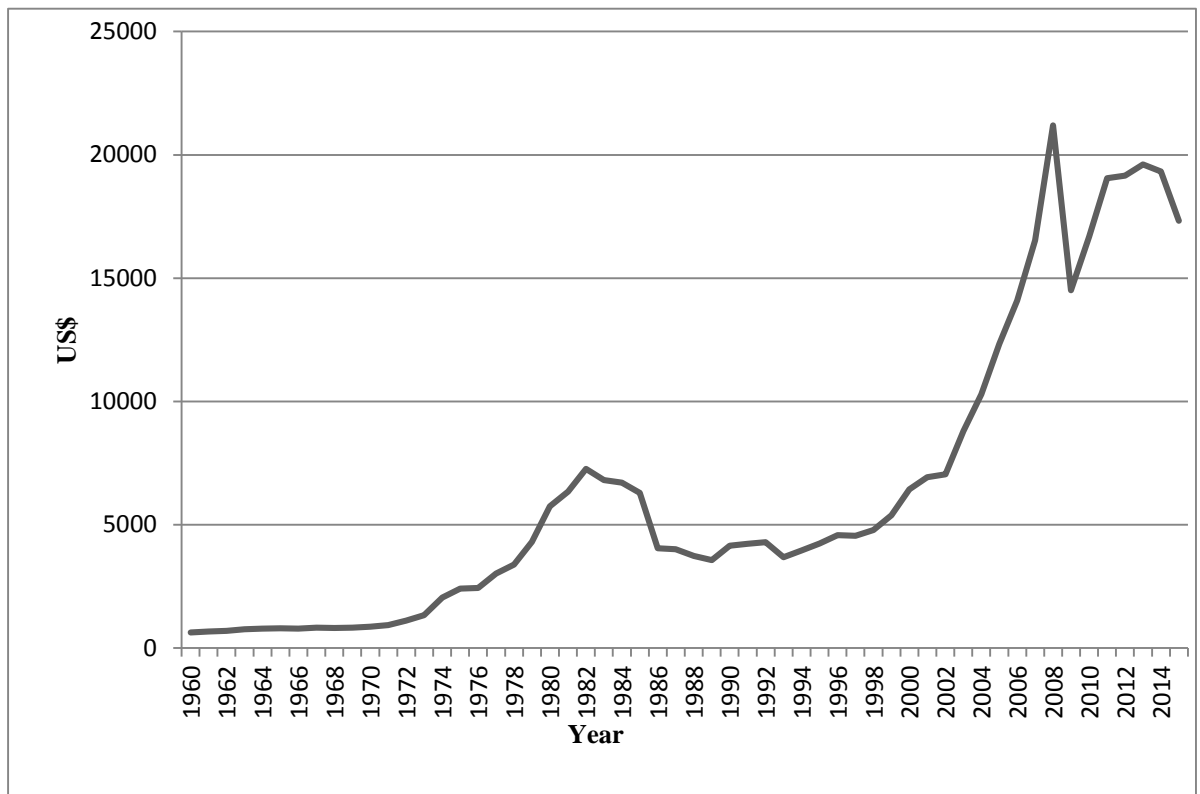
This move was meant to pivot the organisation as a revenue-generating one and more long-term projects were shelved. Earlier successes became a distant past for the organisation when during the early 1980s it undertook a number of low-profile projects to

achieve greater technical progress, which in the circumstances was not the primary goal of policy (Pantin, 1994). The absence of an effective local demand and the change in the business environment after the 1987 structural adjustment have rendered the S&T institutional framework ineffective (Toney, 1996). In effect, a fragmented bureaucratic system was created in which various departments became responsible for policy-making (Braveboy-Wagner and Gayle, 1997). In this respect, while it was envisaged that the NIHERST and the University would provide the institutional support the hydrocarbon sector this was not realised (Pantin, 1997). These institutions in effect has relatively less influence the policy making system compared to earlier periods and had to also adjust to the changing political settlement.

The period from 1995 onwards witnessed a number of political developments that undoubtedly had an effect on policy and socio-economic relations. The country saw the election of the first Prime Minister of East Indian heritage, Basdeo Panday, who was a lawyer and a former trade unionist. As indicated above the ethnic element has played an important role in the control of state power and the patronage structures that emerged. Panday's election advanced state activities towards a more facilitative and market-friendly paradigm. One of the institutional developments in this period was the establishment of the National Energy Skills Centre (NESC) – a joint arrangement between the government and key companies in the oil and gas sector that sought to address the training and human resource shortages and quality concerns of the energy industries (Barclay, 2004b). During this period foreign capital increased to US\$ 1 billion in 1990, and declined marginally to US\$ 835 million in 2001 (Barclay, 2004b, see Figure 3.3). For this reason, there were some aspects of continuity in policy priorities, though he promised that his government would adopt a results-oriented approach to economic management (Meighoo, 2003).

In the 1990s, the malfeasance associated with the airport terminal construction made headlines and the Panday administration was deemed corrupt. Political financiers, former government ministers and UNC party officials connected to government agencies were later charged for fraud. They include businessmen Ishwar Galbaransingh, CEO of Northern Construction Ltd (NCL), Amrith Maharaj, Chief Corporate Secretary NCL, Steve Ferguson, Maritime executive, Peter Cateau, Ameer Edoe, former government ministers Sadiq Baksh and Brian Kuei Tung and former Airport Authority head Tyrone Gopee. The airport terminal construction deal ballooned to TT\$1.6 billion and allegations included the manipulation of the tendering process (Kerrigan and Sookoo, 2013). Kerrigan and Sookoo (2013, p. 154) posit that these corruption allegations stemmed from ‘an alliance between government officials and businesspeople’ well as close comradery among business people of similar socioeconomic classes, status backgrounds, neighbourhoods, schools, and professional membership clubs. This gave rise to the summary downfall of the Panday administration in 2001, after his Attorney General and other members defected and were convinced that Panday had not effectively challenged corruption in his government. An election was subsequently announced by Panday leading to a tie between the UNC and PNM opposition, and the decision by Panday’s former ally in the NAR government and now President Arthur Robinson to appoint Opposition Leader to the Prime Ministership on December 24, 2001.

Figure 3.2 GDP per capita growth, T&T, 1960-2015



Source: World Development Indicators, 2016 (<http://data.worldbank.org/>)

The increased public glare of corruption in the media and in public life in T&T, did not however stymie growth, the balance of forces seemed to have become embedded and new configurations settled after structural adjustment to such an extent that growth continued uninterrupted from 1992 as shown in Figure 3.2 to the late 2008 under both the PNM and UNC administrations. Contrary to NIE approaches, good governance requirements such as no corruption, transparency, and secure property rights did not explain high levels of investment or the trajectory of growth. These views also overlook the ways in which footloose capital can be unproductive and have deleterious effects on more productive investment (Kiely, 2005). In this respect, the nature of the political settlement has more explanatory weight, where transnational forces and political elites were able to take advantage of the commodity boom from the late 1990s and 2000s and

secure rents from the hydrocarbon sector. The challenge has still been to sustain growth and promote a dynamic comparative advantage.

3.5.2 Re-invigorating an explicit ST&I policy (2001-2015)

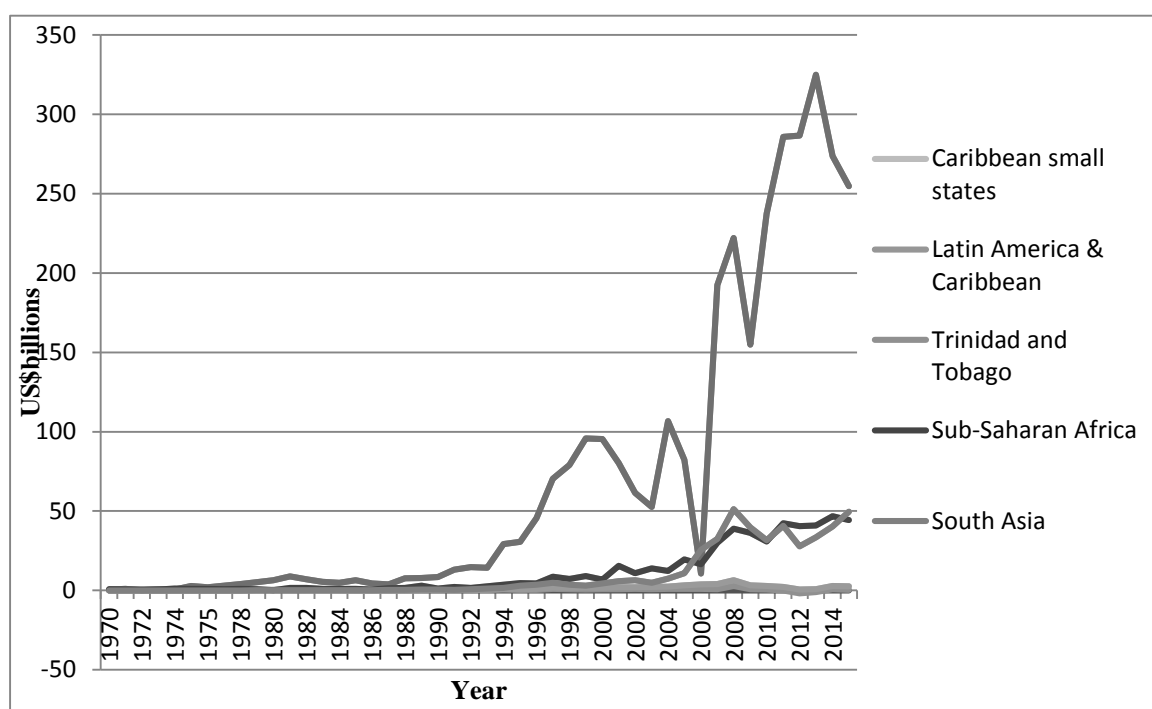
The PNM's government's approach to ST&I from 2001 was explicitly to try to advance the country's competitiveness. To this end the government under Patrick Manning's leadership launched the wide-ranging Vision 2020 multi-sectoral development planning initiative to respond more meaningfully to the globalisation imperative that was sweeping the world over (Government of Trinidad and Tobago, 2004, p. 20). In large respect the divestment activities of the previous decade were curtailed, but business elites had amassed a huge amount wealth from open trade policies and ability to challenge certain policy decisions behind closed doors (Ramsaran, 2004). The creation of new agencies and public sector reforms were enmeshed with its mainstream strategy to promote natural gas priorities and downstream investments along the oil and gas value chain (Barclay, 2013). In December 2001, the first ever Ministry of Science, Technology and Tertiary Education (MSTTE) was set up to pursue the rapid expansion of technical and tertiary level training and enrolment opportunities for the population (Villavicencio and Ponce, 2006). Its main aim was to develop human resources through relevant training programmes, scientific discovery in order to meet the future needs of a diversified economy. According to the review of the science and technology policy sub-system:

Over the past two decades, the Government has been a prolific creator of both ministries on business and development institutions. The resulting dynamic has given ministries and institutions little tie to coordinate with each other, connect with private-sector stakeholders, or implement long-term policies. Institutional weaknesses are routinely addressed by creating new organizations or adding new functions to existing structures. As a result, private and public institutions remains disconnected and sometimes operate in a vacuum, and new public

institutions concentrate their success in areas where interaction with the business environment is least critical (Villavicencio and Ponce, 2006, p. 2–3)

In a similar vein, the University of Trinidad and Tobago (UTT) was instituted in 2004 with a specific focus on technological training and scientific areas for industry as the national alternative to the regional UWI. It would become the umbrella institution for a number of unaffiliated training and research institutions, later branding itself as an ‘entrepreneurial university’. Additionally, during this period, liquefied natural gas had surpassed oil in terms of revenue generation, and the government proceeded in partnership with private players, the commissioning of new liquefied natural gas projects (LNG) through the Atlantic LNG Trains I and II in 2002 and 2003 respectively (Boopsingh, 2014). This new political strategy of market-driven growth has increased foreign investment in the energy sector surpassing much of Latin America, amounting to US\$ 1.8 billion in 2011 and US\$ 2.5 billion in 2012 (ECLAC, 2015 see figure 3.3 below). Nevertheless, public research organisations did not appear to successfully develop the relevant scientific and technological linkages to create the technological spill-overs in the hydrocarbon sector (Barclay, 2013).

Figure 3.3 Net inflows of FDI (in \$US billion) in T&T and other regions, 1970-2015



In order to avert the possibility of another electoral tie, and consolidate its electoral win, in 2002, the PNM government state created new social programmes in education and training, and expanded short term employment programmes (Ramsaran, 2004). The continued presence of the state sector and its investment in some aspects of the economy, even after divesting many assets throughout the late 80s and early 90s, still worried some segments of the business community and certain economists (Farrell, 2012). In fact, the manufacturing associations became wary, as attempts were made by government to raise the minimum wage and increase social programmes for unskilled labour (Moonilal, 2006). They believed that the programmes encouraged a poor work ethic, as well as crowding out the private sector in the labour market since workers would remain in the state sector where less effort was required for more handsome wages and conditions. An IMF Article IV consultation confirmed that poorly targeted social programmes encourage under- and low wage/skill employment, as significant numbers of people do not have sustainable sources of income (IMF, 2014). These events highlight the

configuration of forces since the late 1980s towards short-term gains and private sector development (see chapter 4 for specific cases on contemporary ST&I policies).

From late 2000s, T&T was grappling with myriad societal and economic challenges ranging from transnational crime, low levels of growth and productivity, plummeting commodity prices, and a lack of diversification and lower commodity exports (ECLAC, 2012; Girvan, 2011; Jaupart, Longmore and Cazorla, 2014; UNDP, 2013). The entry into office of the People's Partnership, a coalition of opposition forces and civil society interests, including trade unions, with a 'people-centred vision' and mantra to 'serve the people' offered by the first female leader Kamla Persad-Bissessar. This victory appeared to the public and international media as a rightful punishment for the previous Prime Minister and his government's arrogance and perceived malfeasance (*BBC News*, 2010). The overarching philosophy of 'people centred development' that was largely reminiscent of the United Nations Millennium Development Goals that had been launched in 2000. The government took over an ailing economy as demand for hydrocarbon products; especially from its major trading partner, the United States was declining 67.6 per cent of US demand in 2006 (Humphries, 2010). However, the rhetoric and policy positions taken did not significantly diverge from that of the PNM. In fact, several scandals and 'missteps' as termed by the Prime Minister, as newspaper media called them, further revealed the weaknesses of state institutions to grapple with the power relations of patron-client networks.

Up to 2013, the economy was still showing signs of meagre GDP growth averaging 1.5 per cent, and new institutional arrangements were now being put in place to meet the goals of the MTPF (2011). During its term, several ministers were also reassigned and dismissed by the Prime Minister for perceived non-performance, internal rows, alleged illegal activities, including the Attorney General and Minister of National

Security who were implicated for witness tampering and an international FIFA scandal respectively (see chapters 4 and 5 for presentation of details of links to fragmentation of public policy) . All this was happening while, the economy was entering a recession due to decline in energy demand, plummeting prices and structural changes in energy markets as OPEC’s principal member Saudi Arabia opted to maintain supply arrangements on the global market, while the United States increased fracking activities and asserted itself as an export of natural gas. As a result of lower production yields and moderate growth prospects, revised downward from 1.5 per cent, the Trinidad and Tobago government has had to review fiscal spending and reduce its budgeted oil price from USD\$75 to USD\$45 (O’Brien *et al.*, 2015).

Table 3.2 Macroeconomic and Social indicators, T&T

Population (Total)	1,337,439
GDP growth (annual %)	1.5 ¹¹
GDP per capita	17436.5
Unemployment, total (% of total labour force)	5.8
Exports of goods and services (% of GDP)	78%
GINI index	43.9* (2006)
Poverty headcount ratio at national poverty line (% of population)	22% ⁺¹²
Life expectancy at birth, total (years)	69.8
HDI ranking and value	67 /0.760

Source: World Development Indicators; WTO (2012); Kedir and Sookram (2013), UNDP (2013).

¹¹ There was zero growth in 2009, with negative growth in the following years.

¹² This is calculated by Kedir and Sookram using innovative methodological techniques based upon data in the SLC 2005.

1818	Establishment of Botanical gardens
1899	Imperial Department of Agriculture (Barbados based)
1921	Imperial College of Tropical Agriculture
1930	Cocoa Research Scheme
1948	University College of the West Indies (as a college affiliated to the University of London)
1958	Agricultural Research Station (Tate and Lyle sugar manufacturing company)
1959	Industrial Development Corporation
1961	John Donaldson Technical Institute to meet technical training needs of the new nation
1962	Establishment of the University of the West Indies as independent university (Engineering Faculty)
1963	Cocoa Research Unit replaces cocoa research scheme
1970	Caribbean Industrial Research Institute was founded
1972	National Science Advisory Council (NSAC) was constituted
1973	Bureau of Standards was created
1975	Metal Industries Corporation Limited; Coordinating Task Force for both set up to support the natural gas sector
1976	Natural Gas Company to distribute and price gas products; National Council for Technology in Development replaces NSAC
1979	National Energy Corporation
1980	National Institute of Higher Education in Research in Science and Technology (NIHERST) was created
1997	National Energy Skills Centre was instituted
2000	College of Science, Technology and Applied Arts of Trinidad and Tobago
2001	Trinidad and Tobago Institute of Technology (TTIT) was set up to develop skills at the middle and upper levels of the industry
2002	National Draft Strategy on ST&I, Vision 2020, SSTI committee appointed led by Professor Clement Sankat
2004	University of Trinidad and Tobago was established

Source: (IDC, 1969; Ali, 1975; CARIRI, 1978; Ministry of External Affairs, 1979; Chalmin, 1990; Toney, 1996; Pantin, 1997; Pemberton, 1999; Barclay, 2004; Bekele, 2004; Barclay, 2013)

Even though there were rhetorical commitments to drive innovation in several sectors, there was very little to show by way of implementation of innovation policy to ensure technological and other activities were developed (see chapter 4 for empirical case studies on ST&I policies). In any case, there were considerable weaknesses and fragmentation in state institutions and the political equilibrium had not changed to enable

policy implementation. The state was unable to create the conditions and foster broad-based and balanced coalitions in the face of powerful transnational and bi-lateral interests, among industry, the university system, and international community apart from enduring clientelist arrangements between politicians and certain groups of firms (see Chapter 4 for more detailed empirical examination of this period).

The political and economic machinations of these periods suggest that ST&I policy remained on the agenda, but given ideological and policy shifts based on promoting human capital, they remained unworkable. Market-friendly policies had the effect of reconfiguring the forces within the state system, by empowering transnational and merchant class interests that appeared to have little interest in technological progress in T&T (Ramsaran, 2013). Indeed the competitive environment in which domestic firms operated leveraged foreign competitive forces to drive the incentives for short-term profitability and consolidated commodity specialisation (Barclay, 2007a; World Bank, 2005). The relationship between politicians who had to promote these policies, and the permanent secretaries (or the chief administrative officer) who had to ensure the administrative structure for implementation had also been altered. These new governance arrangements entrenched a new form of interdependence between administrator and politician (Bissessar, 2003; La Guerre, 1994). The state, its limited regulatory role and its internal contradictions have impeded efforts to make the structural transition that will unleash new productive activities and enhance technological capabilities for long-term developmental ends.

Over the course of its history, T&T has witnessed changes in institutional structure, when it comes to S&T, and its place in its industrial policy and development strategies. Starting off from the late 1950s, there were some minor institutional supports where the state's plan sought to promote R&D in firms geared towards the expatriate

private sector while it create the contributed significant incentives, infrastructure, basic research and feasibility studies. While the second plan during the mid-1960s brought about minor changes in institutional arrangements and greater investment in education and skills, the period most noted 1970s and early 80s were the best periods in T&T's history for the investment in S&T development. This was the time private companies and industries were nationalised and government invested in new downstream energy activities. It was equally a time of heightened international relations dynamics to re-invigorate S&T efforts for development.

After measures were taken to privatise, deregulate and liberalise the economy in the late 80s, a number of collaborative projects were not sustained or were neglected of funding. At any rate, the state's capacity to induce productive expansion and enforce S&T and industrial policies was considerably curtailed as private sector companies had invested a great deal of effort to preserve subsidies from earlier periods. Nascent developmental coalitions that emerged in the previous decade were disintegrated into disjointed networks with diffuse organisational power and interests driven by the economic downturn. It would appear that the myriad of industrial projects and political mandates redirected attention from promising agricultural research activities, and diluted the state's capacity to effectively pursue potentially successful initiatives. In essence, the experience has shown continued growth based on static comparative advantage based on a few export products which insufficient for broad-based development (Kiely, 2005). Through this historical analysis, the political dynamics and institutional rules that typify the T&T society have elucidated the ways in which clientelistic politics i.e. networks of power defined as the uneven and dynamic social organisation of players with diverse interests, capacities, legitimacy and power in these different institutional environments. Based on the interaction with institutional arrangements, these relations may have

solidified a particular pattern of technology development. Institutional and capability improvements, though short-lived point to wider possibilities for change, structural learning and sustained efforts at building developmental coalitions.

CHAPTER 4 – EMPIRICAL RESULTS: A CRITICAL ASSESSMENT OF RECENT ST&I POLICIES (2002 - 2015)

4.1 Introduction

Chapter 3 offered a long-range historical survey of political and institutional developments and their interrelations to investment and shifting interest in ST&I policies in T&T. The latter have been influenced by both domestic interests and struggles, and favourable international conditions that have shaped the country's industrialisation process. It evinces the origins of rudimentary ST&I infrastructure and the battles underpinning the institutional apparatus in the colonial period that resulted from and gave rise to further changes. The rise of a militant trade union and educated middle class during the post-independence period certainly shaped institutional changes towards the formation of developmental coalitions during the 1970s. These improvements were later undermined by fiscal and economic challenges and concomitant policy reforms centred on macro-economic stability and growth. In particular, these Washington-consensus policies reconfigured the balance of social power, which the previous chapter argues is the principal determinant in the evolution of ST&I policy to date. While international alliances have proved beneficial in the early days of institutional development, local practices and political activities have equally contributed to understanding the progress made and degree of policy effectiveness during the period of more centralised state intervention. The levers that created these linkages have hitherto not been examined at an in-depth level.

Since the 1980s, multilateral lending agencies have taken on a greater role in the policy process by providing technical support, and thus shaping the issues with which the

country's policy making system must grapple. In the current situation, they have generated knowledge, funded one of the main advisory bodies of the government, and contributed through consultancies undertaken in many instances by external experts. This chapter is concerned with the results emanating from the data collected during the field interviews from September 2014 to July 2015, with industrial, state/ bureaucratic, donor and the scientific communities. It addresses the second auxiliary research question as presented in Chapter 1: what are the institutional and political factors that shape exchanges of actors and agencies in the ST&I domain? It further examines: how does the interplay of these interactions influence policy design and outcomes since 2002? The questions are examined in the context of two more recent policy regimes which have been formulated under different political administrations during 2002 and 2015.

Beyond a conventional policy analysis, these instruments will be analysed in the context of the minutiae of interactions and relationships, namely the 'networks of power' or the asymmetric and dynamic relations among the relevant agencies and actors in the policy sub-system that have impinged upon the contemporary pattern of technological development. As have been showed previously, these configurations have implications for policy effectiveness, and so greater attention will be paid to the process dynamics involved. Central to this is the question of state capabilities in managing, conducting and enforcing the policy process and its legitimacy as a patron, and sometimes client, among the various groups in question. The remainder of this section introduces the policy processes, institutional arrangements and dynamics that underpin both regimes – the Vision 2020 Draft ST&I Strategy and the 2015 National Innovation Policy (NIP), and elements of the current S&T policy that was being redrafted¹³.

¹³ The most recent S&T policy document was not obtained as informants were hesitant to share this document, in part due to the distrust of external individuals and the underlying politics that have shaped the process.

4.2 Case study 1 – Private Sector development: the Vision 2020 ST&I strategy (2004)

4.2.1 The Context

In 2002, the Vision 2020 multi-sectoral development strategy process began in earnest from a need for the country to engage in a more long-term development planning exercise. It constituted the brainchild of the Patrick Manning led PNM government during its 2002 to 2007 term of office. The initiative was couched in the context of ‘globalisation as an imperative’ to which the country’s people and institutions must respond (Government of Trinidad and Tobago, 2004). It aimed to be inclusive and sought a hybrid top-down and bottom up approach aimed at engendering a democratic and open process of consultations while provoking commitment by all players. The Plan was predicated upon the following five pillars: 1) developing innovative people; 2) nurturing a caring society; 3) enabling competitive business; 4) investing in sound infrastructure, and 5) promoting effective government, all aimed at achieving ‘developed country status by the year 2020’ (Government of Trinidad and Tobago, 2004). For this to be attainable, it was believed that the economy and society needed to undergo significant transformation from its present state of economic volatility and export specialisation in petroleum and natural gas (Henry *et al.*, 2006). This planning process harkened back to the earlier days in development planning undertaken in T&T (Downes, 2000). However, there were apparent differences in focus and approach from earlier indicative planning. The strategic report enunciated that

Vision 2020 forms the basis for a new approach to planning for the future of Trinidad and Tobago. It is an approach that is multi-sectoral in scope and involves the forging of deeper and more active partnerships throughout the society (Government of Trinidad and Tobago, 2004, p. 2)

In fact, its essential features in promoting principles of macroeconomic stability, inflation targeting, fiscal discipline were seen by some analysts as a welcome divergence from the rigid top-down ‘planning years’ (Farrell, 2012). Given its twenty-year time horizon, the approach to partnership with civil, public and private sector organisations needed to be robust for success to be achieved (St. Bernard, 2008).

The government expressed this approach by appointing a multi-sectoral core group (MCG) that was spearheaded by business leader Arthur Lok Jack, which further appointed 28 sub-committees to develop sectoral and issue-specific plans involving over 600 participants. These deliberative procedures were also accompanied by an extensive multimedia outreach and promotional campaign, in addition to town hall meetings with special interest groups (Farrell, 2012). At the time, this media blitz particularly oriented the speeches of politicians and public sector leaders at the time towards their audience i.e. the entire national community. The official process of planning ended after two years and the government proceeded to put additional arrangements in place for its implementation. From 2004 up to 2008, some elements of the plan were implemented, notably: free tertiary education, new infrastructural projects, trade agreements, as well new state agencies were set up as a two-tier administrative bureaucracy (Barclay, 2013).

There were early signs that it could not be fully implemented due to political developments, culminating in the PNM demitting office in 2010. The administration was riddled with a number of skirmishes, including accusations of arrogance, that is, it ‘lost touch’ with the population, as well as scandals involving the Prime Minister, such as the alleged construction of a Church in the heights of Guanapo, East Trinidad, run by a ‘spiritual adviser’ believed to have been funded by the state. Additionally, the PNM fell into disrepute with the population, through one of its major executing agencies, the Urban

Development Corporation (UDECOTT) whose Chairman holding several leading roles in government had been implicated in alleged corrupt deals. By the time, the global financial crisis hit in 2008, many aspects of the plan were left in abeyance or were deemed impossible to implement.

The so-called imperatives of competitiveness and innovation that policy-makers perceived imputed the need for a new national multi-sectoral strategic thrust to private sector development. For a small, resource-rich island nation it would appear that this meant a considerable embrace of the global economic order, and instituting relevant mechanisms that can adequately respond to the new external environment. Coming out of a period of political uncertainty (Ryan, 2007), domestic political figures needed to put the country on a new footing with ST&I occupying an increased role in a new development strategy. The establishment of a Sub-committee on Science Technology and Innovation (SSTI) in 2004 under the Manning-led administration exemplified this additional emphasis. The idea was to mainstream ST&I in the development process as a cross-cutting area. Concomitantly, in the years prior to the committee's establishment successive global competitiveness reports ranked T&I at a relatively low level in competitiveness (see Table 4.1 below). This external mandate coupled with the ideological commitment and other funding pressures supposedly produced an easy-to-follow list of guidelines and action items for the government to achieve greater competitiveness over time. Alongside the 'ease of doing business' business indices which began to be promoted from 2001, they created an environment for, and signalled to this developing country the requirements for making progressive strides at all cost and often to no avail.

As seen in the following table, over the five-year period, the country's ranking remained relatively stable at mid-point of all the countries surveyed for the report. It begs the question whether market liberalisation and good governance reforms during this period and the previous decade towards greater trade and market openness had a consequential benefit on export and technological capabilities in more sophisticated product ranges (for example, Hausmann and Klinger, 2009; World Bank, 2005).

Table 4.1 Global competitiveness¹⁴ rankings – T&T (2001-2006)

Year	GCI overall Ranking	Technology	Institutions	Macro-economic climate	Business Environment
2001 (75 countries)	34	52	25	36	37
2002 (101 countries)	47	42	43	25	44
2003 (101 countries)	49	47	56	47	53
2004 (104 countries)	51	47	56	47	53
2005 (107 countries)	60	62	83	40	63
2006 (125 countries)	67	60	85	38	64

Source: (Porter, Sachs and Schwab, 2002; World Economic Forum, 2003; Porter *et al.*, 2004, 2006; Porter and Lopez-Claros, 2005)

The global public relations machinery and attendant influence of the World Bank, and increasingly the World Economic Forum which holds their high-profile meeting annually in Davos (Switzerland). This global agenda has provoked a national discussion on competitiveness and productivity, manifest in the Global Competitiveness Reports.

¹⁴ According to the GCI Report 2001, the overall Growth Competitiveness Index (GCI) aims to measure the capacity of the national economy to achieve sustained economic growth over the medium term, controlling for the current level of economic development.

Policymakers, business people and other sections of society have actively imbibed these reports' conclusions and simplistic rankings as targets for improvement and intervention. This narrative has become integral part of the intellectual arsenal and policy toolkit, reinforced through newspaper stories, meetings and technical reports commissioned by multilateral lending agencies, especially the IDB. They serve to further create mounting pressures to prove adherence to the findings and recommendations for institutional reforms. The year 2005 stands out as the country showed very negligible improvement in the technology and public institutions rankings, featuring in the upper half of the 107 countries ranked, while slipping again the following year just prior to the global financial crisis. In particular, despite the challenges and vagaries of liberalised markets for small economies looking outward, it was clear by the World Bank that the only route for an 'open economy' is to improve the competitiveness of existing products and the functioning of the socio-economic system (World Bank, 2005).

Between the years 2002 to 2008, dubbed the 'golden age' of growth for the T&T economy output growth was witnessed in several sectors, including construction, services and petroleum fuelled by expansion in the offshore sector of the economy (Best, 2012). Per capita income was valued at US\$11,000 attaining the middle income status according to World Bank thresholds¹⁵ (Henry *et al.*, 2006). These conditions provided the opportunity for an expensive national development strategy process and for extensive dialogue among various groups on S&T and development issues. Though domestic actors and institutions took centre stage, institutional impulses provoked the need to incorporate several other actors, especially multilateral institutions which became part of the political

¹⁵ According to the World Bank classifications: as of 1 July 2014, low-income economies are defined as those with a GNI per capita, of \$1,045 or less in 2013; middle-income economies are those with a GNI per capita of more than \$1,045 but less than \$12,746; high-income economies are those with a GNI per capita of \$12,746 or more.

economy by offering both research and advisory support. The government deemed the World Bank as a 'partner' to perform its important intelligence function for data-gathering as well as support for planning and implementation (Government of Trinidad and Tobago, 2004, p. 76).

In the section about improving government effectiveness, the report suggests that the approach to governance developed by the Bank was most appealing, and the need to focus on four aspects, including improving stakeholder participation, accountability and transparency in the public sector, the requisite legal apparatus to ensure predictability, property rights protection, and enforcement of contracts (Government of Trinidad and Tobago, 2004, p. 213). It noted that good governance and its corollary of an independent implementing institution were in support of the overall aim of private sector development (Government of Trinidad and Tobago, 2004). However, the quick pace of liberalisation and 'opening up' that the T&T government took appear to contradict initiatives of other countries such as China and Mauritius. In these jurisdictions, state ownership of resources were maintained while increased market competition was only introduced after taking stock of existing capacity of domestic producers at a gradual rate (Wignaraja, 2002; Khan, 2007). The role also demarcated for public action was increasingly circumscribed, and constituted one solely based on a 'service delivery' view of the state, not necessarily as an active economic participant in the development process (Fukuyama, 2014; for a critique, see Khan, 2004a). It is against this backdrop that deliberations and activities of SSTI were constructed and took place.

4.2.2 The actors and the process of engagement

Despite this period of unprecedented economic growth, the major constraints facing the SSTI committee were research funding, human capacity and the fragmentation among the S&T institutions (*Chair, SSTI committee, interview, Feb. 23, 2015*). These main issues framed in the committee's reports concerned the divide between the supply of, and demand for knowledge by the private sector, and the requirement of constructing an NIS to bridge the gap. Developing relevant S&T skills and infrastructure were also pinpointed. As a consequence, the Vision 2020 SSTI group articulated the intended goal in the following way: 'the quality of our human capital is one of the best indicators of the potential competitiveness of the knowledge economy of the 21st century' (Sankat *et al.*, 2004, p. 64). The need to integrate the basic requirements of communities, including shelter, food, clothing and health with research activities and outputs also featured, while a sectoral approach would be taken to understand their specific S&T requirements (Vision 2020 Sub-committee on Science, Technology and Innovation, 2005). However, the governing structures according to a senior member of the committee of the relevant institutions remained quite inward-looking and set their priorities and allocated funds according to their specific agendas (*Chair, SSTI Committee*). According to one scientist who sat on the Board of CARIRI,

that process [of changing institutions] has been difficult because traditionally institutions in Trinidad have been set to work together but they tend to build very strong and thick walls ...and over time they become very independent and self-governed (*Professor, UWI, interview, .*).

Such agendas were driven by external conditions and interests of constituencies that could prove to have solidified path dependencies. Researchers at this time were operating in isolation from industrial needs, and no central authority, even NIHERST at the time had the responsibility to hold various organisations accountable or was able to direct

resources to the needs of these various groups towards common projects and objectives (*Chair, SSTI Committee, interview*). With plans afoot to establish the UTT, there was a proposal for NIHERST to be subsumed under this new university structure, but this was resisted by staff at the organisation (*Senior public official, MSTTE, interview, Feb. 19, 2015*). These problems certainly extended beyond the science community and S&T institutions to other organisations and groups.

At the national level, domestic research and training institutions as well as chambers of commerce and groups of executives were willingly co-opted by Vision 2020's overarching thrust for private sector development. The Arthur Lok Jack Graduate School of Business (ALJGSB) later became the operational site to carry out the mandate of the WEF and by extension other multilateral lending agencies. It is in this context that ST&I policy and institutions were deemed necessary to achieve greater competitiveness (Sankat, Pun and Motilal, 2006). In the Draft Vision 2020 report for the SSTI, the major goal was stated as follows:

By the year 2020 Trinidad and Tobago should rank in the top ten in the global competitiveness of nations. Trinidad and Tobago of the 21st century is a country that delivers quality and lifelong education and learning, quality nutrition and health care, and good, decent housing for all (Sankat et al. 2004, p. 3).

Nested among the several sub-committees as a genuine locally-driven process, it was led by an astute Dean of the Faculty of Engineering at the UWI, Professor Clement Sankat. The chairperson also determined the committee's membership along with MSTTE officials, since most persons were drawn from the university. It also comprised several current and retired officials in the public sector and key agencies related to S&T, including NIHERST, as well as other professionals in the academic, medical and management fields. It is notable that only three of the twenty-two members of the SSTI appeared to have direct links with the private sector, while no representative was drawn

from the donor community, though the larger Vision 2020 group had more influential private sector and donor participation. The roles ascribed to various players including government and market actors demonstrate the philosophical view of the committee and its adoption, that of the wider government. The latter's role was seen as follows:

Government must provide leadership; it must set targets and provide and co-ordinate resources; it must integrate science and technology into its overall macro-economic planning and strategic thinking; it must open opportunities for technological advancement; and it must ensure that the results of research and innovation are exploited (Sankat *et al.*, 2004, p. 10).

This specific character of state involvement is further understood as facilitative and enabling, by setting the appropriate macro-economic and market-supporting regulatory framework. While it was decided that it can invest in certain aspects of basic research, it was believed that the private sector should take the lead in promoting investment of new commercial projects.

In the case of the private sector, more emphasis was placed on aggressive participation to exploit technological opportunities, while the state, it was noted needed to supply more incentives to firms to adopt better technologies and coordinate collaborative arrangements. To this end, a number of tax relief measures were also envisaged. These proposed measures did not however take into account that since 2002, income tax exemption was already in place to support the manufacturing sector in aid of the procurement of new machinery and production facilities between 50 and 60 per cent of the cost and a bid was being made to increase it to 75 per cent (Lemarchand, 2010).

Among its mission was:

We see an active technology development programme that can energise the private sector to take a prime role in this country's future, driving innovative products and services emanating from Trinidad and Tobago, contributing to sustainable job creation and employment growth and the accumulation of wealth (Sankat *et al.*, 2004, p. 10).

This role of the state as a public goods provider was stark in the report as the government was tasked with creating the relevant climate for success in S&T, by providing educational and research opportunities, by supporting graduates in the fields of science, engineering, technology, academia, especially at the postgraduate level. A number of specialised funding initiatives were proposed to meet the supposed shortfall in these areas. The state also had to ensure that institutional buffers were in place to protect those marginalised and unable to acquire more sophisticated skills.

In relation to the donor and international agencies, these actors were seen as a source of funding and technical knowledge for national actors and institutions. The involvement of the donor community and multilateral lending agencies in this process appeared sparse at the surface, but there was extensive interaction with the IDB, World Bank and UN agencies in the background (*former UN resident coordinator, pers. comm.*). However, the Plan predated direct relations forged under the 9th European Development Fund (EDF) to support educational and research initiatives in conjunction with government policy (Ministry of Integrated Planning and Development and Delegation of the European Commission, 2001). In recognition of the many social challenges, the cooperative arrangement allocated EUR17 million for a series of interventions that would address educational quality in post-secondary and tertiary level programmes, with some emphasis on S&T as a means to foster ‘human development’ (*ibid.*). This was all bolstered in the wider mandate of promoting sustainable development and global economic integration. In light of this, leading Caribbean academic Hillary Beckles (2004) lamented that:

The most visible expression of global trade liberalization within the regional HE [higher education] sector is the expansion of ‘for profit’ foreign universities, mostly registered as ‘offshore’ institutions that are transacting as corporate style business within most communities (cited in Ali, 2007, p. 4).

The Vision 2020 Plan highlighted the need for greater investment in R&D geared towards solving societal problems, increasing graduate numbers and transforming institutions like the MSTTE to become geared towards ‘tertiary education research, intelligence-gathering, formulating policies and managing policy investment’ (Ali, 2007, p. 8). To this end, the UWI saw its future role as an ‘internationally recognised Centre of Excellence for Research, knowledge creation and innovation on matters related to the Caribbean’(University of the West Indies (St. Augustine, Trinidad), 2008, p. 45). State support was particularly key in providing additional funding to the initial annual sum of \$5 million established in the period 2005 to 2006, later increased to \$7 million, for research activities in several areas, including marine ecology and agriculture, in particular cocoa. Cumulatively, a total of \$16.4 million was provided by the T&T government (The University of the West Indies, 2014, p. 3). Simultaneously, a standalone tertiary education policy was subsequently drafted seemingly during the EU negotiations for support under its 9th EDF programme (Ali, 2007). Donor support, national institutional mandates and the prerogative of technocratic and political elites furthered the MSTTE’s main goal towards promoting greater tertiary education participation. Thus, as part of the wider ST&I framework, the government’s higher education strategy benefitted from support of international agencies, including UNESCO and the European Commission. Over time, one defining feature of tertiary education sector is that it has become increasingly populated with a diverse set of public and private providers both local and abroad that effectively emerged since the mid-1990s (Herbert and Lochan, 2014).

4.2.3 The initiatives and institutional framework

Moreover, the implementation of various public S&T initiatives was dispersed across several agencies. Of the many recommendations of the Vision 2020 S&T committee, three key proposals survived to full or partial implemented or were carded for implementation: the Technology Park, later known as the Tamana Intech Park, the expansion of tertiary education and S&T training opportunities through the establishment of the UTT, and the Research and Development funding (RDF) grant facility housed at the Ministry of Trade and Industry (MTI). The introduction of the Government Assistance for Tuition Expenses (GATE) which offered universal tuition coverage for all T&T citizens formed an important part of the Vision 2020 strategy (Government of Trinidad and Tobago, 2004). These arrangements each reflected the political appetite to meet the needs of various clients of the ruling party in the population. The administration of the RDF was handled and plans elaborated for the technology park by two wholly-owned state agencies attached to the MTI, while the MSTTE took responsibility for the UTT. Under the RDF scheme, support was provided by the government for R&D projects in non-energy manufacturing and services to the sum of TT\$500,000 to single firms, while a consortium can gain access to TTD\$200,000 (Ministry of Trade and Industry, 2009). The following table shows the range of goods/services and other activities for which funding could be sought.

Table 4.1 Range of goods/ services and activities under the RDF Grant

Type of eligible activity/ expenditure	Criteria
Prototype development costs including material and labour costs	Must be locally owned and operated
Patenting costs including application fees, translation costs, office actions, patent legal fees and filming fees	Must be in existence for a minimum period of two (2) years

Costs for internal personnel directly involved in R&D activities (based on work days/hours)	Must be able to contribute a minimum of 33. 33% of the cost of the project;
Pilot projects costs whose results will be used to complete product service development as part of R&D	Must have investments in non-property assets e.g. machinery, equipment and working capital of TT\$50,000 - TT\$5,000,000
External consultancy fees as relates to the conduct of R&D activities e.g. certification and testing costs to complete project, design costs, product trials	making annual sales turnover between TT\$50,000 - TT\$5,000,000

Source: (Ministry of Trade and Industry, 2009, p. 22)

Lobbying by larger business interests, in particular the Energy Chamber, as well as under-subscription by other sectors like manufacturing seemed to have impacted the decision to change the policy from earlier versions strictly destined for smaller firms and projects to include larger revenue-earning firms to have access to these subsidies (Ministry of Trade and Industry, 2014).

The governance protocol, especially with respect to project evaluation did not appear to be very rigid, and it can be reasonably gleaned that such leaves room for intensive rent-seeking by incumbent firms in existing economic sectors, such as hydrocarbons. Specific documentation about the regulations, monitoring or possible sanctions for not delivering on projects were not available to determine the extent of oversight and performance evaluation. Historical insights and an understanding of current state capacity can however lend support to the conclusion that these arrangements would be weak and sanctions for non-performance on projects would not be easily or strictly enforced. The lack of transparency in the use of these funds certainly set the tone for possible stiff competition among firms' leaders with connections to political parties. A very low subscription rate also occurred among local enterprises facing foreign market competition in the domestic market. Given the requirements of the RDF, it is unlikely that

many small firms which would be in principle more flexible to adjust production regimes would be able to meet the partial upfront costs. This may thus discourage the pursuit of R&D investment projects. Overall, this mechanism operated in a wider institutional vacuum in terms of working within a productive sector that was decoupled from knowledge production and oriented to short-term profitability. A senior representative repeatedly pointed out may have been the reason for poor overall institutional performance and organisational uptake of S&T incentives (interview *Senior Officer, MPSD, Feb. 3, 2015*).

For its part, an EU representative expressed concern that systems were lacking, there was no monitoring and evaluation mechanisms and there were serious shortcomings in statistical data and capacity which delayed implementation of projects (*EU Representative, interview, Mar 28, 2015*). These performance constraints meant the EU had to provide capacity building and upgrade systems in order to implement the projects and effectively utilise the funding, which prompted the creation of an EDF Unit at the Ministry of Planning (Delegation of the European Commission and National Authorising Officer of the European Development Fund, 2008). At the end of 2006, funding was reduced by EUR4.7 million due to under-performance and lack of decisive projects underway (*ibid.*). It would seem that these systems needed to be in place to give the assurance that transparency and accountability was adhered to by the recipient government so that the EU delegation could justify to their principals that the funding would be appropriately utilised. These funding arrangements were not ideal as they demanded additional financial outlay and diversion of the state's resources to actually be able to access the funding. It also undermines certain levels of autonomy even though the principles laid out in their cooperative agreements suggest that it should be done on the terms, and based on the needs of the T&T government. Extant institutional capacities in

this issue area were nevertheless not assessed beforehand especially since delays and difficulties were experienced with past EDF disbursements (Delegation of the European Commission and National Authorising Officer of the European Development Fund, 2008).

According to the Vision 2020 ST&I plan, the main institutional solution proposed with the SSTI and would be vested with the authority was the National Council for Science Technology and Innovation (NCOSTI) (Sankat, 2005). In fact, it was suggested integrating transnationals into the NIS and taking a sectoral approach to technological forecasting through the provision of additional incentives would stimulate technological transfer and development (Sankat, 2005, p. ii). The harmonious relationship that would be brought about by these mechanisms were considered pragmatic and almost an automatic result. At this time all relevant S&T agencies, including training, educational and R&D institutions were subordinate to the MSTTE that could possibly facilitate such an undertaking but it was not realised (Nurse, 2007, pp. 16–17). Commenting the plan a senior staffer at NIHERST was of the view that it was a laudable effort:

They did think up specific areas for diversification that should be developed in the Vision 2020 plan. The incentives, resources to produce knowledge, develop technology and disseminate throughout society were all taken into account and the effort was nationalistic (interview *former Acting President, NIHERST, Mar. 20, 2015*).

The Committee envisaged that the NCOSTI would constitute a research council resembling institutions in the developed world which had equally grown in popularity in developing countries. It would thus be vital for ‘funding basic, strategic and applied research, advising on and implementing national science policies, and being primary agents for science communication’, thereby replacing the erstwhile NIHERST (Sankat, 2005, p. vii). In order to institutionalise its autonomy, the NCOSTI would be appointed

by the President of the Republic, comprising a board of fourteen (14) members, headed by a Chairperson, drawn from civil society, business, and government, and supported by an Executive Secretariat of qualified professionals (Sankat, 2005, p. x).

In terms of operational financing, it would be initially capitalised with an outlay of \$80 million, allocated to a number of subsidiary schemes as follows: in postgraduate research and scholarships, basic and applied research, industry R&D, advanced high-tech and other specialised training, and one geared toward societal improvement (Sankat, 2005, p. xi). Financial contributions will gradually increase in subsequent years to ultimately reach one per cent of GDP by the year 2020. Given NIHERST's pre-existing role, it would serve as the foundation and as the precursor for the establishment of the NCOSTI, but it required recruitment of scientists and researchers who had migrated upon the establishment of the College of Science Technology and Applied Arts of Trinidad and Tobago (COSTAATT) in 2000. It would also be expanded to include, and where lacking develop the necessary capability for new functions in fund management and policy intelligence functions. According to its proposed governance structure, the NCOSTI would report to the Minister of Science, Technology and Tertiary Education, and be run like a typical board of a corporate entity with a Corporate Secretary, Executive Director and heads of four sub-units. In order to successfully fulfil its new expanded ST&I functions, the SSTI group expressed the need for a new legislative framework.

With respect to areas of priority for ST&I, the committee identified six broad areas with twenty-one sub-categories in which the NCOSTI will be charged to invest and disburse funds through a competitive bidding process. The new organisation would oversee this programme of work, provide the support mechanisms and financing, rather than direct the conduct of such activities itself. The main principles to be observed were

‘the exploitation of knowledge, value for money, commercial viability’ to accumulate wealth and greater prosperity for the country as a whole (Sankat, 2005, pp. 10–11). In this way, it would function as the platform to connect the supply of knowledge and knowledge workers with the demand in the productive sphere (Sankat, 2005, p. 17). The new institution would effectively become the fulcrum for the NIS as envisioned to foster the productive relationships and alliances among organisations and actors in the public and private spheres. In the end, while the committee acknowledged funding as a major impediment in past S&T coordinating mechanisms such as the NSAC and NCTD, the political costs of change to such ‘an efficient, productive and symbiotic’ system were not equally considered (Khan, 1995). Instead, they appeared convinced that the technical recommendations were sufficient, and the establishment of the NCOSTI may be a seamless process or one that would go uncontested from the existing actors. Such an oversight may have contributed to it not being realised at all.

4.2.4 Assessment of Vision 2020 ST&I process

The ambitious character of the Vision 2020 ST&I strategy did not consider the costs involved in transitioning to new political alliances, institutional arrangements, given the balance of organisational power, and institutional capacity gaps to deliver on its many mandates. Indeed, no assessment was done on the impact of the social context on the political feasibility of the ST&I strategy. The major institutional leaps that the strategy required to successfully execute these ambitions seemed largely out of reach with the local institutional structures and governance systems. Ironically, contrary to its initial intentions, the planning process seemed to have also been mired in internal disagreement and what one committee member indicated was an elite operation that was ‘badly run’

with too many ‘cooks in the kitchen’ (*SSTI Committee member, pers. comm*). The resulting document was believed to reflect ‘the interests of a few who were at the helm’ (*ibid.*). In addition, the perennial challenge was that there was no mandated institutional system to adequately execute and manage the S&T policy process, and address the need to create backward linkages between knowledge and existing production activities. The Sankat committee conceived a framework that will be insulated from the ‘cut and thrust’ of the politics of the day, constitutes as the NCOSTI and empowered under the parliament to whom it would be ultimately unanswerable.

However, this could not be necessarily be realised, as the changing atmosphere of clientelistic political relations based on personalities and leader idiosyncrasies were endemic in the public sector, and the society as a whole. More than that respondents perceived that when governments changed (recalling the PNM was voted out in 2010) there was a clear political rationale for policy changes where it was believed that because one regime constructed Vision 2020, the subsequent regime decided to move in another direction as there was a lack of understanding and no broad-based support (interview *Senior Officer, MSTTE, Feb. 19, 2015*). According to an engineering professor whose department was involved,

the previous [administration] had the Vision 2020 ... the current government threw that out, so there is that political issue of continuation... they don’t want the other side using their stuff. We need to find a way to prevent that from happening (*Professor of Engineering, UWI, interview, May 21, 2015*).

The lack of progress also has to do with the position the committee occupied outside of the mainstream public bureaucracy, which could not guarantee that the suggested measures would be vigorously pursued, given bureaucratic hurdles and other vested interests. The perceived failures of the SSTI policy have evoked a sense of disillusionment among advocates in scientific community, as progress was largely short-

lived (*Chair, SSTI Committee*). As a result, it was suggested that a bipartisan approach to ST&I policy involving a long-term vision and knowledgeable leadership that can attract talent and funding to advance it towards implementation. But even with an express set of plans contained within Vision 2020 with the former Prime Minister Manning at the helm, the internal struggles of the state apparatus and the balance of power relative to other constituencies affected whether this vision will be put into effect.

Furthermore, it went beyond considerations purported by NIE proponents that it would necessarily be as a threat to political elites, but to the nature and quantum of investment required would create losers at the lower levels of the political party or the business who benefit from existing arrangements. It also appears that the committee did not take into the amount of political advocacy required and opportunity costs of reallocating rents to meet the proposed initial expenditure and financing for R&D activities, to setting up a new state institution, and replacing the erstwhile NIHERST. All these were by virtue political activities that would have led to displacements of public sector workers, as well as create new streams of rents for mainly university researchers and latterly some private sector, with which existing social and market actors may not have been pleased. These redistributive outcomes were not adequately explained in the committee's technical plan.

The private sector emphasis of the Vision 2020 ST&I policy, where market actors would avail themselves of relevant benefits, appeared to be determinant in shaping its implementation or lack thereof. Macro-economic stability, deregulation and lower taxation towards short-term goals without government leading the transition constituted its paragon features (Farrell, 2012). According to a subsequent World Bank report: 'vested interests will block and parry; and political groups may see insufficient political

returns in supporting of driving change' (World Bank, 2005, p. xi). To this end, to make change possible: '[p]roper account, must be taken of winners and losers, of transition costs, and of bringing in previously disadvantaged and excluded groups (World Bank, 2005, p. xi). The Bank is suggesting that to meet its longer-term prescribed goals of efficiency and competitiveness, that rent-seeking would need to be curtailed. In other words, the operation of the market need not be constrained by the unpredictable and perverse manoeuvring of political actors (Munck, 2005).

The World Bank report was seminal as it provided preliminary indicators after the Vision 2020 planning process was more or less concluded, about the direction the government might take based on policy actions up to that point. The report intimated that there needed to be greater use of ICTs in firms, supposedly imported technological solutions, and a closer link between training opportunities and needs of the private sector (World Bank, 2005). On the other hand, increases in wage rates, market instability inadequate skill and technological absorption, and protectionist policies, according to the Bank, limit the competitiveness of firms and the economy more widely (World Bank, 2005, p. xxiv). From this angle, moderate increases in worker remuneration can stifle economic growth if not on par with productivity (World Bank, 2005, p. xxix). It cites SM Jaleel, a T&T-based beverage manufacturer as a relevant case of investing in staff training and building technical capacity, seen more importantly as an ingredient in technological development within a global environment (World Bank, 2005, p. 168).

The significant lesson that the Bank derives from the experience of the telecoms sector where liberalisation has occurred in comparison to other sectors is also quite telling, in that it views the presence of public sector enterprises as inimical to growth and competitiveness (World Bank, 2005). Above all, without the necessary market reforms

such as reducing high tax rates, labour market flexibility and privatising public enterprises as well as openness to free trade and investment, improved technological conditions will not materialise. Though these measures may improve aspects of the growth based on static comparative advantages, their downside is that there is little effect on building domestic firms' capabilities beyond the mere use of foreign technology in T&T (Barclay, 2004).

The SSTI Report eventually did not reach to the execution stage of the policy process of being translated into a White, then Green paper to be presented before the T&T Parliament for debate. It was believed however that the strategy was indeed an accomplishment and its multi-sectoral framework that enabled a diverse coalition to develop these ideas and to give greater credibility to ST&I policy as a national endeavour (*Chair, SSTI Committee*). As it would seem, the implicit aspects of the ST&I policy that primarily encompasses the macroeconomic framework (Forsyth, 1990), along the lines of the Washington consensus took precedence. Apart from the three projects that survived into this period of deepened market promotion, and it became an area of tension among the new empowered business elite and the traditional sectors (Ramsaran, 2004), both of which seemed reluctant to take on new long-term projects. Perhaps, a new future-oriented capitalist class with a strategic orientation could not emerge in the existing institutional scenario, or existing entrepreneurs were already constrained by external competition, that short term profiteering seemed more viable. Within the context of deepened clientelistic networks that emerged among the business class and the political elite, both of which depend on each other to varying long term capability development seemed unlikely. In addition, the possibility of creating new alliances between resident merchants and other political parties threatened the PNM government, preventing it from taking a long-term developmental view and pursue the ST&I policies in their entirety.

In the next section, the National Innovation Policy (NIP) and elements of the latest science and technology policy will be explained along similar lines. The issues and relationships that arise from these new regimes suggest a more complex set of interactions, some level of continuity with change in policy stances. The more pronounced role of multilateral lending organisations is apparent, a lesser role of leaders in the scientific community, while industrialists seem to generally adopt the same position (as seen in Chapter 3) even if given a more concrete role in the policy process.

4.3 Case study 2 - The competitiveness dilemma: towards a national S&T policy and National Innovation Policy (2010-2015)

4.3.1 The Context

Two years into the 2008-2009 global financial crisis, a UNC-led People's Partnership coalition government took office after a two-year slump in the economy in 2008 and 2009, when the demand for energy products was depressed (chapter 3 gives the example of the steel sector). In 2010, new government established a mega ministry under the title of 'Planning, Economic and Social Restructuring and Gender Affairs' with a neophyte politician, and former independent senator Mary King as minister. There was a serious departure from the long term planning to a supposedly more pragmatic policy approach that was adopted within the bureaucracy. The government returned to medium term planning protocols which would last for a three year period with its people-centred development approach under seven interconnected pillars: poverty eradication and social justice; national and personal security; information and communications technology; a more diversified, knowledge-intensive economy; good governance and foreign policy (Ministry of Planning and the Economy, 2011).

This methodology primarily aims at ‘the strengthening of the country’s macroeconomic policy framework and the implementation of sound sectoral policies and programs to lay the foundation for long-term growth and development’ (Downes, 2000, p. 11). One of the main objectives of the MTPF 2011-2014 was ‘economic growth, job creation, competitiveness and innovation’ which motivated and directed efforts towards the formulation of a National Innovation Policy (NIP). The rationale given for adopting the MTPF was that there was little reference to sustainability and sustainable development in the last plan (*Former minister, MPSD, Apr. 17, 2015*). Besides, this variation might have been merely superficial rather than substantial, provoking the renaming of the department as the MPSD in 2012.

To this end, it was envisaged that the initial stages in the process would be conducted at the state level; at later stages, relevant constituent groups would be consulted. In addition, a number of institutional arrangements were put in place at the ministerial level including new institutions like the Council for Competitiveness and Innovation (CCI) and Economic Development Board (EDB) which were installed in 2011 made up of academic, business and public sector representatives. Plans were also afoot to establish a civil society board to be subordinate to the Economic Development Board to gain the input of civil society organisations in the development planning process. Later, a results based-framework was adopted to establish monitoring and evaluation mechanisms and conduct periodic evaluations of both internal policy development and execution of strategic plans elaborated by other ministries and departments.

Under the direction first Minister of Planning of the administration, economist Mary King, a CCI chaired by Dr Bhoendratt Tewarie, UWI Pro-Vice Chancellor for Planning and Development was appointed in June 2010, along with an EDB. Previously,

Tewarie had the distinct reputation as an academic and of serving as a Minister of Industry, Commerce and Tourism during the former National Alliance for Reconstruction (NAR) administration which initiated structural adjustment reforms in the late 1980s. According to Caribbean Compete website, the IDB private sector development support agency for the English-speaking sub-region, these committees represent an important step to initiate public-private dialogue that promote business climate reforms, and to ‘provide critical inputs to the current efforts to bring about a more innovative and diversified economy’¹⁶. In this vein, the CCI was set up in June 2010 to ‘assist in developing and implementing a holistic and competitive innovation policy that will transform the economy of Trinidad and Tobago and improve its global competitiveness and innovation rank over ten years’ (Ministry of Planning, Economic and Social Restructuring, and Gender Affairs, 2011). These committees were set up to fulfil the goals proposed by its then Minister Mary King. At the time, the government expressed its intended policy approach advocated by Minister King to institute an NIS to nurture ‘centres of Excellence, small and medium enterprises, finance, marketing and market development systems’ (Ministry of Finance, 2010, p. 18).

In 2011, based on its priorities, the government through the MSTTE opted to assign the responsibility for developing a national S&T policy to the NIHERST, arguably because of its longstanding status in the national S&T institutional ecosystem and resources at its disposal. Given the reassignment of the Chairman as Central Bank governor, and the instalment of a new Chairman later in the year, the policy process took on new orientations and idiosyncrasies with the direct involvement of the chairman in the policy process. The data collection and consultation processes with various

¹⁶ See Caribbean Compete Project Highlights: <http://competecaribbean.org/project/support-for-economic-growth-competitiveness-and-innovation-in-trinidad-and-tobago/>

constituencies, including the scientific community, private sector and general public by NIHERST's policy intelligence unit led by its senior staffer had already taken shape and was well advanced (NIHERST, 2013). The splitting of the primary ministry into two separate entities and reassignment of ministers by the Prime Minister in September 2012 saw the creation of the Ministry of Science and Technology (MST) as a standalone entity, as well as appointment of new senior executives at the ministerial level. The relationship between the Chairman of the NIHERST Board, and the Ministry was suddenly changed where the Chairman who decided that he would report directly to the Minister and not professional staff at the Ministry. All these institutional changes contributed to delays, frustrations and created tensions between professional staff at the Ministry and at NIHERST. The reporting relationships with other agencies such as the Ministry of Planning responsible for the formulation of an innovation policy is unclear, and this has posed difficulties in terms of information-sharing, even when inter-agency committees have been set up and formal requests have been made (*Senior Economist, MPSD, interview, Feb. 3, 2015*).

In spite of these ongoing challenges, and after talks with relevant national and international parties, NIHERST has progressed towards the formulation of an official the national S&T policy. This policy seeks to

to strengthen institutional linkages among academia, government and industry; to establish new networks with Trinidad and Tobago's scientific diaspora; to increase the amount and variety of S&T outputs, including patents, new products and services; and to dovetail with other relevant national policies in the pursuit of the overall development objectives of the Government of the Republic of Trinidad and Tobago (NIHERST, 2013, p. 173).

These objectives seem somewhat contradictory in light of the ongoing internal organisational squabbles that have ensued between the Chairman and senior staffers,

where it was believed that the Chairman had hijacked the process (*Senior S&T officer, MST*). In fact, it was acknowledged that he has made requests to significantly truncate the initial policy draft from several pages to a few pages to supposedly make it intelligible to the “man on the street”. In this sense, this problem could have stemmed from one of the challenges that the organisation has itself highlighted in the lack of political commitment to S&T at a national level (*former Acting President, NIHERST*), and may have contributed to ‘a perennial problem as this situation has stymied the growth and development of S&T within the country’ (NIHERST, 2013). In fact, very few champions in the public sector or the private sector for S&T progress have emerged. These very problems of fragmentation were highlighted by stakeholders, principal among which was a deep level of mistrust in key government agencies and coordination problems among ministries that have contributed to low take up of S&T support services (NIHERST, 2013).

Over the first two years of its life, the CCI was tasked to deliver on four formidable mandates: the expansion of exports; dramatic improvement of the country’s ranking on competitiveness; new investments by existing competitive companies to sustain their competitiveness or to develop new ventures; raising of awareness with regard to competitiveness by mounting a national event on Competitiveness in 2012 (Ministry of Planning, Economic and Social Restructuring, and Gender Affairs, 2011). The CCI initially comprised six members, five from the business community and a representative drawn from the UWI. In June 2011, two additional people were appointed including a new Chairman Chandricka Seeterram, and later a representative from the Ministry of Trade was co-opted.

A senior member of the ministry was unsure of the Mary King's approach would be effective and believed that it did not gain sufficient traction at the department (*Senior officer, MPSD*). It could be argued the former minister 'centres of excellence' idea was unfamiliar or was in competition with more accepted, popular frameworks as the NIS concept. Mary King had not been able to achieve much during her short tenure and thus had not made a lasting imprint on the innovation policy trajectory. In her place, Dr Tewarie was appointed as the new Minister of Planning, Economic and Social Restructuring and Gender Affairs, later to be renamed the Ministry of Planning and the Economy, and then Planning and Sustainable Development after two subsequent Cabinet reshuffles. Tewarie immediately mandated the bureaucrats at the socio-economic planning policy division (SEPPD) of the ministry to undertake writing of the Medium Term Policy framework for the period 2011-2014.

4.3.2 The actors and process of engagement

In the present context, the scientific community appears to have a circumscribed role in advising on policy priorities and interacting with the policy-making process, which varies according to the political office holders. In certain ways, certain personalities have had influential roles but based on informal affiliation / social identifiers or based on the preferences of other actors like donors and politicians/state officials certain figures can come to have a defining role such as the chair of the NIHERST Board. The level of engagement is intermittent and this parochial influence can be possibly traced back to the overarching social order, relevant incentive structures, and the marginal place that 'evidence-based' policy-making has occupied in the T&T as a whole. According to a senior scientific officer, 'the MST is not considered high on the political ladder', and did

not have the reputation, given the entire executive of the Ministry was fairly new (*Senior S&T Officer, MST, interview Mar. 3, 2015*). The priorities for S&T policy and framing of the problems have been predominantly based on prevailing economic and social circumstances and politicians' mandate to diversify the economy.

Through the interplay of state relations with international donors and industrial players, the priorities are defined in international terms such as 'competitiveness' and 'market-friendliness'. The incentives for scientific engagement with policy makers rarely exist, either at the university level or through specific mechanisms. In its ongoing efforts to establish international alliances and support for the formulation of the S&T component of the ST&I policy, the critical agency in NIHERST hosted an international conference. Most of the participants and presenters appeared to come from international organisations in Europe and North America. The resulting political imperatives have come to mediate the ways in which the scientific community is engaged in policy making processes through the state, such as through state supported organisations and enterprises. This rebuts the so-called thrust towards evidence-based policy making as they are not engaged on an ongoing basis to frame questions for public debate or to give overall guidance to state interventions and projects in the S&T realm.

Later in 2012, the Ministry of Planning contracted its first business unit manager responsible for Competitiveness and Innovation. The individual's background was in innovation studies having done postgraduate level studies in the United Kingdom at the well-known Science and Policy Research Unit, University of Sussex. His specific area of interest was in ICT policy. After being recruited, there was very little work in term of actual policy-making and he took the role of programme manager to co-ordinate an entrepreneurship programme, a number of studies on innovation activity and governance of the innovation system. These efforts and salaries of the department were funded by the

IDB who proclaimed that this relationship was merely of a technical supportive nature, and there was no overdue influence in the policy-making process. However, regular missions were held between the IDB with the government as well as other ‘stakeholder’ groups, namely the university sector and the business community to ensure compliance and monitor progress in terms of the implementation of business friendly reforms.

According to one perspective involved in the missions to T&T on the innovation and competitiveness agenda however noted that:

The work of the IDB has been very influential and the agency has had constant presence in Trinidad. It continually holds dialogues with stakeholders and had several team visits. We’re in the process of setting up a team with the government to manage the loan operations ... that will be an effort to promote the national innovation system’ (*Senior staffer, IDB, interview, Nov. 9, 2015*).

Further in 2013, another expert in energy policy was recruited to manage ‘research and policy’ aspects of the governmental unit. The contracting of experts for various roles, including consultants closely monitored though subject to public service procedures. No local consultants, either from the management sector or the university were hired during this period. At the university level, apart from the formal meetings for research and compliance purposes, there was very selective engagement with the academic community. The involvement of the academic community came through the Ministry of Planning, with the support of IDB funding, contracting of a micro-level study that sought to understand the level of innovative activity at the firm level in several sectors. This contract was awarded to the ‘Centre for Strategy and Competiveness’ at the ALJGSB – the UWI Business School, which is responsible for administering the yearly global competitiveness surveys to leading business elites.

Furthermore, this relationship has evolved over time in part due to the fact that the Minister in charge had previous connections with the Business School as he served as a

former director. These past professional ties mattered in the work to be undertaken and ensured special preference for the ALJGSB in some respect, given its role in the GCI executive surveys (see chapter 2 and 5 on networks of power). This selective approach to the use of local capacity has given the perception that the government, in particular the Ministry of Planning's policy efforts are data-driven, that eschews any charge of ideological approaches. It was also the institution that was selected to under cluster/value chain studies to determine the feasibility of the priority economic 'clusters' as part of the government's diversification strategy. Though micro-level in nature, one of the reports undertaken was a comprehensive snapshot of sector-level activity that depicted disappointing results (Centre for Strategy and Competitiveness, 2014).

They were synonymous with and reflected the conceptual moorings and measurement tools contained within the Frascati Manual, the European-based measurement approach developed by the OECD, and targeted the following sectors: energy, creative industries, tourism, maritime, finance, food sustainability and ICTs. Its findings reported a low-level of innovation among a cross-section of firms, with the ICTs sector standing out as highest level of innovation activity. The influential role of the Business school of the main institution with links to the IDB and international organisations like the WEF was critical in securing these assignments and for applying popular concepts and approaches to research innovation and offer policy advice in T&T.

It also revealed that the general level of connections between firms and the university/research systems was minimal, while specific sectors such 'food sustainability' interacted most with government agencies. This is a credible conclusion given that most of agricultural produce is destined for local markets, where government creates effective demand even amidst the reduced contribution that agriculture has made to output in real

terms, notably from 4.2 to below 1.0 per cent of GDP during mid-1980s to 2004, while from 2006 to 2014 it shrank to 0.5 per cent (Government of Trinidad and Tobago, 2006; Central Bank of Trinidad and Tobago, 2016, p. 35). According to its repertoire of recommendations, the report proposes: additional incentives for firm internationalisation, increased access to finance by firms, fostering greater collaboration and linkages among ‘stakeholders in the innovation system’, a sensitisation programme about intellectual property rights (IPRs), and greater attention to important issues for creating ‘an enabling environment’ for business innovation (Centre for Strategy and Competitiveness, 2014). While not always explicitly stated, it is latently recognised that government will facilitate these changes in different ways, rather than take the lead.

In 2010 a new board was appointed at CARIRI which started the process of re-organising the institution to focus on research, development and innovation. A member of the CARIRI Board recalled:

When we went into the Board of CARIRI, we realised that CARIRI’s mandate was off the mark. It had developed into a successful testing organisation where they do a lot of accredited tests for the oil and gas and other industries. And those tests had done them very well But their converting innovation into industries was not happening at all (*Professor, UWI*).

At this time, most of its income came from the energy and petrochemical sector companies which contracted services for their accreditation for laboratory testing. Headed by Hayden Ferreira, it took the decision to set up parallel operations that would not undermine lucrative contracts in the energy sector but ensure that a thrust towards commercialising research and innovation would be renewed in order to meet government’s mandate based on increased competitiveness, employment generation and foreign exchange earnings for the long term. Over this period, some of these initiatives helped bolster the rapport with government as they acted as flagship projects were eye-

catching, about which the line minister could be proud and give him further reason to stand out among his peers. One Board member noted some progress:

during the five years, we have created two parallel arms in the CARIRI, the commercial arm is still doing quite well, and the other arm is still in a fledgling stage... we have set it up, they have infrastructure, staffing and we're still trying to get the learning process going ... and we're trying to build the connections (*Professor, UWI*).

Due to its shift in focus from earlier periods, CARIRI had lost much of technical capabilities in conducting research-driven projects. The process to advance this agenda and give new significance to its activities appeared difficult. However, the government took a number of steps to establish new organs attached to CARIRI, including a new Centre for Enterprise Development in 2012, which now functions as a business incubator and innovation centre. In addition, CARIRI now houses the Canadian-funded Caribbean Climate Innovation Centre¹⁷ (CCIC) and has collaborations with a number of external institutions, including Microsoft in the area of ICTs. The intention was meant to focus the organization on RD&I and recruit relevant skilled staff in engineering and management to advance the new areas and projects, but in the end its capacity was stretched and its operation became quite diffuse. This was due to the fact that the organisation was pursuing opportunities for international funding from these additional areas of operation. In other previous relationships, especially with the Office for Knowledge Transfer at the UWI, even though CARIRI is located on the university campus, the relationship became strained and the only links that existed were some board members were also university academics.

¹⁷ The CCIC is meant to collaborate with stakeholders to accelerate the development, deployment and transfer of locally relevant climate technologies in developing countries. Even though the CCCIC is financially supported by the Canada government through a CAD20 million grant, it is administered and supervised by the World Bank's Entrepreneurship Programme for Innovation in the Caribbean.

Prior to his transition into government Minister Tewarie set up the Centre for Caribbean Competitiveness, a research and policy centre at the regional University located in Trinidad. Similarly, in 2014 the government of Trinidad and Tobago through its MPSD hosted eighth Americas Competitiveness Forum that brought together a number of participants, including international speakers, corporate, policy makers, donors and regional bodies under the theme of ‘the Human imagination at work: driving competitiveness and powering innovation’. A staffer at the IDB remarked on the role of Tewarie as government champion for innovation:

Minister Tewarie provided the initial impulse to the Centre for Caribbean Competitiveness. He was influential in advocating a new innovation culture and knowledge culture by setting up the innovation council and economic board as well as other institutions to promote innovation (*Senior staffer, IDB*).

Most of the participants giving contributions and directing the operationalisation of the event appeared to be of foreign origin and stature providing lessons to local and regional organisations and participants. Thus, the progress of T&T as an innovation-driven economy¹⁸ according to the WEF categorisation is salutary warning of the limited relevance and understanding of the context and specific ground-level factors that drive innovation processes.

It is typified in the report commissioned by the government with sponsorship from the IDB for the event, whereby significant emphasis was placed on denoting the competitiveness ranking of T&T and other Caribbean countries, while glossing over the important informal and contingent features and relationships that drive the innovation process and policy cycle (Nurse, 2014). The ‘path dependencies and forms of structural inertia in public administration and in the private sector’ to which Nurse (2014, p. 4)

¹⁸ In 2014, the GCR elevated the Trinidad and Tobago economy to innovation-driven status.

refers does not seem to draw upon in-depth analyses and coalition-building processes that have resulted in the periods of momentary success, which a more in-depth approach alluded to here would reveal. Heavily conceptual and empirical reliance on external sources of information, agencies and contexts can therefore stymie domestic capability building and understanding of local practices and contexts (Girvan 2007; Marcelle, 2017).

4.3.3 The initiatives and the institutional framework

Additionally, in an effort to ‘increase the relevance and impact of the Campus’ research’ the regional university, the UWI, sought research funding from the T&T in 2012, with which it set up a Research and Development Impact Fund (RDIF). In the early planning stages, the Fund was meant to align with the MTPF in the themes and issue areas, fill certain performance gaps, and address criticisms levelled at it about its perceived insularity and disconnect from the needs society (UWI, 2011). The main priority areas were: climate change and environmental issues; crime violence and citizen security; economic diversification and sector competitiveness; public health; finance and entrepreneurship; technology and society: enhancing competitiveness, social and cultural well-being (The University of the West Indies, 2014). The aim of the RDIF is:

to support projects that address pressing development challenges and that will achieve recognizable and substantive impact in the short and medium term (3-5 years). Emphasis will be placed on: multi-disciplinary research, collaboration and strategic partnerships, participation of PhD students and/or post-doctoral researchers, a focus on research-directed action and impact on policy, practice, products and/or services, contribution to shaping the intellectual discourse on a policy issue of national/regional importance, knowledge dissemination and stakeholder engagement¹⁹.

¹⁹ <https://sta.uwi.edu/rdifund/>

Government's annual support totalled TT\$7 million added to which counterpart funding was sought through private or international sources to undertake projects. The RDIF provides as much as TT\$2 million for research teams up to a period of 2 years. In addition, it generated a number of unique partnerships with domestic private, public and international organisations in research and for-profit sectors.

It was clear that the state came to influence this new agenda and the mandate of application of knowledge and in policy-making process along market-conforming lines. References to 'research enterprise, impact and competitiveness' make this clear, even though it pursued social and related developmental initiatives (UWI, 2015). From the beginning of 2012 to late 2014, the initiative funded a total of 22 projects at a cost of TT\$14,343,228 (UWI, 2015, p. 8). While its motivations appeared worthwhile, the philosophical underpinning suggest that 'impact' was simply gauged in numeric terms, similar to a business generating profit. Its methodologies related to strategizing and stakeholder meetings also give a similar impression of how it proposed to deliver on its objectives. The longer term vision and effects of a project of two years duration seem to simplify issues such as crime, the environment and health into piecemeal chunks that may not reveal and act to give meaning to the underlying causes and thus seemed narrow in scope.

One such project that received funding to the cost of \$1.5 million was housed at the Cocoa Research Unit (CRU) of the university, encouraged collaborations with local chocolatiers, farmers, researchers and international capital, where the lead activator sought to make T&T fine cocoa more competitive along the product value chain into high-end chocolates. According to the principal, these collaborations proved worthwhile and the RDIF grant was instrumental in forging these relationships, in particular research collaborations and attracting investors. However, the distributive effects of an unequal

relationship with international investors or the potential lack of spill-overs to the local economy have been ignored in an attempt to be competitive and remain attractive for foreign capital in the future. This could come at an added cost of limited development of local technological capability and marginalisation of small producers. After three years of the fund's operation, in 2015, the dedicated funding was rescinded from the UWI by the Ministry of Tertiary Education and Skills Training, on account of intentions by the government to establish a national research fund (*Chair, SSTI Committee*). This

experience shows the arbitrary nature of government action and its approach to building S&T capabilities. While funding was removed from university-based research activities, at a national level, there appeared to be more governmental S&T activity.

Box 4.2 Sectoral snapshot - partnerships in the ‘fine flavour’ cocoa sector in Trinidad

Cocoa, or *cacao*, has been produced in Trinidad for almost two centuries. By 1830, Trinidad and Tobago was the world’s third highest producer of cacao, producing 20% of the world’s output. The country dominated the industry between 1866 and 1920 (Bekele, 2004). In the early 20th century, the system of production shifted from estate-based to smallholder plots. Dynamic international conditions and productive decline prompted research activities into cocoa cultivation in 1930 at the Imperial College of Tropical Agriculture (ICTA) (set up in 1921) under the Cocoa Research Scheme – a five year funding arrangement by producing colonies – to increase yields and rejuvenate the sector (Hodge, 2002). In 1945 the Cocoa Board was set up to restore and develop the sector, followed in 1961 by a Cocoa and Coffee Industry Board (CCIB).

Trinidad is considered one of the eight exclusive producers of fine or aromatic cocoa beans that offer peculiar colour and flavour distinctions, and for which there is a high demand in US and European markets. It is known best for its Trinitario variety of cocoa which yields three times the world price of cocoa. There are currently 2000 famers growing cocoa whose average yields amount to 300 kilograms per hectare and commands a price of between US\$4,500 to \$5300 per tonne. In 2010, when Professor Pathnamanathan Umaharan took over as Director of the new Cocoa Research Centre (CRC), there was little research activity in comparison to the early years, and no industry relationships existed. At the turn of the millennium, the Centre represented about 60 per cent of all research capacity on cocoa in the sub-Caribbean region (Roseboom, *et al.*, 2001). The new mandate was to ensure the centre can mobilise knowledge and expertise from all areas of the university community to produce both applied and basic research outputs, and contribute to an expansive research portfolio that serves the world. In 2010, the CRC received a TT\$1.5 million grant from the RDIF facility sponsored by the Trinidad and Tobago government, which served as a catalyst for additional funding and research partnerships.

The CRC now hosts an international cocoa gene bank with 2400 varieties that attract international funding, research collaborations and industry partners. Research projects are now ongoing with foreign research bodies, including City University, Stanford, Penn State, and the Federal Department of Agriculture in the US, and Hamburg in Germany. Additional financing was secured from the EU-ACP scheme – EUR2.7 million. Under Umaharan’s leadership, it has also forged industry affiliations with three industry associations, namely, Chocolate Biscuits and Confectionery of Europe (CAOBISCO), the Federation of Cocoa Commerce London (FCC) and the European Cocoa Association (ECA). Apart from research, there are ongoing projects to develop new mechanical tools for cocoa production, local chocolatiers, international showcases, and a British investor has built a small factory, all of which is meant to build a successful model along the entire value chain. To advance the commercialisation and business development effort, an outreach mechanism called the International Fine Cocoa Innovation Centre has been set up. It is hoped that the government would intervene and provide the nurturing and policy framework to ensure that T&T becomes a high-value chocolate exporter in the near future.

At the governmental level, this was further evident through internal processes such as with the IFF, where an independent panel was appointed to select entrepreneurial and business ventures to be granted subsidy funding (Council for Competitiveness and Innovation, 2012). The IFF was translated into a national grant competition, allowing existing businesses as well as individuals to apply for funding between TT\$75,000 to \$200,000 and continued for the subsequent years of the government's term with the revolving outlay increased to \$14 million annually between 2013 to 2015 (Ministry of Planning and Sustainable Development, 2012c). The Council's staff also brought together experts and interests together to guide their conceptual development process in August 2011, but did not appear to have the internal capability to design an innovation policy. Senior technocrats however challenged the role of the CCI in the process and believed that the Ministry as a whole and not an advisory council was responsible for formulating the policy. According to a senior officer at MPSD, the CCI's role was to put forward the private sector perspective:

CCI has not been able to produce the private sector perspective. The Ministry's role is not to solicit the private sector perspective... Policy was delayed by a year because of the CCI not having a deep discussion with the private sector' (*Senior staffer, MPSD*).

In the first instance, the panel comprising business, academics and other senior professionals in private and public practice decided upon which activities would be funded, not usually beyond the 'proof of concept' stage which had never been clearly defined. In the first two versions of the report the Panel justified this threshold as 'potential for commercial success' (Council for Competitiveness and Innovation, 2012, p. 4) In its 2014 report, the panel elaborated this to signify

the simplest tangible manifestation of an idea (product or service) that shows its technical feasibility and can give an indication of potential market interest. In a broad sense it can be thought of as a demonstration of an idea to show that it can

have potential real-world applications. It is a demonstration of feasibility that need not be a full or complete working prototype or representation of the concept being tested (Council for Competitiveness and Innovation, 2014, p. 4).

There is still a high level of ambiguity here, as with the innovation process any market success is highly uncertain and the different points of market entry given particular stages and types of technology vary across sectors (Pavitt, 1984; Dosi, 1988).

Finally, these firms were given strict guidelines in terms of what types of activities for, and agencies from which they could seek goods and services to implement them²⁰.

While these guidelines were set by an external panel, some of whom had connections to institutions such as CARIRI, UWI, and the TTMA, it is unclear whether they were upheld. The panel's chairman was also handpicked by the minister to oversee the process, though one member of the CARIRI Board expressed the view that the chairman was apolitical (*Professor, UWI*). According to one report, of the 50 grants awarded in 2012 totalling TT\$4.7 million, only 9 recipients have progressed to start new enterprises, while another 19 are 'trying to start new businesses' (Swift, 2014). The challenge has remained that the state institutions have been unable to insist on performance on the part of the entrepreneurs within this framework. Three successive cycles of the initiative have been held since 2012, in which administrative changes and efficiency improvements over the period of the evaluation process appear to have taken place (Council for Competitiveness and Innovation, 2013, 2014). Both the smallness of the society and interconnections among leaders of organisations continue to prevail upon ST&I programming in T&T, blurring institutional boundaries in the process.

After selection, there is no evidence to suggest that similar changes have taken place on the part of CARIRI and the CCI, to robustly enforce the terms of the subsidy,

²⁰ It was later found out that one of the grant winners was a relative of the Minister.

and the government's performance monitoring of the selected firms to improve their efforts. Hardly any institutionalisation of the overall governance process and the recognition of the need for adequate support to the different types of firms which must face the discipline of market competition appear prominent (see Chapter 5). Finally, the arbitrary one-year timeframe offered for financing for such firms and initiatives to take shape and achieve some level of viability can be questioned but again this is determined by a mix of external imposition and internal complicity of arbitrary requirements. Indeed, the current institutional environment of market friendliness for businesses limit the ability policy entrepreneurs and governing agencies to influence the technological learning processes of firms by setting targets, monitoring and withdrawing rents when projects are not successfully undertaken²¹ (Khan, 2010a).

In the case of the IDB Innovation Window Fund, financial incentives were offered to Caribbean wide businesses for the following: an innovative business Plan; investments in capital goods critical to implement consultancy services, including market studies, specialised technical assistance and management consulting; product upgrading, including product packaging and label design, certification in corresponding regulatory agencies, marketing, production of samples for market testing; strategic investments in inputs and machinery to improve productivity; intellectual or industrial property protection; and knowledge management²². This set of criteria was reproduced by CARIRI who supported efforts in designing the competition, its criteria, and governance structure. Similarly, the IFF or *idea to innovation* grant offers funding to local business and teams along the following lines: prototype development activity including design, testing, and

²¹ In the early stages of programme design, the CCI leadership decided that the government should not impose any strict regulations or obligations for grant funding on firms and the funding would only be for a year.

²² Ibid.

field trials; market testing, if necessary to establish proof of concept; expenditure on services and testing up to 40% of project cost; raw materials necessary to achieve proof of concept; equipment necessary to achieve proof of concept; intellectual property investigation and documentation, but not patent application (Council for Competitiveness and Innovation, 2012, p. 3). As the networks of power concept suggest, the IDB through formal channels has become partially embedded in T&T society and continues to have disproportionate influence in demonstrable ways by setting the agenda and framework ST&I programming and policy.

The pace of progress with the NIP had several strategic areas of interests and interactive interventions and took a more straightforward route than the S&T policy. One interviewee noted that prior to her appointment that the MST focused solely on education and ICTs:

The positions at the ministry did not match the needs of an S&T ministry; it did not have core technical capability. Great emphasis was therefore placed on education. For instance, the current policy makes reference to investing in science, but little mention is made about the application of science to the production of goods and services.... It is important to create the demand for S&T inputs.... And this needs a team effort, while right now everyone is doing their own thing in isolation (*Senior S&T Officer, MST*).

It must first be noted that the notion of an innovation policy is a new one to the T&T institutional environment, and this is in part reason that it also became closely associated with the stated goal of economic diversification. The goal is outlined as follows:

The crucial element in creating a sustainable economy is to create a diversified platform of production, which is based on a wide range of profitable sectors. Having a diversified economy allows us to strengthen sectors and clusters, market different goods and services, develop capacity to create new and innovative products and earn more revenue. When our nation successfully diversifies its economic activities we can also become more resilient to economic shocks (Ministry of Planning and Sustainable Development, 2012a, p. 4).

Policy writers were initially challenged to conceive the necessary inputs, since they did not have prior experience in drafting and designing innovation policies. Technical support was deemed necessary and it was naturally sought from the IDB who also have intellectual and financial backing. A number of structures and consultations were subsequently held to garner support and solicit inputs from various sectors, including a National Diversification Conference in July 2012. According to the report of the event, it is noteworthy that several key business people lambasted government, among which was the President of the TTMA, indicating that:

we need to look at the environment, not only at the incentives but at the disincentives, and how we can eliminate the frustrations and obstacles. It is when we do this innovation will come forward. Mr. Hadeed felt that there is a need to focus on the ease of doing business and that we need to innovate and then diversify (like the USA). He was of the view that we need to remove the old style of thinking – move away or diversify from Government involvement” (Ministry of Planning and Sustainable Development, 2012b, p. 9).

In similar fashion, another prominent business man echoed these sentiments that from his viewpoint:

the less Government got involved the more could be achieved. There has been a lot of the entrepreneurial talk which is lip service. There should be freedom (allowing entrepreneurs to do what they want)... (Ministry of Planning and Sustainable Development, 2012b, p. 14)

From this event, a series of follow-up discussions were held where task committees aligned to Six Strategic clusters were set up to generate input into an overall action plan. The EDB, whose role somewhat overlapped with that of the CCI was headed by the Chief Executive of the Energy Chamber of Commerce, convinced the government that energy services should also be included as an area for economic diversification and investment promotion. In close support of this action, Caribbean Compete, the IDB’s private sector development agency based in the island of Barbados, which oversees much of its activity

in the Caribbean sub-region, including T&T produced a report that also called the government to focus its efforts on diversification with energy services as an anchor (Compete Caribbean, 2013). This faced mixed reactions from government minister who was evidently in disagreement with this proposal.

The first draft of the NIP, characteristically called InnovateTT, was devised in February 2015 and espoused the international and local events that necessitated a new approach to growth and development in the Trinidad and Tobago context. In its preamble, it states:

Trinidad and Tobago needs to create an environment in which businesses have the confidence to invest, entrepreneurs take risks, and barriers to new ideas are non-existent. An environment in which the effects of climate change is mitigated, burgeoning health challenges are successfully surmounted through the use and application of scientific knowledge and advanced technology, and the economy is diversified into strategic knowledge intensive areas. Government will address issues such as access to finance and education, investing where the private sector will not, and use its financing, procuring and regulatory tools to support innovators (Ministry of Planning and Sustainable Development, 2015, p. 3).

It seemed to adhere closely to the main contours of the private sector development under market-driven terms but retained a more important role for direct public investment in the face of market failures. It is perched upon to the need for the development of greater capacity for technological innovation in light of dwindling natural resource rents as a relevant factor in becoming knowledge oriented society and achieving global competitiveness. To this:

the country's future prosperity depends on its ability to generate new ideas, processes and solutions, and use innovation to convert knowledge into social good and economic wealth, and provide answers to the most significant societal challenges (Ministry of Planning and Sustainable Development, 2015, p. 4).

In this demanding endeavour, it advocates that all segments of society must advance an innovation agenda and innovation becomes vital to achieving greatness in several areas

including culture, business, government, civil society, labour and academia. The Policy therefore seeks to ‘create the policy framework and environment that will position Trinidad and Tobago among the world's leading knowledge- and skills-based countries’ (Ministry of Planning and Sustainable Development, 2015, p. 4), while providing strategic focus for relevant elements of society and operationalize the NIS. Meanwhile the conceptual underpinnings of the innovation systems approach as per Lundvall are utilised to make the case that innovation processes embody learning and interaction among socially embedded agents. From this perspective, it is believed that innovation occurs at two levels: research and development (science-based) and from the experience of performing agents (experience-based) (Ministry of Planning and Sustainable Development, 2015, p. 5).

The policy considers innovation as a response to the structural challenge and specific characteristics of the economy that may presently stymie innovation efforts in T&T (Ministry of Planning and Sustainable Development, 2015, p. 6). These factors include small market size; the inward orientation of the majority of small and medium sized firms; paucity of institutional mechanisms; the disproportionate role of public sector research versus business R&D activity; an under-developed high-tech sector and no impetus among non-energy firms for innovation. It also points to past efforts that have created supply-side advances without the concomitant linkages to demand by firms, especially in the non-energy sectors. This misalignment of policy choices to influence firm-level action has been acknowledged as a key policy challenge in developing countries, and one which is inherent in the definition of science versus technology interventions (Bastos and Cooper, 1995a). It further acknowledges some level of innovation and foreign technology adoption in the dominant sector but does not specify evidence of the occurrence of such activity. Among the intended policy responses include

enhancing ‘the value and quantity of exports by applying more world class knowledge and innovation’, formalising the relationships and roles of NIS participants towards the adoption of advanced technology, enhanced collaboration and a systematic transition to higher-value added activities (Ministry of Planning and Sustainable Development, 2015, p. 7). Indeed, it seeks to bridge the gap in policy regimes that tackle only basic research considerations without seeing the firm as one of the principal institutional actors that drives the innovation process (Marcelle, 2017).

Moreover, the major priorities outlined in the NIP include: strengthen the framework for innovation; develop the requisite talent and skills for innovation; increase the capacity for world-class research; provide support to business innovation; improve the governance of the NIS (Ministry of Planning and Sustainable Development, 2015, p. 15). The government’s investment will therefore be directed in the following way: i) support to indigenous and non-technological innovation; (ii) financing of research leading to the development of a ‘research industry’; and (iii) financing of core business innovation (Ministry of Planning and Sustainable Development, 2015, p. 15). In order to deliver on these areas, a number of facilitative mechanisms and strategies were put forward, including enhancing public sector performance, public procurement, improvement property rights protection, education and training and designing appropriate data techniques and metrics.

This strategy hinges upon the increased use of ICTs to deliver services and improve efficiency in service delivery and ‘open up’ government to the public, and improve the state’s capacity for policy-making that will hopefully democratise the relationship between the state and society. Another strategy laid out is the use of public procurement or its public sector investment programme (PSIP) to create and regulate demand and promote local content and public-private collaboration. Certifications of

public organisations as innovation-inducing partners will be carried out to expedite uptake of incentives and give the government preference of domestically created technological solutions that drive technological development. The government also anticipates to boost existing knowledge infrastructure through promoting standards and accreditation and the intellectual property rights (IPR) system, in light of the low level of patent registrations and weak institutional capability (Nurse, 2014). With changes in the worldwide IPR regimes, intellectual property is seen as important source of innovation for developing countries where the problem of appropriability associated with returns from investments are not clearly defined (Khan, 2015, pp. 101–102). To meet these ongoing challenges, it proposes that:

Government will provide greater support, particularly in the areas IP registration, enforcement and focussed campaigns to promote greater awareness and understanding in the use of IP (Ministry of Planning and Sustainable Development, 2015, p. 19).

Another important intervention is the highlighted need to devise appropriate metrics and data systems that capture the realities of the country's innovation performance. This was highlighted as an important action point in previous consultancy work conducted for the CCI (Marcelle, 2012b). New incentives are also earmarked for research activities and business R&D that target individual enterprises at different levels of the innovation spectrum, and with the relevant collaborations between research institutions and businesses a new cadre of 'global firms' will emerge. It is expected that all of these elements of the plan will fall into place with the necessary good quality infrastructure, the local and international partnerships and attracting foreign high tech investment.

The effectiveness of all these measures is predicated on improving the overall governance of the innovation ecosystem which had been highlighted as having serious institutional and funding gaps, overlaps and misalignments as a whole (Guinet, 2014). As

a consequence, the new major institutional arrangements that the policy proposes to set up a Research and Business Innovation Council, an Inter-ministerial Committee on Science, Technology and Innovation (ICSTI); and a Research and Innovation Agency (Ministry of Planning and Sustainable Development, 2015, p. 30). In addition, the EDB will become an Economic Development Agency in order to disburse the \$50 million business innovation fund by:

- Providing innovation vouchers to encourage businesses to seek and work with academic institutions to gain new knowledge that facilitates firm growth and development
- Developing public-private partnerships (PPPs) for innovation in areas such as small technologies
- Employing a mixture of tax credits for firms that can afford to and have invested in innovation and direct support for smaller firms
- Development of research and innovation plans to map the future needs of each of the priority sectors (Ministry of Planning and Sustainable Development, 2015, p. 28).

The new ICSTI, comprising several ministerial heads will essentially merge the formerly proposed NCOSTI (under Vision 2020), and the Inter-ministerial committee on the economy, supposedly vested with the authority to regulate conflicts and co-ordinate the NIS, but with secretarial support provided by the Ministry of Planning. The new RBIC, instead of the CCI, will be the formal mechanism responsible for oversight and management of policy, advisory functions in the areas of input sectors like education, devising relevant indicators, and will be constituted by a multi-sectoral team of experienced scientists, business people, labour representatives. A new legal instrument called the Innovation Act will empower these new set of institutions. To finance all of these proposals, a National Research and Innovation Fund (NRIF) will be instituted with an initial contribution of \$500 million, estimated as half of one per cent of GDP. It will also undertake all the related activities, such as new enterprise creation and the gamut of

scientific and technical research, under the NIP with a strategic intent to improve innovation performance within an articulate results framework.

As a result, responsibilities were divided where the CCI gave some strategic input and supported through the gathering of expert knowledge and technical studies, and giving some strategic direction. A committee was thus set up including the CCI, other business leaders and ministry officials, but activity in the committee waned over time, until some members who were assigned were unsure whether any progress had taken place with the drafting of the policy. Although, the appearance of a certain level of insulation was given by the heavy involvement of the public sector in the process against other interests such as the business sector, there were personalised relationships and ties that feed into the process behind closed doors that had a less than meritocratic dimension. For example, the line minister responsible for the policy whose son was the chief executive of the American Chamber of Commerce (AMCHAMTT) was tasked to head a committee to recommend a governing structure for a TTD\$50 million innovation fund (*Retired Senior official, MPSD*). Its implementation and disbursement for the benefit of the private sector was to be fast-tracked before the election, which was later scheduled to take place in September 2015. Arguably, the ensuing economic decline and possible political fallout from may have derailed these plans. The minister was non-committal about the structure it would take, while the Chamber executive remained unaware of extant schemes to promote innovation in the private sector such as the RDF housed at the National Export Facilitation Organisation of Trinidad and Tobago (EXPORTT), an executing arm of the MTI. As a result, the role of industrial associations came closer to the process than before.

Box 4.4 - The CCI as a peripheral agency?

The creation of so-called ‘Schumpeterian development agencies’ as sites for revolutionary innovation policy-making that draw upon the experiences of Finland and Israel merits critical consideration. Breznitz and Orston (2012) describe such agencies as public organisations with a mandate to facilitate innovation in new industries that occupy a peripheral position in the public sector. They are considered adaptive, even with limited budgets and are subject to limited political interference. Based on the evidence in this chapter, this ideal-type ST&I public agency, “revolutionary” in terms of its performance and immunity to political struggles in effectively conduct policy making towards innovation based-development (Breznitz and Orston, 2012b), a number of weaknesses arise in the case of T&T.

The idea of a ‘Schumpeterian’ agency that experiments and innovates with new policy ideas, though not undesirable in itself, is consistent with the concept of the small country as an SME (Davenport and Bibby, 1999) or to marketing-friendly precepts present in the New Public Management literature that have created new challenges especially in relation to private sector intrusion and the harnessing of relationships between private and public players that can facilitate certain corrupt practices (Chang, 2008). To the contrary, the roles of government and business have to be appropriately determined based on the institutional and political context. In addition, the possibility of rent-seeking in the given agency even with small budgets depends on the organization of power in society and its source of funding than can undermine formal regulations. This study understands the state’s role as relational or coordinative to address collective action problems and building developmental coalitions, strategic by intervening to foster new activity through the allocation of rents. In this sense, the actions of interested parties are an outcome of complex interactions among social forces acting through the state apparatus.

Fundamentally, the CCI occupies this ‘peripheral’ position. It has been in existence since 2011, but according to internal reports and data, it has not been given the political commitment necessary to push the national innovation agenda. For example, the Ministerial committee¹ chaired by the Prime Minister along with other Minister had not met once during its existence. Its peripheral status and small budget have nonetheless induced rent-seeking by business elites and political affiliates. In addition, its funding comes from external sources and staff recruitment has been based on both ministerial preferences and IDB procedures. Its flagship project the idea 2 innovation initiative aimed to invest in new projects in varied sectors. Though some experience in programme management has been accrued, no notable successes have been made to date.

Programme reviews of institutional performance are ad hoc and based largely on demand by donors. In addition, the funding made available by the IDB for staff and consultancies (*Senior Officer, MPSD*), makes it difficult for the CCI to autonomously pursue radical initiatives given its responsibilities and supervisory relationship with donors (Breznitz and Orston, 2016; Szczygielski *et al.*, 2017).

Moreover, direct involvement in the policy process through funding of agencies, studies and other carry an important force in the process to achieve greater competitiveness and drive innovation at the national level. In this respect, the IDB's bilateral relationship with local institutions and champions has proven quite instrumental in formulating the policy ideas and framing the problems for which a national innovation policy was required. According to an insider, unlike other traditional multilateral lending agencies, there may be some flexibility exercised in the conditions of the lending relationship with a country. Discussions with government and other relevant university personnel proved instrumental in first setting up the Caribbean Centre for Competitiveness based at the University of the West Indies, financed by the IDB, the Canadian International Development Agency (CIDA) and the Department for International Development (DFID), first headed by former University Pro-Vice Chancellor for Planning and Development, Dr. Bhoendradatt Tewarie, who had established a relationship with the international lending agency prior to his appointment as a Minister of Government in 2011.

In November 2011, Tewarie sought to deepen links with the IDB Group by requesting their support in funding consultancies to carry out analytical work on the most efficient structure that the CCI and EDB would take, given potential overlaps. In 2012, through a formal agreement, funding from the IDB amounting to approximately US\$500,000 was provided as grant funding with T&T government. The support included technical arrangements for the establishment of a Council for Competitiveness and Innovation (CCI) made up primarily of private sector partners, academics and other representatives. In fact, it was through the Tewarie's efforts that preliminary discussions about a loan estimated to as much as USD45 million for the Competitiveness and Innovation Programme with the IDB had taken place (Inter-American Development

Bank, 2015). The decision to access the loan was delayed through the relevant channels, and seemed likely to be rejected due in part to the declining economic situation and the forthcoming elections. Ironically, in its country strategy, one of the major risks identified for establishing and engaging on issues of innovation promotion included:

that new business processes and technical innovations require cultural changes that are expected to disrupt power relationships and public employment terms and scope, and would likely be met with resistance (IDB, 2011, p. 4).

In their dialogues were held to strengthen institutional capacity and existing arrangements including an innovation financing facility that came into existence in 2011.

It would appear that the initial grants totalling US\$500,000 from Caribbean Compete, supported heavily by the IDB and other donors, was the carrot, whereas the loan would become the stick to follow through with relevant private sector reforms. In a letter transmitted by IDB country representative Michelle Cross-Fenty, the following guidelines were outlined for the grant:

- (i) inform the Bank before proceeding with the contracting of the Consultants or undertaking the activities to be financed with Counterpart Resources;
- (ii) assist the Consultants hired by the Bank in the performance of their tasks;
- (iii) provide the necessary technical, logistic, and secretarial support required for the execution of the Technical Cooperation;
- (iv) prepare and submit to the Bank Technical Cooperation progress reports within thirty (30) days of the completion of each semester starting the date of the signing of the Letter of Agreement, and a completion report within three (3) months of final disbursement;
- (v) store and provide access to all necessary information and documentation required to conduct the monitoring and evaluation of the Technical Cooperation as described in the Plan of Operations;
- (vi) take other actions as described in the Plan of Operations to support the monitoring and evaluation of the Technical Cooperation by Compete Caribbean (Cross-Fenty, 2012).

The insider further noted that given the structure of the IDB as both a lending agency as a private bank, with an aim to promote developmental outcomes creates continual tensions,

its primary objective is ‘to channel financial resources to a country and make profits out of it’. Furthermore, contrary to the seven sectors promoted by government for priority support, the IDB’s support was targeted at two sectors: natural gas and creative industries’ clusters (Compete Caribbean, 2013). This was deliberate by the IDB to shape the focus of the government’s and scope of its relevant support, but was met with some surprise by policy makers. The body engaged primarily with government and the private sector, with no consultations held with trade unions, to try defining the implementation strategy. For this purpose, to understand the overall organisation and challenges of these sectors, studies were commissioned to be carried out by a leading economist at the Sir Arthur Lewis Institute of Social and Economic Studies (SALISES). Implementation however has not begun in full due to electoral cycle and a change in the government that occurred in September 2015.

The European Community also has a stake in the process, as it has prioritised innovation in the 11th European Development Fund (EDF). As part of its support amounting to EUR9.7 million, the government needs to initiate programmes that ‘contribute to creating the business environment required to drive competitiveness and a more diversified economy’ (Trinidad and Tobago Government, 2016, p. 8). Through supporting measures that enhance ‘institutional capacity’ the EU’s role will be to prop up institutional and cooperative frameworks, capacity-building in monitoring and evaluations, strategic communication and prioritizing sustainable development (Trinidad and Tobago Government, 2016, p. 10). While the IDB provides a mix of small grants and may eventually convince recipient countries to access loan funding, the EC strictly provides grant funding to T&T. This is as a consequence of its historic relationship as an ex-colony of Great Britain, of which T&T has been a recipient of approximately EUR100million over the last 15 years (Ministry of Planning and Sustainable

Development, 2014, p. 8). From 2011 to 2015 years, assistance amounted to approximately EUR16million (Government of Trinidad and Tobago, 2011) and a further EUR8 million for the subsequent 5 years to promote competitive business and diversification. In the case of Trinidad and Tobago, such grants are highly sought after since its high-income status based on the World Bank's classification disqualifies the government from seeking concessionary financing arrangements in international capital markets. As such, the monitoring of these agreements is closely followed, and metrics designed by what the EC considers with international 'best practice' in mind. As such this arrangement sends important signals, including expediting the NIP, through formal meetings and mechanisms with the resident delegation in Port-of-Spain, Trinidad. Within the framework of support, a great deal of emphasis is placed among governance mechanisms including the promotion of transparency and accountability and the inclusion of civil society to which the EU attached EUR1 million funding stream (Trinidad and Tobago Government, 2016).

4.3.4 Assessment of the S&T and NIP policies

Technical aspects

The S&T and NIP form part of a series of strategies and policy documents which attempt to promote economic diversification and private sector competitiveness, but they lack internal coherence. In fact, it would appear that the document was expedited to meet donor's demands for funding which would not have been supplied without documentary support. For the S&T policy, a senior S&T officer at MST observed that for the S&T policy did not seem to undertake a root-cause and situational analysis of the existing institutional capacity and challenges within the ecosystem. Given the lack of technical expertise in this area, structure of the government apparatus and no coordinating

mechanism, there will be challenges to implement and assign responsibilities and keep track of each agency's actions. In the S&T regime, there was an increasing emphasis on supply side factors, in particular education and references to investing in science, but the perennial problem of demand for S&T resources and the application to the production of goods and services was not expressed. On the other hand, the NIP is aligned to developing several key clusters, which have been previously outlined under different rubric, but the needs of each sector in terms of technological inputs, assessment and human resource inventories are not specified.

The ongoing participation of the IDB as an agenda-setter has seen the issues framed along the lines of adopted conceptual approaches, namely Dani Rodrik's and Ricardo Hausmann's growth diagnostics framework (Compete Caribbean, 2013; Hausmann, Rodrik and Velasco, 2008) that stresses interaction among private and public sector interests and organisations. This may present a challenge as this locks the institutional system into a specific trajectory where particular emphasis is not placed on state capacity to develop its own perspectives and drive the process but other more powerful players may hijack the process altogether. Given the environment of liberalised trade and foreign investment, the task of technological choice would inevitably be left to firms to execute, rather than the government, which may not have the resources or capacity to monitor, and so firms may decide upon less demanding options such as through licensing rather than make efforts to invest in R&D projects or utilise staff from local suppliers or research organisations. This process would in the short-term come at a more expensive cost than importing technologies but have longer term effects (Girvan, 1983).

The conceptual lens through which problems or failures are to be addressed is problematic, unsystematic and inconsistently applied. It leaves room for misinterpretation and an inaccurate representation of the issues. They are not appraised with a degree of consistency and measurement and indicators are widely variable from agency to agency. Policy transfer is also easily adopted as the default mode of operation where the formal mechanisms and modalities that appear to have worked elsewhere based on a superficial assessment. No particular attention is paid to the struggles, structures, processes and systems that brought them about. Multilateral lending agencies seem to be indirectly setting the agenda and overall philosophical tone back up by their funding mechanisms. Although local policymaking capacities show signs of improvement remain a relatively small pool and there is only rhetorical commitment to improving the capacity and use of local research personnel and resources. This again is dictated through financing arrangements and the rules there of. The goal thus is not genuinely developmental or transformative from the standpoint of MLAs but simplistically technocratic. Since the problem of economists' and policy makers' blind spots in relation to technology policy (Farrell, 1984), some policy-oriented efforts to put technology at the centre of development strategy have been whittled away by other concerns and / or by a lack of expertise, ideological currents, wider macro-economic and material factors, and knowledge gaps on the part of the high-level decision maker (Bissessar, 2003; Moniquette *et al.*, 1986). The policy tool kit therefore remains very narrow in scope.

Structural aspects

With respect to the structural questions of ST&I, the demand for indigenously generated technological solutions appear abysmally low. It is due to patchy indigenous

technological capability and imbalances in the structure of the economy that favour an already competitive, capital-intensive sector like hydrocarbons and petrochemicals. There are attempts being made to create links between the energy sector and the university, via the Energy Chamber utilising the engineering services of the Faculty of Engineering (*Lecturer, Mechanical Engineering, UWI*). It is unclear whether this may induce the backward and forward linkages to other sectors of the economy (Best, 2012; Barclay, 2013). In fact, there seems to have been little systematic consideration of utilising resources and capabilities across sectors and to solve these technical and productive imbalances (Girvan, Gomes and Sangster, 1983 see figure 5.1 in chapter 5). Learning from past attempts in utilising knowledge to support and implement industrial projects in state-owned enterprises has not been carried forward. From this standpoint, the concept of ‘structural learning’ is relevant. It refers to

the continuous process of structural adjustment triggered and oriented by existing productive structures at each point in time. Structural learning trajectories allow for the transformation of structural constraints such as bottlenecks and technical imbalances into structural opportunities *geared towards advancing long-term, developmental purposes* (Andreoni, 2014, p. 8 emphasis added in italics).

Unlike industry associations and chambers of commerce in India and South Africa (Papaioannou *et al.*, 2016), intermediaries in T&T are not well equipped to facilitate this transition in part due to the clientelistic relations that have narrow aims of obtaining rents for short-term profit-making. The industry associations’ structure, historical role, and level of competence also limit their effectiveness to advocate for developmental objectives. In this respect they have fulfilled the role as trade facilitators but do not currently promote knowledge diffusion and up-take in the private sector.

Despite these drawbacks, the approach of relying upon government for rents is typical of the local private sector, and therefore requires an appropriate re-orientation of

the 'risk-taking' state (Mazzucato, 2013). It is worth mentioning that industry associations provided some project support for the Sitek Solar Park initiative aimed at promoting a high-tech solar energy manufacturing hub that was proposed by private sector firms seeking government support (Trinidad Guardian, 2013). This example shows a contradictory relationship between the private sector and government, as both view the state's role as facilitator. The private sector, as shown above has even asked the government to 'get out of the way' but new industrial investments in T&T's history have been more successful, when government deliberately fosters a developmental coalition. If this project was pursued independently from a private standpoint there may have been signs of progress and potential that may have attracted government support later on. Indeed Sitek's own forgoing on the possible learning from such an investment also highlights the ethos of certain private actors. Though the agenda of industry associations are quite broad based, their lobbying attempts have proved unproductive at times unless as part of a broader coalition. However, this does not preclude business folk who use other private channels or personal relationships to members of government to have their requests attended to.

Political aspects

Apart from waning and shifting interests in the mobilisation of S&T resources for advancing development, politicians and some high level have little understanding of the issues and rely on MLAs to define and clarify them. There is some contextual appreciation but it remains very superficial, and without adequate commitment, given the deficiencies already outlined, self-reflexive analysis, and pushback from national actors to mobilise resources in a more developmental way. Policies are rebranded by the new

political office holders under new rubrics and guises with little substantive changes to their content or overarching philosophy. This seems that much more chronic in the current period than in previous ones, when neoliberalism was not the driving force of the national development architecture. There was a lot more experimentation, and less concern for upsetting the pre-determined status quo. This is manifested in NIHERST's closed approach to policy-making and conducting relevant activities in isolation of other key critical agencies in government. Perhaps, it was recognised that this is because the organization was challenged in the past by proposals for its closure or personal competition among staff in terms of their relevant knowledge in a particular area. This modus operandi is underpinned by an approach for maintaining organisational survival and relevance as well as the inter-personal networks that have failed to flourish in relation to the formulation of the policy and the need for engagement among the critical agencies.

Further, political changes, albeit a satisfactory requirement for procedural democracy, have not proved useful for policy advance or renewal. That is to say, even though governments may change and their actors also change, any commitment to a long term agenda seems impractical. On the other hand, short term horizons will not see extensive improvement in the S&T infrastructure or development. The very adversarial nature of politics becomes the sticking point for a supposed lack of bi-partisan commitment to long term goals. A case in point is the abandonment of Vision 2020 in 2010 by the incoming PP regime and the adoption of the MTPF and 'seven pillars' merely as a political branding exercise than an enhancement on or building upon the previous agenda. Given the problems identified, an easier approach that seems to have been adopted is to engage in procedural consultations and technocratic engagement with multilateral organisations and other constituencies without adequate internal appraisal of implementation capacities and organisational functions, the degree of political

commitment to the issues at hand and how to mobilise political capital to manoeuvre government agencies and the Cabinet. The nature of patronage politics that aim to satisfy short-term demands, also appear to take precedence over longer run developmental needs and prospects. Inter-ministerial competition in terms of delivering ostentatious public projects occurs at the expense of a well thought out government-wide approach or strategy to address S&T issues. Given that no policy that has had long-term bipartisan commitment existed in this area, this poses some challenges.

Moreover the flexibility that needs to underpin how government intervenes in various activities along the policy cycle and innovation spectrum to generate successful outcomes may not be entirely understood by policy makers in practice. Apart from the provision of public goods, the strategic role government can play has been diminished significantly. While the present climate seems to attach an uncompromising obligation on how it should act, in reality there have been several ways in which it can do this. One principle that remains salient is that it must set the agenda more astutely than is presently done, and direct the relevant actors towards achieving the development strategy - a notion captured in the early planning exercises. The false dichotomy that it does one thing or adopts one position or another in ST&I policy does not hold. There is much more variability difference between a facilitative and an depending on the nature of the project, its level of sophistication, stages of development, technological requirements, etc. that would be determinate upon the need for a particular disposition. Though it could be argued this gives into the dictates of, or leaves room for the market to predominate, policy effectiveness requires that greater attention is paid to these details. In any event, the state would need to be at the forefront of bringing actors together to form relevant coalitions and be more decisive in protecting the interests and welfare of citizens towards pursuit of a stated developmental goal.

CHAPTER 5 –THE DYNAMICS OF GOVERNANCE CAPACITY: ORIGINS, ADVANCES, AND CONTRADICTIONS

Introduction

The previous chapter focused on the process dynamics and networked uneven relations that have emerged in the ST&I policy domain in T&T after 2002. Through careful presentation of evidence, namely interview data linked when necessary to documentary materials, Chapter 4 illustrated the nature and quality of exchanges among the relevant actors in defined institutional structures have been lacklustre and fragmented under conditions of market driven governance. While new dynamics in the social relations have emerged with a greater emphasis on technocratic policy-making, the contradictions emerge in the political system, and in the wider constellation of power. As such,

Addressing this type of issue would require enlarging even further the concept of “systemic failure,” adopting a historical and macroinstitutional view, a perspective raising both old and new questions regarding the modus operandi and “social performance” of current capitalist economies, and the role that technological change plays in this institutional context (Evangelista, 2017, p. 12).

This chapter delves more deeply into the rationale for the current level of institutional performance and implications based on an overall consideration of the previous historical analysis and empirical findings. As shown previously, the current policy paradigm appears to leave very little room for sustained progress from previous periods, either in the development of technological capabilities for firms, and in public research organisations and overall institutional coherence and development.

Specifically, this chapter discusses the implications of these interactions noted above for governance capabilities. By first developing the argument that historical

continuities in terms of the patronage structures exist in the postcolonial bureaucracy, it demonstrates why past successes in industrial S&T projects may not have been sustained. It critically discusses the trajectories of the colonial state in the area of ST&I, and how certain continuities impinge upon policy choices, in particular the evolution of technical and policy capacities. It discusses the possible implications for implementation drawing lessons from the Vision 2020 in particular, as the current NIP regime was only undertaken since the year 2010, and eventually drafted in 2015. The present S&T policy draft remains undisclosed to the public and outsiders. It further acknowledges that as a small society and given the technological and economic conjunctures, T&T may have with limited capacity from an international perspective in terms of its development pattern and process (Farrell, 1982b; Marcelle, 2009). Given that the recently drafted 2015 NIP is not yet executed, conclusive claims on the likely success of various initiatives are not made. Indeed, the process dynamics detailed previously can shape implementation mechanisms and enforcement. From what we have seen from the historical analysis in Chapter 3, the state's ability to foster mechanisms for change is contingent, on many factors, but since the 1980s it has been somewhat path-dependent.

The chapter offers explanations by considering the effects of political changes and perceived discontinuities in policy, germane to the given political configuration, the need for 'brand' distinction among political parties to main their support bases, as well as lack of consensus on ST&I across the institutional divide. It further analyses organisational leadership, its effects the state's effectiveness and the relational dynamics to draw out relevant insights. Further a critical assessment of the role of rents offered by multilateral lending and bilateral donor agencies intended to support private sector development is undertaken. It appears vital that the state engenders new developmental coalitions that can have wider impact. Based upon the prevailing configuration of power, that is the uneven

exchanges among various interests and agencies, and the structural, technical and political constraints, the Developmental Governance Capability Framework (DGCF) is therefore elaborated in the final section.

5.1 The long shadow of the colonial state

In some fundamental ways, institutional arrangements presently in force display marked divergences compared to colonial times, given the demands placed on the state by various groups, including organised labour (Edwards, 2016). To some extent these adjustments have reversed under the current paradigm. In the colonial and post-colonial period, S&T did not form a part of the specific demands and interests of indigenous mobilising forces. However, progress in this respect, as argued in Chapter 2, is currently subject to the nature of state-society relations. In spite of this, there have been and institutional shifts that have encouraged technology development in production in a greater diversity of sectors especially during the 1970s, nuances which dependency plantation economy scholars failed to acknowledge (Best, 2012; Best and Levitt, 2009; Girvan, Gomes and Sangster, 1983). Notwithstanding attempts to shift the production structure of the society, innovation capabilities have not been adequately generated at an economy wide level due to challenges of particular social forces. This can be attributable to certain patterns of accumulation as well as the institutional drivers that harken to colonial times, and further entrenched after market-friendly policies during the late 1980s and 1990s. As such, there were important continuities and divergences over period of the country's independence.

There are indeed subtle but important continuities and contradictions currently being grappled with by critical S&T agencies in T&T. One serious challenge is the

inability or willingness to provide consistent indigenous, historically sound conceptualisations of the role of technology in the local development process, and the recourse to external agencies for that support (for instance, Dohnert, Crespi and Maffioli, 2017; Grazzi and Pietrobelli, 2016; Guinet, 2014; for a critique, see Girvan, 2007). Supported by a paternalistic approach, which deems the relationship between external actors and policy makers as mutually beneficial or a ‘partnership’, multilateral agencies view their role in knowledge production as a public good to the society. This ideological basis influences the methodologies, apparent lack of interest in historical work and knowledge produced by Caribbean scholars and institutions. An abiding support and respect by policy makers for activities and processes to can provide so-called realistic and empirical evidences remain a relevant dilemma (Girvan, 2007; Marcelle, 2017).

These issues however cannot be simply explained by neo-institutional theory which suggest that political elites disfavour technological progress because of the perceived challenge to their power (Acemoglu and Robinson, 2006; Juma, 2016; Mokyr, 1992; see chapter 2 for extensive theoretical discussion). Based on our analysis, the situation is much more complex, and power dynamics play a central role in these processes. As such, new clientelist relations have emerged and patronage systems remain intact with greater stickiness, especially as social forces have become more entrenched, manifest in the uneven relationship between politician, top-level bureaucrats, university researchers, and other multilateral and bi-lateral donors. For instance, in order to be perceived favourably by, and continue obtaining funding from the latter, it was revealed by one senior science policy specialist that sometimes policy writers tend to overestimate positive aspects of the society or the specific issues in highly optimistic situational analyses (*Senior Science Policy Specialist, NIHERST, Feb. 20, 2015*). Key agencies therefore try to depict a particular stance that may inaccurately represent current realities,

leading to contradictory policy conclusions. This, the informant attributes to poor training in policy design.

In the past, Royal Commissions set up by the British imperial state provided this analysis of the society, which has been further contradicted assessments that stress the agency of creole forces (Edwards, 2015). In contrast, multilateral bodies currently in part perform significant aspects of this function of studying the society and providing policy proposals. According to Brereton (1981, p. 139): ‘the central fact about Crown Colony politics was that the planter merchant community was able to exercise very considerable influence over policy-making’. The political dynamics play out somewhat differently, and the role of the multilateral entities is possibly less paternalistic and more demanding based on an ideological frame of reference, though policy-making is subject like in the colonial past to patron-client exchanges and informal rules. Now, more diverse economic and social interests in the current environment, beyond property and wealth (Brereton, 1981), including identity and political affiliation have influence in policy-making compared to the colonial period.

In respect of the lack of use or underdevelopment of local expertise, this relation between the state and donors creates a dilemma in which there is little compulsion to improve policy capabilities overall, as the donors provide or contract their own experts. It creates a system where successive governments have looked outward for solutions in the hope that this brings credibility to and national support for actions, while not steadfastly building the problem-solving capabilities of the local institutions (Lewis and Simmonds, 2010). This represents to a certain extent lack of confidence or perhaps mistrust of local agencies, and professional researchers, political insecurity, as well as dependence on

external validation for state action. The current uneven relationship preventing decisive state power is indeed illustrative as local resource mobilisation is not made a priority.

For instance, senior S&T officer at MST believes that an external agency, perhaps UNESCO or UNCTAD needed to be brought in after the current S&T policy is formulated for it to be checked and evaluated according to 'international standards'. The competition between researchers at the university and critical S&T agencies also suggest that the motivation to move beyond 'blue-sky' research and undertake commercially oriented leads to bottlenecks, turf wars and lack of coordination. Local in-depth research and problem-solving is thus left off the agenda (Bishop, 2013), and academic institutions follow the priorities of funding bodies. This imperative that research must be commercial and generate profit for holders of knowledge, and their supporting institutions have led to secrecy, and without a policy framework from government or the required pushback of state officials, it diminishes the potential for collaborative projects. Reflecting the current dilemmas between grounded research for developmental purposes appear to have a short-term profit motive that can be 'taken up' by the market (Scoones, 2005)

Moreover the colonial era represented a period where minimal capabilities resided in colonial T&T, and expertise was sought from abroad (Ali, 1975; Jöns, 2016), while decision-making authority was first centralised in the metropolitan centre (Minto-Coy, 2015). This was later devolved somewhat after some political negotiation and requests for greater autonomy of colonial institutions (Hodge, 2002). One cannot suggest that this has not improved in absolute terms, as the previous chapter attests to significant increases in spending on tertiary education and participation rates (Ministry of Tertiary Education and Skills Training, 2015). This has however been stymied by poor planning, institutional inertia, political commitment and a lack of demand especially, as private enterprise was

promoted as routes to growth and development. For instance, under the PP administration (2010-2015), there was minimal political support and persistent fragmentation that agencies responsible for labour market planning were unable to make effective decisions or undertake policy changes (Ministry of Public Administration, 2013). Indeed, about 20 individuals were removed or resigned from the government; leading to five Cabinet reshuffles, including the Minister of Public Administration who was in charge of personnel planning in the public service was demoted. Compounded by high levels of emigration of technical talent have also plagued the country for several reasons, including the prevailing structure of the economy in oil and gas (Ruprah, Melgarejo and Sierra, 2014). In the current paradigm, the free market doctrine purports that the market will automatically absorb excess labour, as well as create compulsions for technical change through foreign competition (Amsden, 2010; Taylor, 2016). This has not occurred in the current period (see Chapter 2 where the challenges of unemployment and labour absorption are explained).

Moreover, at the level of the state, technical capacity in this area was minimal in the earlier period of the study for the 2004 Vision 2020 policy, and there was no dedicated in-house policy or advisory bodies in government, apart from skeletal cadre of staff that pursued myriad objectives and activities. These outputs were extensively cited and used to shape NIP and agenda for T&T (Ministry of Planning and Sustainable Development, 2015). As a result, there is a certain obligation to follow the rules set out by these agencies, advance their agreed upon agenda and list of private sector institutional reforms. The grant funding offered by the IDB and EU have in different ways obliged to undertake certain changes to advance good governance, including transparency, accountability, and minimise corruption. The developmental role of the Bank in supporting local institutions and building local research capabilities, as one Caribbean

political economist envisaged has not truly been fulfilled in this manner (Girvan, 2007).

A senior IDB staffer noted this tension:

The IDB structure is such that the two cultures conflict - the idea that the 'Bank is a Bank' just like any private bank where its role is to channel to financial resources to a country and make profits out of it. The development dimension for financing is an instrument to promote development and the profitability can suffer, but the suffering would be justified by the pursuit of development objectives.

The Vision 2020 ST&I task force was set up as a temporary entity which was dissolved in 2005 and did not morph into a permanent structure or absorb the expertise on the committee. Scientists, engineers and even economists have led the NIHERST at different points, but it still has been consistently marginalised by governments, thereby diminishing NIHERST's organisational power. Although it is a statutory body empowered by legislation, its budgetary allocation remains the prerogative of the Ministry responsible for S&T issues, its board is appointed by the President after receiving the advice of the Cabinet (Sankat, 2005, p. 22). Over time, this has created a territorial and distrustful relationship between the ministry and the agency, and has in some ways undermined policy efforts.

Further, no action has been taken to effectively transform the organisation into one with the requisite mandate that will be able to achieve greater potential in S&T. Over time, there have been minor changes, with NIHERST taking the lead in setting up a policy and intelligence-gathering department to undertake analyses and formulate policy proposals. Among the various sectors, there was increased institutional fragmentation, and a diminished capacity compared with the 1970s (see section 3 below). To relieve these tensions and streamline the organisation, some respondents, especially past policy advisors and current technocrats were convinced that a new S&T law was required instead of a laissez-faire approach. It was expected that this will induce government to

spend more on research and technological activities if there were mandatory legal requirements.

To make this possible, the policy-making exercise was primarily organised as an elite activity, where the key players and officials would agree to the law's enactment and have it passed through the parliament. Informants have concurred that even though NIHERST has officially occupied a subordinate role to the Ministry, the latter's technocrats have been unable at different intervals to impress upon NIHERST's staffers to meet deadlines, share information and comply with requests and / or instructions (*Senior S&T Officer, MST*). In part, this has to do with NIHERST being more established than the young MST set up in 2012, a lack of expertise at the Ministry in this area, but more particularly with the resilience of the organisation and great deal of experience to manoeuvre the environment. However, the state does not currently have an autonomous capability to design legal or policy instruments and hence stave off political challenges to potentially economic beneficial decisions (Barclay, 2015a).

NIHERST's Chairman also maintained top-down process in overseeing the process of policy design that was open only to him and close associates (*Senior Policy Specialist, NIHERST*). A senior officer shared that there were internal tension between the Chairman and the senior policy officer provoked by what was perceived as a 'hijacking' of the policy. It was believed that he wanted to modify it to reflect his own preferences and approach that is, according to the senior policy specialist, to make the content short and simple which contradicted with her view of a detailed document. These occurrences shed light on the peculiar institutional rules that guided the agency, and the highly unpredictable character of the policy process as a whole. Similarly, at the Ministry of Planning, the Minister made several staff appointments, including at the CCI that was

apparently partisan (Newsday, 2015). Prior to the 2015 election, according to a former leading bureaucrat, the son of a former Minister, an executive at a leading business association, was also assigned a key role (*former senior staffer, MPSD*), to design a governance structure for a new innovation financing mechanism of TT\$50million. These interactions show how institutional boundaries are quite fluid and the continuation of patronage on its own logic.

The partial flexibility of institutional boundaries among state actors and other entities that allow information flows to happen more seamlessly can have varying effects as well as pose challenges. Communication and openness envisaged under ‘good governance’ has not been achieved, because of turf conflicts and differential power. Similarly, the organisation of scientific activity in the colony took a networked institutional form, and was centred on agriculture with some authority on planning and financing aspects (Hodge, 2002). Today ministries still hold to a great degree authority for major planning initiatives and are organised across agencies at various levels and geographical boundaries. The deviation lies however where ‘explicit’ S&T policy during the last decade and a half have been deployed as a supply-side tool, rather than based on demand of private or of state-owned enterprises through public procurement, with the policy process subject to intense contestation. Thus, institutional development in terms of deepening state capacities to promote S&T activities has thus been largely stymied.

Despite continual political changes over the course, technical capacities among local staff have improved marginally, but widespread appreciation of S&T needs and issues in the public sector is absent. Leading officials who have had final decision-making was even the case when leading officials had ultimate authority, when they lacked knowledge and expertise in the specific area (Bissessar, 2003). Since the creation of a

new MSTTE in 2001, no minister has had a scientific background nor has been able to convincingly lobby at the Cabinet level for greater investments in ST&I. There have only been occasional rhetorical expressions of interest at the political level; but any long-term commitment seems illusory given current adverse macro-economic conditions and failure between two major political parties to agree to a broad bi-partisan ST&I strategy.

Additionally, the specific S&T needs of targeted sectors have not been adequately elaborated by policy makers; all sectors have largely been treated in a similar fashion with an orientation to export trade, and not to technological advancement. It may be because the locus of power does not currently reside in the state machinery but with the transnational and other domestic enterprises which have control over the oil and gas sector and finance (see chapter 3 for the role of the TTMA). In this sense, both expatriate business and political classes have become interdependent for their survival and social reproduction. The informal enforcement mechanisms and an enduring patronage system have thus become embedded.

These ties between political elites and transnational and ethnically-aligned businesses appear to shape policy outcomes in favour of significant flows of rents to the oil and gas sector or certain unproductive firms (Guinet, 2014b; Jaupart, Longmore and Cazorla, 2014; Khadan, 2017). For reasons not fully explored in T&T before, rent-seeking is not a negative effect of Dutch disease or resource curse which some authors claim (Artana *et al.*, 2007; Khadan, 2017). It is rather due to efforts made during the past thirty years to promote static comparative advantage under the structural adjustment regime and neoliberal governance (Kiely, 2005), which strengthened certain sectoral interests. Subsequently, the ability to withdraw subsidies became politically unfeasible (Khan, 2010a). Historical accumulation in certain sectors created a dependence of such

firms and organisations on government support, while state actions to reallocate subsidies or insist on performance targets were susceptible to intense political fallout (as per Chapter 3, for e.g. Trinidad and Tobago Federation of Chambers of Industry and Commerce, 1969; Moonilal, 2006).

Moreover, the current policy approach eschews a specific consideration of technological characteristics and dynamics of each sector may lead to faulty policy making. In a invited presentation to support and frame the work of the CCI and its partner organisations in devising a national innovation strategy, Gillian Marcelle, an international expert of T&T origin conducted a workshop on August 24 and 25, 2012 emphasised the need for sectoral specificity in policy decisions to support firms (Marcelle, 2012b, p. 14). Girvan et al. (1983) long argued that sector specific instruments are critical to designing policies, as each sector has its relevant business cycle, a different set of technological needs, inputs and processes, and operate at different levels of development. Accordingly, Marcelle's was based on work that demonstrates that each sector has its own 'technological trajectory' and systems of technological accumulation (Arora, Romijn and Caniels, 2013b; Malerba, 2002; Pavitt, 1984). Concomitantly, the advisor further pointed out

at an aggregate level of a nation, there will be extensive variation in innovation performance at the firm level, which then translates into different requirements and expectations from the ecosystem and from public policy agencies and actors (Marcelle, 2012a, p. 25).

These pronouncements may shed light on cocoa sector. As highlighted in the previous chapter, since 2010 attempts at improving the contribution of S&T to revitalise the cocoa sector by the CRU at UWI. Research partnerships have been forged and investments made towards the improvement of technology. Given the pattern of technological accumulation in and demand in the energy sector, the country's major revenue earner,

dependent on imported technology through foreign investment, limited local technological capability has been accomplished over the years (Barclay, 2005; Boopsingh, 2014). A similar pattern of unequal organisational networks could emerge in the cocoa sector, where local industry remains under-developed and stuck in primary production, while value added occurs abroad. According to one official in the cocoa industry:

There seems to be a lack of strategic direction and policy coherence at the level of government.... And all we hope is that there will be foreign investment and a free market to allow investors. We also hope the government will help (*Professor, UWI*)

The extent of collaborations undertaken by the CRU at the UWI St. Augustine campus draws heavily upon so-called ‘international best practice’, research and investor relationships. The formal arrangements with research institutions and industrial associations could be an important source of intervention. The local shortage and the high concentration of expatriate skills in S&T (Gaillard, 2010) constitutes a potential disadvantageous feature of the local system on current activities and future prospects may have a lock-in effect if not appropriately addressed. Given the overall institutional environment, and asymmetric negotiating power of local organisations vis-à-vis foreign chocolate manufacturers and industry groups, the local firms and research organisations may be unable to capture value and grow relevant capabilities to ensure investments generate technological progress.

The lack of an institutionalised and recognised process of democratic and transparent engagement in the policy-making process also appears to be another colonial inheritance. As with former Prime Minister Williams’ ‘meet the people’ tours in the 1960s, these were often one-off community visits, and no long-term agenda was set to ensure ongoing political interaction with communities (Jones and Mills, 1976). Civic

input and consultations often occur as an ex-post facto routine activity when decisions have already been taken or a general direction has already been agreed upon, leaving the people's reaction as a rubber stamp. Alternatively, it is then too late to make major changes to the process as funding and other commitments have been made. This is in part due to the low level of knowledge at a high political and bureaucratic level of the relevance and nature of S&T investments, as well as to the everyday concerns and long-term needs of the population. Relatedly, the nature of the political settlement, where political parties rule also distorts how information is disseminated throughout the wider population – in other words they can also act upon the information they are aware of and can engage with. Given that S&T may have complicated facets, and can produce contradictions in terms of employment and social welfare, a greater appreciation among the population of these dynamics may facilitate more demands for wider consultation, education and debate. The policy-making process seems exclusively top down and closed with the population not directly engaged to understand its relevance and effects on their lives, as well as the roles of relevant authorities and agencies.

The political system is perched upon the procedure of electing political parties to run the country's affairs, and therefore make all the policy decisions and determine the needs on behalf of the population (Hinds, 2008). Given the long-term horizon of ST&I investments and the regular electoral changes since 1986²³, rhetorical commitments are insufficient without the political capital. ST&I investments are also inconsistent with the short-term interests of certain segments of the society which wield disproportionate power including ethnically aligned business people, the financial sector or transnational

²³ No incoming government has served full successive five-year terms without being ousted at the ballot box, in part due to broken promises and allegations of corruption that have tested the social contract between the population and politician. The state has thus been unable to exercise social control to implement and follow through on developmental plans (Migdal, 1988).

enterprises whose long-term investments have no backward linkages to the economy. Factional groups and businesses aligned to political parties may want short-term concerns met through fiscal allocations and recurrent expenditures at significant opportunity cost, when the mark-up on rent-seeking activities (e.g. contracts, jobs) are taken into account, leaving back minimal resources and political capital for longer term developmental matters. Even for those segments of the society that may want to participate, the costs are too high, as personalised politics is seen in a myopic fashion for or against the political group in office, and any dissidence could lead to potential victimisation. This made much more difficult when no clear-cut procedures for participation exist as public information or for incorporating their concerns and input into the design of policy.

In some ways, the colonial period of unequal power relations are mirrored in the contemporary market-driven paradigm where external actors are the driving force of policy making and institutional changes. Through the provision of funding and expertise, both external colonial and multilateral authorities have devalued local expertise and (re)-fashioned the balance of power susceptible to the international political economy. It is in effect a neo-colonial engagement that has further relegated societal elements. Policies are thus not devised in conditions of a rational approach based on formalised procedures and institutional rules but are embedded with their informal logics. The technocratic approach has furthered an undemocratic *modus operandi*. Further driven by patterns of accumulation of natural resource rents are common to the agricultural motif under colonialism as well as the present period, with the international agencies promoting energy services as an area for development (Compete Caribbean, 2013). So-called partnerships with aid agencies like the IDB and the EU have been instrumentally based on the provision of finance to state institutions and this forms the basis for the networks of power that have evolved since the early 2000s. This requires much deeper analysis of its

effects on the T&T state-society interface, and the governance capabilities which have been deployed to serve narrow set of interests. This will be the subject of the next section.

5.2 The competitiveness paradigm: donors, political rents and ‘clients’

For small developing countries like T&T, generating products and utilising technologies that can enhance productivity are imperative for economic success and societal transformation. Many developing country firms encounter significant challenges, including access to long-term financing, human resource shortages, unsophisticated managerial capabilities, and poorly performing institutions like intellectual property rights systems (Khan, 2015; Mohan, Strobl and Watson, 2017). All of these concerns require institutional responses in conditions of underdeveloped capital markets, a weak private sector, and fierce global competition. The experience of T&T has been no different according to a recent survey on seven targeted clusters: creative industries, financial services, ICT, food, maritime, tourism and energy (Centre for Strategy and Competitiveness, 2014).

Financing strategies thus has constituted part of the state’s response in T&T including the ‘idea to innovation’ and research and development fund (RDF) of the MTI (see chapter 4 for discussion). In the former case, the IDB has been very instrumental, if not rhetorically, in its formation and implementation. However, these rents have not produced the intended results, given that firms are more encouraged based on the burden of global market pressures that instead encourage short-term profit-making activities rather than a long-term investment in innovation activity (see chapter 3 for past successes). Historically these have also not created new types of activity when left solely up to private initiative as governance agencies did not appear to have the infrastructural

power and capabilities to withdraw rents from poorly performing firms (Guinet, 2014; Jaupart, Longmore and Cazorla, 2014).

To reiterate the definition of rents offered in Chapter 2, rents refer to the incomes generated both by the official state policies, in addition to the informal or extra-legal aspects the underlying relationships, including taxes and subsidies, resource allocations like land or natural resources, create employment in public organisations, or institute regulations that levy costs and benefits on different social groups (Gray and Whitfield, 2014; Khan, 2000; Ngo, 2016). They also confer rights on the recipient and occur in formal and informal settings (Ngo, 2016). It introduces a novel theoretical insight of this study that has implications for the improvement in governance capacity in effectively implementing ST&I policies. This is because the state is usually seen as the source of rents in conventional and heterodox analysis (Chang, Cheema and Mises, 2002; Krueger, 1974).

The presence of multilateral and bilateral donors in the political economy have created new social configurations (Hout, 2012 chapter 3 and 4 offer insights into these relationships). These institutions operate as intermediaries for the industrialised countries and have amounted to at one point to US\$106.8 billion in 2006 ODA and other technical assistance as grants (Girvan, 2007). Under Washington consensus policies and governance arrangements, the state viewed as a 'social relation' and donor agencies as increasingly part of the political settlement or multilevel networks (Khan, 2010b; Jessop, 2015), in a small country they have ever increased power to configure the interactions, provoke competition between parties, and influence the policy agenda. Thus, these resource flows from multilateral lending and bilateral donors into T&T can be considered a new stream of *rents* as they directly finance policy-making, S&T institutions, policy

outputs and productive activities. As Ngo (2016) explains such policies effectively stand within the institutional boundaries among the political system, the structure of sectors and organisations themselves where rents are created, allocated and contested (see chapter 2, section 2.5 for a more detailed discussion about rents).

The heterodox approach permits an understanding of the relational power differentials that emerge between the state, business and the rent provider (Chang, Cheema and Mises, 2002). While it is shown that rents can have important positive as well as negative effects given the structure of the society (Khan and Kwame Sundaram, 2000). Dynamic efficiencies, an crowding-in effect for innovation investment, and promoting innovation capabilities in firms can also be achieved in developing countries (Bell and Pavitt, 1992; Hall and Maffioli, 2008). It depends on the targeted firms, the allowable time of the subsidy to motivate technological learning, their own relative power to mobilise and challenge decisions, and the ability of governance agencies to ensure performance standards and withdrawal/adjustment of the terms of the subsidy when necessary (Khan, 2015).

This study extends this analysis in two ways. First, it integrates the multilateral development banks/bilateral donor agencies, and international dimension into the national political economy and institutional environment which new development studies has ignored (Pradella, 2014; Marois and Pradella, 2015). It also problematises their role in the overall post-Washington Consensus agenda (Andrews, 2008; Fine and Saad Filho, 2014; Saad Filho, 2005), and demonstrates the governance influence that these global/regional players have as actors of the global economy in performing policy roles, and advancing certain ideas about development processes in a small developing country context.

Indeed, given that political competition in T&T is driven by ethnicity and control of the state, the results of which motivate certain interdependencies between political

parties, the ruling elite and favoured firms it is clear these sources of funds can serve as funds to be allocated according to the existing enforcement logic and mechanisms. Even with the formal rules of donor bodies, extra-legal and informal allocations of funding still persists as the society is organised differently from advanced countries where rules are enforceable, and where early periods of capitalist transition have created sources of income that are much more diversified. In the present case, the donor is able to exercise a level of control over state activity in policy making and institution-building, hitherto not acknowledged in the realm of ST&I policy literature.

The state's role is further circumscribed as the donor gives certain guidelines, demands institutional requirements as a *quid pro quo* for its funding, defines what activity may be funded, or implicitly guides other operational matters, like hiring of staff and consultants for technical assignments and research output. Moreover, staff recruitment to the CCI in particular is based on this level of support. Through various meetings the donor is able to 'socialise' recipients in their worldview. For example, the *idea to innovation* grant competition (www.i2itt.com) unwittingly followed a similar format to the IDB Innovation Window Fund Programme,²⁴ and criteria for selection of businesses to be support through subsidies (see chapter 4 for a more in-depth briefing of the idea to innovation scheme).

In particular, there have been visible signs of such fragmented activity in the PP government, than in previous ones that engendered competition amongst ministers and policy makers than productive relationships towards an agenda based on 'innovation for last prosperity' as outlined in the MTPF document – its vision and operational statement.

²⁴ Source: <http://competecaribbean.org/program/enterprise-innovation-challenge-fund/innovation-window/guidelines-for-application-innovation-window/>

The CCI and the Ministry however have been able to circumvent some of these procedures in the hiring of staff in particular, calling into question the governance rules that were initially proposed. It would appear that the IDB has established a monopoly on both types of rents, i.e. grants and loans. While the EU offers grants and imposes good governance measures to be implemented, that extend outside of an in-depth understanding of history of institutional development and informal rules in the context, the latter of which in their view would be considered inimical to progress. As such the EU and IDB have both been instrumental in promoting this agenda of competitiveness and good governance (Delegation of the European Commission and National Authorising Officer of the European Development Fund, 2008; European Union, 2011; IDB, 2011).

At the national institutional level a number of large-scale infrastructural, educational and financing schemes have served to further this competitiveness agenda. As indicated in the previous chapter a number of projects survived subsequent to the survived the change in government in 2010, were two initiatives were implemented: the Tamana Intech Park, a Research and Development Facilitation (RDF) Grant, and the UTT. Indeed, all of these projects were supply-driven (Edler and Georghiou, 2007). The last project was also promote as part of the EU thrust to promote research, education and the improvement of human capital that drive innovation (Ministry of Integrated Planning and Development and Delegation of the European Commission, 2001). Local institutions and networks have also become conduits of the private sector-led development agenda of the state, and ST&I policies promote greater external technical input and human capital development, while seeking to build inter-agency linkages and attract foreign investment.

All of these policy components are reminiscent of the ascendant innovation systems framework that appeared in the major policy documents (Ministry of Planning

and the Economy, 2011; Ministry of Planning and Sustainable Development, 2015; Sankat *et al.*, 2004 see chapter 2 on innovation systems). In this sense, the UTT has become the main training institution for training human resources for promoting competitiveness. It is known as an ‘entrepreneurial university encouraging and creating opportunities for students to thrive and to develop their own businesses is a priority’ with an ‘entrepreneurial mission of functioning as an engine of innovation and enterprise, as it seeks to foster an ecosystem that supports entrepreneurial mind-sets in both staff and students’²⁵. Though much of the infrastructure and built-in capabilities remain, given the modus operandi of the system, where political entrepreneurs make the decisions, certain S&T institutions that were bolstered and given support during the previous administration (2002 to 2010) may now be neglected, except those with a certain prestige premium.

Although all policies have been listed in the current public sector investment documents (Ministry of Planning and Development, 2015, p. 3), it is unclear if the required vigour will be given to their implementation. The institutional levers that might give some prospect of policy continuity are proposed funding commitments with the multilateral lending agencies and donors like the IDB and EU. In the past, as the EU delegation reports the government took firm steps to lay a policy document in parliament as a result of its funding (European Union, 2011). However, experience suggests that there may be divergences in some respect, if only for the ruling political elite to partly pursue a narrow objective of branding these efforts and programmes as its own.

Furthermore, it would appear that each of these initiatives sought to offer rents to specific clients in the society, the business community, the population at large and to partially create a political legacy. Apart the technical discussions that would have been

²⁵ https://www.u.tt/index.php?page_key=7&main=1

held during their design stage, it has been usual for leaders to attempt leaving a legacy behind in the instance they do not return to office after the subsequent elections. In the first instance, the increase in university participation and enrolment suggests that government wished to appease popular interests about the importance of education, while following narrow precepts associated with new growth theory (Bell and Pavitt, 1992). According to government estimates this has increased tertiary education enrolment to upward of 65.2% in 2015 (Ministry of Tertiary Education and Skills Training, 2015) compared to 7.0% in 2001, 15% in 2004 (when the Government Assistance for Tuition Expenses (GATE) programme which covered free tuition for all qualifying nationals was introduced), and 40% in 2008 (Ministry of Science, Technology and Tertiary Education, 2010).

According to the UNDP, figures that indicate that 12% of the population are of tertiary education enrolment age (UNDP, 2015). Up until the late 2000, the government's agenda was not aligned to specific research activities at the university which could improve S&T activity and productive uptake of research by industry. It was the University of the West Indies which decided in 2010 to align their research objectives and priorities with that of the government's agenda (UWI, 2011). Following the market driven model, the University's agenda to maintain an adequate supply of research funding from the government and that its research could be commercialised to have 'impact' (Krishna, Waast and Gaillard, 2000; The University of the West Indies, 2014). To the dismay of one high-level university official, the funding was later withdrawn by the very Ministry of Tertiary Education.

The government has also not used its public spending and procurement capacity²⁶ to ensure that firms that are awarded state contracts partner with the university on research projects, or utilise any research from the university in their delivery (Nurse, 2014). From this perspective the prevailing view of the government towards its state enterprises, beyond political tools of providing a mechanism for rapid implementation geared towards circumventing bureaucratic inefficiency (Ali, 2010), instead as vehicles of innovation success and instruments of policy seems severely constrained (Edler and Georghiou, 2007; Tönurist and Karo, 2016). Tönurist and Karo (2016, p. 8) suggest that:

In principle, having more direct influence over specific activities of some firms and industries may allow innovation policy makers more policy space (through more intimate and immediate feedback mechanisms between ‘state’ and ‘market’) for policy experimentation and for steering innovation processes than through traditionally fragmented innovation policy mixes where ministries and agencies relate to firms indirectly via basic regulations, systems of subsidies, general procurement rules, and other formal and informal interactions .

This may represent an ideal scenario, in which they admit, requires a high level of coordinating capacity, which is not usually present in most developing countries (Andrews, 2008). Given what Breznitz and Ornston (2016) purport state enterprises could become sites for intense political struggles especially if they are charged to implement large-scale, prized projects. There are instances where with the right approach, even with weak governance capabilities, the state can undertake successful projects (Khan, 2013), which has historically been apparent in T&T in the 70s and early 80s.

In a promotional report, it was remarked that ‘eTeck (the state agency responsible for the development of Tamana) has been specifically created to cause a shift from the energy sector. We are industrialising [sic] and the TIP (Tamana Intech Park) is our

²⁶ Between 2009 to 2013, public spending as a percentage of GDP (non-energy sector) in T&T ranged from 54.7 to 59.9 with projections of 57.3 and 58.5 % for the years 2014 and 2015 respectively (IMF, 2014).

testimony' (IFC Reports, no date). These initiatives may reflect in part the 'centrepiece syndrome' as articulated by one respondent where governments and political leaders from developing countries become enamoured by certain showy ideas as seen in the advanced world, and return home to seek to implement them in their own contexts. These contexts are qualitatively different and possibly less organised from their advanced counterparts, where many cases the infrastructural power and project implementation capabilities exist to successfully facilitate their implementation.

According to respondents, there are varying views about whether industrial and investment policies have substantially changed over time, typified by the use of 'sectors', 'clusters, or 'growth poles' and this adds to the challenge in conceiving and then implementing projects (*Senior consultant, ALJGSB, Jul. 7, 2015*). In several cases new administrations decide to pursue certain projects at the expenses of others and re-brand them politically. Substantively, the contents of policies have not been modified over time, but new ministries or departments may be reconfigured based on the leaders and officials' wishes. A consensus among several respondents however has emerged, albeit latterly that the government's role is to 'sets the framework', following the good governance model. This represents a sharp contrast from earlier years where there was more activist state engineering. The facilitative role is synonymous with providing public goods and consulting with business to set the agenda (Khan, 2004a; Fukuyama, 2014).

It regards determining in concert what actions are to be taken driven by external factors and demands, internal alliances and the wishes of policy entrepreneurs. This type of approach across government administrations has led to unintended consequences and distributional conflicts. While certain sectors such as firms operating in the upstream energy sector have been able to build alliances with government, evidenced by the chief

executive of the Energy Chamber sitting as chair of the Economic Development Board, other sectors like agriculture and creative industries have had difficulty performing at the same level. It thus creates a paradoxical situation where government continues to build the relationships with high-performing sectors, while the alliances and compulsions in other areas are not as strong to help them move forward.

In order to mediate these relationships, more effective state capacity is critical but it continues to be circumscribed by these forces. The impetus to build relevant capacities over a longer term period are not manifest in the regular run-of-the-mill efforts, coupled with the ensuing discordance among actors. The lack of policy consistency and coherence have led to continued distrust and distorted distributive outcomes, whereby certain business groups can be relatively more effective in their representation and in advocating certain policy positions, such as the Energy Chamber. The latter has the ability to make specific distributive claims especially during times of low commodity prices. The resulting distributive outcomes are such that other sectors are neglected (Best, 2012, p. 201) and do not yet have the organisational and mobilising power to exact specific demands at the coalface of competing interests. Policy effectiveness can be further undermined because governing bodies are uncoordinated preventing the achievement of broad developmental goals.

The wide-ranging planning exercise of Vision 2020, though a departure from the medium term policy planning process provided the backdrop for ST&I policy making up to 2007, but the overarching philosophy of private sector-led development seemed to undermine a long range view. The culture of policy-making seems to be at variance, as the initial intention of the most recent S&T policy attempts to elaborate certain new goals and policy inputs – which placed great emphasis on the technical aspects rather than the

political problems and processes. Such a technocratic approach has not delivered a workable policy for the particular institutional realities and political context. In terms of geographical variation, the differences are manifest between T&T was also apparent, where according to a senior public servant, Tobago stakeholders wanted separate recognition and even a separate policy.

Notwithstanding such skirmishes, there is no widespread perception about the continuity of policies, as policy makers and officials have mentioned continuities over time, but have equally signalled that governments wish to distinguish themselves from previous ones. This type of environment, where there is little bi-partisan accord on the specifics of development agenda, does not augur well for creating the type of institutional commitment to S&T development. It has also created a type of ‘wait and see’ and uncertain approach in the business sector, especially during election campaign periods. In consequence, there has been very little signal that investment strategies of export-oriented corporations are directly linked to productive development and innovation efforts of local institutions (Mohan, Strobl and Watson, 2016).

In the final analysis, since donor agencies may consider the provision of rents or subsidies to firms as inherently distorting or only useful under very restrictive conditions i.e. carrying strict cut-off times, for the procurement of certain goods and services or in particular firms with a certain amount of sales or which can usually put up some of the funds (Navarro, Benavente and Crespi, 2016; World Bank, 2010). Grants received from donors also required a number of institutional namely accountability and reporting mechanisms regarding their use and execution. Even policy outputs, as in the NIP, were closely monitored and went through iterations based on multilaterals’ feedback to ensure that they were oriented in the manner intended. Measures of accountability and openness

to the providing agency are strictly observed. In this instance, the rents are provided to the state and then sometimes re-distributed in different ways, such as to private sector participants. The proposed IDB loan (US\$35million) was offered to the T&T government for use by the private sector, as well as part of the EU \$9 million grant. The remaining funding was meant to reform institutions to serve the goal of private sector development. It was uncertain what these activities for firms would entail as only vague references were made in the NIP: ‘government will address access to finance’ by firms, and ‘improv[e] (sic) innovation in the public sector’.

Overall, these intentions were understood as promoting international trade competitiveness rather than improving firms’ absorptive capacity and technological capabilities. Indeed, the competitiveness agenda could not be achieved without a requisite and comprehensive list of reforms envisaged to improve the ‘business climate’ (IDB, 2011; Donhert *et al.*, 2016). The challenge is that most of the development support for ST&I at present comes from the IDB, and the country has not been able to diversify its sources of funding or promote donor competition to any great extent that could leverage its own institutional capacity. Supposedly, underwriting the huge risk associated with innovation projects and potential consequences arising from diverting rents from its existing clients for state contracts, has led the T&T government to initiate these external arrangements as opposed to utilising sums from the Treasury.

A competing yet plausible explanation is that there may not be a wide appreciation of innovation or its substantial requirements among ‘clients’ in the society as groups intensely compete for dwindling resources (Wilson, 2012). It has therefore not accepted much support from the Caribbean Development Bank (CDB) and UNDP, both of whose support in this area come without much funding, as T&T is a net contributor to

these agencies. The lack of local knowledge inputs and use of that knowledge in policy-making also stifle the development of research capacities and show the disproportionate leverage these agencies have in the political economy (Girvan, 2007). Accessing donor rents however comes with certain trade-offs that can limit overall institutional development on the country's own terms, can create further fragmentation in the institutional system, and can lead to imbalanced achievement of the development agenda. From this perspective, further analysis of the internal institutional factors and arrangements of is therefore critical, and will be now elaborated.

5.3 Networks of power: organisational performance, leadership and capabilities

Even though there appears to be some rhetorical acknowledgement of the need for integrating S&T into the development agenda, a combination of political and institutional factors has delayed progress. There were varying views about the inputs of technological innovation and the relevance of S&T as a driver of innovation processes among the myriad agents. The main S&T organisations and policy making arms of the state have differing and uneven levels of performance. In fact, there are few public organisations that currently have the autonomy or capacity to influence the process themselves because of this fragmentation. For example, the erstwhile MST did not have the in-house capacity, and differed in its understanding of its role, paying more attention to ICT policy, and not S&T policy development. According to one senior functionary:

That has been always been a feature of policy design in Trinidad and Tobago, where you see in some cases they try to configure ministries to go through the whole spectrum of design and implementation to have a seamless policy formulation, but when delegated the function to design, these agencies do not have the sufficient authority to influence all relevant areas (*Assistant Director, SEPPD*).

The devolution of policy formulation authority to the NIHERST has complicated matters further and created cleavages between the Ministry and this implementing organisation. Though NIHERST was delegated this mandate from the line ministry, but proceeded to formulate policy in a closed manner, perhaps as a means to prove its relevance and consolidate organisational power, while eschewing cooperation with other government officials and departments.

Moreover, personal relationships or the lack thereof, and institutional disconnect between the main officials have provoked a turf war. The Ministry of Planning, though seemingly having greater control over its policy process with more staff and capabilities, does not have the autonomy or authority to ensure compliance of agencies in other ministry departments, such as NIHERST. This is despite the fact that some respondents were of the view that the planning department should have a government-wide authority. Thus, officials have not been able to compel NIHERST to share information or to work alongside it, even after several requests and meetings. This was in part to the fragmenting of S&T policy on the one hand and innovation policy portfolio within the planning ministry. The political clout of the Minister of Planning in the division of labour also proved decisive in creating such a scenario as he was personally interested in the innovation agenda which he thought should be handled separately from S&T.

Noticeably, CARIRI has been able to have greater input through closer relationship and enhance in its status through acquisition of external funding opportunities and delivery of prestige projects under its purview, including the establishment of the Centre for Entrepreneurship and World Bank Climate Innovation Centre. This could imply its more influential role in policy processes and in fact it has positioned itself in this space more actively through the stewardship, personality and

active participation of its Chairman and Chief Executive. The latter was able to secure its function as a technical agency to support the implementation of the IFF and *idea to innovation* grant competition, through lobbying meetings at the CCI and presumably informal talks with the Minister of Planning. These organisations seemed to respond much more quickly claiming that it has achieved the requirements in terms of staff and technical competence, and putting in place the institutional mechanisms to exploit the external financial support.

At present, competition among these public organisations for resources has also constrained the development of relevant policy and coordinating capabilities. The ‘silo effect’ has undermined the coherence of the policy frameworks and organisational collaboration in designing and developing more appropriate instruments. There has been some level of improvement at the technical level, but limited political progress on mainstreaming these issues in a systematic way. For example, a senior policy official suggested that if permanent secretaries lent their support there is a possibility that a particular policy area would receive attention, as well as improve communication and relationships across ministerial departments. Policy development has been delayed as a result of the intra-organisational culture to keep information closed and only available to insiders. It has also limited to a certain extent democratic scrutiny of the internal processes.

Political elites have also affected the degree to which policies advance towards implementation, given their own understanding of an issue area and the concomitant gravitas to push an agenda through the level of Cabinet. It is signified varyingly through the roles of the Minister of Science and Technology who was appointed in 2012 and was slow to move in this area, and to establish a reputation, whereas the Minister of Planning

was able to become a champion for innovation policy and push ideas through Cabinet. In other words, the Minister of Planning was able to utilise his political capital in gaining support, though implementation has faltered. On the other hand, the Minister of Science and Technology did not command a similar level of political recognition.

With respect to trade and industry associations, they were included in formal mechanisms set up by the Minister of Planning through the CCI for example, which had three past and / or current leaders in various industry associations, such as the Trinidad and Tobago Chamber of Industry and Commerce (TTCIC), American Chamber of Commerce (AMCHAM) and Trinidad and Tobago Manufacturing Association (TTMA). Given the history of the relationship between government and the private sector these arrangements did not seem to give the spectre of legitimacy to the wider business groups and private sector, perhaps because of the agency's its budgetary allocation, and thus the stream of rents available, was relatively small (Breznitz and Ornston, 2012). Contrary to the view expressed on power of peripheral agencies by Breznitz and Ornston (2012), the CCI was unable to experiment with innovation policy instruments due to the industry structure and path dependency of private firms in T&T to seek short-term gains.

There was greater interest by an emergent cadre of entrepreneurs in the IFF and the *idea to innovation* grant competition that had to face the forces of market competition and incumbent firms in their area. Notwithstanding this interface, the CCI representative groups seemed more successful in lobbying for their own companies, than in advancing the innovation agenda more widely. The business associations demonstrated patchy knowledge of the government's innovation policy efforts, and what their role was intended to be. Their leaders facilitated dialogue in different ways and ensured meetings

with relevant government representatives, but generally there appeared to be a lack of interest in government-facilitated projects, and in improving policy outcomes.

Maintaining close ties to with politicians and bureaucrats guarantee patronage toward the private sector whose short-term interests can be pursued. The state's continued fragmentation drives these incentives and can limit successful project implementation. Segments of the current private sector believe that their agendas may have been more successful or significantly better advanced through interpersonal contacts and informal ties, than necessarily through the industry association. The association however gave the appearance of legitimacy. Key business people have attempted to make contributions and to facilitate dialogue from the association with the government in the past, but it comes down to the association's leadership and structure to follow through on issues of innovation policy and mobilising local demand for current S&T infrastructure. This level of representation does not appear to be consistent, and shifts according to the agenda and relevant industry.

In one instance, the Energy Chamber for example shows much more leadership capacity and organisational ability because they represent the most important industrial sector in the country. Their representatives also have the demands of transnational companies and international agents to satisfy and work with, which may expect certain high levels of standard, access and operation. They were also in the process of forging some alliances to utilise local research and knowledge in their long-term strategic plans. In addition, constraints with respect to the measurement of S&T activity in firms and public organisations that can be used as a basis for policy development are also rife. In T&T, a recent study has utilised traditional measures of patent registrations, R&D expenditure and introduction of new technologies (Nurse, 2014) to determine innovation performance.

These measures do not capture the process of accumulation of technological learning capabilities and other tacit factors in a development context (Bell, 1984, 2009; Bell and Figueiredo, 2012; Khan, 2010; Kim and Nelson, 2000). This recognition was made in the context of the Caribbean over thirty years ago:

A second difficulty that was encountered arises out of the frequently implicit assumption that ‘technological activity’ is identical to R&D activity, and/or with the effort to develop ‘indigenous technology’.... However in certain other areas of activity the huge cost of R&D, the small size of Caribbean economies relative to the output of industrial plants, and the apparently ready availability of existing technological solutions, make local R&D activity beyond the resources of region and in any case unnecessary (Girvan, Gomes and Sangster, 1983, p. 28).

This focus on R&D is acutely evidenced in the recent report on firm level data, and has been used as the evidentiary basis in the formulation of the NIP (Centre for Strategy and Competitiveness, 2014). Feeding narratives that suggest that organisations do not innovate or do not engage in activity that contribute meaningfully to innovation (Nurse, 2007, 2014).

They also are ahistorical and de-contextualise such analyses from the wider institutional and social structures and global environment. They also do not consider the effects of previous structural adjustment policies and social forces on the ability of organisations to adapt to changed circumstances since the 1980s (Barclay, 2007). Recent research seems to suggest that there are a number of small ‘innovative firms’ that number 20 from a sample of 120, which are more likely to be foreign-owned or large exporting firms (Mohan, Strobl and Watson, 2016). It may leave one with the conclusion that certain ideal-type institutions (as per the innovation systems approach, see chapter 2 for more detailed criticism) and arrangements are necessary to achieve ‘world class’ innovation outcomes.

In this sense, the innovation systems view may unwittingly propagate such precepts based on its thrust to measure performance with an in-built notion of the technological leader countries as demonstrable trendsetters to follow (Nelson, 1993). It therefore shows that the use of data in policy-making can be misleading depending on the nature and design of the research. The 'evidence base' for policy making efforts need consider the structural conditions and the institutional environment in which a number of networks, characterised by institutional, political and informal aspects underpin interactions and shape the activity of all relevant agents in the process. It goes beyond the question of measurement of one of the key participants, to consideration of a number of contingent factors in policy formulation. It can be complicated affair, but can help better understand and determine policy effectiveness (Khan, 2010).

In the current context, the interaction with the science and research community and the government remain weak and sparse. A lack of incentives from the viewpoint of academics and the experience of certain high-profile academics with policy makers (for example, the relationship between Kenneth Julien and Eric Williams) and the ruling party further marginalise their role in the policy-making process. In the current period, as compared to the 1970s when academic and expert leaders like Professor Kenneth Julien, or even early 2000s Professor Clement Sankat, is now skewed to institutions with closer relationships to the business community and/or to the ruling party. Indeed, the ALJGSB is one of the main centres where consultancies on competitiveness are being commissioned for use as evidence in policy making compared to the Engineering Faculty of the UWI in previous times. Inter-organisational engagement is mediated by the personal roles and the legitimacy that international financial institutions bestow on the Business School, versus other research departments at the UWI.

The role the Business school plays in research and advocacy has come to influence in a real way in the number of studies that have commissioned there since the government has taken office, in particular four studies on value chains, a firm-level innovation survey, and economic growth poles²⁷. This is facilitated by requests from agencies like the IDB, its Barbados-based Caribbean Compete agency, the Caribbean Growth Forum (supported a consortium of international development agencies) and the Executive surveys of the World Economic Forum. Most importantly, the EDB has also commissioned studies. All of these activities have filtered into training workshops and provoked the formation of new degree programmes for public and private sector managers and employees. Therefore, they will inevitably have intellectual and pragmatic impacts on the design of current and future government programmes and institutional arrangements in a number of areas in an overall development strategy.

The historical basis of the study has provided the opportunity to better understand the manner in which governance has shifted and how various actors have factored in in relation to their effects on state effectiveness. It is undeniable that societal actors, and those germane to this study in the scientific community as well as multilateral and bilateral donors (the latter's role will be treated separately in the next sub-section). Even though the period of the case study during the 2000s and up to 2015 do not provide cogent clues to specific shifts in governance approaches and capacity, the longer view helps provide better insights. In the period under review there were some minor changes in the institutional apparatus that were discussed in the previous chapter, but this had little impact on the improvement of institutional capacity, in the areas of designing policies, coordinating actors and mechanisms, the provision and performance monitoring of

²⁷ A list of relevant past and current projects undertaken is here:
<http://www.lokjackgsb.edu.tt/research-centres/centre-for-strategy-and-competitiveness.html>

financial and other incentives, and the general trend towards implementation of ST&I policies in T&T.

The general philosophy and operation of the state tended to engage in technocratic functions, primarily across agencies and to a greater degree the inclusion of business representatives in the process. Even though many actors in the state viewed their role as independent of other actors, in practice, especially at the high level of the bureaucracy and the policy makers/politicians, these lines were largely blurred (see chapter 2 on networks of power). These kinds of interactions often occurred beyond the formal conference rooms and as reciprocal arrangements, as supporters and other aligned figures were placed in key positions. However, the role of civil society is unclear in the policy-making equation, which has created the present constellation of unequal power and calls into question the democratic nature of the policy process.

In terms of the evolution of the governance arrangements, starting in the late 1960s, it represented a period of heavy state involvement and launched serious efforts and institutional development in ST&I. Although past policy research suggest that there were no explicit references to S&T, or S&T policies (Lemarchand, 2010; Pantin, 1997), this study found that indeed from the late 1960s explicit attention was paid in the formulation of the country's third national development plan. In fact, as detailed in Chapter 3, an entire section of the development plan focused on research, science and technology. This period was known for the active role played by government and the state apparatus in convening a number of committees and new state enterprises such as the Energy Task Force, chaired by reputed contributor to the country's development agenda, Professor Kenneth Julien. It was a time when the government realised that technological development and industrialisation had to be state-led. It led to the establishment of several

institutes including CARIRI and NIHERST targeting several sectors, including agriculture and industrial research.

The adoption of the direct-reduced iron (DRI) technology and the process of acquiring and assembling different technological components at a small-scale in the steel sector at ISCOTT also demonstrated that the country had some operation and process engineering skills and expertise. Therefore, while the state showed ability to drive some aspects of its agenda and undertake a number of initiatives with majority shareholding (Pantin, 1987). It however maintained much of its decision-making power at the investment stage. There were nevertheless definitely signs of weakness even at this point:

The one feature that stands out is the heavy reliance placed on foreign firms. The CTF (Coordinating Task Force) continued an approach originally developed by the IDC. In-house desk research identified potential commercial uses of natural gas. From this point, further detailed research was entrusted to foreign consultancy firms (Pantin, 1987, p. 316).

Even though the business community, especially the domestic private sector was for all intents and purposes distinct from government policy efforts, except, the accumulation and retention of technological capability was not automatic (Boopsingh and McGuire, 2014). As both Trevor Farrell and Martin Bell have argued protectionist measures and nationalisation are insufficient for the accumulation of these capabilities, and only under certain conditions can they occur (Bell, 1984; Farrell, 1979b). Nevertheless this period represented the most promise in terms of state effectiveness in ST&I policy but this soon disappeared.

Attracting large quanta of foreign investment and export promotion have been the goals of policy since the 1980s, while existing of S&T institutions were increasingly marginalised and under-funded. Agencies like CARIRI lost government funding and strategically restructured themselves to be focused on clients within the country's comparative advantage. The government basically provided the supportive institutional

framework and later continued its stream of incentives to existing profitable sectors and businesses. Indeed technology policy was deemed unnecessary and that government only needed to provide the right incentives and institutions held strong. Institutions like the IDC was increasingly deemed irrelevant, or significantly had to reorient its activities to being a service provider. Overall, government policy shifted towards the increased demands of the IFIs who required certain terms and conditions in accession of structural adjustment loans. As a result, even though the institutional apparatus existed under these circumstances, very little accumulation new technological capabilities occurred.

Later, investments in social infrastructure during this period created certain compulsions for new production activity led by private sector players. In fact, new investments in energy and natural gas processing, exemplified by the Atlantic LNG Trains I-III, were undertaken with favourable tax incentives for private transnationals and some local firms, including energy service providers (Boopsingh and McGuire, 2014). The global financial crisis however led to a collapse of demand from traditional markets, especially the United States. As the trend continues, although development strategy sought to improve prospects for economic diversification through Vision 2020, there was little or ineffective state enforcement and oversight of new schemes such as the R&D Fund. Research activity at the UWI in the early part of this period focused on economic incentives towards commercial ends. The GATE programme was solely geared towards human capital development than research driven efforts. Developmental research projects faltered as there was no direct state support or strategy for development of research activities until 2005.

Though the Vision SSTI Committee was instrumental in bringing together a diverse set of interests and reaching the point of designing a draft policy, it was located outside of the bureaucracy. Bureaucratic, commercial and political interests took

precedence in deciding the aspects of policy to be pursued, elaborated and implemented, especially vested interests at NIHERST who saw their institutional presence as being threatened. The demanding thrust of the Vision 2020 report did not appear to attract sufficient administrative, business and political support when economic and political conditions eventually changed in the latter part of the decade. The market-oriented underpinning of the report also downplayed active state involvement in certain circumscribed areas of activity – basic research, infrastructure and supporting institutions – while the market actors were expected to take the lead. The latter however did not materialise as envisaged and the report was not eventually adopted as official government policy in Parliament. The coordinating capacity of the state was apparent, but the implementation capacity to ensure credible commitment was very weak (Sen, 2013).

The PP's 'innovation-driven' development agenda between 2010 and 2015 has taken on new salience. With Tewarie's connections at the Arthur Lok Jack Business School, the IDB, and later the business groups, innovation and competitiveness were promoted as essential ends in themselves through events and conferences. Inter-ministerial competition limited a government-wide acceptance of this agenda along beyond the official policy rhetoric. With the creation and subsequent split of the MSTTE, into two entities the assignment of the national S&T policy was given to the MST, while the MPSD retained the responsibility for a new innovation policy. Under Tewarie's tenure, CARIRI re-oriented and refocused efforts on what it calls its new portfolio RD&I, opening a new incubator and enterprise centre, as well as entering into new arrangements with international bodies such as the World Bank. In addition, a number of industry associations, especially the T&TCIC and AMCHAMTT were directly involved in the policy process, but their impact in terms of bringing the 'private sector perspective' and coordinating with the business players was not apparent.

These dynamics demonstrate the prominence of various actors and bodies, institutional changes and the basis for less than effective state machinery apart from certain pockets of activity in ST&I. The overall division of labour and increased rent-seeking claims of private firms on the state has undermined effectiveness. Over time, the state has shown a level of long-term development vision, in which ST&I have played some role, either explicitly or implicitly but reversals and institutional re-branding of various sorts have modified the level of primacy given to ST&I at different periods especially since 2002. In this area, state action has been determined to a large extent by what agendas are supported and driven by external actors, especially multilateral and bilateral agencies. Even though there is rhetoric and advocacy for ‘innovation’ and ‘knowledge-driven’ economy, the emergence of a powerful private sector uninterested in such an agenda since the 1990s. Residual capacity in coordinating actors around a particular goal is being frustrated by little achievement over time.

It does not appear that the ethnic connections between patrons and clients, namely policy makers and certain businesses or political supporters have created compulsions for innovation investment through fiscal measures. To this end the informal nature of the policy process both in terms of the absence of standard or institutionalised rules and procedures can also have benefits and drawbacks in terms of policy advance in some instances. There are opportunity costs involved that must be considered for new policy changes. Recognition of the legacy effects of market-driven policies in empowering certain actors, as well as the political costs to transition to an innovation-based growth agenda is a first step. In this regard, a focus on key low profile projects through the state enterprise sector, in tandem with research activity at the UWI, as opposed to a new round of state divestment, towards a social transformation agenda that can have wide-ranging effects (Tönurist and Karo, 2016).

5.4 Towards a Developmental Governance Capability Framework (DGCF)

This section attempts a perspective to consider how to foster developmental coalitions and develop relevant policy instruments that considers the political economy of technological change in a small developing country. The DGCF is an inductive approach that integrates the four broad components of politics, bureaucracy, knowledge and production to marshal resources and capabilities that drive development processes (see figure 5.1 below). It integrates the core aspects of the thesis, namely the political and social aspects of policy-making, the interrelations between social configurations, development strategies and techno-economic outcomes over time in T&T. It represents the complex and non-linear dynamics between technological change and development (Evangelista, 2017; Girvan, 1979). It starts with the premise that development is a complex process of society-wide transformation that integrates: environmental sustainability, structural changes, governance improvement and basic human needs (Vázquez and Sumner, 2013).

All of these aspects interact with the knowledge system, the bureaucratic system, the productive system, and the political system (see figure 5.1 below). In particular the embedded nature of state-society relations are in relief and under what conditions the state may seek to promote ways of thinking through developmental problems and generating possible interventions with relevance to ST&I policies. It is empirically based on a small country setting, in particular T&T. It is important to understand that each country will have a separate nexus of political, productive, structural, institutional and historical relationships and conditions. As one heterodox economist has argued long ago,

A satisfactory theory should certainly be one that conforms more closely to the available empirical evidence; it should also (like the other social sciences) take more account of the emergence of qualitative new features of the system's

behaviour and of the capacity of human agents to falsify predictions based on experience. Greater humility is important as well as greater realism. The vitally important contribution of economists (or political economists) to policy debates and formation will not be diminished if it is more modest in its claims (Freeman, 1988, p. 4).

In this sense, this framework offers the academic community, policy makers, government and other actors in T&T a basis from which to take these factors into account.

Figure 5.1 - Development constitutive of the Bureacracy, Politics/Society, Knowledge and Productive systems

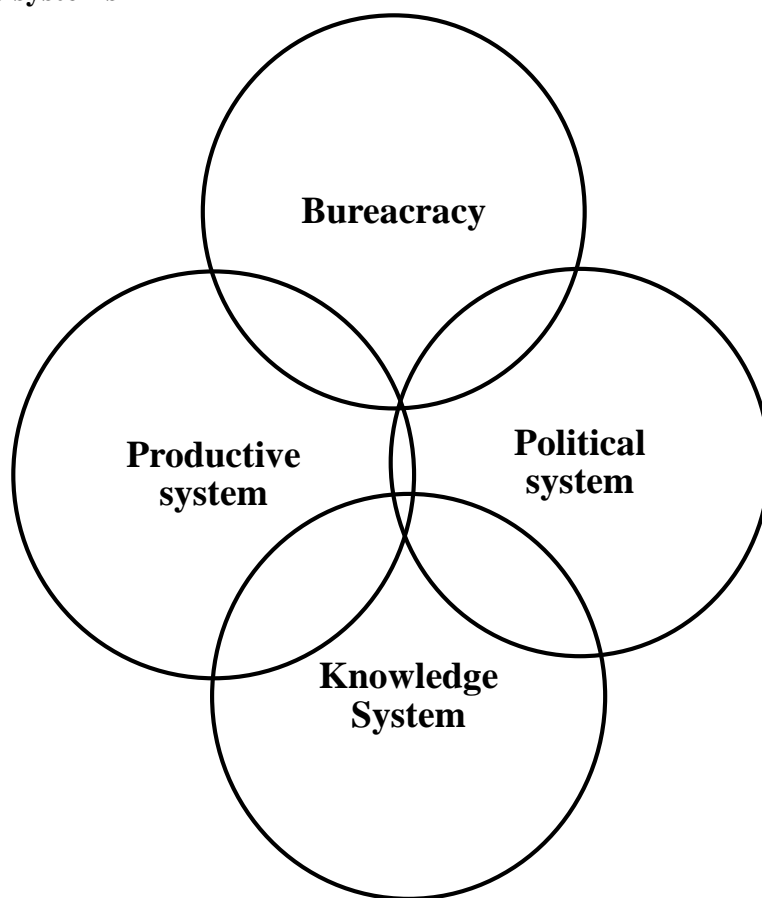


Figure 5.1 integrates the various groups and constituencies that have been drawn from the thesis. The four areas: productive systems, knowledge systems, politics and bureaucracy all have convergent points through which goals can be pursued. Each aspect requires state coordination and collective responses in a coalitional configuration to drive technological and socio-economic processes that can meet the basic needs of people (Girvan, 1983;

Saad-Filho, 2007). Knowledge, for instance can be person specific in terms of skills and formal education, or based on experience in production, or within a social system that encapsulates understanding of how people operate and communicate with each other and practices within that society. The productive system comprises firms and institutional arrangements that support firms' and organisations that generate value-added goods and services that meet society's needs. The political system incorporates the political groups and institutions that influence the activities, beliefs and systems of organisation to achieve the society's goals. Finally, the bureaucracy represents the administrative arm that is organised to pursue these collective goals on behalf of the population. These relationships are unbalanced in favour of a state invested in recognising its potential and improving its internal capacities.

Following Girvan (1983, p. 29-30), the DGCF includes 9 steps which have been clustered into 3 broad areas:

1. Specification of basic needs and inventory of resources (natural and human resources): this includes the determination of nutritional targets, housing, education and training and employment, as well as identification of available skills and training needs.
2. Identification of available materials, technological areas and research activities: the conduct of relevant resource surveys, basic scientific research on general technologies and focused areas; upgrade of training facilities, training in new identified areas, appropriate foreign consulting and specification of problem areas that require technological and knowledge inputs to maximise local resource use and meet basic needs.
3. Local and international search for appropriate technologies: inventory of local and international materials and techniques; acquisition of products and design

of production systems; appropriate importation and adaptation of technologies based on new rules. Diplomatic advocacy is also critical at an international level for shifting international regimes and protocols to support development.

To these, the following area is added:

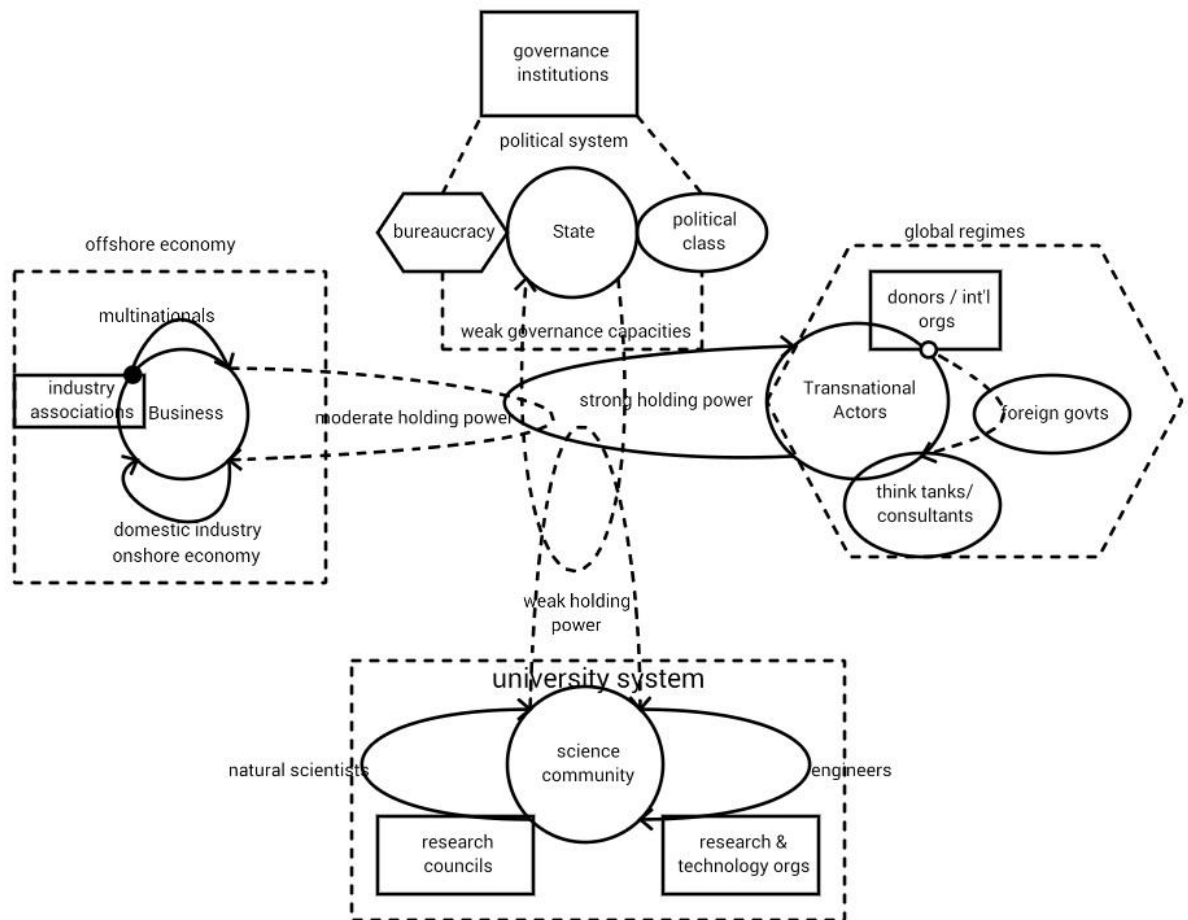
4. Assessment and enhancement of bureaucratic/governance arrangements and capabilities for implementation across sectors of interest: based on the empirical findings in chapter 4, a further requirement is the sectoral analyses of technological capabilities utilising an historical approach across the productive and bureaucratic systems. Further, an analysis of the burgeoning productive and technological areas, where old commodities are dying and new demand is being created is needed (see below).

Given varying levels of performance of economic sectors and other societal demands, the generation of possible solutions and interventions must be sequenced and address their specific needs at a sectoral and institutional level. This approach seeks to contribute to a more critical perspective that seriously considers the specific context and normative ideas on broad social and economic goals (Delvenne and Thoreau, 2016). It is predicated on the goal ‘to promote learning and problem-solving capabilities at the individual, community and institutional levels, where the leadership is not to be left to the top of the social pyramid but to grow from the bottom with government support’ (Kuhlmann and Ordóñez-Matamoros, 2016, p. 5). With this in mind the importance of building and improving governance capability as a whole that is historically, contextually and theoretically relevant forms a critical basis and outcome.

Moreover, the approach is underpinned by a transition from current social relations and distributive impacts according to networks of power, defined as the complex and circuitised relations among institutions and actors across national and international

boundaries that comprise the S&T ecosystem as outlined in Chapter 2 (Figure 2.2 repeated below). The underlying heterogeneity of actors and their different capabilities and organisational structures can produce pockets of activity and conflict that lead to uneven outcomes and potentially detrimental effects (see number 4 above).

Figure 2.2 - Networks of power - institutional arrangements and corresponding governance capabilities among the relevant groups and actors in the policy sub-system



Source: Chapter 2

As mentioned in Chapter 2, the networks of power describe the dynamic and asymmetric relations and distribution of capabilities, organisational power, legitimacy and knowledge among a variety of actors, in the bureaucratic, scientific, political and productive domains across domestic and international spheres. Drawing upon the actors which have been influential in the formulation of ST&I policy from the literature (Patel

and Pavitt, 1994; Watkins *et al.*, 2015), the state albeit represented here as analytically discrete is the site where all these interests and identities are expressed and mobilised in a relational manner. It comprises for analytical purpose, the political and governance institutions including the Parliament, various ministries and political groups. Bureaucratic and governance capabilities in ST&I are stymied and generated through these uneven and informal linkages across the transnational, domestic and sectoral spheres.

The transnational node has a strong holding power, in that actors here can mobilise a large quantum of material resources and capabilities and possibly challenge with a high degree of effectiveness, even make claims on the state for resources or exact requirements on the state to adjust priorities and activities. They include bilateral donors like the IDB and EU, multilateral agencies like IMF, OECD, World Bank and World Trade Organisation (WTO) as well as foreign governments with whom T&T has trading relationships or agreements. Think tanks and foreign consultants also have an institutional presence and may work through the aforementioned agencies. The scientific node represents the sphere where knowledge is generated, and policy advice can be marshalled (for e.g. the ALJGSB, CARIRI or educational institutions). In T&T, during the 1970s engineers and scientists had a stronghold on policy advice, in the person of Kenneth Julien, but their influence is patchy, in some instances weak, and based on and there is no unity given the ethnic divide in the country.

There is also a practical element where organisations like CARIRI or the Engineering Faculty may undertake industrial research projects (see chapter 4) in tandem with the private sector that may have generate private and/ or benefit. CARIRI is also embedded in transnational networks and thus draw up different sources of knowledge and compulsions to drive its activities. The question of appropriability of knowledge is

dependent on whether firms are mobilised to utilise skills from this sector or knowledge inputs based on international regimes like the Trade-Related Aspects of Intellectual Property Rights (TRIPS) at the WTO. Finally the business node contains all the firms operating in offshore and domestic sectors of the economy, including their membership associations and currently possess ‘moderate holding power’ on ST&I policy. Their ability to accrue rents is through direct personal links with politicians and the driving philosophy of market driven growth promoted by the transnational actors. Here, as mentioned above, the close relationship between a Minister and relative at a business association has been key on innovation governance programming but was interrupted by political events. This represents the kind of exchanges that occur in the state that may be uneven across policy domains (Centeno, Kohli and Yashar, 2017). It is now useful to outline the range of ideas, mechanisms, pathways and implications that the DGCF proffers as starting points and a testing bed for further elaboration.

Aspects of the Developmental Governance Capability Framework

Principles

The DGCF does not purport an imagined ideal type or best practice of governance, or assumes that there is an institutional end point in the development process archetypal of certain industrialised states (for example, Levy, 2014). A fundamental insight of this research exercise is that technological change in contemporary developing countries is shaped by a unique balance of social forces, and of bureaucratic capabilities to implement its policies and enforce particular rules (Khan, 2010; Centeno, Kohli and Yashar, 2017). Given that development is a difficult task, one cannot predict *a priori* that countries inevitably transition from competitive clientelist or dominant-leader political

relations to impersonal institutional frameworks and so-called ‘sustainable democracy’ as Levy posits (2014, p. 31). In fact, scholars have shown that this relationship is not so straightforward, and even if you arrive at a stage of advanced democracy present in many capitalist countries it may incur many social costs on the poor or engender unfortunate disparities (Bardhan, 1999; Bishop, 2016). If we casually consider political developments in Western democracies today, these disparities in income, wealth and political power lead to democratic deficit of the masses (Palma, 2009; Piketty, 2014).

The DGCF allows for different possible paths in line with different historical conjunctures. In T&T, bureaucratic capabilities of designing, implementing and enforcing ST&I policies are fragmented and unbalanced that create islands of activity and low levels of performance (for instance the R&D Fund or idea to innovation scheme). It can exercise capacity in areas under certain conditions given the interplay of internal and external forces and conditions are in favour of state action to respond to shifts in international demand and technological opportunities (Farrell, 1980, 1982b). Capabilities are thus contingent on external factors and based on internal mobilisation of resources, capabilities, agents, and actions. Wade (2014, p. 797) puts it in the following way:

States will have to manage capitalism more actively; which heightens the interest in questions raised here about the role of the state, the nature of state–society relations, and opportunities and constraints in the world economy and interstate system.

Moreover, it does not view ‘market’ or ‘systemic’ failures in their narrow sense as only rationale for government intervention (for example, see Chaminade and Edquist, 2010; Khan, 2010a; Khan, 2015; Stiglitz and Greenwald, 2014; and for a synthetic discussion, see Andreoni, 2016; Bleda and del Rio, 2013; Flanagan and Uyerra, 2016; Mazzucato, 2016 offers a critique from an advanced country perspective). Both types of rationales lack appropriate analytical foundations that consider aims beyond making

markets work or improving the ‘framework conditions’ (see chapter 4 for assessment of structural, political and technical imbalances). These formulations may not accurately capture the wide-ranging challenges faced in developing countries that have underlying social, economic and political causes, and generate imbalances to which ST&I as part of the overall development strategy could help address. The DGCF represents one significant departure from the innovation systems in line with (Khan, 2012a, p. 13) to ‘enhance the governance capabilities of states so that they are better able to address specific problems in developing countries’. Systemic and market failure approaches limit consideration of required political processes and shifts in the international environment for T&T to catalyse structural opportunities towards more productive transformations and new developmental possibilities.

Instead, we propose a *developmental* or *transformative* basis on which ST&I as well as other complementary developmental policies can be devised to suit the manifold concerns that befall developing countries. From this standpoint, it eschews goals generated from analyses predicated upon on simplistic, formulaic and rational ranking of countries, like the World Bank’s Ease of Doing Business or WEF’s Global Competitiveness Index (see chapter 4). These tools are ineffective for broad based development policy as they are predicated on making markets work better through institutional reforms and comparing countries of very different historical experiences (Kiely, 2005). By using the same criteria for all countries, these metrics take advanced countries as the ideal-types, drawing on their current experience to determine what exists and works in these places, and then suggest the same in less advanced economies.

The DGCF instead notes that structural, technical and socio-political constraints emerge from historical processes and in the recent policy process in T&T (see chapter 4

and figure 5.2 below) would determine the best suited policy instruments. Rather, it embraces the legitimacy of strategic collective state action to identify market opportunities, responding flexibly to demand, and advancing product niches in global capitalist structures (Baldacchino and Bertram, 2009; Farrell, 1982, 1984; Marcelle, 2009). In addition, as the state helps in creating demand through public procurement measures that respond to societal needs. The small state has to also take into account changing geopolitical configurations that pose certain constraints and opportunities (Bishop, 2015; Farrell, 1984; Marshall, 1996). However, the embedded social contradictions in terms of ethnicity and history of political struggles among classes can produce and reproduce certain unbalanced outcomes in social, economic and technological terms. The framework adopts the view that the effects of technological change are contingent in relation to inequality; they can reflect existing distorted social relations, or can equally undermine them (Evangelista, 2017; Rennkamp, 2016).

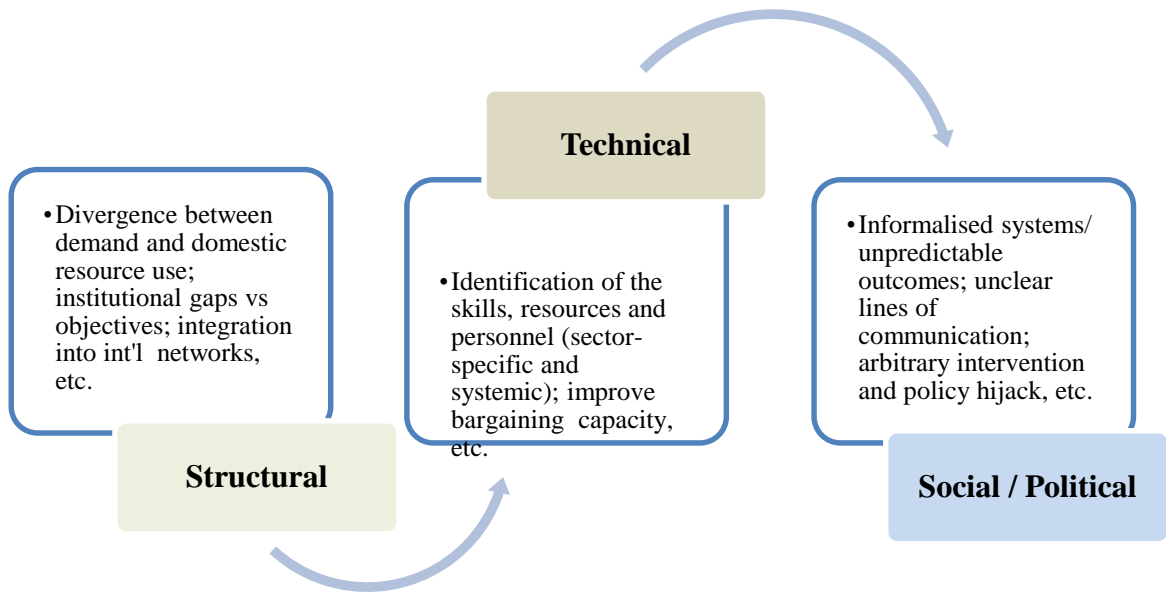
Developmental rationales are dynamic and socially embedded sources of contradictions. They necessitate state intervention to not simply smooth out technological and other social processes to achieve broad based development (Kiely, 1996). But to accumulate experience in productive activity and structural learning processes that underpin them that are particular to the nexus of local resource usage, accessing technologies and other inputs from abroad, generating and scaling up capabilities in the domestic private sector (Andreoni, 2014; Farrell, 1982; Girvan, Gomes and Sangster, 1983). Achieving dynamic comparative advantage, or productive flexibility defined as ‘the ability to perceive what commodities are ‘comers’ in international trade, which commodities in decline, and the development of the capacity to shift one’s economy out of the declining sectors into the burgeoning ones’ (Farrell, 1982, p. 14–15). This is closer to the structural development economics à la Hirschman and Myrdal as representing a

shift in the entire social system (Hirschman, 1958; Myrdal, 1974; for a recent elaboration, see Vázquez and Sumner, 2013).

In other words, the contradictions between the social, technical and structural factors are considered as a whole in lieu of limiting the analysis to defining one area of social organisation that is the economic market as the principal basis of public action. Possible pathways can then be determined that consider the most desirable outcome for achieving technological as well as other developmental objectives. Investing in new areas can also bring about social dislocations that will require redistributive policies in employment or social insurance schemes. Indeed this complicates things but it further suggests market growth on its own does not necessarily deliver developmental progress without these dimensions being considered beforehand and not as an afterthought.

As a conceptual tool Figure 5.2 below helps illustrate the interactions between the structural, technical and social/political dimensions necessarily understood as a starting point to policy options in the DGCF. Problems that appear or are directly interrelated across all categories are addressed first, by designing relevant instruments, then the next most prevalent one and so on. The idea of sequencing is critical in development interventions to avoid problems of cumbersome loading capacity that good governance policy reform efforts tend to bring about (Grindle, 2004). The instruments that are designed must also be based upon grounded analysis of the real problems of the society and economy commencing with a definition of the problems that ST&I policies are seeking to address (Girvan, 1979). This discussion on the problem definition and the process of prioritisation is detailed in the next sub-section.

Figure 5.1 – Structural, technical and social/ political drivers that constitute the ‘transformative’ or ‘developmental’ basis for ST&I policy processes



Source: adapted in part from Girvan, Gomes and Sangster (1983) and Forsyth, (1990).

This approach offers a complex understanding of the nature and effects of technological change and how governance processes are interlinked in a non-linear manner. Put another way, any policy efforts in ST&I and development have structural, technical and socio-political dimensions that must all be considered in an integrated fashion and approached in that way. In addition, the question of sustainability of efforts in ST&I have come up often in the previous chapters and how to ensure policy efforts address the real problems. When projects are developed or technologies imported, how can they be diffused in such a manner that it minimises dysfunctional conditions (Girvan, 1979), or creates awareness among policy makers and other publics, of the issues which require ST&I interventions. The idea here is that information asymmetries is not a useful way to understand the flow of information between different groups but sources of information and their flows are culturally and socially reproduced influenced by those with differential power and access. The knowledge associated with different types of institutional or productive activities can be dispersed across agents and sectors, and sometimes induced by political and / or social actions towards collective capability

building. These activities can in turn generate conflicts. The goal therefore is to build technological capability to deal with the real challenges of the economy and society which in turn generate new activities over time in different areas. Therefore, technological change is not only a matter of increasing R&D productivity, as a movement toward the production function or the prospect of convergence (Kiely, 2015), but the process requires more in-depth historical view that incorporates agency within the overall development process.

Priorities and Actors

The second area of concern is how to construct a development vision and prioritise activities that can address the basic needs of the people within the society. The DGCF takes into account all relevant context-specific problems, which sufficiently broad as an umbrella-like reference point from which all policies can be derived. This process imputes a range of actors and design features. In order to align the developmental needs with the overall ST&I strategy, one must be cognisant of not to advocate preferred solutions, but to frame problems appropriately. Appropriate analytic diagnostics are critical. Carving out space and institutionalising to some degree, better distribution of power in this agenda-setting effort outside of the incumbent actors, including civil society, would form part of the DGCF approach²⁸. From this point of view, understanding the nature of organisational structures, work practices, and institutional cultures that may impede or facilitate this type of activity can serve as a useful way of introducing a mechanism that will induce greater civic input.

²⁸ One high-level staffer at a multilateral bank involved in the innovation policy activities in T&T made the point that labour unions were not involved and may not have been viewed as critical in the policy formulation process.

Efforts at promoting of broad based development rough ST&I therefore suggests the deliberate act of selecting certain types of productive activities and projects as well as the types of transformative activities over others. This effort must deliver employment-generating growth that shifts political power, better income distribution and meets the basic needs of the most marginalised (Saad-Filho, 2007; Vázquez and Sumner, 2013). It also necessarily involves putting in place distributive mechanisms that growth is shared to such an extent that it reduces social costs (Lauridsen, 2012). In certain instances, moving towards desirable goals requires social and political mobilisations that are strategic and focused on the needs of the society, to drive an agenda and transform the relations of power over time to meet more broad-based goals.

In the context, this requires parallel efforts by civil society at participating formally and mobilising independently; this requires enhancing dual capacities at technical analysis and public education and mobilisation (Girvan, 2012). This type of activity can induce citizen participation and prevent misguided government rhetoric that public policy formulation is only for state agencies to perform. Or those so-called ‘consultations’ in which answers and draft policies are presented to the public for rubber-stamping are sufficient form of state-society engagement. In other words, government cannot claim to operate autonomously, when other agents, especially external bodies have greater influence versus certain domestic actors and groups whose goals are broad-based social well-being and employment.

In this governance framework, the main considerations have to do with incentivising greater advances in technological development, and the skills, knowledge and tacit learning components that underpin such dynamic processes, undertaken across the bureaucratic, knowledge, political and productive systems. The regulation of and provision of resources for public research and research institutions, such as universities,

that generate forms of scientific know-how that can be beneficial to enterprises and for developmental purposes. Included are the kinds of knowledge and skills that are critical for firms to absorb and invest in for productive output and innovation process (Bell and Pavitt, 1992; Marcelle, 2017). It equally incorporates activities that occur within state-owned enterprises and public agencies, in particular that are geared towards generating and using of knowledge. In addition, governing agencies that perform public policy-making and redistributive functions that support the provision of public goods as well as equitable distribution of gains, and steering activities in a particular way (Evans, Huber and Stephens, 2017).

The DGCF specifically targets a new cadre of national firms for new financing schemes from national owned banks – from this angle rents needs to be distributed based on production targets and learning. For these measures to be implemented, a coalition of national-minded people, in the professions, private sector and labour can be instrumental in applying pressure on the state in distributing resources. Other intermediary actors such as industry groups that seek to use knowledge with varying degrees of effectiveness in influencing policies (Watkins *et al.*, 2015). Finally, development institutions, which are normally considered outside the political economy, but have an interest in providing support and have been characterised as endogenous agents in this study, such as multilateral lending agencies and bi-lateral donors.

While the current configuration in T&T constrains the state in autonomously setting priorities, re-directing efforts, political mobilisation, carrying out technical work, and engaging with new ideas can help sensitise state officials along with actors identified above about pitfalls of the current approach and new possibilities. The current political and economic context where several resource-based economies are struggling with mounting indebtedness, diminishing revenues and low prices for exports can serve as a

window of opportunity for the political elite to act in developmental ways. For instance, the reduction in commodity prices may limit the fiscal space but such conditions may be seen as temporary by elites and may not marshal strategic public action. The emergence of new coalitions constitutive of the labouring classes which has played a historical role in demanding social changes and better working conditions. These coalitions can place pressure upon the political class and policy makers to undertake efforts at upgrading and transforming institutions accordingly. It all depends on the organisational capacity of these groups and whether ensuing material conditions motivate them to take action along these lines. It then becomes a question of ordering suitable reforms and negotiating the best possible compromises (Grindle, 2004), in terms what can bear results in terms of inducing capability-building efforts in the private sector and public agencies..

With these trade-offs and contingencies in mind, based on an in-depth understanding of the configuration of power among these actors, it can serve to determine creative ways to set an agenda and promote certain ideas. According to Best (2012, p. 122) ‘the knotty issue here is to give precedence to projects of long-term validity’. Priorities can be better outlined where there is consideration of the potential results and implications of particular actions, their feasibility, their relative time horizons for various actions (short, medium, or long-term), and under what conditions they will have the most impact. Selecting priorities is critical as the manner in which these projects are chosen in a small society can have, based on economic costs and bureaucratic capacity; large beneficial effects if successful or disastrous effects that can create instability within the society (Farrell, 1982; Roolaht, 2012).

More nuanced depictions suggest that in these countries macroeconomic shocks and fiscal crises, as the thesis has shown reorient patron-client relations and tend to undermine long term investments in capability development (Boodraj, 1995; Girvan,

Gomes and Sangster, 1983; Kattel, 2009; Roolaht, 2012) whose returns are believed to be uncertain and risky. Global governance structures are also sometimes inimical to their interests as these polities lack the political clout, human capacity and financial wherewithal to truly make impact except in blocs and in certain circumstances. From this angle, investment and interests need to be aligned in such a manner and relevant criteria made clear in advance and adapted over time that bring parties together in coalitions to pursue developmental objectives. T&T's state authorities have shown marginal capacity in bringing stakeholders together, but their interests diverge to some degree from the society that have prevented them in acting in a steadfast and productive manner towards achieving desired outcomes.

Politically, it means that in small multi-ethnic countries, given the sometimes extremely close links between some political actors and clients, and intense interactions such, priority-setting may be manipulated and reinforce certain types of political behaviour that discourages dissent and active engagement (Wilson, 2012). In the current environment, it is difficult to gain information on policy activities and in turn to diffuse new ideas. This may stymie active involvement by some members of civil society and ensure political control and information sharing capabilities are concentrated in a few hands. So-called market failures or 'information asymmetries' that arise due to differential access to information by among state-business actors (Stiglitz, 2002) are not easily reconciled with these logics. Stiglitz (2002, p. 461) argues that

‘[t]here are asymmetries of information between those governing and those governed, and just as participants strive to overcome asymmetries of information in markets, we need to look at ways in which the asymmetries of information in political processes can be limited and their consequences mitigated’.

This idea of a political market and the consequent institutional failure have been criticised as unrealistic, given that certain powerful groups may resist institutional change and there is no compensation for losers in this scenario (Khan, 1995). Instead we argue that the

‘silo’ effect witnessed in T&T where agencies do not share information forms part of the *socio-political* constraint that is historically rooted. According to one observer in the case of T&T:

In effect, once the electorate has cast its vote, it has no real role in the running of the country, even in terms of simply being informed. The electorate's only power is at the next polls. The lack of information, of education on the issues, and the subtle corruption of some lead to a political cynicism on the party choices of election candidates and hence reduces the electorate to either large-scale abstention from the exercise of the franchise or to picking from among parties which, in varying measure, already have been compromised by the contributors to party election funds (Pantin, 1991, p. 70).

It is manifested by information not being shared across agencies or relevant aspects for public scrutiny and input. It is in fact a consequence of the nature of social relations and the culture of politics inherited in part through the colonial process and further emphasised by the actions of the ruling elites. As Brereton (1981, p. 139) puts it: ‘the poor had no access to the policy-makers, while the propertied interests could lobby effectively’. Nowadays, access to policy-makers is based on ethnic clientelism and political-party financial interests. This status quo however can be challenged through the formation of coalitions of groups and people who are currently at the fringes and organised across class lines.

The small pool of talent and financial and other resources are also another important consideration, which means that the high cost of R&D may be outside the immediate reach of some agencies and therefore may not be a top priority in early periods of new activity. Other learning, skill formation and deepening absorptive capacity of firms in engineering and design activities can form immediate possibilities (Bell and Pavitt, 1997; Bell, 2009). Table 6.2 outlines a spectrum of possible priorities, related activities and the developmental needs that can serve as a starting list to prompt discussion and interaction among relevant parties. The very nature of technological

processes as long-term that transcend electoral cycles may offer some hope for different aspects of the problem of designing policy that can be implemented while keeping the overarching vision in mind. The clientelistic relationships that have emerged affect the public and private investment strategies of actors, with usually ad-hoc arrangements, but new ways of engagement and building partnerships even in such constrained circumstances need to be considered that deliver results. Attention to past efforts on low-profile projects which can be supported within fiscal resources, as well as the types of relational barriers that have blocked their implementation and wider diffusion in the economy (chapter 3). Specific regard to learning from historical patterns can be used as a basis for understanding the processes that will advance and initiate new mechanisms for structural learning.

Table 6.2 ST&I Priorities, Related Activities and the corresponding Developmental needs

Priorities of ST&I policy	Activities	Development Needs
Generation of appropriate technological solutions	Evaluation and rationalisation of basic and applied research	Expansion of skills and opportunities for citizens Reduced import bill
Development of technology sectors / high quality niche markets with high labour intensity (both low- to high-level skills)	Investigations into new uses of technologies, and subsidised provision of in-train products to private and public firms	Employment generation in new sectors
Deepening capacity for service firms and contractors in particular small-scale industries (e.g. repairs, tooling)	Contract-based partnerships between government and private firms for provision of labour and relevant incentives for upgrading	Creation of low to medium skilled jobs
Expansion of capabilities of new enterprises to absorb technological solutions from domestic market	Use of procurement and fiscal policy as a tool of ST&I policy	Output expansion and domestic linkages

Creation of linkages between service exports and domestic solutions	Revision of existing investment and related policies to promote linkages	New high-value service employment
Incorporation of indigenous practices and knowledge into new product niches	Analyses/Surveys of local activities e.g. creative industry sector to tourism	Expansion of technological learning capabilities and potential new niche markets
Educational and research opportunities aligned to specific commercial projects and sectors	Re-orientation of national research funds for support to technical students and defined prototypal projects	Expansion of productive capabilities and enterprise development

In all of these instances, the actors and institutions involved must be identified, with state agencies with relevant governance capabilities with relevant fixed arrangements that ensure that private firms and university partners adhere and report when necessary of shortcomings. Building upon existing professional or interpersonal relationships for research or commercial projects could prove useful between targeted actors and government agencies, but those that are purpose-driven. Performance should be the driving factor that promotes these arrangements. In sum, priority-setting and success criteria would be premised of the need to encourage participation of several groups in the process.

Mechanisms & Trajectories

To derive a suitable approach to governance of technological development, there are mechanisms of transition that need to be considered within the overall DGCF. They include: rent management systems – sources of subsidies and incentives, the procedures of rent provision (Ngo, 2016); power relations and dynamics – i.e. the position of actors in the system and the organisational locus of interactions; institutional pulses / arrangements – based on historical cues; and projects that respond to the development

vision and priorities outlined based on a deliberate goal-setting process. One important insight that is useful from a recent UNCTAD Report is that ‘institutional memory’ (UNCTAD, 2015), or what is more accurately labelled here as the conjunctures of ‘*institutional pulses*’ i.e. social life as a dynamic part of historical processes, breaks, and reformations in a society, matter for determining the causes of particular policy episodes (i.e. success or failure). According to the report, ‘looking inwards to assess and apply the learning of the country’s past as to why policies failed or what factors vitiated the policy processes helps to promote successful coordination’ (UNCTAD, 2015, p. xxii). Project selection then becomes part and parcel of this process and is often determined both by agents within the institutional apparatus that are brought together at any one time. In essence these mechanisms respond to the structural, technical and socio-political aspects of the governance system, and consider the historical experience as a critical variable.

There are conjunctures and historical episodes that reflect breaks from the prior trajectory. These have to be considered on a case-by-case basis on its own merit based on a clear and relevant historical analysis. In T&T, historical experiences suggest that the establishment of natural gas industries in the 1970s, the truck scale management system developed in the sugar industry during the 1980s, the collaborative industrial projects done by the Real Time Systems Group at the UWI from the 1980s, and the digital switching systems in telecommunications sector in the late 1980s, the coconut de-husker initiative by CARIRI, and more recently the revitalisation of cocoa research activities, are all developments that need to be understood and can be incorporated in learning modules and training activities. All of these below-the-radar projects incorporate state involvement and funding support, and involved external and domestic actors. The mechanisms such as state funding and their governance arrangements, private sector demand and contracting, level of external support, internal conflict and hierarchical decision-making and

foreboding alliances need to be understood as a source of learning to re-design and improve the design of relevant instruments that address these issues. They arise in specific historical and institutional contexts and each of these has contributed in different ways.

The exceptional cases mentioned in the previous paragraph can perform demonstrative roles in building historical study material and narratives to suggest that technological capability can be built under certain conditions. It can be used to build momentum among actors, and show the starting points, champions and other factors that contributed to their initial success and/or subsequent decline. The use of alternative search strategies for technological components, deliberate use of local personnel and capabilities, and creative negotiation strategies can be a priori set into arrangements with donors or external sources of funding. From this angle, the promotion of greater competition among donors and diversity of funding sources, as well as the requirement of mobilising internal resources can be given priority.

One candidate entity in T&T that has been revitalised and can be involved in these processes offering sufficient scope is CARIRI, in terms of its internal capacity, international networks and local staff. Besides, as noted previously its current expansive repertoire of commitments and projects can diminish its performance over time if capabilities are not enhanced simultaneously. In cases where appropriate, mobilising domestic sources of finance can replace donor funding through greater reliance on fiscal policies, including progressive taxation and post-performance prizes whereby firms are rewarded after undertaking technological upgrading (Khan, 2013). Scholars already argue that the nature and sources of funding are not neutral as they can affect the rate and direction of innovation (Mazzucato and Semieniuk, 2017). The cases of Poland and Turkey are instructive as EU funding was received in the former, while domestic sources

of finance were mobilised in Turkey (Szczygielski *et al.*, 2017). In Poland, the rate of innovation was much slower and donor investment less efficient, than in Turkey due to the different requirements attached to, and context-relevant purposes for which the funding was used.

All of these possibilities can appropriately support and be included into a DGCF learning and information processing system, which Trevor Farrell has called the *probensol* (Farrell, 1979) which has now come to be known as ‘strategic intelligence systems’ (Smits and Kuhlmann, 2004). This can help in discovering commodities and sectors that are burgeoning to adjust systems accordingly. An example of a nascent research and intelligence unit is at NIHERST that performs this function and in other agencies scattered across government. However, they are grossly understaffed, underfunded and uncoordinated, and cannot meet the needs to adequately carry out the analytical functions required to support the innovation policy development process. Investment into these functions is all however subject to political negotiations and processes of forming coalitions that can be stoked once actors internalise the value of ST&I within development strategies, and can mobilise effectively to influence appropriate agendas more effectively for the long term.

Implications

Within the overall framework, actors can be encouraged to think about the possible scenarios from different institutional and organisational configurations, though this may not be easily malleable, given the distribution of power and patronage system in force in T&T. The historical cues and experiences are important starting points to understand possible implications of present projects based on past efforts, whether they have failed or succeeded. It is understood that a tautological or one-dimensional view of

history can be problematic, as it can create deeply incensed political tensions among several actors. It must be based on a realistic, in-depth and dynamic understanding of historical periods and project cases and their effects, from which key aspects of failure, success and sustainability effective public and private action to be marshalled. Reform proposals can be derived from such a tool.

In this regard, a number of questions need to be posed to better comprehend the effects and usefulness of identified projects and modes of operation:

1. Does it represent the most appropriate use of local resources?
2. What are its effects on the natural environment and ecosystem (and other infrastructure, physical or social systems)?
3. To what extent do the terms and conditions do the terms and conditions of its implementation, operation, deployment contribute to the enhancement of local skills?
4. To what extent does it satisfy local needs, especially in terms of the quantity of required resources and concessions to the project?
5. How does it contribute to process of 'genuine' development, based on the articulated vision? (adapted from Girvan, Gomes and Sangster, 1983, p. 14)

These are not prescriptive but indicative of the considerations that need to be made when selecting and deciding to undertake particular projects. Understanding the initial conditions, the different conjunctures, actors involved and taking a long-term view of the process is a useful proxy for comprehensive feasibility studies, extensive vision documents or technical analyses (Grindle, 2004; Khan, 2015). Some technical work is required and assessment of various complex factors, but with the best-fit tools, including an orientation towards evaluation of, and social learning through documenting, and

exploring issues and experiences in their temporal, political and institutional context. These activities all depend on how the state intervenes in the present historical conjuncture, and the ability of the state to engage in the types of collective actions, strengthen new class formations and make beneficial compromises. This could create the likelihood of much more refined solutions and proposals that meet the needs of the society at large.

In conclusion, in the present dynamic environment where commodity-dependent countries' like T&T continue to suffer from weak demand, and parlous economic conditions subsequent to the global economic crisis. It is especially as the global development community has adopted the Sustainable Development Goals (SGDs)²⁹. In particular, small developing states are constrained in meeting all of these targets given their pool of technical expertise, the need for coherent public administration, and highly interwoven informal characteristics. Undertaking ST&I policy design and implementation integrated with a development strategy is difficult. The DCGF approach therefore can prove useful as its offer a range of relevant of normative possibilities based on foundational and empirically relevant insights that can match simultaneous efforts to improve democratic policy-making and advance a broad-based developmental agenda.

²⁹ On June 6-7, 2016, the UN hosted its inaugural forum on STI for Sustainable Development at its headquarters in New York City. The absence of any T&T official representation was notable. See: <https://sustainabledevelopment.un.org/TFM/STIForum>.

CHAPTER 6 – CONCLUSION

‘It is time to reclaim the right to development and the right of nations to engage in the international economy on their own terms. This implies an international rule-based order, which permits space for member countries to follow different and divergent paths to development, according to their own philosophies, institutions, cultures and societal priorities’. – (Levitt, 2005, p. x)

6.1 Summary

The study set out to ascertain the development of state capacity in the area of ST&I in T&T over the course of its post-independence period. It was determined that this historical process has been quite uneven, and the ability of the state to mobilise actors, allocate material resources, and carry out policy decisions were influenced by changes in the balance of forces in the society. These processes were further delimited by internal mobilisations and external influences that have had complex interactions and outcomes for ST&I policy development. The initial assumption that technological development had changed little over the course of history was debunked by review of the historical materials and secondary data. In particular, in the second decade of independence when social movements pressured the state into a particular developmental direction, while the oil boom of the 1970s, and the explicit policy focus on ST&I, led to institutional changes and improvements in social conditions more generally.

Secondarily the study examined the nature of interactions about the actors in the policy system, both domestic and external. It was understood that these have indeed changed and affected the pattern of technological development with various configurations, starting off with limited state that underpinned its early industrialisation drive, then to more proactive state impulses. Indeed, over time, starting from the colonial period there have been continuities in terms of building technical capabilities and

organising the bureaucracy through the ongoing pattern of patron client-exchanges among state, business, scientific and international development agencies, that are in the first two communities are ethnically-driven, and latterly determined through the access to resources, especially funding, informal ties, and nationalist ideology. There are however attempts at building relevant projects and skills in various state-owned agencies, but these are continually sparse and unfocused.

In the ongoing phase of policy-making where emphasis has been placed on ‘good governance’ and free-market competition, increasingly innovation systems approaches have been co-opted, due in part to its close association with the OECD during the rise of the Washington consensus and its relegation of key insights of development studies (Delvenne and Thoreau, 2016; Marcelle, 2017; Reinert, 2007; Sharif, 2006; Weber and Truffer, 2017). Innovation systems and institutional economics have come to be understood as mutually reinforcing, effectively creating a marriage of sorts (Weber and Truffer, 2017). Despite some of these welcome critiques, they advocate for a so-called adaptive approach to policy-making aligned to micro-foundations and role of actors (Flanagan and Uyarra, 2016; Marcelle, 2017). Even new calls for renewing IS approaches by salvaging the ‘useful’ elements with new actors or emphases (Weber and Truffer, 2017) seem to gloss over the contradictions within these areas and the political context of developing countries. They fundamentally do not regard the role of power relations among these actors in the policy sub-system that can generate uneven outcomes that do not necessarily improve social welfare. The thesis has argued that analyses and policy implications derived squarely from both approaches eschew historical dynamism, institutional diversity, power relations, and context specificity across the developing world.

In particular, in T&T, the use of these approaches has been quite prominent but often tricky and inconsistent because governing elites often apply the rules of the society quite distinctly from what is envisaged in the NIS. It thus has not borne intended results (Guinet, 2014). The constant comparison to advanced industrialised and newly industrialising economies that have become technological powerhouses is not only self-defeating but fulfils the narrative of vulnerability of small island states of some development scholars. In the field, it became clear that a lack of capabilities or institutions was not the major or only issue, but something else lay behind the lack of progress or so-called optimal use of resources and institutional mechanisms. Recognising deeper insights into how changes in socio-political processes over time have thus been the main thrust of this study.

The persistent low levels of performance in innovation and technological development in macro-economic terms and even at the firm level in T&T (Mohan, Strobl and Watson, 2016) that can give rise to the generation of new product spaces and new sectoral activity is therefore not accidental. Indeed, some researchers attribute this phenomenon to the so-called resource curse (Artana *et al.*, 2007; Auty, 2017; Khadan, 2017). This argument is not convincing on several accounts: first, there is a clear causality problem, where inferences about the negative effects of natural resources on growth and development confuse initial conditions with consequences and disregard political processes and social relations (Edwards, 2015; Rosser, 2006; Saad-Filho and Weeks, 2013). Second, resource curse explanations disregard empirical anomalies, including periods of positive growth and collapses in resource rich countries, leading to a historical reductionism (Jerven, 2015; Sen, 2013). In addition, less attention was given to the political economy factors that explain the configuration of the political settlement changes based on the development strategy and accumulation regime in force (Di John,

2011; Osei *et al.*, 2015). In sum, developmental outcomes are linked to political decisions and social relations in a given society that are historically constructed.

Industrial development has also historically been linked to resource exploitation (Mitchell, 2011), and in T&T has led to high levels of human development due to the determinant role of trade unions (Edwards, 2015). In terms of innovation performance resource abundance has shown to have divergent and discontinuous capability levels across time (Figueiredo and Piana, 2016). As the present study has shown, ST&I development is in fact consonant with policy approaches and institutional guidelines that are currently difficult to realistically pursue or to reconcile. They reproduce inferior outcomes and misguided public action as these approaches give only rhetorical attention to the lived experiences in a particular setting (Marcelle, 2017). ST&I policy-making rules have largely been set by international agencies and gradually filtered into the national bureaucratic system, and accepted by state and local actors as international best practice. The space for manoeuvring and defining wider scope for policy in the current period is that much more restrained.

Therefore, the market failure rationale of neoclassical economics, and even systemic approach of evolutionary economics and their hybrid forms (Andreoni, 2016; Bleda and del Rio, 2013; Khan, 2010b) do not adequately address the issues of development or the very problems they have in fact created and embedded (Bayliss, Fine and van Waeyenberge, 2011; Evangelista, 2017). More recent acknowledgment by a recent World Bank report the reasons why 'good' policies do not often work is due to challenge of powerful interests, but subtly suggest that market-friendly policies and outcomes such as convergence, efficiency and competitiveness are themselves desirable and possible (World Bank, 2017). Beyond the mainstream understanding, the study has widened the scope for policy action through presentation of the DGCF framework that

addresses the structural, socio-political and technical constraints in T&T to advancing technological, broad-based development.

It is not claimed that specific mechanisms for achieving development strategies such as economic diversification rest solely upon policy efforts in ST&I, but the latter do appear to have a great deal to do with it. In addition, taking account of the contradictions and anomalies that arise from the complex relations of technology, economy, social processes is an area that has been neglect in innovation research (Evangelista, 2017; Leach, Sumner and Waldman, 2008). Such considerations have been central to the study, and have borne out in the historical analysis, especially during the capital-intensive industrialisation phases in T&T's post-independence period. The study also does not intend to claim any specific authority in understanding the sectoral drivers that are certainly germane to diversification efforts. But given the small size of the polity, and the resulting monopolistic, multi-purpose role of institutions in these activities, it is not a great exaggeration to suggest that the evidence and conceptual arguments presented heretofore do impinge on the practice of economic development policy. Indeed new political configurations and refined institutional solutions based on the findings here might serve to guide new practices and possibilities.

Instead of presenting particular policy proposals, the study has endeavoured to advance a new interpretative framework, the DGCF, and the underlying rationale to possibly help generate new ideas and solutions. This unorthodox position is a challenging one to adopt given the desire and demands of policy makers for clear-cut solutions and formulae to address their intractable challenges related to technology. The study's methodological and conceptual approaches do not easily fit to formulaic prescriptions, simple-to-follow recipes, or step-by-step guidelines familiar to the Washington and post-Washington consensus to instigate social change and new institutional arrangements. It is

especially the case since political changes and networks of power are contingent and historically dynamic processes and configurations that proposing hard and fast solutions is not possible. It is also believed that some level of democratic engagement unlike the good governance ideal, or the unhelpful formal routines, must underpin solution-finding. It is because all knowledge is not confined to a single actor, and as it is acknowledge here that organisational power is much more diffuse than usually admitted by state officials, that further democratic input is warranted. It is hoped that the proposed governance framework for generating these modalities and potential interventions can be at its heart democratic.

Starting with the concern the paradox of why after creating and possessing the so-called set of 'right' institutions, the research evolved to look below the surface and symptoms of stagnation and dysfunction (see preface and chapter 3). Even after use of dominant frameworks such as innovation systems and rhetorical commitment to good governance by successive governments such as in Vision 2020 policy and thereafter, it aimed to delve into an institutional analysis. It sought specifically to understand the exact nature of the interactions among agencies and the reasons for the current under-performance in technological innovation. The study has managed to consider these problems along two axes: the governance challenge and the real nature and policy effects of interactions in ST&I policy in a development context. The specific emphasis on the state was critical and given more useful approaches like the political settlement or the social relational it shows the question of autonomy is difficult to reconcile in contemporary T&T.

In addition, an historical emphasis on policy and the state opened up new ground in light of the 'neoliberal counterrevolution' that has had deep and far-reaching consequences in this small society. Even as some critical scholars in discussing Caribbean

countries question the supposed sovereignty of the nation-state in small countries and worse for it to pursue a development strategy (Lewis, 2012; Bishop, Heron and Payne, 2012; Bishop, 2015). The thesis started off by posing three primary questions for investigation:

1. How have state capacities in promoting ST&I policies evolved during the post-independence period in T&T?
2. How do relevant agencies and /interests interact in formulating ST&I policies in T&T?
3. What are the institutional and political factors that shape these exchanges and the implications thereof?

The dominant paradigm used as an analytical device to design and implement ST&I policies has been put on the analytical radar, juxtaposing the NIS or innovation systems approach with political economy and developmentalist perspectives. The approach adopted in this regard was a political economy framework, which has been itself reflexively assessed and reformulated. The NIS was found lacking as a model that effectively takes the dynamic interactions of multiple players, in industry, the administrative bureaucracy and political arena, international institutions, and the university system. These interactions do not reach a point of equilibrium or are not necessarily path-dependent in a static sense, and have evolved over the course of time, which has generated past successes. The state has also been brought into relief, thanks to the adopted approach that consider the distribution of power. The state driven by actors from within has taken on different orientations, but has not been independent of societal interests and the international political economy.

In terms of the evolution of the governance arrangements, starting in the late 1960s, it represented a period of heavy state involvement and launched serious efforts and institutional development in ST&I. Although past policy research suggest that there were no explicit references to S&T policies (Lemarchand, 2010; Pantin, 1997), this study found that indeed from the late 1960s explicit attention was paid in the formulation of the country's third national development plan. In fact, as detailed in third section of the Third NDP focused on research, science and technology (Government of Trinidad and Tobago, 1968). This period was known for the active role played by government and the state apparatus in convening a number of committees and new state enterprises such as the Energy Task Force, chaired by reputed engineer Professor Kenneth Julien. This represented a shift from the dominance of economists in policy making and implementation to scientists and engineers in key state projects. According to a scientist who has been involved in advocating greater use of science at the national level:

‘It's been challenging to gain support or engage effectively with the private sector on S&T issues... The private sector needs to see how they are going to benefit. The government also needs to listen more to the scientific community and then we will see more progress’ (*Professor Emeritus, UWI*).

In the past, the government realised that technological development and resource-based industrialisation could not be left to market. It led to the establishment of several institutes including CARIRI and NIHERST targeting several sectors, including agriculture and industrial research, among others. Notwithstanding, its main sector, petroleum in which the government exercised some influence had already shown signs of technological dependence, with no plans for transnationals desirous of engaging in technology transfer (Farrell, 1979). This trend seems to have persisted over the last 50 years (Barclay, 2005).

It appears to be a similar situation in the sugar sector, when Tate and Lyle's Caroni Ltd. sugar plant was nationalised in 1975 – and technology was not transferred (Carr, 1983). Nevertheless, the deployment of the direct-reduced iron technology process for small scale steel production in Trinidad in this period was made possible by both local engineering skills and expatriate expertise. The state showed its ability to drive some aspects of its agenda and undertake a number of initiatives with majority ownership of companies (Pantin, 1987), by means of building developmental coalitions in industry, the university and international organisations. It however maintained much of its decision-making power at the investment stage. There were nevertheless definitely signs of weakness even at this point:

The one feature that stands out is the heavy reliance placed on foreign firms. The CTF (Coordinating Task Force) continued an approach originally developed by the IDC. In-house desk research identified potential commercial uses of natural gas. From this point, further detailed research was entrusted to foreign consultancy firms (Pantin, 1987, p. 316).

The adverse effect was seen first and foremost in the Iron and Steel Company which it launched on its own eschewing support from Japanese and German counterparts (Ramlogan, 1985). Nevertheless this period represented the most promise in terms of state effectiveness in ST&I policy, but this soon disappeared.

In contrast, the 1980s and 1990s were a period of significant reconfiguration of state power, relative to other interests such as transnationals and the international lending agencies. The state found itself indebted on account of the dramatic decline in commodity prices and rise in US interest rates after undertaking several industrial projects. The rapid divestment of state assets that were deemed unprofitable in the late 80s and early 90s and the focus on macroeconomic concerns removed explicit technology policy from the agenda. There was still some interest in technology transfer, albeit it was deemed that this could happen almost automatically and through arrangements between technology-

acquiring firms and technology-producing firms. The domestic cohort of industrialists showed greater influence as economic conditions changed, and policy seemed to reflect more and more their interests (Industrial Development Corporation, 1987). Increasing inflows of foreign investment and export promotion ensued, while existing S&T institutions were increasingly marginalised and de-funded. Agencies like CARIRI increasingly lost government funding and were strategically restructured to focus on clients within the hydrocarbon sector. The government basically provided the supportive institutional framework and continued its stream of incentives to existing profitable sectors and businesses. Overall, government policy shifted towards the increased demands of the IFIs who required certain terms and conditions in accession of structural adjustment loans. As a result, institutions were not oriented to supporting the accumulation of new technological capabilities and the pool of technical skills were redeployed to the hydrocarbon sector, or were almost lost entirely through emigration.

The next two decades witnessed additional shifts towards a private sector development paradigm in which the government sought to step back from domestic economic activity and allowed individual companies to take the economic lead. Investments in social infrastructure during this period created certain compulsions for private sector growth in energy sector. In fact, new investments in energy and natural gas processing, exemplified by the Atlantic LNG Trains I-III, were undertaken with favourable tax incentives for private transnationals. Favourable external conditions and increases in commodity prices enabled economic growth of close to 8 per cent during the period 2000 to 2008. Subsequently, the global financial crisis led to a collapse of demand from traditional markets, especially the United States. Vision 2020 the rubric under which the government promoted private sector-led development and good governance did not ensure enforcement of proposals. New schemes such as the R&D Fund received little

uptake. University research also increasingly focused on economic incentives towards commercial ends. Any development-oriented research faltered as there was no direct state support or strategy for development of research activities until 2005.

Though the Vision ST&I Committee was instrumental in bringing together a diverse set of interests and reaching the point of designing a draft policy with proposed enabling legislation, it was located outside of the bureaucracy. Bureaucratic interests took precedence on what aspects to be pursued, elaborated and implemented, especially vested interests at NIHERST who saw their institutional presence as being threatened. The demanding thrust of the Vision 2020 report did not appear to attract sufficient administrative, business and political buy-in. Governance agencies also appeared not to compel a new growth trajectory. The market-oriented underpinning of the report circumscribed state involvement to basic research, infrastructure and supporting institutions – while private enterprise was expected to take the lead. The latter however did not materialise as envisaged and the report was not eventually carried forward to the Parliament. The coordinating capacity of the state was apparent, but the implementation capacity to ensure credible commitment was very weak (Sen, 2013).

Moreover there is perception even among key decision-makers and observers that there is very limited reinforced by the research originating from the multilateral agencies. The approaches to ST&I also limit analysis of the state and of historical episodes. For instance, two recent studies on industrial policy T&T by leading economists hardly even mention technology issues as separate concerns (Farrell, 2012; Mottley, 2008). Additionally, history and political events are considered as background material to the analysis, which may presumably arrive at pre-conceived conclusions and weaken the analysis. These aspects are not integral to the methodological or theoretical approach adopted and are often associated with neoclassical economics and neo-institutionalism.

And it is often very narrow by way of policy conclusions. For more critical scholarship, in the case of dependency scholars (Best, 2012), there are no historical anomalies or micro-level dynamism is underplayed, leading on most occasions to conclusions about technological backwardness. Another account plays particular attention to technological outcomes with ideal-type institutions deemed necessary for greater policy effectiveness (Barclay, 2015). This perspective pays little attention to the historical evolution of T&T society in line with the processes of accumulation and social pressures, nor to the minutiae of institutional dynamics, while the political costs of institutional change and the process of transition of technological and innovation capabilities are outside of the discussion (Andreoni, 2014; Bell and Figueiredo, 2012; Khan, 1995) .

Moreover the political centralisation of rents and rent-seeking activities under the PNM during the early from the early post-independence period up to 1986 provided the environment for improvements in technological capabilities and growth. The 1970s opened up the possibilities of clientelism as the state's legitimacy was increasingly being threatened and because of alliances formed between the ruling PNM at the time and certain sections of the capitalist class. The 1990s and 2000s thus facilitated a form of competitive clientelism as factions in the society depended upon the state. What these shifts meant especially from the late 1980s is that economic conditions created compulsions for the use of fiscal power for maintaining electoral support, and limited moves toward longer term shifts in the production structure. The implementation of policy efforts was limited and compromised by market-driven economic principles that create islands of activity and chasms among government and the private sector and scientific community, the latter of which previously had a more influential position in policy-making.

The nuanced approach to the state adopted throughout the study offers a macro and micro-level picture to state-non-state interactions and innovation occurring based upon state investment activities. Innovation activity therefore is not seen as the special preserve of private firms and not necessarily state or public enterprises as mainstream analysts question the efficiency of said entities. Emerging actors such as industry associations and international development agencies are also not viewed as endogenous to the national political economy of this developing country. Given its size and limited technical capabilities at its disposal, though the latter is much improved over the course of history, the research shows that increasing reliance has been placed upon external and domestic institutions for knowledge and capital that meet the demands of current market-driven governance regimes. Even within these constraints, domestic agents driven by political factors and motivations have played an important role over time in first placing the issue of ST&I policy within the development agenda, and helping to bring some level of coordination in devising policy.

The precise influence on policy-making of much of the domestic private sector is in question, even though members of the private sector formed the CCI, but were in contestation with the bureaucratic arm; the state nevertheless continues to act in the market's interest, especially to attract foreign investment in energy-related industries. However, some parts of the private sector especially the energy sector has exerted some influence in the policy-making process and has shifted certain decisions in its favour, such as the inclusion of energy service sector in the draft NIP, firmly supported by the IDB in this regard. The thesis thus concludes that present governance capabilities are presently more stymied compared to previous periods, in respect of driving efforts of firms and public agencies to improve their technological capabilities, or to even trigger the emergence of a new cadre of productive enterprises. Notwithstanding this, the

research and academic experience have shown some promise in past periods that could be marshalled and public investment measures used to create much needed demand (Bell and Pavitt, 1992; Edler and Georghiou, 2007).

The relative small size of the economy and society also herald peculiar political orientations. In particular, in contrast to scholarship that emphasise high levels of social capital and harmony (Ocampo, 2002; Streeten, 1993). For instance, at the William Demas Memorial Lecture in May 2002, José Ocampo, former Executive Secretary of the Economic Commission for Latin America and the Caribbean asserted that:

‘it can be argued that small economies have both advantages and disadvantages, in particular disadvantages relating to economies of scale, less diversification and macroeconomic policy autonomy, but also –at least potential— sociological and political advantages in achieving greater social cohesion’ (Ocampo, 2002, p. 1).

The empirical findings do not bear out this assumption, as intense factionalism has been seen at the macro-political level and within organisations seen at the University in the 1980s and at NIHERST more recently, that have had effects on curtailing progress on projects and policy development. This is further intensified by the role ethnicity has played in the political landscape where contests for state control have led to resources directed in particular ways to firms and party supporters. Size is less significant in terms possessing or developing the capabilities to innovate as shown in several sectors, including iron steel, telecommunications, natural gas, and agriculture. The potential for diversification during earlier periods was clearly shown, and claims to the contrary are either ideological or based on Ricardian trade theory. In fact, the lack of diversification is not an accident of history or a natural feature of smallness but result from historical, economic, political and institutional drivers and processes. Included here is the interference of forces from the international political economy which have undermined

past diversification efforts. These empirical findings have given way to the theoretical extension of the political settlements framework to an approach which eschews equilibrium as previously noted above, and that incorporates the international economic context. Networks of power has been proposed as an appropriate conceptual device to take account of these interactions in the present-day ST&I policy subsystem. It serves as the basis of the proposed governance framework in the previous chapter – a policy design and implementation approach for idea and solution generation and for thinking through implications of past case histories and policy outcomes.

The study has also engaged more fully with the so-called competitive paradox that has emerged from the global ranking and institutional processes in T&T, where even despite many market reforms over the past thirty years and new classification as an ‘innovation-driven’ economy. Despite reclassification by the World Bank, and now the WEF competitiveness reports, the country’s economy still strongly feature a resource-driven comparative advantage. This conclusion allows the IDB and other analysts to continue promote private sector reforms with ‘active’ state intervention and vigorous political rhetoric for only improving the business climate so firms can become more globally competitive (Donhert *et al.*, 2016)– truly ahistorical and de-contextualised proposals. As a result, the new thrust for innovation-driven prosperity linked to so-called people centred development between 2010 and 2015, very little is in evidence that such has or could be achieved under current state-society relations. In the final analysis, though the state has shown some marginal improvements in technical capabilities, its overall capacity to direct resources and provoke new coalitions inspired by a long-term horizon is mired in political and institutional fragmentation and a patronage system that rewards clients based on social ties than improved performance. Supply-side approaches to policy-making has shown to be ineffective (see chapter 3 for the case of ISCOTT and chapter 4

for the Tamana Technology Park) and has increased demands for rents from several quarters especially the business community that are not based pre-determined innovative performance indicators. Current fiscal problems and political compulsions for creating new institutions to replace old ones when they appear dysfunctional without changes to the political settlement will not be effective. A lack of systems and policies that emphasise a demand oriented approach has limited what Farrell (1982, p. 14-15) has referred to as productive flexibility – that is the ‘the ability to perceive what commodities are ‘comers’ in international trade, in decline, and the development of the capacity to shift one's economy out of the declining sectors into the burgeoning ones’.

In sum, the evolution of policy capabilities in ST&I strategies and institutional changes do not represent a linear process of learning (Borrás, 2011) or the rational design of policy instruments (Borrás and Edquist, 2013). If one were to consider these conceptualisations as true in every circumstance, one would assume based on the synchronic nature of innovation systems research that very little learning and structural change has occurred. However, the historical analysis has shown that policy and institutional changes were provoked by a nexus of factors, especially leadership responses to external social and economic pressures. The critical junctures for change catalysed PNM leadership on the one hand, and later other administrations such as the NAR and PP to carry out a variety of changes for the better and worse. The critical insight here is that political events given the nature of state-society relations and economic system give rise to structural learning episodes and new productive efforts (Andreoni, 2014). In consequence, there is a pattern of nonlinear interactions between the material, the social and the ideational factors that are causally interlinked and mutually reinforcing. In other words, increases or declines in material conditions affect/are affected by the possibilities of new ideas emerging and in turn impacts/are impacted by the socio-political

configurations. Ultimately, the lesson here is that social relations impact on technological changes that can produce the incentives for technological upgrading activities at the national level.

6.3 Limitations and future research

This study has only tipped the iceberg in respect of understanding the variegated dynamics of ST&I policy making and its outcomes. In particular, the actual relational power struggles that underpin policy processes, and how governance evolves over time in particular constrained circumstances. Given the well-known limitations of the case study approach, the insights and issues raised may not be generalisable to other developing countries and other policy sub-systems. The in-depth historical approach has enabled the establishment of causal links and enabled informed inferences to be made about the case country in particular. The approach is not able to give adequate reasons for any lack of development or better development performance across countries, except in specific set of institutional circumstances and social relationships. Indeed, from this perspective relationships mattered in the research setting and pre-existing encounters or relationships facilitated access to particular documents or informants. This was indeed reflective in the findings.

It does not establish correlational relationships in this regard, whether better policy-making would lead to more superior development outcomes. The questions addressed were not about optimal policy outcomes but about understanding the relationships fostered, the mechanisms, their historical evolution and discussion of potential implications. The study however does not consider the precise role of other constituencies such as labour and civil society, does not make the argument that its inclusion may necessarily change the conclusions made. This is because of the weak

power of civil society in the current period compared to earlier times and the nature of current social pact where labour unions are fragmented and from recollection, have made little reference to S&T issues. Besides, the specific dynamics of labour, trade union representation and the wider civil society groups can deepen insights on state-society relations and democratic embeddedness of the policy process and to gain more specific understanding of awareness of ST&I issues. Incorporation of these additional groups into the framework may also address certain questions on agency outside of specific focus on the state. It would certainly add new dimensions and emphases to the analysis and ongoing critical scholarship.

Additional scholarly work can investigate the relationship between the state and labour in the technological development processes and outcomes for firms with different configurations of labour power in different comparative settings. It can in particular include labour as a constituent group, which was not possible here given certain refusals to disclose information about groups and representatives consulted in the policy development process. It would also be interesting to apply the governance framework to particular settings and compare different institutional and political environments to understand how developmental coalitions emerge in ST&I policy, or not.

Finally, a major constraint of this study is that there were no other competitive sectors apart from oil and natural gas in the case country. Further study can look specifically at these dynamics in a particular sector, albeit for a small country some of the same institutional actors and activities might be impacted, but the significance of industry-level studies cannot be understated. Specific technological and sectoral domains can also be pursued to understand the kinds of institutional arrangements and the policy process that are embedded. Specific sectoral analyses are also required and are

worthwhile additions for future research, especially in the area of renewable energy, an area that current government leaders have recently pronounced as an area of priority. In light of the Sustainable Development Agenda, this would be useful. It also sets the framework for comparative political economy studies of sectors as well as at a macro-institutional level across countries of similar size or different levels of development. It is hoped that this is useful advice for tangents that can be further developed and examined in future scholarship.

6.4 Concluding remarks

In the final analysis the study has shown that the need for new ‘directional thrust’ of state action (Wade, 2014) . Evidenced by the historical analysis, the political dynamics and institutional rules that typify the T&T society have elucidated the ways in which clientelistic politics and institutional arrangements may have solidified a particular pattern of development. Equally relevant is that historical moments for improvements in welfare and institutional changes conducive of development require social mobilisations. In the current moment, the state does not have the capacity or disposition, as policy makers, advisers and media, and academic community in the country have closed ranks, and the state does not have the legitimacy or disposition to ensure credible commitments to long term agendas. Its bureaucratic capabilities are being fashioned according to the compelling thrust to implement off-the-shelf business climate reforms than an appreciation of the power structure and conjectural opportunities that current socio- and geopolitical configurations may offer to policy entrepreneurs or political elites.

This is the reason why a new approach that considers these dimensions and intractable constraints appear increasingly important. As represented by the DGCF, intrinsic to the processes of change is a social awareness and greater movements to

imbibe democracy beyond electoral contests. The DGCF offers a prism through which to organise democratic efforts to challenges the effects of neoliberalism on the state-society dynamic. The approach outlines mechanisms through which state capabilities can be improved to successfully deploy policy instruments and enact a hegemonic vision for employment-generating growth and advance basic needs of the society. It specifically seeks to address the structural, technical and political imbalances in developmental processes. It also endeavours for new institutional pathways across the productive, bureaucratic, and political and knowledge systems based on in-depth understanding of past failures and incremental successes, and where there are opportunities for public actions to prioritise broad-based technological development.

Indeed the new Sustainable Development Agenda and the SDGs represent global commitment to such an outcome, but as has been recognised by some scholars, they must be approached on a differentiated basis based on countries' level of development (Andreoni and Chang, 2016). If long-term sustainability is to be achieved it may require a consolidation of mass interests to bolster new directions of state power not only in service of the market or macro-economic fundamentals, but to pursue S&T development. This would entail a more in-depth study of state effectiveness related to the channelling of resources, nature of information and resource flows and how bureaucratic systems within critical agencies and across networks of actors can be differently coordinated. These issues could potentially enhance economic performance, transformation of the economy, by neutralising volatile macro-economic effects, and generating new productive employment.

In effect, this study has problematised a topic of interest to both the scholarly and policy communities in the developing world, with specific case analysis of T&T over

two-time periods as part of the wider historical trajectory of the country's development. It is a popular topic for the many discoveries and interests in new technologies, like synthetic biology, renewable energy, new materials and 3D printing, among others. The nature of these innovations and the social changes that they bring about can trigger immense marvel and commentary about their potential in countries of the Global South, in particular T&T which is a significant importer of technology.

The process of more in-depth thinking about these social processes and issues that underpin the process of technological change can lead one to conclude that the division of labour in many respects still remains distorted in favour of industrialised and newly industrialised regions, especially larger countries. Though it has international appeal, it appears that immediate circumstances may crowd out new ideas and ways of addressing technology and governance issues that are internal to the state and its appendages and external in terms of the present economic and political conditions post-2008 global economic downturn. The lessons of this period will remain with many scholars and policy makers, but the risk of remaining in stasis or comfortable with existing ideologies and paradigms, like the NIS, is ever present, given the great deal of capital and institutional commitment at a high-level in the 'belly of the beast' as it were to promote and diffuse them.

The current policy paradigm to ST&I policy that more or less leaves technological development up to the market based on an inadequate understanding of the capabilities of firms, public organisations and the wider society. Based on external diagnostics and conceptualisations of the role of the state and of technology in the development process, there have been important affronts at the margins on the neoliberal development paradigm, even by insiders at the IFIs (Ostry, Loungani and Furceri, 2016; World Bank, 2017). Indeed these critiques may not go far enough in light of the resilience of

neoliberalism as the current stage in the process of capitalist accumulation that has particular enduring institutional characteristics (Fine and Saad Filho, 2014; Khan, 2007). As Maurice Obstfeld, IMF Chief Economist has described ‘the process (of rethinking macroeconomic and financial policies) as evolution, not revolution’ (IMF Survey, 2016).

These debates in fact seem remote from the realities in T&T, as policy decisions at least over the past thirty years have taken on a path-dependent character. To this, multilateral institutions have made significant contribution, through their interactions and requirements of domestic policy-making organisations do not seem to accept the need to broaden perspectives (Navarro, Benavente and Crespi, 2016). Increasing amounts of multilateral donor funding is being spent on research on innovation, at the exclusion of appropriate reflection on these relationships and how it really impacts on the political environment. In fact serious questioning of the paradigm is ongoing, but in small societies where the degree of separation from business, the international organisations and politicians leaving policy making teams impervious to external critique. In these circumstances, it is very difficult to infiltrate these ‘old boys networks’ and generate new ideas that would serve context-specific needs. The impetus for changing these networks of power should therefore come from the within the T&T society.

In addition, T&T’s external relations are bound to be more dynamic, not only for the fact of depressed energy prices and increased productive capacity of energy in the United States, which by themselves are significant threats. But the current international relations environment is increasingly unpredictable, with the new President of the United States, the British vote to exit the European Union. Both events could have decisive effects on the country as the United States is a major recipient of T&T’s exports, and the EU serves as an important source of funding for innovation activities and bilateralism,

which is currently in abeyance or under threat. History shows that T&T is not immune whatsoever to these developments. The rise of right-wing politics throughout Europe, Latin America and elsewhere T&T should not only receive the attention of policy-makers and their potential effects on trading relationships and ultimately the local society and politics. In the area of ST&I policy and more broadly development, the effect of ongoing changes in trading patterns and rhetoric especially from the US administration for changes in its international relations. These aspects can have potentially profound effects on T&T. The jury however is still out on what they mean in precise terms for technological improvements and productive transformation of the economy. Only time will reveal the truth, but scholarship and research need to proactively tackle these concerns.

The prospects for improved performance in ST&I in T&T bring into stark relief the content and intrinsic nature of such policies and processes, the political situation and the institutional capabilities to pursue development strategies. To mount a challenge to the continued fixation on technocratic fixes or equally myopic market-promoting policies, would be no easy task for heterodox political economists. It may likely take a lifetime's work to shift gears and attention of policy-makers and the international development structures to new ideas and approaches. It is not suggested what is proposed here would necessarily solve all of the challenges in T&T, but the effort to delve more deeply into social formations, and insight gained from policy-oriented studies is a humbling and fulfilling task in itself. The journey to deepen these insights, restructure power relations through democratic processes beyond formal elections, and gain further knowledge into new possibilities has only indeed just begun. It is hoped that this study would make some contribution to this long-term effort.

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APPENDICES

APPENDIX 1- SOAS RESEARCH AND DATA CONSENT FORM

Project Description

This section provides you with information about the SOAS research project in which you are participating, and how the information which you provide to the project will be used.

Project title:	<i>Growth Dynamics in small economies: the political economy of innovation policy and productive transformation in Trinidad and Tobago</i>
Project coordinator:	Mr. Keston Perry % Department of Development Studies, SOAS, University of London
Project objectives:	<ul style="list-style-type: none"> • To identify and assess the institutional factors that contribute to growth-oriented development strategies, specifically science, technology and innovation (STI) policy in Trinidad and Tobago. • To deepen understanding about the policy process, relationships and inter-organisational dynamics among various stakeholders in the development ecosystem i.e. government, private sector, key experts and international development agencies as they relate to their relative involvement and agency. • To better give an account of the reasons for the degree of effectiveness of STI policy as it relates to the political context and micro-level factors in the Trinidad and Tobago economy.
Reasons for data collection:	Your involvement in this research project is vital in gaining and advancing knowledge on relevant strategies for economic development in Trinidad and Tobago. Any information collected will be used for the researcher's doctoral thesis and any resulting publications.
Data recipients:	No institution or individual will have access to non-confidential data apart from the researcher, his supervisor and academic mentors, unless otherwise provided for in the UK's Data Protection Act.
Countries to which the data may be transferred:	Data about you gathered in the course of your participation in this project may be transferred to countries outside of the present site for purposes connected with this project and similar future projects, subject to appropriate safeguards to protect the security and confidentiality of your data.

Security measures:	The data will be stored on password protected devices and computer equipment, with relevant names anonymised, only accessible to and identifiable by the researcher.
Methods of publication:	Data gathered in the course of this project will be published via academic journals and relevant academic publications and policy documents.
Methods of anonymisation:	The data collected will be kept <u>strictly confidential</u> and names will be anonymised in transcripts by using initials. Pseudonyms may be used for reference purposes.
Archiving:	The thesis may appear online via SOAS research online portal and other outlets, with only anonymised references to research participants.
Future use:	<p>Data about you gathered in the course of your participation in this project may be used in similar future research projects, by researchers at SOAS or elsewhere. We cannot predict all the ways in which your data may be used. However, any specific future projects where it is intended to use your data will be described below.</p> <p>Data gathered in the project would contribute towards academic articles, chapters and even the publication of a book in future with <u>only</u> general reference (e.g. job title or group member such as private sector stakeholder) to identity of participants.</p>

Data Protection Statement

Information about you which is gathered in the course of this research project, once held in the United Kingdom, will be protected by the UK Data Protection Act and will be subject to SOAS's Data Protection Policy. You have the right to request access under the Data Protection Act to the information which SOAS holds about you. Further information about your rights under the Act and how SOAS handles personal data is available on the Data Protection pages of the SOAS website (<http://www.soas.ac.uk/infocomp/dpa/index.html>), and by contacting the Information Compliance Manager at the following address: Information Compliance Manager, SOAS, Thornhaugh Street, Russell Square, London WC1H 0XG, United Kingdom (e-mail to: dataprotection@soas.ac.uk).

Copyright Statement

By completing this form, you permit SOAS and the project coordinator to edit, copy, disseminate, publish (by whatever means) and archive your contribution to this research project in the manner and for the purposes described above. You waive any copyright

and other intellectual property rights in your contribution to the project, and grant SOAS, the project coordinator and other researchers a non-exclusive, free, irrevocable, worldwide license to use your contribution for the purposes of this project and similar future research projects.

Research Participant Declaration

I confirm that I have read the above information relating to the research project. I consent to my information being used in the manner and for the purposes described, and I waive my copyright and other intellectual property rights as indicated. I understand that I may withdraw my consent to participate in the project, and that I should contact the project coordinator if I wish to do so.

Name:

Signature:

Date:

APPENDIX 2 – INTERVIEW GUIDE (SEMI-STRUCTURED)

Relevant stakeholder groups and questions

Policy official / bureaucrat / policy committee member

1. What do you understand by science, technology and innovation? How can policy influence innovation?
2. How did you get involved in STI policy? What is your professional experience and background?
3. What is your role in policy formulation in STI? What is the overall objective and mandate being pursued in the policy?
4. What has been the progress made in this area over the years?
5. What are your impression of past policy efforts? What are the key lessons?
6. How have you monitored progress from the past policy efforts to the present one?
7. What have been these outcomes?
8. What is organisational relationship with other agencies and bodies (e.g. implementing agencies, CARIRI, Ministry of Planning, business associations)?
9. What are the internal relationships and factors that shape the process? How do these influence the outcome?
10. How do you believe STI policy can specifically support economic growth and transformation in Trinidad and Tobago?
11. What other stakeholders are involved in the STI policy process?
12. How do you engage with entrepreneurs and the private sector? What is the involvement of the scientific and research community?
13. What are the political/external factors that influence the goals of STI and the design and implementation process?
14. How do past policy efforts relate to the present draft document? What were the challenges?
15. What are the present political and organisational challenges that impact policy design in this area?
16. In what ways does your organisation participate in public policy formulation, especially related to economic policy on areas such as science, technology and innovation?

Politician / Former minister

1. During what time did you serve? What were the policy objectives? How did the political environment impact upon these objectives?
2. What was your role in STI/economic policy?
3. What is the involvement of political party / stakeholders/ constituents in policy formulation? How are they engaged?
4. What were/are the political goals and objectives of economic/STI policy?
5. How do political and national objectives relate to each other?
6. What are the factors to be considered when proposing policies?
7. How did you manage various interests? And what were the implications for policy directives?
8. How are projects / policies prioritised? What are the major considerations? Budget allocations?
9. How did STI factor in your tenure/ term of office?
10. What other groups / factors influence these policy processes?

International/Regional Organisation representative

1. In what ways has your organisation supported or been involved in economic policy making in Trinidad and Tobago?
2. What specific goals do you have in offering such support?
3. How do you engage with local groups/ government organisations/private sector in the pursuit of these objectives?
4. How has your experience been engaging with government and private sector groups in this area?
5. How would you evaluate your influence over time? Please elaborate.
6. What particular goals have been achieved/ outcomes? How was this meaningful or not?
7. What challenges/drawbacks have you faced in the process?
8. What external factors influence the progress / outcome of your support/involvement?

9. Specifically, in the area of STI has there been any particular observations as regards policy design and effectiveness?
10. In what ways does the organisational and external political environment influence your involvement, and the outcome of such involvement with stakeholders (especially government)?
11. What changes do you believe are necessary for the process? How do you think these changes can be effected?

Business Association representative

1. In what ways has your organisation supported or been involved in economic policy making/ development strategy in Trinidad and Tobago?
2. What are the key challenges your members face? What are the factors that contribute to those challenges?
3. What specific goals do you have for participating? How do your members view this process? How do you involve them?
4. Have your members benefited in any way through participation? What are these benefits?
5. What economic sectors does your organisation support?
6. Specifically, in the area of STI have there been any particular observations as regards policy design and effectiveness?
7. How does your organisation engage with government departments/ other enterprises/ international organisations in the pursuit of these objectives?
8. What are the key areas that innovation policy should address?
9. Describe your experience engaging with government and other groups with respect to economic development policy.
10. How would you evaluate the effectiveness of such engagements over time? Please elaborate.
11. How would you describe the effects on the sector you're involved in? In what ways have your members benefitted from government action?
12. What particular goals have been achieved/ outcomes? How was this meaningful or not?
13. What challenges/drawbacks have you faced in the process?
14. What external factors influence your involvement?

15. In what ways does the organisational and external political environment influence your involvement, and the outcome of such involvement with stakeholders (especially government)? How do you decide to get involved?
16. What changes do you believe are necessary for the process? How do you think these changes can be effected?

Other stakeholder representatives

1. How did you get involved in the STI policy process?
2. *How has/does your organisation contribut(ed) to previous and present efforts in STI policy making? Describe your involvement.
3. What are your interests/objectives in the science, technology and innovation policy process?
4. What are some key problems that need addressing?
5. What are some key considerations that would contribute to the success of policy efforts?
6. What are your interests and/or objectives in this process?
7. What are your impressions about the consultation process?
8. *How do you evaluate past policy efforts? What are some important lessons from these consultations?
9. *What are the key contributing factors that have influenced their performance?
10. What are some of the problems that need addressing?
11. What are the challenges faced by your group in engaging with government and other stakeholders on policy matters?
- 12.
13. What other key factors influence the process of consultation in which you were involved? Do these impact on the quality of policies and their effectiveness?
14. What changes in your view are needed to the consultation and policy process? What factors do you think would impact upon these changes?
15. What are some key considerations that would contribute to its success?
16. Any further comments on your involvement, the process or its implementation?

N.B.: * for persons who have been involved in past efforts.

Other key past officials (state enterprises etc.)

1. Please give me a bit of your background and experience in science technology and innovation and how you became involved at the state enterprise.
2. What was your role? How has your background contributed to that particular venture?
3. What were your key interests/reasons for involvement?
4. What were some of the ongoing efforts and relationships forged to establish and operate the enterprise? What was the main contribution(s) of the enterprise overall?
4. What was the level of success in this particular technology/ operation? Who developed in? And who were the main contributors? What were the key characteristics about it in T&T compared to other jurisdictions? What were the key factors that influenced performance?
5. How was it deployed locally? What was the level of local input/foreign input? On average, how many other local technical staff involved? And what areas of skills did they possess?
6. What were the reasons for the enterprise's level of performance? What were the main issues faced?
7. In what ways did the state engage with technology providers/ external parties/ private sector/ other national groups and organisations? Who was responsible for managing these relationships? (university/ research sector relationships?)
8. How would you evaluate efforts at building capabilities in the local enterprise / state entity and associated entities?
9. What other groups had a key role? What was their contribution to efforts?
10. In what ways does the external political environment influence its ability to contribute in this area? How did policymakers contribute?
11. In the present environment, what are some of the key challenges faced by the business / state sector with respect to innovation?
12. Any further comments on your involvement, or lessons that were learnt in organising the enterprise, in particular the use and development of the technology?