



A University of Sussex PhD thesis

Available online via Sussex Research Online:

<http://sro.sussex.ac.uk/>

This thesis is protected by copyright which belongs to the author.

This thesis cannot be reproduced or quoted extensively from without first obtaining permission in writing from the Author

The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the Author

When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given

Please visit Sussex Research Online for more information and further details

**Organisational Capabilities for
Science, Technology and Innovation Policy Formulation in
Developing Countries:
The case of Nigeria's Federal Ministry of Science and Technology**

Chux Uzoka Daniels

A thesis submitted in partial fulfilment of the requirements
for the degree of

Doctor of Philosophy
in
Science and Technology Policy Studies

September 2015

SPRU – Science Policy Research Unit
University of Sussex
United Kingdom

I hereby declare that this thesis has not been submitted, either in the same or different form to this or any other University for a degree.

Signature:.....

University of Sussex

Chux Uzoka Daniels

Doctor of Philosophy in Science and Technology Policy Studies

**Organisational Capabilities for
Science, Technology and Innovation Policy Formulation in Developing Countries:
The case of Nigeria's Federal Ministry of Science and Technology**

Thesis Summary

It is widely accepted that public policies have an important role in driving science, technology and innovation (STI) initiatives in order to achieve socio-economic and development objectives. Nevertheless, previous research reveals that developing countries still face difficulties in formulating policies to support and promote STI. A possible reason for this is found in the apparent lack of capabilities for policymaking.

Capabilities are "a precondition for effective policy formulation in developing countries" (UNIDO, 2005, p.16). However, our knowledge and understanding of what these capabilities are, remain limited. In this thesis I examine the roles that capabilities play in formulating STI policies, the development of these capabilities and their evolution over the years. I group policy capabilities into organisational capabilities – which refers to policy processes and routines – and individual capabilities – which refers to the skills of individual policymakers (Nelson and Winter, 1982; Dosi et al., 2000; Feldman and Pentland, 2003).

In order to address the identified gaps in literature, I use the Nigerian Federal Ministry of Science and Technology (FMST) – which in 2012 completed the formulation of a new national STI policy – as an illustrative case for the investigation of these issues. To achieve the aim of the thesis, I address three research questions: (1) What roles do capabilities play in formulating STI policies at FMST and why? (2) How did policy formulation capabilities originally emerge at FMST and why? (3) How have policy formulation capabilities evolved (i.e. changed over the years, from 1986 to 2012) at FMST and why? To collect data, I interviewed key staff at FMST and stakeholder organisations (who participated in the STI policy formulation exercise), in addition to secondary data from relevant policy documents. The data analysis was based on the "explanation-building" technique (Yin, 2009). The findings reveal the various roles that policy capabilities (processes, routines and skills) play in policy formulation; how and why policy capabilities were developed and their evolution over the years at FMST. The results address the aforementioned gaps. The findings should be useful to policymakers, decision-makers and practitioners involved in STI policymaking, research and capability management.

Table of Contents	
Thesis Summary	3
List of Tables	7
List of Figures	8
List of Appendix	9
List of Abbreviations	10
Acknowledgements	12
Chapter 1. Introduction	13
Introduction	13
1.1 Brief Background of FMST	20
1.2 Key Failures of FMST's Science and Technology Policies	21
1.3 Outline of the Thesis	23
Chapter 2. Literature Review	26
Introduction	26
2.1 The Policy Process and Developing Countries	27
2.2 Capabilities - Overview	36
2.3 Capability Challenges for Policymaking in DCs	44
2.4 Capabilities and Policymaking at FMST	53
2.5 Theoretical Framework	57
Chapter Summary	59
Chapter 3. Conceptual Framework	60
Introduction	60
3.1 Conceptual Framework of Capabilities for Policymaking	60
3.2 Processes as Policy Capabilities	61
3.3 Routines as Policy Capabilities	68
3.3.1 Routines – Deconstructing the Concept further	69
3.3.2 Routines – the Selections Addressed	72
3.4 Skills as Policy Capabilities	73
3.4.1 Analytical Capability as a Policy Skill	74
3.4.2 Administrative Capability as a Management Policy Skill	76
3.4.3 Reflexive Capability as a Policy Skill	76
3.4.4 Technological Capability, Knowledge and Experience as Policy Skills	77
3.4.5 Academic Qualification as a Policy Skill	78
3.4.6 “Absorptive Capacity” as Knowledge and a Policy Skill	79
Chapter Summary	80
Chapter 4. Methodology	81
Introduction	81
4.1 Research Questions	81
4.2 Research Design	81
4.2.1 Rationale for Case Study Approach as the Research Design	82
4.2.2 Units of Analysis and of Observation	84
4.3 Data Collection	85
4.3.1 Pilot Case Study	86

4.3.2	Semi-structured Interviews	91
4.4	Data Analysis	95
4.4.1	Data Screening	95
4.4.2	Data Manipulation	95
4.4.3	Explanation Building	97
	Chapter Summary	100
	Chapter 5. Findings	102
	Introduction	102
5.1	Research and Interview Questions Revisited	102
5.2	Data Presentation	103
5.2.1	Policy Processes and Routines	103
5.2.2	Policy Skills	127
5.3	Policy Formulation Stages at FMST	134
5.3.1	Key Stage 1: Decision to Formulate Policy and Committee Set up	134
5.3.2	Key Stage 2: Policy Formulation Committee activities	136
5.3.3	Key Stage 3: Policy Drafts and Stakeholders' Engagement	138
5.3.4	Key Stage 4: Policy Draft Ratification and Legalisation	139
5.3.5	Key Stage 5: Signing STI Policy into Law	141
	Chapter Summary	145
	Chapter 6: Discussion	147
	Introduction	147
6.1	Research Question 1: <i>What Roles do Capabilities Play in Formulating STI Policies at FMST and Why?</i>	147
	Formal and Informal Policy Processes and Routines	148
	Role of Policy Capabilities	154
6.1.1	Agenda Setting Policy Processes and Routines	155
6.1.2	Research Policy Processes and Routines	157
6.1.3	Stakeholder Engagement Policy Processes and Routines	161
6.1.4	Leadership and Management Processes and Routines	162
6.1.5	Funding Policy Processes and Routines	165
6.1.6	Individual Capabilities - Skills	168
6.2	Research Question 2: <i>How did Policy Formulation Capabilities Originally Emerge at FMST and Why?</i>	170
6.3	Research Question 3: <i>How have Policy Formulation Capabilities Evolved at FMST and Why?</i>	175
6.3.1	Policy Processes that have Evolved	175
6.3.2	Policy Processes that have not Developed/Evolved	179
6.3.3	Reasons for Weaknesses in Development and Evolution of capabilities	179
a)	<i>Leadership and Management</i>	179
b)	<i>Lock-in and Blocking Mechanisms</i>	180
c)	<i>Perceived Relative Importance of Policy Processes at FMST</i>	181
d)	<i>Best Practices by Imitation</i>	182
e)	<i>Policy Learning not taking place at FMST</i>	183

<i>f) Funding (for Policy Formulation) and Resource Constraints</i>	184
<i>g) Consultancy Approach to Policymaking</i>	184
<i>h) Weaknesses in Policy Skills – Absorptive Capacity</i>	185
<i>i) Absence of a Policy Formulation Framework</i>	186
6.4 Framework of Policy Formulation Capabilities	186
6.5 Rival Explanations	192
Chapter Summary	194
Chapter 7. Conclusions	196
Introduction	196
7.1 Contribution to Theory	196
7.2 Implications for Policy and Practice	200
7.3 Limitations of the Research	203
7.4 Directions for future research	205
Chapter Summary	206
References	208
Appendix	228

List of Tables

Table 1.1	Definition of Policy Processes and Routines	15
Table 2.1	Summary of Definitions and Interpretations of Policy Capabilities	43
Table 2.2	Theoretical Framework of Policy Capabilities	58
Table 3.1	Agenda Setting as a Policy Process	63
Table 3.2	Summary of Process Capabilities for Policymaking	67
Table 3.3	An Illustration of a Policy Routine and Routine Tasks	73
Table 4.1	Summary of Interview Participants and Data Collection	94
Table 5.1.1	Interview Questions – an Overview of Thematic Areas	102
Table 5.2.0	Definition of Key Policy Terminologies	104
Table 5.2.1	Typology of Policy Processes at FMST	106
Table 5.2.2	Policy Routines	107
Table 5.2.3	Utilisation of Policy Processes at FMST	111
Table 5.2.4	Attributes of Policy Processes at FMST	112
Table 5.2.5	Core Policy Processes Identified by Interview Respondents	114
Table 5.2.5.1	Agenda Setting Processes, Routines and Skills	115
Table 5.2.5.2	Research Policy Processes, Routines and Skills	115
Table 5.2.5.3	Stakeholder Engagement Processes, Routines and Skills	116
Table 5.2.5.4	Leadership and Management Processes, Routines and Skills	117
Table 5.2.5.5	Funding Policy Process, Routines and Skills	118
Table 5.2.6	Roles played by Processes and Routines in Policy Formulation	120
Table 5.2.7	Development of Policy Processes at FMST	123
Table 5.2.8	Evolution of Policy Processes at FMST	125
Table 5.2.9	FMST Staff Classified According to Grade Levels	129
Table 5.2.10	Policymaking Skills Training at FMST: 2010 – 2012	133
Table 5.3	Summary of Key Policy Formulation Stages at FMST	142
Table 6.2.1	Typology and Taxonomy of Policy Processes	153

List of Figures

Figure 2.1	A Typical Policy Cycle Framework	29
Figure 2.2	A Systemic View of the Policy Process	31
Figure 2.3	The Policymaking Process, National Audit Office	32
Figure 3.1	Conceptual Framework of Policy Capabilities	62
Figure 5.1	A Flowchart of Key Policy Formulation Stages at FMST	146
Figure 6.1	Conceptual Framework of Policy Capabilities – Revisited	189
Figure 6.2	Framework of Policy Capabilities	192

List of Appendix

Annex 1: FMST and Nigeria's STI Governance	228
Annex 2: Organogram of Federal Ministry of Science and Technology (FMST)	229
Annex 3: FMST and STI in Nigeria – Major Historical Developments	230
Annex 4: UNESCO National STI Policy Formulation	232
Annex 5: Current Status of UNESCO STI Policy (STIP) Review in Africa	233
Annex 6: FMST – List of Coordinating Departments and Agencies (Parastatals)	234
Annex 7a: Data Collection Sheet	235
Annex 7b: Summary of Interview Responses – Capabilities Mapping Exercise	236
Annex 8: List of Data Collection Organisations	237
Annex 9: Interview Questions - Qualitative Data Collection	238
Annex 10: Staff Classification at FMST	241
Annex 11: Key STI Policy Formulation Stages and Processes at FMST	243
Annex 12: Participants and Organisations in FMST 2012 STI Policy Formulation	244

List of Abbreviations

AfDB	-	African Development Bank
AU	-	African Union
AUC	-	African Union Commission
CHELTECH	-	Federal College of Chemical and Leather Technology
CTER	-	Chemical, Technology and Energy Research
DCs	-	Developing Countries
ECA	-	Economic Commission for Africa
ECOWAS	-	Economic Community of West African States
FCT	-	Federal Capital Territory (Abuja)
FEC	-	Federal Executive Council
FIIRO	-	Federal Institute of Industrial Research
FMST	-	Federal Ministry of Science and Technology
GDP	-	Gross Domestic Product
IBRD	-	International Bank for Reconstruction and Development
ICT	-	Information and Communication Technology
IDRC	-	International Development Research Centre
IP	-	Intellectual Property
MAN	-	Manufacturers Association of Nigeria
MDGs	-	Millennium Development Goals
NABDA	-	National Biotechnology Development Agency
NACETEM	-	National Centre for Technology Management
NAEC	-	Nigeria Atomic Energy Commission
NAO	-	National Audit Office
NARICT	-	National Research Institute for Chemical Technology
NARSDA	-	National Space Research & Development Agency
NASENI	-	National Agency for Science and Engineering Infrastructure
NASRDA	-	National Agency for Space Research and Development Agency
NASTECH	-	National Science & Technology
NBBRI	-	Nigerian Building and Road Research Institute
NBS	-	National Bureau of Statistics and
NBTI	-	National Board for Technology Incubation

NCC	-	Nigerian Communications Commission
NCST	-	National Council for Science and Technology
NEPAD	-	New Partnership for Africa's Development
NSI	-	National System of Innovation
NISER	-	Nigerian Institute for Social and Economic Research
NISLT	-	The Nigerian Institute of Science Laboratory Technology
NITDA	-	National Information Technology Development Agency of Nigeria
NITOR	-	Nigerian Institute for Trypanosomiasis and Onchocerciasis
NNMDA	-	Nigerian Natural Medicine Development Agency
NOTAP	-	National Office of Technology Acquisition and Promotion
NPC	-	National Planning Commission
NU	-	National Universities Commission
NV2020	-	Nigeria Vision 20:2020 Program
OECD	-	Organisation for Economic Co-operation and Development
PRODA	-	Project Development Institute
PRPA	-	Planning Research and Policy Analysis
R&D	-	Research and development
RMRDC	-	Raw Materials Research and Development Council
S&T	-	Science and Technology
SHESTCO	-	Sheda Science and Technology Complex
SMEs	-	Small and Medium Enterprises
SMST	-	State Ministry of Science and Technology
SSA	-	Sub-Saharan Africa
STI	-	Science, Technology and Innovation
STISA	-	Science, Technology and Innovation Strategy for Africa
TAA	-	Technology Acquisition and Assessment
UK	-	United Kingdom
UN	-	United Nations
UNCTAD	-	United Nations Commission on Trade and Development
UNDP	-	United Nations Development Programme
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
UNIDO	-	United Nations Industrial Development Organization
WB	-	World Bank

Acknowledgements

I am greatly indebted to my supervisors at SPRU – Science Policy Research Unit, especially Puay Tang, who started my PhD journey with me and also finished with me, and to Ben Martin, for agreeing to co-supervise my thesis at a critical stage that made my completion in time possible. Puay, your dedication, hardwork and tenacity is second to none, more so your patience, wisdom and encouragement. Thank you. I thank Kevin Grant who was my supervisor at the beginning of my PhD study in SPRU but had to leave to another University. Thank you also, to James Wilsdon, who co-supervised my thesis but had other pressing engagements that meant he was not able to complete it with me. I am sincerely grateful to all of you.

I am also grateful to Martin Bell for his invaluable inputs on capabilities and the analytical insights he provided. Thank you also to Geoffrey Oldham whose early work on *Priorities for Science and Technology Policy Research in Africa* provided the inspiration for the ideas I have developed in this thesis. Thank you to Johan Schot and Ed Steinmueller for intervening at a critical moment to provide timely leadership and management support. I thank all my friends at SPRU, Institute of Development Studies, STEPS (Social, Technological and Environmental Pathways to Sustainability) Centre and the University of Sussex for the times we spent together and the in-depth discussions. Thank you for your inputs on my thesis and for the constructive criticisms.

I would like to thank the management and staff (particularly Olayiwola Agoro) at Nigeria's Federal Ministry of Science and Technology, Abuja and National Centre for Technology Management (particularly Willie Siyanbola) for their assistance during my fieldwork in Nigeria. I am also grateful to the policymakers, decision-makers and senior government officials who participated in my research and provided interview responses.

Finally, I thank and dedicate this work to God Almighty and to my loving family: Nicoleta “Scumpa”, Maria, and Melissa Daniels; Ifeanyi, Azubuike and Amechi Uzoka; my father (and mother, who passed away too soon and was not around to see me complete my PhD, may her soul rest in peace); extended family and friends. Thank you all for your love and prayers. Your support and encouragement made all the difference and sustained me through the duration of PhD studies and thesis writing. Thank you all!

Chapter 1. Introduction

Introduction

“In the process of public policymaking, problems are conceptualised and brought to government for solution; governmental institutions formulate alternatives and select policy solutions; and those solutions get implemented, evaluated, and revised” (Sabatier, 2007, p.3).

It is widely accepted that public policies have an important role in driving Science, Technology and Innovation (STI) in order to achieve socio-economic and development objectives and improvements in the quality of life (Freeman, 1991; FMST, 2012a; OECD, 2014; STISA-2024, 2014). Despite this realisation, developing countries (DCs)¹ still face difficulties in formulating policies to promote STI. A possible reason for this is to be found in the apparent lack of capabilities for policymaking (Oldham, 1981; UNESCO, 1986; Adubifa, 1988; NEPAD, 2006, 2007, 2010, 2014; UNESCO, 2006; Bell, 2009; FMST, 2011; AOSTI, 2013; STISA-2024, 2014). This is in line with Martin Bell (2013) who lamented in a recent conference lecture that too much focus has been placed on the development of science and technology (S&T) and research and development (R&D) capabilities by DCs, to the neglect of other capabilities, such as policy capabilities (processes, routines and skills), the subset of this thesis.

There are still gaps in our knowledge and understanding of what these policy capabilities are for policymaking in DCs. In this thesis *Policy Capabilities are defined in terms of policy formulation processes, routines and skills*. These will be elaborated below and in Chapter 2. This thesis focuses on policy formulation – a particular phase in the policymaking cycle. In this thesis, I distinguish “policy formulation” (i.e. the development of a new policy document) from “policymaking”, which, in addition to policy formulation involves other phases such as policy implementation, monitoring, evaluation, and review. Policymaking in this thesis therefore refers to the totality of these phases; while policy formulation refers to a specific early phase of policymaking. I retain this distinction for the remainder of the thesis.

¹ That is “developing economies”, based on United Nation's "World Economic Situation and Prospects 2014" country classification, United Nations (2014), New York.

This thesis focuses on the identification and examination of policy formulation capabilities in a DC government institution context. It investigates these capabilities, the roles they play in STI policy formulation, their development (i.e. origins, introduction, and establishment) and their evolution (i.e. changes over the years). In order to achieve this aim, I use Nigeria's Federal Ministry of Science and Technology (FMST) as the illustrative case of a DC government policymaking institution. FMST is the government Ministry charged with the formulation, management and coordination of Nigeria's national S&T, and more recently since 2012, STI policies.

The research questions therefore are:

- I. What roles do capabilities play in formulating STI policies at FMST and why?
- II. How did policy formulation capabilities originally emerge at FMST and why?
- III. How have policy formulation capabilities evolved at FMST and why?

I briefly explain policy capabilities as used in this thesis².

Policy Capabilities - Definition

Capabilities in the context of this research are grouped into (a.) organisational capabilities and (b.) individual capabilities. Organisational capabilities refer to specific and identifiable processes and routines used or adopted in organisations (Nelson and Winter, 1982; Pavitt, 1998, 2002). Individual capabilities, on the other hand, deal with the skills of individuals within an organisation (Lindblom, 1959; Nelson and Winter, 1982; UN, 1997; Dosi et al., 2000; Eisenhardt and Martin, 2000; Dosi et al., 2008). Examples of organisational capabilities in terms of policy processes and routines are: agenda setting, setting of clear policy priorities, construction of policy alternatives, research, consultation, coordination (of, for example, policy actors during policymaking), stakeholder identification (for subsequent engagement in policy formulation processes), leadership and management, and decision-making.

A policy process (for example, an Agenda Setting policy process) as used in this thesis refers to a collection of interrelated policy tasks (that is, policy routines) initiated in response to an event (policy formulation) that achieves a specific result (the production of a policy). The undertaking of a group of routines (i.e. policy tasks) constitutes a policy

² I acknowledge in this thesis that there are some generic policy capabilities (i.e. processes, routines and skills), which are relevant to the formulation of public policies across the range of government ministries.

process; whereas the completion of a group of policy processes results in a policy (Becker, 2005a/b). "A routine is a way of doing something, a course of action" (Nelson, 2002, p.267). Routines, therefore, are an integral element, that is, building blocks of policy processes. The Agenda Setting Policy Process, for example, based on this definition, therefore, include routines (tasks involved in setting a policy agenda, e.g. routines 1 to 5, Table 1.1 below). Table 1.1 helps to further illustrate this definition and enhance clarity between the concepts of processes and routines as used in this thesis.

Table 1.1: Definition of Policy Processes and Routines

Policy formulation (<i> Policymaking event initiated</i>)	Routines <i>Interrelated policy (formulation) tasks. Items 1-5 below are agenda setting routines</i>	A Policy Process <i>A collection of interrelated routines e.g. 1-5</i>	The production of a policy <i>Specific result (i.e. goal intended)</i>
	Examples (of tasks involved in setting a policy agenda at FMST)	Example of a policy process	Example
	1. Set up Committee(s) and/or working group(s)	Agenda Setting policy process	Nigeria's 2012 national STI policy
	2. Research (to review extant S&T/STI policies, national development goals, conduct data collection and analyses...)		
	3. Identify policy objectives, priorities, stakeholders, communicate, consult		
	4. Develop policy draft(s)		
	5. Engage with stakeholders...		

Source: Author

A central argument of this thesis is that in order to better understand and improve policymaking, careful attention must be paid to the routines involved in operationalising policy processes. It is therefore imperative that critical questions are addressed. Examples of such critical questions include: What routines are involved in each policy process? How are the routines carried out, why, at what stage of policymaking (or policy formulation in this case) and under what circumstances? Are the individuals responsible for carrying out the routines sufficiently equipped with the relevant skills? What weaknesses have been identified in carrying out the routines and what implications do these have for future policymaking? This thesis contributes to deepening our understanding of policymaking by helping to address these questions using empirical data from FMST's 2012 national STI policy formulation exercise in Nigeria, a DC.

Routines are used in this thesis to refer to the *repeatable ways* in which tasks are carried out in an organisation (Nelson and Winter, 1982; Dosi et al., 2000; Dosi et al., 2008). Routines, as with processes, are important because they are a means to accomplish a goal within an organisation (Feldman and Rafaeli, 2002; Winter, 2012). Some of the characteristics that help to define routines are: patterns (Winter, 1964; Nelson and Winter, 1982; Becker, 2004); actions (Cohen et al., 1996); activity (Winter, 1990³; Dosi et al., 2000); behaviour (Winter, 1986; Bessant et al., 2001) and interaction (Zollo et al., 2002; Dosi et al., 2008). Routines are recurrent and repetitive (Pentland and Rueter, 1994; Feldman and Pentland, 2003; Becker, 2004).

In line with Table 1.1, this repetitive attribute of routines applies to the development a policy draft and subsequent revisions in order to incorporate stakeholders' feedback and new insights from consultations.

Furthermore, routines involve multiple actors (Feldman and Pentland, 2003), as the routines identified in Table 1.1 indicate. This thesis therefore adopts the definition for routines put forward by Feldman and Pentland (2003, p.2), which state that organisational routines are "*repetitive, recognisable patterns of interdependent actions, carried out by multiple actors*". I revisit this in more detail in subsequent chapters and show how policy routines contain policy tasks that require skills. Skills refer to the ability of an individual policymaker. Dosi et al. (2000, p. 5) sums this up stating that: "in our view, clarity would be served by reserving the term 'skills' to the individual level and 'routines' to the organisational level".

In investigating capabilities this thesis therefore considers individual capabilities in terms of skills and abilities of individual policymakers. Skills constitute a subset of policy capabilities in that skills reputedly help individuals to better perform their functions within the confines of the processes and routines that exist in organisations (Dosi et al., 2000). The skills of interest to this thesis are those that support policymaking processes and routines in government policy institutions, such as FMST, which is responsible for the formulation and coordination of Nigeria's national STI policy. Examples of skills (i.e. individual capabilities) relevant to this thesis therefore include: research skills (useful for data and evidence collection, and analysis), communication (necessary for policy

³ See Becker (2005a) for more on Winter (1964, 1986 and 1990).

processes such as consultation and stakeholder coordination and engagement), analytical, interpersonal, management, administrative, ICT and technical skills. These skills are selected on the basis of their use in operationalising the policy formulation routines examined in this thesis.

Policymakers versus Decision-makers – the distinction

By policymakers I refer to the civil servants (this includes scientific officers, chief scientific officers, principal scientific officers, science desk officers, and researchers) and directors (including assistant and deputy directors) at FMST (and related Ministries), who were involved in the policy formulation exercise, i.e., carried out the policy routines and were in charge of the low-level decision-making at committee and FMST agency (e.g. National Centre for Technology Management (NACETEM)) levels.

Decision-makers, on the other hand, refer to the senior management and leadership team at FMST (e.g. the permanent secretary and minister), the National Council on Science and Technology (NCST), the National Assembly (i.e. parliamentarians) and the Federal Executive Council (FEC⁴ - led by the president of the Federal Republic of Nigeria). This group of people were responsible for leadership and management and higher-level decision-making. Examples of such higher-level decision-making include the final decisions on the contents of the policy drafts, setting out the scope of the policy formulation exercise, approving the final draft, and decisions on securing/allocating funds. In summary, the decision-makers were responsible for overseeing the work done by the policymakers.

A key aspect of this research is that it borrows the capabilities concepts of processes and routines from business and management studies. It attempts to use these concepts which have previously been largely neglected⁵ in public policy literature, to improve our understanding of STI policymaking. It suggests that an in-depth examination of the processes and routines involved in policy formulation at FMST may help to enhance our understanding of the roles, development and evolution of policy capabilities, thus contributing to improvements in policymaking.

⁴ I provide more details on NACETEM, NCST, the National Assembly and FEC in subsequent chapters.

⁵ In all cases probably, not only in DCs

Research Justification

The justification for this thesis derives from various factors, one of which is that policymaking processes in democracies are becoming more complex (UNESCO, 2006, Sabatier, 2007, pp.3-5), with policymakers still having to “muddle through” (Lindblom, 1959). As captured in the introductory quote above, Sabatier (2007, p.3) submits that one factor which contributes to this complexity is the multiplicity of actors involved in policymaking (Flanagan et al., 2011). These complexities in formulating public policies in democracies are further heightened by the fact that increasingly diverse interests need to be represented, coordinated and addressed. One implication of these complexities in modern policymaking and governance is that “it is unlikely that policies can be designed perfectly, so that nothing will go wrong or need to be revised (Hallsworth et al., 2011, p.9). This observation calls for improved understanding of the policy capabilities and frameworks necessary for formulating policies that address diverse, and sometimes conflicting socio-economic growth and development needs, actors and stakeholders.

Another factor arises from the fact that in democracies citizens are arguably better informed and have rising demands and expectations from public policies, necessitating reforms and improvements in policy capabilities and frameworks (NAO, 2001; Hallsworth et al., 2011). Lundvall (2005, p.6) notes that one impact of the National System of Innovation (NSI⁶) framework is that the “system” dimension “has moved the attention in policy circles in charge of research, innovation and industrial development from linear to interactive thinking of innovation. This can be referred to as a movement from “Science Policy” and “Technology Policy” to “Innovation policy””. This move has extended the traditional set of policy instruments, necessitating greater attention to policy capabilities. This transition from science and technology (S&T) studies to innovation studies (Martin, 2012a) and the progression from S&T to STI policies and policymaking at FMST (FMST, 2012a) has a bearing on this thesis. For example, it highlights the importance of new, improved or additional policy capabilities necessary to account for the “innovation” components of Nigeria’s 2012 (and future) national STI policies.

⁶ “The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies” (Freeman, 1987, p.1). See also, Lundvall 1992; Nelson, 1992, 1993.

Concerns in this regard also range from the role of STI policies in supporting innovation and promoting competition, to ensuring sustainable growth and fostering socio-economic development. There is also the challenge, especially in DCs, of ensuring a balance between STI contributions to development (Muchie et al., 2003; Kraemer-Mbula and Wamae, 2010; Sutz, 2012) and reduction in poverty, inequality and social exclusion (Cozzens and Kaplinsky, 2009; Cozzens, 2010; STEPS Centre, 2010; Stiglitz, 2012). Well-targeted government STI policies are one of the intervention mechanisms to address and achieve this balance (Pavitt and Walker, 1976; World Bank, 2010, 2013; UNCTAD, 2011; OECD, 2012; UNCTAD, 2014; UNDP, 2014).

Authors such as Oldham (1981), Bell and Pavitt (1995), NAO (2001), UNESCO (2005), Bell (2009a, 2013), UNESCO (2010) and Siyanbola (2010, 2011a/b) highlight the need for improvements in policymaking capabilities in order to help address developmental challenges facing DCs. Their work helps to illuminate some of the characteristics of modern policymaking, which include the need for better problem definition, highly scrutinised delivery timeframes, alternative pathways with multiple decision points, growing interdependence, and the need for improved coordination between government policymaking departments and agencies. The implication is that if policies are poorly formulated, the results can be sub-optimal. The importance of policy capabilities (organisational and individual alike) in formulating STI policies in DCs, therefore, cannot be overemphasised.

In this thesis I examine FMST – the government institution mandated with the formulation and coordination of Nigeria’s national STI policies – as an illustrative case for the investigation of these issues. Consequently, although I acknowledge in this thesis, as noted above, that there are likely to be processes and routines that are common across the range of public policies; the empirical data for this thesis draws from Nigeria’s 2012 national STI policy formulation exercise and previous national S&T policies formulated at FMST. Such data help (1) to better understand how and why policy capabilities were developed – their origins, introduction and utilisation at FMST starting from Nigeria’s first S&T policy formulation in 1986; (2) to improve our knowledge of how policy capabilities have evolved, since their utilisation in 1986; and (3) to examine the roles that policy capabilities played in formulating Nigeria’s 2012 national STI policy.

The identification and critical examination of the capabilities involved in policy formulation at FMST in this thesis yields certain findings that contribute towards: (1) Improving our understanding of the roles that identified policy capabilities play in STI policy formulation at FMST; and, (2) Explaining how policy capabilities have developed and evolved at FMST and why. The outcome of the thesis research also sheds light on the “core capabilities⁷” for STI policy formulation, in addition to helping advance our knowledge of other policy capabilities that FMST and significantly DCs government institutions involved in STI policymaking may be seeking to acquire and why. Consequently, the findings could be useful to policymakers, decision-makers, governments, agencies, and other practitioners involved with STI policymaking formulation and capabilities management, particularly in DCs. Furthermore, the results provide new insights to the academic community and a wide range of stakeholders (such as policymakers, decision-makers, governments, firms, civil society and non-governmental organisations) interested in capability studies and STI policymaking, again particularly in DCs with similar⁸ characteristics (e.g. at the same development stage) to Nigeria, for example, Ghana, Egypt, Kenya, and South Africa. Finally, the conclusions contribute towards improvements in STI policymaking and practices at FMST.

In the section below I present a brief background of FMST. This helps to explain the choice of FMST as the illustrative case for the investigation of these issues.

1.1 Brief Background of FMST

The choice of FMST in Nigeria stems from many factors. Nigeria is a large country, with over 160 million inhabitants (World Bank, 2013) and considerable influence across Africa. It is a very diverse, multi-cultural, multi-ethnic and multi-religious country. In addition, Nigeria has, in recent times, experienced a somewhat chequered democratic and governance history characterised by social, political, religious and economic instabilities, including a civil war which ended in 1970. These conditions characterise many other DCs.

⁷ Defined in this thesis as those organisational processes (Pentland, 1995) and routines considered to be critical to policy formulation at FMST and therefore must be incumbent (i.e. present) at FMST in order to facilitate effective policy formulation.

⁸ For instance, in terms of operating a Government Ministry of Science and Technology responsible for policymaking. In this thesis DCs i.e. “developing economies”, defined above based on UN’s “World Economic Situation and Prospects 2014” classification, are regarded to be at the same developmental stage.

Despite its size, regional influence and economic potential, Nigeria, like many other DCs, is blighted by limited science and technology (S&T) policy capabilities, weak institutions and underdeveloped STI infrastructure such as electricity, computers and broadband connection. As a result, identifying organisational and individual capabilities, with the potential to improve STI policy formulation in Nigeria, should have a positive impact on the country's socio-economic development.

The creation of an institutional framework for the development of S&T in post-independent Nigeria began effectively in 1966 with the establishment of the Nigerian Council for Scientific and Industrial Research. From then on, the institutional framework went through a turbulent history that witnessed no less than eleven major changes⁹ in the twenty-two years from 1970 to 1992. Since the reconstitution of the Ministry in 1993, FMST has been operating as a full-fledged Ministry of its own. Additional information on FMST, its structure, departments and its position in Nigeria's STI governance are provided in subsequent chapters of this thesis and presented in Annex 1 and 2. Annex 3 summarises FMST's major S&T/STI historical developments.

In Section 1.2 below I provide an overview of the key failures of FMST's S&T policies.

1.2 Key Failures of FMST's Science and Technology Policies

In 1986, Nigeria produced its first National Science and Technology (S&T) Policy (FMST, 1986). Since then, there have been various revisions to the S&T policy aimed at incorporating new developments in the domain. These revisions, driven by failures in existing S&T policies, as identified by FMST, and the need for economic development, suggest that insufficient attention had been paid to the formulation phase of policymaking and the policy capabilities necessary for delivering the expected outcome, that is, the national S&T (and since 2012, STI) policies. The objective of this thesis, as outlined in the research questions above, is therefore to critically examine what these policy capabilities are, their roles in STI policy formulation at the FMST, and their development and evolution over time at FMST.

⁹ Which included closures of FMST, various reopening, drastic changes in organisational structure and leadership, merging it with the Ministry of Education and many others.

The aim of the first S&T policy (1986) was to use S&T knowledge to ensure a better quality of life for the people (FMST, 1986). FMST recognised that the goal of this policy was not achieved (Siyanbola, 2011a). This led to a review of the policy in 1997, the outcome of which was to lay more emphasis on policy processes and routines that include collaboration, coordination and management of the S&T system. Sanni et al. (2001) in analysing Nigeria's S&T policies "concludes that the national S&T output is inadequate and ascribes the inadequacy to defects in the policy formulation" (p.237). These defects, according to the authors, are due to the fact that some key sectors were left out, arguably, as a result of weaknesses in capabilities as I show in subsequent sections and chapters.

Siyanbola (2011c, p. 16) records that in 2003, "there was another attempt to review the S&T policy" in order to take account of policy formulation lapses such as the need to address capability gaps and the institutional frameworks that should foster interaction among the various elements of the NSI. The 2003 policy gave rise to prominent flagship programmes of Nigeria's government such as: biotechnology, information and communication technology (ICT), space science and technology, energy and engineering materials. However, "the policy document that emerged was a voluminous compendium of key S&T sub-sectoral policies and paid insufficient attention to the issues of developing an S&T culture and harmonizing the S&T policy with other socio-economic policies" (Siyanbola et al., 2013, p.2). This outcome indicates a lack of policy capabilities necessary for research, stakeholder engagement, consultation, coordination, agenda setting, and setting of S&T policy objectives and priorities that are in line with other socio-economic growth and development policies pertinent to the nation.

In 2005 another revision under the Nigeria/UNESCO STI reform initiative was undertaken. This introduced the NSI approach¹⁰ as a framework for STI system reform, resulting in the shift from S&T policy to STI policy (Siyanbola et al., 2013). Despite this effort, NACETEM (2011) and Siyanbola et al. (2013) identify further weaknesses in Nigeria's S&T policies resulting from gaps in policy processes and routines (such as, Deciding on Policy Instruments, Constructing Policy Alternatives, Research, Decision-making, Funding, Coordination, and Collaboration) and skills.

¹⁰ Used in relation to the argument for a departure from top-down policy paradigm to "a bottom-up, all-inclusive participatory approach with clearly defined roles for key [NSI] stakeholders" (Siyanbola et al., 2013, p.1).

The current national STI policy of 2012, with a focus on innovation, is expected to support Nigeria's STI and Vision 20:2020¹¹ aspirations. The 2012 national STI policy builds on the policymaking experience gathered over the past twenty-five years at FMST (FMST, 2012). The national (Presidential and National Assembly) elections of March 28th, 2015 produced a new government, sworn in on 29th May 2015. It remains to be seen what impacts the newly-elected government will have on Nigeria's STI governance, policymaking and policy directions.

In subsequent chapters I examine policy processes and routines further. I argue that skills alone are inadequate in policymaking and has contributed to the failures observed in FMST's S&T policy formulation to date. I therefore advocate the development of policy processes and routines and a framework of policy capabilities to guide policymaking at FMST as these play important roles in the formulation of effective (i.e. achieves the goals it sets out to) national STI policies.

1.3 Outline of the Thesis

The remaining chapters of the thesis are organised as follows:

Chapter 2 Literature Review

In Chapter 2, I synthesise insights from relevant bodies of literature drawn from the policy process theories, capabilities (processes, routines and skills), STI policymaking, Nigerian politics and government, and developing countries (DCs). I use these bodies of literature to discuss capabilities for policymaking in greater depth. Following that, I develop the theoretical framework, based on the interpretations of processes, routines and skills in existing literature.

Chapter 3 Conceptual Framework

In this chapter I use the insights gathered from the literature reviewed and theoretical framework advanced and present the Conceptual Framework of Policy Capabilities (Figure 3.1). Thereafter I use the conceptual framework as the basis for the development of three theoretical constructs: "process capabilities", "routine capabilities" and "skills capabilities". The constructs help maintain clarity for the in-depth discussions that follow.

¹¹ 2020 is the year in which Nigeria hopes to be one of the top 20 economies in the world.

In addition, they form the basis for the data collection and analysis of policy capabilities as they apply to STI formulation at FMST.

Chapter 4 Methodology

In Chapter 4, I explain and justify the thesis research design. Also, in this chapter I discuss the rationale for the qualitative case study approach adopted. I explain how data were collected using semi-structured interviews with key staff at FMST and the selection of FMST as the illustrative case study. Arguments for the collection of additional secondary data at FMST through the review of FMST and national STI policy documents are advanced, as these provide useful background information relevant to answering the research questions. Finally, I discuss the explanation-building data analysis strategy used in this thesis.

Chapter 5 Findings

In Chapter 5, I present the findings from the case study research carried out at FMST in order to illuminate the capability gaps under investigation. I identify policy capabilities (processes, routines and skills) at FMST. The findings help in the discussion of the roles, development and evolution of policy capabilities. The extent to which generalisability can be inferred from the conclusions is informed by the data, analyses and results presented in this chapter.

Chapter 6 Discussion

Chapter 6 draws together the findings from the case study to answer the research questions and address the gaps identified in literature. I discuss the new insights gained from the analysis of the wide range of policy capabilities examined. I use the knowledge obtained to explain the role of capabilities in policy formulation at FMST, the development of the policy capabilities examined and how policy processes have evolved over time at FMST. Finally, I use the findings to refine the conceptual framework proposed as this forms a major component of the contributions that this thesis makes.

Chapter 7 Conclusion

In Chapter 7, I summarise the contributions of this thesis to capability, STI and policy studies. I discuss the implications of the findings for FMST, STI scholarship, policymakers, decision-makers and STI policy practitioners in Nigeria and in other

developing country STI policymaking institutions. The thesis concludes with a discussion of the limitations of the thesis and directions for future research.

In the next chapter I review the relevant literature that inform the theoretical framework. This provides the basis for a deeper understanding and analysis of the roles, development and evolution of policy formulation capabilities at FMST.

Chapter 2. Literature Review

Introduction

"Despite over a decade of sustained efforts to improve policymaking, civil servants, politicians and academics continue to express concerns about the way policy is made, and whether it is ready to meet future challenges. These concerns need to be taken seriously. The strength of policymaking is integral to the strength of government as a whole, and that of the country at large. When policies fail, the costs (whether monetary or otherwise) can be significant" – Hallsworth et al., 2011, p.4, Institute for Government, UK.

In Chapter 1, I introduced the aim of this thesis, which is, to examine the role of policy capabilities in formulating STI policies in a developing country (DC) context. In addition, I examine the development (i.e. origins) and evolution (changes) of policy capabilities. I use the Nigerian Federal Ministry of Science and Technology (FMST) as an illustrative case for the investigation of these issues. I acknowledged in Chapter 1 that there are some generic policy capabilities (i.e. policy processes, routines and skills, as used in this research), which are relevant to the formulation of policies across the range of government ministries. Although FMST is solely concerned with national science, technology and innovation (STI) policymaking, as opposed to other forms of public policy, it is possible that many of the capabilities in this policy area will be similar to those employed in most other ministries.

To reiterate, this thesis addresses the following research questions (RQs):

- I. What roles do capabilities play in formulating STI policies at FMST and why?
- II. How did policy formulation capabilities originally emerge at FMST and why?
- III. How have policy formulation capabilities evolved (changed) at FMST and why?

In Chapter 1, I defined capabilities in terms of organisational and individual capabilities. I explained that while organisational capabilities refer to the processes and routines involved in policymaking; individual capabilities are defined in terms of the skills (i.e. abilities, knowledge and experience) of policymakers that enable them to perform their tasks.

In this chapter, I review the extant body of studies on capabilities (processes, routines and skills) drawn from the management literature, policy process, Nigerian politics and government. In Section 2.1, I examine policy processes. I provide an overview of capabilities in Section 2.2. Next, I focus on capability challenges for policymaking in DCs (Section 2.3) followed by policymaking at FMST (Section 2.4). I end the chapter with the Theoretical Framework (Section 2.5), which informs the Conceptual Framework in the next chapter.

2.1 The Policy Process and Developing Countries

“Policy is a deliberate action of government (the executive branch) that in some way alters or influences the society or economy outside the government” (OECD, 2007, p.10). A well-formulated policy (STI policy in this thesis) can be a major component and engine of economic development in DCs and elsewhere (UNIDO, 2005). However, if “science and technology (S&T) policies consist of a set of principles, declarations, guidelines, decisions, instruments and mechanisms oriented towards scientific and technological development in the medium and long term” (UNESCO, 2006, p. 1); then it is necessary, as students of policymaking, to examine the whole range of capabilities needed to formulate such policies. This research contributes towards existing literature in this regard in seeking to improve our understanding of what these policy capabilities are, their roles in policy formulation, development and evolution over the years (in the case of FMST, from 1986 when the first national S&T policy was formulated, to 2012).

There is consensus among scholars and policymakers that S&T can contribute to economic development (Clark and Mugabe, 2004; NEPAD, 2006, 2010; UNESCO, 2006; Bell, 2009a/b; Niosi, 2010; FMST, 2011; 2012; UNCTAD, 2011, 2014; AOSTI; 2013; STISA-2024, 2014). Despite this acknowledgement, many DCs still struggle with the attainment of the capabilities to enable them formulate appropriate policies necessary for reaping the rewards of STI. An illustration of the lack of capabilities of DCs policymakers may be evidenced by the high number of STI capacity building trainings and workshops held by international organisations in DCs (UNIDO, 2005; UNESCO, 2009; UNU-MERIT, 2014).

Against the backdrop of these capability challenges, some scholars have argued that one of the major differences between prosperous and poor nations lies in their ability to

effectively apply knowledge (Radaelli, 1995), guided by effective policies, to their economic, development and competitive¹² advantage (Niosi, 2010). Intarakumnerd et al. (2002), for instance, state that one of the main problems preventing governments in many DCs from becoming effective in policymaking is that government agencies have inadequate capabilities to formulate policies. Such observations underpin the focus and research questions of this thesis.

Sabatier (2007) discusses various theoretical frameworks for understanding policy processes and identifying capabilities for policymaking. Sabatier asserts that the “stages heuristics”¹³ (a theoretical framework that provides the basis for “dividing the very complex policy process into discrete stages”, such as, policy formulation) “has outlived its usefulness and needs to be replaced with better theoretical frameworks” (p.6-7). The main weaknesses include its inability to identify “causal drivers that govern the policy process within and across stages”, inaccurate description of stages, legalistic and top-down nature, and assumption of a single policy process (p.7). Despite these weaknesses, the stages heuristics clearly identifies policy formulation – the focus of this study – as a unique phase of policymaking. Furthermore, the stages heuristics informs the concept of the policy cycle.

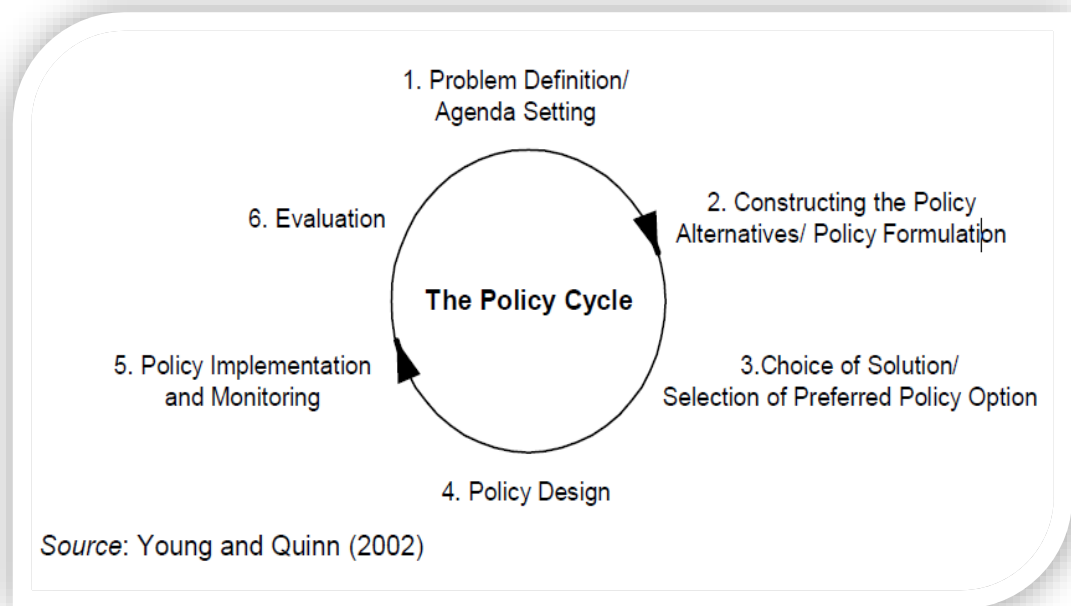
The Policy Cycle

The policy cycle, which builds on the stages heuristics theory, divides policymaking into various phases, with each phase (e.g. “4. Policy Design”, Figure 2.1 below) considered as a policy cycle, interacting with multiple policy cycles (e.g. “1. Problem Definition/Agenda Setting” and “6. Evaluation”, Figure 2.1), at various levels of government and involving many actors.

¹² The World Economic Forum (WEF) defines competitiveness as “the set of institutions, policies, and factors that determine the level of productivity of a country” (WEF, 2014, p.4).

¹³ “Termed the ‘textbook approach’, it divided the policy process into a series of stages - usually agenda setting, policy formulation and legitimation, implementation, and evaluation - and discussed some of the factors affecting the processes within each stage” (Sabatier, 2007, pp. 6-7).

Figure 2.1: A Typical Policy Cycle Framework



Policy cycles have been criticised for oversimplifying the complexities involved in policymaking as multiple processes and levels of government are involved (Sabatier, 2007). Another source of criticism is that it fails to explain what it describes and ignores aspects such as national contexts, differences in capability levels, and takes politics and governance out of policymaking. In spite of these weaknesses, the relevance of policy cycle to this thesis lie in the distinct phase of formulation that policy cycles highlight as a critical phase of policymaking. In addition, policy cycles help to illuminate the capabilities involved in policymaking and the roles that policy capabilities play in policy formulation. I have therefore included the policy cycle in this thesis in order to show that policymaking involves different phases (and stages within each phase) which, although clearly delineated in frameworks, are interwoven in practice, and require policy capabilities in order to operationalise the policy tasks (i.e. routines) involved.

Based on Figure 2.1 above, this thesis covers policymaking stages 1 to 4: problem definition/agenda setting, constructing the policy alternatives/policy formulation, choice of solution/selection of preferred policy option and policy design. I refer to the specific and distinct steps as policy processes in this thesis, with Agenda Setting (in Stage 1) as an example. I identify other policy process in subsequent sections. This research, therefore, extends the work of Young and Quinn (2002) by discussing the role of policy

capabilities in realising the objectives of policymaking stages 1 to 4, as outlined in the framework by Young and Quinn (2002), above. Figure 2.1 also helps show that this thesis focusses on formulation, with agenda setting and decision-making included; but does not address implementation, monitoring or evaluation.

Young and Quinn (2002) in their example (Figure 2.1 above) also outline some of the major phases in policymaking: problem definition and agenda setting, selecting policy options and constructing policy alternatives. In later sections of this chapter and subsequent chapters, I argue that these are examples of policy processes and routines. By presenting policymaking in a cyclical form Figure 2.1 shows that policymaking is a continuous activity that can be initiated or terminated at various points in the loop.

The UK's National Audit Office (NAO¹⁴, 2001) and Dufour (2010) are in line with Young and Quinn (2002) depiction of policymaking as a cycle, rather than a linear process. These literature indicate that stages can be skipped. Dufour (2010) (Figure 2.2 below) goes a step further in explaining some of the activities that occur under each phase. This yields valuable insights into the organisational (processes and routines) and individual (skills) capabilities required to carry out the policy tasks (routines) contained within each policy phase.

¹⁴ Selected because it is a government agency and so might offer a contextual background similar to FMST.

Figure 2.2: A Systemic View of the Policy Process

A SYSTEMIC VIEW OF THE POLICY PROCESS

Public Policy Process (Steps of the Policy Cycle)				
Agenda-setting→	Formulation→	Decision-Making→	Implementation→	Evaluation→
Government accepts to evaluate an issue brought up by an actor.	Possible solutions to a problem are elaborated by a network of actors.	Government chooses a solution among those formulated by the network of actors.	Public servants, possibly working with the network of actors, translate policy into concrete action using substantive policy tools. <u>Existence of a public policy</u>	Evaluation can be performed by any actor. Government actors conduct impact, process and/or efficiency evaluation so the policy can be adjusted.

-To start the policy process, a government must decide to pay attention to an issue.

-The policy process always starts with the agenda-setting.

-The policy process is not necessarily a linear process. From the formulation, steps can be skipped or repeated. It can also stop and resume.

-The policy process can stop at any moment.

-The duration of a policy cycle is variable.

© Caroline Dufour, 2010

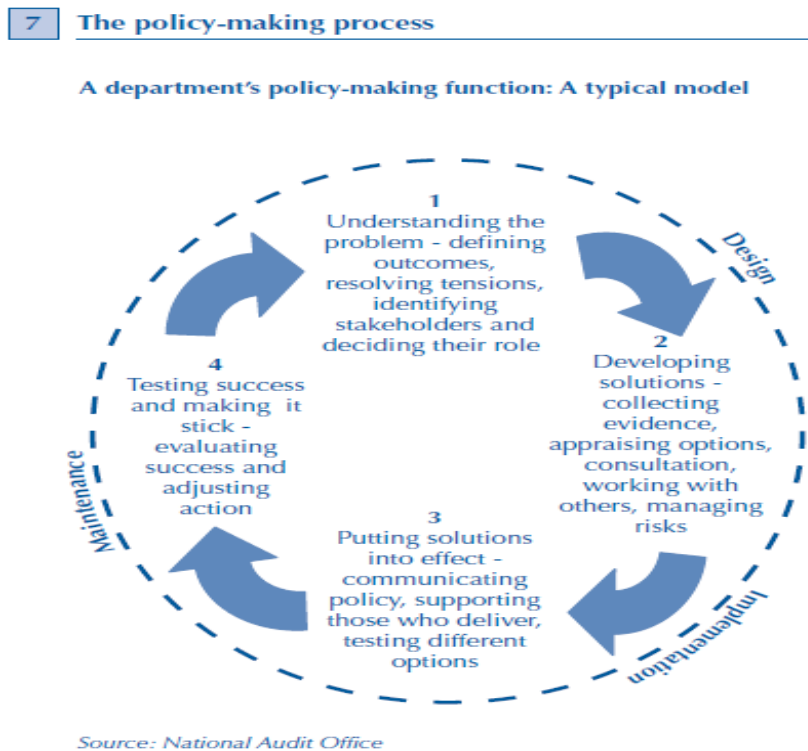
This thesis is concerned with the policy capabilities (processes, routines and skills) primarily needed for actualising the policy formulation phase of policymaking¹⁵. Lindblom's (1959) seminal work, identifies capabilities relevant to policy formulation to include knowledge (intellect), problem-solving, administration, resource planning, allocation and management and deciding on policy instruments. Others include, constructing policy alternatives (or choices), setting policy objectives and priorities, research, analysis, coordination, decision-making, funding. In subsequent sections and chapters, I group these into organisational and individual policy capabilities. Some examples of organisational capabilities (defined in terms of processes and routines in Chapter 1) for effective policymaking are shown in the policymaking framework (Policy Cycle) above (Young and Quinn, 2002, Figure 2.1).

The framework by the NAO below goes a step further than Young and Quinn (2002) and Dufour (2010) in that it highlights some of the key policy processes and routines contained in some policymaking phases. Such a framework allows a more efficient identification of the capabilities that underpin policymaking. Although this study borrows from the framework to help examine policy capabilities at FMST, it acknowledges the

¹⁵ In Chapter 1, I distinguished between policy formulation (i.e. the development of a new policy document) and policymaking, which include policy formulation, implementation, monitoring, evaluation, review.

differences between the respective organisations (i.e. NAO and FMST) and countries, United Kingdom and Nigeria. It therefore does not imply or make claim to the transferability of the NAO framework. However, by critically examining the framework, it adds value to this thesis by providing a useful lens to explore policy capabilities at FMST.

Figure 2.3: The Policymaking Process, National Audit Office¹⁶



Using Figure 2.3 above as an example, STI policy formulation at FMST could be expected to involve capabilities similar to those outlined in the policy design phase represented by processes grouped into 1 and 2. This would include policy processes and routines such as problem definition, stakeholder identification, evidence gathering, consultation and risk management, amongst others. By identifying the policy formulation stages, tasks and relevant capabilities at FMST, it may be possible, based on empirical evidence, to provide explanations on the roles (Research Question [RQ]1) that capabilities play in public policymaking, such as in the formulation of Nigeria's 2012 national STI policy at FMST. The insights can also contribute towards improving our

¹⁶ This framework is used as an example only and does not imply it is the "best" or "better than the rest". Rather it is a presentation of (government) policy formulation activities useful in the discussion of capabilities.

knowledge and understanding of the development (origins), of capabilities at FMST (RQ2) and how the policy capabilities have evolved, i.e. changed, over time (RQ3).

In summary, Hallsworth et al. (2011) describes "policy cycles", as a way of presenting policymaking processes and routines "as a logical flow between discrete phases, so that the defining of objectives precedes and informs the appraisal of options, and so on" (p.5). This thesis draws from these theoretical underpinnings of the policy cycle and frameworks (by NAO, 2001; Young and Quinn, 2002; Dufour, 2010; Sabatier, 2007; and Hallsworth et al., 2011) in arguing that policymaking involves specific organisational policy processes and routines that require policymakers' skills. I build on the policy processes and routines outlined in these literature and frameworks, and use them as starting points for investigating the Research Questions.

An important aspect of policy formulation, as shown in Figure 2.3 above (NAO, 2001; see also, Young and Quinn, 2002), is the need for consultation – an example of policy capability examined in this study. Consultation in policymaking is well established in developed countries, e.g. United Kingdom (Sutcliffe and Court, 2005) and the European Union (OECD, 2001) where S&T, supportive institutional resources and structures exist. FMST (2011) records that during the formulation of Nigeria's 2012 STI policy, the Ministry conducted consultation exercises, through "sensitisation workshops" in Abuja and Lagos (Siyanbola, 2010), representing two out of the 36 states in Nigeria. This illustrates a distinct lack of coverage, indicating that consultation is not yet well developed or widely implemented. This practice reveals a reliance on traditional engagement channels through industry unions, trade associations and personal expert contacts. In addition, the reason for consultation was simply based on the need to 'carry stakeholders along', and obtain their approval, rather than an attempt towards effective engagement that provides essential inputs that feed into the policy processes. The apparent lack of wider consultation can therefore be attributed to gaps in policy capabilities (such as funding shortages, leadership and management, stakeholder engagement) or inadequate appreciation of consultation as a key process in policy formulation.

Challenges in the Nigerian Context

Although the frameworks described above have the benefits of providing a broad systemic view of the typical steps involved in policymaking, they are based on assumptions that present peculiar challenges in Nigeria's context. A brief discussion of these assumptions is important in improving our knowledge of policy processes (Radaelli, 1995) as we examine the capabilities necessary for policymaking in DCs. With improved understanding of the role of capabilities in policymaking, DCs can then focus on the development of those policy capabilities that are core and most effective to their policymaking needs and contexts.

To start with, these frameworks fail to differentiate between developed or developing countries in terms of the domestic context and practical application of the steps outlined. They assume universal applicability regardless of, for instance, the development level of the country, nature of governance, availability and/or quality of policymaking institutions¹⁷, level of policy capabilities incumbent in the government policymaking institutions, domestic infrastructure (such as, internet, telecoms, electricity, and computers) and resource challenges. Originating from the global North, these policy frameworks, also assume the existence of a functioning policy network of relevant actors, the operation of democratic institutions and autonomy of policymakers (Carden, 2009). Furthermore, Carden maintain that these policy frameworks fail to sufficiently account for the role of intermediary (e.g. policy research) institutions, and social problems such as tribalism in the case of DCs, are not taken into account. Consequently, recent evidence (see for example, UNESCO 2003; Carden, 2009; Chaminade et al., 2009; UNESCO, 2010; Urama, 2011) suggests that DCs efforts at adopting and utilising these policy capabilities and frameworks yield, at best, meagre results. Therefore, an empirical study that examines policy capabilities from a developing country context, contributes to filling these knowledge gaps.

¹⁷ "Organisations consist of people producing some form of common work (Feldman and Rafaeli, 2002, p. 299). "Institution" in this research is used interchangeably with "organisations". The term "institution" has been used in policy literature to refer "to an organisational entity" (Sabatier, 2007, p. 23). The author also referred to institutions as the shared concepts used by humans in repetitive situations organised by rules, norms, and strategies (Sabatier, 2007). In this thesis, therefore, I use both terms interchangeably.

One of the ways some DCs, such as Nigeria, have tried to overcome this problem - of insufficient understanding of policy capabilities and the frameworks needed to operationalise them – is by relying on international organisations (i.e. “development partners”) such as DFID, UNESCO, UNDP, World Bank, and IDRC. These development partners provide guidance and support (through for example, leadership, capacity-building trainings, seminars, and conferences) to policymakers in DCs government institutions during policy formulation or policymaking exercises in general. This approach, i.e. the use of international development partners/donors, has some advantages. For instance, it presents DCs government institutions with the general methodology to follow while attempting to guide policymaking through the successful implementation of the policy being formulated. A recent case in point is the assistance UNESCO and UNDP provided to Nigeria. This included the provision of policymaking capacity-building training to FMST staff prior to the policy formulation exercise (FMST, 2011).

Recent reports on Africa, for example, suggest that the overall outcome of this strategy so far has been unsatisfactory, although helpful in the short-term. One of the negative aspects of this approach is its tendency to create dependency on the international agencies. Several African states that have been recipients of such assistance, over the last four decades, as of 2012, still depend, to a large extent, on the international agencies for either the formulation or review of their national S&T or STI policies (UNESCO, 2006). Nigeria is included in this group (FMST, 2011; see also, Annex 4 and 5).

In addition, this approach has been criticised for not being “participatory” (that is inadequate inclusion of domestic knowledge and local policymakers’ inputs) and insufficiently long-term looking (Carden, 2009). This is probably because international agencies and consultants have to complete the projects within a specified time-frame, leaving the locals to deal with the long-term aspects and eventual consequences of post policy formulation exercises. In this thesis I argue that a possible reason for the apparent unsatisfactory result obtained from the assistance of these international agencies lies in the lack of development of incumbent policy capabilities. In subsequent sections of this thesis, I argue that this has implications for the utilisation, roles, development and evolution of policy capabilities in formulating STI policies at FMST.

“Nobody familiar with the difficult uncertainties and scarcities that characterise governance in a developing country gives great weight to these Northern-based schemes, and for good reason. Whatever their strengths are in explaining government in rich countries, they seldom yield a very convincing portrayal of ineffective policymaking in poor countries” (Carden, 2009, p.4)

Chaminade et al. (2009) point out some of the major differences between DCs and developed countries. These distinguishing features or systemic problems, the authors argue, range from capability, learning and infrastructure provision problems to network problems such as weak linkages with other important actors within the policy network. The resulting conclusion is that there are substantial differences which indicate that simply imitating frameworks or policies practised in developed countries, are unlikely to deliver the expected results in DCs. The implication of this argument for policymaking in DCs is that there is a need for improved understanding and development of policy capabilities (i.e. processes, routines, skills) and frameworks that are more appropriately suited to DCs. In this thesis, I identify these policy processes, routines, and skills capabilities, examine their roles in policy formulation and explain how they have developed and evolved over the years at FMST.

2.2 Capabilities - Overview

Capabilities, “generally defined as capacities to act in an intentional way” (Andreoni, 2011, p.8) have been described by different actors and by their different actions and functions – from individual agents such as entrepreneurs, workers and bureaucrats, to collective entities, such as organisations and institutions, or clusters of organisations and institutions (Andreoni, 2011). Capabilities have also been classified in various ways such as: organisational (processes, routines, systems and practices), static (routines, operations and performance related), or individual skills (Collis, 1994; Dosi et al., 2000; Sako, 2004). Subramaniam and Youndt (2005) refer to an incremental or radical capability. Although these bodies of literature are predominantly concerned with the private sector (i.e. management literature), I build on these concepts in explaining the role, development and evolution of capabilities in policymaking. By so doing, this thesis contributes to existing knowledge in this regard by identifying the specific capabilities involved in policy formulation in the public sector of DCs.

Bell and Pavitt (1993a) distinguish between the (1) static perspective of capabilities which relates to the production of goods and services, and (2) dynamic perspective of capabilities, i.e. capabilities needed to discover, absorb, adapt and change organisational techniques, processes and routines. I revisit Bell and Pavitt (1993a) in the next chapter, Conceptual Framework, in the discussions on technological capability, knowledge and experience as policy skills. Various authors, such as Lundvall (1992) and Pianta (1995), have argued that capabilities can be codified or tacit; disembodied or embodied. Disembodied, capabilities can be presented in the form of new ideas and inventions. On the other hand, capabilities can be embodied in equipment, and infrastructure, or skills (Archibugi and Coco, 2004). Therefore, skills (including knowledge and experience), as individual capabilities embodied in humans, have a role to play in policymaking.

According to Andreoni (2011) the reason why a multitude of concepts of capabilities has been proposed is that each theoretical and empirical contribution has formulated a new set of systemic concept of capabilities according to the specific functions or activities focused on; for instance, the static versus dynamic role played by the capabilities under consideration. For example, for the first criterion, the technological capability matrix proposed by Lall (1992, p.167) systematises capabilities according to different functional areas (such as, processes and products) and the degree of complexity of different activities – from simple routines (“experience based”) through adaptive duplicative (“search based”) to innovative risky (“research based”) capabilities.

Based on the proposed capability matrix Lall (1992), identified three main sets of technological capabilities: investment (referred to as funding in this thesis, see section 2.4), productive capabilities (skills involved in carrying out specific functions and processes) and linkage capabilities. Linkage capabilities are needed to transmit information; with capabilities in this thesis defined as the processes, routines and skills (abilities, knowledge, and experiences) that in this instance, enables such linkages to take place. Linkage capabilities related to the ability to send receive information from other individuals, units, departments or institutions (Lall, 1992; Andreoni, 2011). This ‘ability to link’ has also been referred to as ‘absorptive capacity’ (Cohen and Levinthal, 1990).

In addition to the three main sets of capabilities, Lall also specifically address individual (skills) and organisational (processes and routines) capabilities. In the skills capabilities

the author includes capabilities such as research, negotiation, innovation, design and engineering. Under processes and routines, we find capabilities such as coordination, monitoring and evaluation (M&E), research and development (R&D), and exchange of ideas. Lall's contributions to the capabilities discourse also extend to the importance of investigating capabilities as it relates to regional/national capabilities and innovation systems (Lall, 1992). Improved understanding of the role of capabilities at national level in Nigeria has a bearing on the role of capabilities in formulating STI policies at the FMST.

This thesis adopts the view presented by Dosi et al. (2000) and Dosi et al. (2008) that while individual skills and academic qualifications are relevant to organisational capabilities, their value depends upon their application within particular organisational processes and routines in place. And that the notion of organisational capabilities, as distinct from individual capabilities, is intimately related to the issue of complementarities – meaning that organisational and individual capabilities complement each other. These literature focus on the non-reducible and collective nature of capabilities. The authors argue that organisational capabilities are owned more by organisations than by their individual members. The concept of organisational capabilities they propose seeks to capture the different dynamics responsible for: first, the emergence of routines *vis à vis* the intentional development of organisational capabilities; and second, the process through which certain capabilities may become routinised and, *vice versa*.

A routine emerges as a distinctive organisational capability (Andreoni, 2011). This is in line with Nelson and Winter (1982) who argue that organisational capabilities (processes and routines), as opposed to individual (skills), must involve a collective action (Feldman, 2000; Feldman and Pentland, 2003; Becker, 2004). I review the collective nature of capabilities in more depth in Section 2.4.2.

Following on from Nelson and Winter (1982), further work on organisational routines (Pentland and Feldman, 2005) has been carried out by Pavitt (2002) and Sako (2004). Pavitt (2002) discusses organisational practices and routines such as coordination (see also Feldman and Rafaeli, 2002; Feldman and Pentland, 2003) of tasks and resources external to an organisation. As I discuss in Chapter 6, coordination as a policy process

and the routines involved are critical to managing non-FMST stakeholders, i.e. external policy actors', knowledge and resources. More importantly, Pavitt extends the concept of routines by differentiating between formal or explicit routines (e.g. planned flows of information) and implicit, organisationally embedded or informal routines (e.g. office corridor chats, meetings in bars and sports clubs).

"Routines according to Sako (2004, p.282) refers broadly to the way things are done in an organisation, and may include not only well-specified technical tasks" (routines) but also non-technical and informal activities and tasks. Sako's position on the formal/informal and technical or non-technical nature of routines therefore supports the argument put forward by Pavitt (2002). Sako extends the discussion on organisational capabilities by agreeing with earlier works by Winter (2000) identifying "continuous improvement" as an important capability. Winter argues that the practice of continuous improvements amounts to an effort to re-ignite the quest for improvements in organisational routines "so frequently that the flames burn pervasively and, so to speak, continuously" (Winter, 2000, p.993). Incumbent capabilities that have been left dormant in the organisation are likely to become ineffective for the simple reason that they may not have been continuously improved. Since routines are central to the arguments and definition of policy capabilities in this thesis, I revisit it in Chapter 3 and present greater depth of analysis.

Winter (2000, 2003) argues that organisational capabilities can also be considered as high level routines that enables an organisation to carry out specific management and decision-making tasks that result in the production of significant outputs. These outputs may be general in nature or of a particular type, depending on the organisational needs. This definition, therefore, helps to highlight skills and routines as capabilities. It also offers examples important to this thesis such as: leadership and management, and decision-making routines. Routines as capabilities are therefore associated with carrying out specific tasks (See also: Dosi et al., 2000; Eisenhardt and Martin, 2000).

Another form of capability, relevant to this thesis, involves the "capacity of an organisation to purposefully create, extend or modify" (Helfat et al., 2007, p.1-4) its products, processes, routines, or services and by so-doing innovate or adjust to better to external conditions. This is referred to as "dynamic capability" (Teece et al., 1997;

Winter, 2003; Teece, 2007; Felin et al., 2012). Eisenhardt and Martin (2000) identified internal resources and capabilities as important and strategic. The authors argue that capabilities, as strategic routines, make it possible for organisations to configure resources in new ways that enhance innovation and competitiveness.

Capabilities enable the efficient and strategic use of resources in organisations. In firms this enhances competitiveness. However, in governments where competition may not be the primary motivation, capabilities can help in efficient service delivery, effective policymaking or in resource management. This helps in the identification of resource management as a policy process and capability of interest in this thesis (Table 3.2, Chapter 3). The need for better understanding of this capability and its role in policymaking is therefore heightened.

Zollo and Winter (2002) defined dynamic capabilities, as "routinised activities directed to the development and adaptation of operating routines". The authors show how dynamic capabilities relate to many of the concepts relevant to this thesis. These include: routines, experience, knowledge, codification (formalisation, in the context of this thesis), operations and activities, organisational tasks, processes, capabilities development and evolution of capabilities (p.339).

Although the dynamic capabilities literature was developed to explain behaviour in for-profit organisations, the primary focus has always been on using incumbent capabilities and resources to improve performance (Pablo et al., 2007). Teece et al. (1997) describe dynamic capabilities as providing synergistic benefits through internal processes, a condition that could equally apply to government organisations. Elaborating on dynamic capabilities, Eisenhardt and Martin (2000) suggest that dynamic capabilities are of different types. Some integrate capabilities and resources while others focus on reconfiguring capabilities and resources within organisations. And still others are related to the gain and release of capabilities (pp. 1107–8).

One example of a dynamic capability is an organisation's ability to learn new practices, processes or routines. Learning is a dynamic process where capabilities and resources are integrated and reconfigured. Learning combine experimentation and repetition in a non-linear process aimed at continuously improving organisational performance (Teece et al., 1997; Eisenhardt and Martin, 2000). Organisations play an important role in

organisational learning by helping convert individual abilities into organisational shared knowledge (Winter, 2012).

An important type of learning relevant, to this thesis, is policy learning. The definition of policy learning in this thesis (as opposed to policy transfer¹⁸ which this thesis does not address) draws from the insights provided by Borrás (2011). In this context, policy learning refers to the strategic use of knowledge and information in policy formulation. Although studies of policy learning in (science, technology and) innovation policy continue to be scarce in addition to conceptual ambiguities that still exists (Borrás, 2011), there is sufficient evidence in innovation and policy literature that underline the importance of policy learning for inducing innovation (Lundvall, 1992; Bennett and Howlett 1992; Bergek, et al., 2005; Edquist, 2011; Borrás, 2011).

The work of authors such as Lundvall (1992), Bennett and Howlett (1992, p. 275), provide useful theoretical advances which has helped to identify and describe three different levels of learning relevant to policymaking: who learns, what they learn, and the effect of learning on subsequent policies. In analysing who learns, what is learnt and the effects of the learning in terms of innovation/change (i.e. evolution of policy capabilities, RQ3), three strongly interdependent levels of learning – government learning, lesson-drawing and social learning – can be distinguished (Bennett and Howlett, 1992; Borrás, 2011). The most relevant to this research is government learning, that is, state officials learning about policy processes in policymaking and thereby generating organisational innovation and change.

“Government learning relates to the ‘administrative capacity’ of the government itself, or the set of organisational practices and structures by which the administration manages tangible or intangible resources. In other words, ‘resources’ are the given fixed stock of different types of capital available at a certain point in time, and ‘administrative capacity’ is the managerial dimension of ‘using’ them appropriately” (Borrás, 2011, p. 5)

¹⁸ Lack of conceptual clarity and a significant degree of overlap still remain a problem to policy learning and policy transfer. Policy transfer is “the processes by which agents become aware of information relating to the policy domain of one political system and subsequently transfer this into another policymaking system - where it is used or stored for potential use” (Dolowitz, 2009). For Dolowitz, this transfer might entail learning when that information is combined with forms of knowledge within the policymaking process. There is, therefore, the possibility that policy transfer takes place with very little learning (Dolowitz, 2009, p.8 cited in Borrás, 2011, pp.1-3).

Hence, administrative capability, as a management capability, enables government policy institutions in this context, to control resources as it delivers on its public policy responsibilities (Donahue et al., 2000; Hill, 2009). Administrative capability, can also apply to the management of rules, procedures [*routines*] and resources in order to improve decision-making and performance in organisations (Hou et al., 2003). Administrative capability is used in line with the definition of capability provided in this thesis, but extended in this case to include “the structures and procedures [*routines*] that allow learning to take place at all levels of the system” (Borrás, 2011, p.728). The emerging themes from these authors advance the argument that policy learning and change (in terms of evolution of policy capabilities in the context of this thesis) depend on organisational capabilities. Their conclusions emphasise the need for the development of organisational and individual capabilities (Nelson and Winter, 1982; Dosi et al., 2000, 2008), which are necessary “for truly strategic [science, technology and] innovation policymaking” (Borrás, 2011, p.725).

By arguing that routines are organisational capabilities, and that organisational “capabilities are not fully reducible to individual skills” (Sako, 2004, p.283), Sako’s work agrees with Nelson and Winter (1982) and Dosi et al. (2000, 2008). Consequently, this study aligns itself more closely to the literature of Nelson and Winter (1982), UNDP (1997), Dosi et al. (2000, 2008), Eisenhardt and Martin (2000), NAO (2001), Sako (2004) and Lundvall and Borrás (2005), which are more appropriate in explaining the role of capabilities in policymaking (Table 2.1 below). This is because these bodies of literature affirm the importance of organisational capabilities while accounting for individual capabilities. It is however worth mentioning that these studies do not discuss the role of capabilities in (a) government institutions, and (b) which capabilities may be considered to be more applicable in public policymaking in DCs context. The findings of this thesis contribute towards filling these knowledge gaps.

I summarise the various definitions and interpretations of capabilities that this thesis adopts and present them in Table 2.1 below.

Table 2.1: Summary of Definitions and Interpretations of Policy Capabilities

Author, Reference	Capabilities Defined / Interpreted in terms of:	Level of Capabilities	Types
Nelson and Winter, 1982; Pentland, 1995; Eisenhardt and Martin, 2000; Becker, 2004; Becker et al., 2005; Helfat and Peteraf, 2009; Winter, 2012; Feldman, 2000, 2003; Feldman and Rafaeli, 2002; Feldman and Pentland, 2003; Lundvall and Borrás, 2005; Pentland, 2011; Rerup and Feldman, 2011	Organisational processes and routines, involves a collective action. Organisational practices and routines such as coordination of tasks and resources. Context-specific and context-dependent	Organisational	Processes and routines (Formal & informal)
Lindblom, 1959; Oldham, 1981; Radaelli, 1995; Adubifa, 1988; UNDP, 1997; Bell and Pavitt, 1995; UNCTAD, 2003, 2008; Archibugi and Coco, 2004; UNIDO, 2005; Dosi et al, 2008; World Bank, 2009; Andreoni, 2011; Felin and Foss, 2011; Urama et al, 2011; AU, 2014; NEPAD; 2014	Skills, abilities, knowledge and experiences of individuals (public policymaking in this case)	Individual	Skills
Collis, 1994; Teece and Pisano, 1994; Cohen et al., 1996; Teece et al., 1997; Dosi et al, 2000; Pavitt, 2002; Nelson, 2002; Sako, 2004; Becker et al., 2005; Subramaniam and Youndt, 2005; Dosi et al, 2008; Borrás, 2011; Hallsworth et al., 2011	Static (routines – tasks, operations and performance related), individual (skills), organisational (processes, routines, systems and practices), incremental or radical; formal [explicit] routines (e.g. planned flows of information) and informal [implicit] routines (e.g. office corridor chats), embedded organisational practices; dynamic (evolving, change)	Organisational and Individual	Processes, routines and skills
Leonard-Barton, 1992; Lundvall, 1992; Pianta, 1995; AOSTI, 2013; STISA-2024, 2014	Codified or tacit; disembodied, or embodied; skills	Organisational and Individual	Processes, skills
Lundvall and Borrás, 2005; Sabatier, 2007; Chaminade, et al., 2009; Niosi, 2010; Borrás, 2011;	Policy processes, such as research or learning, usually deficient within DCs NIS, results in weak networks and/or interactions among policy actors and NSI components	Organisational	Processes
Lall, 1992	Based on functional areas or degree of simplicity or complexity of different activities. Skills involved in carrying out specific functions and processes	Organisational, Individual	Processes, Skills

Source: Author

The important contributions by Nelson and Winter (1982), Dosi et al (2000), Pavitt (2002) and Sako (2004) reinforce the argument of this research on the need to study capabilities, not only as they apply to skills but more importantly, to examine capabilities in relation to organisational processes and routines (Pentland, 1995). This thesis therefore extends the work of the aforementioned authors by adding that capability studies and efforts aimed at improving policymaking in government organisations should be geared towards a better understanding of the development of both organisational and individual capabilities. Until now, the balance has probably been heavily skewed in favour of individual skills of policymakers, technological (technical), and R&D capabilities (Bell, 2013) – neglecting the relevant processes and routines (Feldman and Rafaeli, 2002; Feldman and Pentland, 2003) within which these individual capabilities are meant to function. Without capabilities, policymakers will have difficulties in translating knowledge (Radaelli, 1995) into effective policies (Borrás, 2011).

In Section 2.3 below, I discuss the capability challenges for policymaking in DCs with emphasis on Africa and Nigeria, which is the focus of this thesis.

2.3 Capability Challenges for Policymaking in DCs

Science and technology (S&T) policy formulation is still a major challenge in many DCs government institutions. UNESCO (2006) on S&T policy formulation writes:

"UNESCO provides guidelines for policy formulation and assists developing Member States in formulating their S&T policies and strategies. UNESCO assisted countries such as Lebanon, Mozambique, Lesotho, Albania, Brunei, and Maldives in formulating their national strategies. Currently UNESCO is helping Mongolia, Congo, Nigeria, Namibia, in formulating their national science policies. Plans are underway to assist other countries such Seychelles, Ethiopia, Swaziland in similar efforts" (UNESCO, 2006, p. 1)

From the above quote, it is clear that Africa accounts for most of the DCs where this need is greatest. Out of the thirteen countries listed, ten of them are African. Fast-forward to the year 2012 and the overwhelming evidence shows that not much has changed. For instance, UNESCO was instrumental to the formulation of Nigeria's 2012 national STI policy in various aspects which include capacity building on policy skills through training, workshops (Chapter 5, Table 5.2.10), S&T policy review and funding. In

Chapter 5, I show that these capacity-building exercises, i.e. skills upgrade, neglect policy processes and routines, within which skills function. UNESCO is also actively involved in the evaluation, review and formulation of S&T policies across many African countries (see Annex 4 and 5 for more details). Evidence of these can be found in Nair-Bedouelle (2009) and UNESCO (2009) which record that about 18 African countries, Nigeria included, have made requests to UNESCO for assistance with the review or formulation of their STI policies. This provides further justification for situating this research in Africa, using Nigeria as the illustrative case. Pertinent to this thesis is the paucity of research on understanding how government institutions in DCs formulate their STI policies, especially due to the fact that capabilities (both at institutional and individual levels), technology and infrastructure are limited (Oldham, 1981; Aubert, 2004; COVIDSET, 2009; AOSTI, 2013).

First capability challenge for policy formulation in Nigeria (and DCs in general) stems from the complexity of modern policymaking (Flanagan et al., 2011). The foregoing discussions in Section 2.1 have attempted to establish that public policies and policymaking are inherently complex in nature. Sabatier (2007, p.3) sums this up in stating that: “for a variety of reasons, the policy process involves an extremely complex set of elements that interact over time”. This statement is echoed by Hallsworth et al. (2011) who maintain that “despite sustained efforts to improve policymaking, civil servants, politicians and academics continue to express concerns about the way policy is made, and whether it is ready to meet future challenges” (p.4).

Second, STI policies, like most other public policies, are multi-disciplinary in nature and draw inputs from various backgrounds (Fagerberg and Verspagen, 2009; Fagerberg et al., 2012; Martin, 2012a; Martin, et al., 2012; Rafols, et al., 2012). This implies that the capabilities required for STI policymaking, may similarly, need to be drawn from different knowledge sources and departments within FMST. According to Smits and Kuhlman (2004), new instruments are needed; while Borrás (2009) argues for a “widening” of the range of innovation policy instruments (see also, Howlett, 2011; Martin, 2012b). To address this requires STI policy research (Morlacchi and Martin, 2009). As FMST (2011) records, policymakers and expert groups were selected from cognate (i.e. related but non-FMST) Ministries and external agencies (such as, Biotechnology, Nigeria Space Agency) for the formulation of the 2012 national STI

policy. Although this research focuses on FMST as a STI policy unit and the Ministry, evidence (see for example, FMST, 2011) shows that FMST pools individual capabilities, resources and knowledge for policymaking from diverse external agencies, institutions and stakeholders. This creates the challenge of having the policy capabilities to effectively manage and coordinate (Feldman and Rafaeli, 2002) the various experts, groups and units involved in the policy formulation processes. Sabatier (2007, p.3) summarises this policymaking challenge:

“There are normally hundreds of actors from interest groups, governmental agencies, legislators at different levels of government, researchers, journalists, and judges involved in one or more aspects of the process. Each of these actors (either individual or corporate) has potentially different values/interests, perceptions of the situation, and policy preferences”

According to Feldman and Rafaeli (2002, p. 299) “organisations consist of people producing some form of common work. Much of organisation theory has been concerned with how to coordinate the activities of people in organisations”. Organisational routines, as “patterns of action” (Pentland and Feldman, 2005, p.793), are one form of tool often used in organisations to achieve coordination (Nelson and Winter, 1982; Feldman and Rafaeli, 2002). This need for effective coordination of policymaking activities and actors therefore calls for coordination of policy process, routines and skills in government policymaking organisations.

The third capability challenge is that STI policy covers a wide range of different sectors such as agriculture, education, energy, environment, healthcare, ICT, R&D, space, trade and investment. Nigeria’s 2012 national STI policy for instance is linked to the operations of 19 “science-using” Ministries (FSMT, 2011; 2012). Such a wide coverage of all major STI-using sectors, sometimes unrelated and distinct from each other, raises yet more capability challenges of great magnitude. Specific capabilities are needed, for example, to successfully carry out activities such as stakeholder engagement, evidence gathering or agenda setting across the sectors for which the STI policy being formulated seeks to include.

Fourth, like other public policies, STI policy is closely connected to various national and regional¹⁹ development interests and policies, thereby exacerbating policy formulation challenges. This is in line with Oyewale et al. (2013) who found that one of the reasons for policy failures in Nigeria is that public policies are formulated as standalones without reference to other policies. The authors advocate the need for capability developments necessary for ensuring the interconnectivity of S&T policies. The point being made here is that, with STI policy having direct bearing and impact on other major national policies, the importance of getting the policy formulation right is amplified. This implies that policymaking processes and policymakers must take into full account, the interdependences, commonalities and differences in related policies during STI policy formulation exercises.

Okonkwo and Akpa (2010) reports that in 2010, there were about twelve other policy documents on S&T at FMST. While some of the policies are draft policies still undergoing scrutiny, others have been given Federal Executive Council's approval. This approval (discussed in Chapters 5 (Findings) and 6 (Discussion)) is a necessary step in the legitimisation of the policy and enactment of relevant bills. The areas covered by these draft policies include space, capacity building of Nigerians, and transfer of technology, energy, biotechnology, engineering, and many others (Okonkwo and Akpa, 2010). There is therefore the need for a wide range of capabilities to cater to these specialised areas in policymaking. Consequently, the availability of the right set of organisational policy processes and routines, in addition to policymakers with relevant skills is of critical importance in order to formulate effective national STI policies, which are expected to operate in tandem with other public policies.

Fifth challenge relates to poor infrastructure²⁰ and weak institutions (NV20-2020, 2009; Akinwale, 2010; Foster and Pushak, 2011; AFDB, 2013) with inadequate infrastructure identified as the most problematic factor for doing business in Nigeria (WEF, 2014, p.294). Infrastructure challenges therefore plausibly remain major sources of concern in DCs. On the other hand, similar to capabilities, infrastructure is necessary in policymaking activities such as research, data and information collection and analyses;

¹⁹ E.g. North/South and East/West regions within Nigeria; or Nigeria's interactions with West African countries.

²⁰ Such as Internet, computers, broadband, roads and transportation, electricity and water.

exchange of ideas and knowledge; identifying and proposing policy options; stakeholders' engagement; engaging in policy debates and intra/inter-sectorial communication. The challenge then arises in DCs where policy organisations are unable to perform essential policy tasks due to lack of organisational processes (Pentland, 1995) and routines, a dearth of suitably qualified pool of policymakers with the necessary policy skills or insufficient infrastructure.

Since the 1960s, there have been various calls for improvements in S&T policy studies and organisational capabilities in order to strengthen the capabilities of institutions in DCs to formulate better STI policies (Oldham, 1981; Adubifa, 1988). Various sources of evidence²¹ indicate that the capabilities to formulate S&T policies are still not fully resident in many government institutions in DCs. In discussing the lack of STI policy capabilities UNCTAD (2003) and UNESCO (2006) note that the majority of African countries states are unable to formulate STI policies by themselves. Although improvements are being made, the situation is largely unchanged (NEPAD, 2006; 2010, 2014); with Nigeria as of 2012, still dependent on policymaking support from consultants and international agencies (e.g. UNESCO, UNDP and World Bank) – an evidence of persistent gaps in policy capabilities (FMST, 2011, 2012a/b).

Oyelaran-Oyeyinka (1998, 2006), Oyeyinka (2012) and UNCTAD (2006) focus on capabilities development and improving linkages and coordination between stakeholders and S&T institutions – formal and informal, private and public, indigenous and exogenous. The authors stress that in cases where research and knowledge-based activities are carried out in external agencies, public laboratories, and universities or other devolved institutions, evidence have shown that these agencies often disconnected due to weak coordination. In such cases R&D activities and linkage, for example, become important in order to be able to feed the outcomes into policies. In Africa for instance, public research institutes, which undertake a large percentage of the total national R&D, tend to have weak links with the rest of the actors within the national system of innovation (NSI) (Adubifa, 1998).

²¹ See for example, NEPAD, 2006, 2014; Bubou and Ini, 2009; UNESCO, 2009; Rath et al.; 2010; FMST, 2011; Urama et al., 2011; UNESCO, 2012; AU, 2014;

Communication is essential in a policymaking environment. Policy actors (i.e. stakeholders in the context of this thesis), by communicating policy tasks for instance, send and receive messages to each other. Nakamura and Smallwood (1980), notes that failure in communication can lead to transmission breakdown through “noise”. The implication for policymaking is that policy processes and routines may not be adequately followed through, thereby resulting in policy formulation failures. In Nigeria’s case, the combination of these factors result in weaknesses in the NSI and policymaking. This is in line with Oyewale et al. (2013) who found that gaps in policy capabilities, poor performance of S&T institutions, weak NSI and poor interactions amongst S&T institutions contribute to the policy failures observed. As a solution, the authors suggest the development of policy and organisational capabilities in order to strengthen S&T institutions. This thesis therefore shares these views, discussed in the preceding paragraphs, in considering that coordination amongst STI policy actors is important. In Chapter 6 (Discussion), I draw from the empirical data and discuss how the processes and routines involved in Stakeholder Engagement²² is useful in reducing these weaknesses and policy failures (Sanni et al., 2001) thereby improving the chances of successful policy formulation at FMST.

Various authors, from Oldham (1981) and Adubifa (1988) through to UNCTAD (2003), UNESCO (2010), Urama et al. (2011) and Bubou et al. (2012), advocate the need for more empirical studies aimed at strengthening policy capabilities in DCs. However, these authors fail to identify or specify what these capabilities needed for S&T/STI policy formulation are²³. In addition, their work focus on the development of skills (individual capabilities) for policymaking with little or inadequate discussion on what the processes and routines (i.e. organisational capabilities, formal and informal) for STI policymaking entail. Some explanations as to why an examination of organisational capabilities may have been overlooked include, too much focus on skills (Adubifa, 1988; Bell, 2013). Some possible reasons for this emphasis on technical capabilities provide useful insights.

First is the result of poor analysis and understanding of capability as equal to an individual’s skills – thereby excluding organisational capabilities – processes and

²² Stakeholder engagement, discussed in greater depth in Chapter 6, includes six policy processes: stakeholders’ identification, stakeholders’ roles, consultation, communications, coordination and collaboration.

²³ See Chapters 3-6, for more discussions on the specific policy capabilities, typology and taxonomy.

routines. A second possible explanation is the premise that skills equate to academic qualification, hence policymakers are government staff with advanced (MSc and PhD) degrees. In this sense, very little attention is paid to the appropriateness of field of study, experience or the institutional environment within which “policymakers” operate. Such institutional environments require incumbent organisational capabilities. A third possible justification in DCs for the emphasis on technical capacities is traceable to international development partners, such as, The World Bank, which measures technical efficiency and skills rather than organisational capabilities (UNCTAD, 2003). This thesis calls for a change of approach and recommends broader measurement indicators that also take organisational capabilities (processes and routines) into account.

Scholars, such as Steedman (1990), have called for the need to improve policymaking capabilities in DCs. Steedman, for instance, emphasise the importance of analytical capabilities. The author found that data and analysis capabilities within government institutions remain, either weak or completely lacking. As a result, international organisations (i.e. development partners and donors) are oftentimes forced to make rapid assessments and policy recommendation, based on their limited understanding of the situation in host countries. In the long run, such policies hardly succeed, essentially due to weaknesses in analyses carried out by these foreign agencies. Steedman (1990) recommends that donors, responsible for capabilities management and capacity-building must ensure continuity in approach, with the aim of formulating effective policies, and assisting with the development of DCs (policy) capabilities.

Significantly, Juma and Clark (1995) note that there is little analysis on the processes typical of policymaking in Africa. There is, therefore, a need for effective identification of the various ways in which the use of research and analysis in policymaking can be greater strengthened. Their insights are relevant to the individual capabilities (i.e. skills) aspects that this thesis investigates. The authors state emphatically that, ‘policy research’, which they define as the provision of intelligence to policymaking communities, is not offered as a specialised area of study in African universities, as in 1995 and the years before that. The situation has improved since then, although gaps remain, as I discuss further in the sections below.

Carden (2009) writes about the need to train, support and specifically build a critical mass of graduate students, researchers, and junior-to-mid-level policymaking cohort with a

strong understanding of the importance of linking skills in the DCs. In addressing organisational capabilities, Carden identifies, for example, research and evidence gathering, and argues that these are particularly useful when trying to formulate public policies that aim at strengthen DCs innovation systems. In this thesis I argue that the full range policy capabilities (processes, routines and skills) are vital to improving the effectiveness of STI policymaking and policies.

Efforts to Build New Capabilities

Bubou et al. (2012) examine the growth, practice and education of Technology and Innovation Management (TIM) professionals in Africa and records that the continent still lags behind in this area of expertise. In Nigeria the authors found near lack of awareness of TIM, stating that "until recently, only one university out of over 150 universities in Nigeria offered courses in TIM, and the National Centre for Technology Management [NACETEM] offers a professional post graduate diploma in technology management" (p.1).

The widespread recognition of the importance and use of policy research, which lies at the very heart of a country's ability to move towards sustainable development, means that there is clear acknowledgement that action needs to be taken to develop research skills. The implication is that variations²⁴ of STI policy research courses are now being offered in African Universities. Examples include (1) Technology and Innovation Management courses at Obafemi Awolowo University (OAU), Nigeria; (2) Management of Technology at Nile University, Egypt; (3) Science and Technology Studies, Stellenbosch University, South Africa; and (4) Innovation Studies, Wits University South Africa. In addition, there are now records of collaborations in this area, for example, between University of Pretoria, South Africa and the University of Port Harcourt in Nigeria (Bubou et al., 2012). However, the focus on skills development, through academic certifications only, means that organisational capabilities (i.e. policy processes and routines), within which skills function, continue to be neglected in Africa (AOSTI, 2013).

²⁴ E.g. Technology and Innovation Management (TIM) (Obafemi Awolowo University (OAU), Nigeria; Science and Technology Studies (Stellenbosch University, South Africa) and Innovation Studies, Wits University South Africa. However, the majority of other generic public policy courses across the continent do not necessarily target STI – e.g. the Public Policy course at National Institute for Policy and Strategic Studies, Kuru, Nigeria or Wits, South Africa.

Also worthy of mention are specialist training courses in the continent, such as those offered by International Development Research Centre (IDRC) “Think Tank Initiative” which supports independent policy research institutions in the developing world (IDRC, 2011). The United Nations University – Maastricht Economic and Social Research and Training Centre on Innovation and Technology (UNU-MERIT) course on the “Design and Evaluation of Innovation Policy in Developing Countries (DEIP)” (UNU-MERIT, 2014) is another example. These courses have many shortcomings. First, they are seminars or workshops, extremely short, e.g. three days to one week and not regular or on-going to allow for the build-up of experience through practise. Secondly, they rarely target policy formulation but instead focus on policy implementation or policy evaluation. Third, the majority are carried out outside of the organisation’s context, in hotels and external locations, thus encourages focus on skills, rather than incorporation of organisational policy processes and routines in their design and delivery.

NACETEM, as an agency under FMST, is vested with the mandate of training middle to high-level government and private sector staff in the conduct of STI management and policy. However, these FMST-tailored capacity building and training activities delivered by NACETEM are designed "to develop participants’ skills", i.e. knowledge gaps (Bubou et al., 2012, p.7; FMST, 2012b; NACETEM, 2014) thus ignoring essential components of policy capabilities, as defined in the thesis – organisational policy processes and routines. Therefore, in spite of the increased awareness of policy research studies in Nigeria, and the wider continent of Africa, the critical mass of professionals required to sustain this field of research, practise and policy is still far from what is desired, thus necessitating the use of external consultants and expertise from international development partners such as UNESCO (Siyanbola et al., 2013).

In summary, despite the emphasis on institutional reforms, policymaking and capability challenges highlighted by the range of experts discussed in this section, substantial gaps remain in our knowledge of (a) the specific policy capabilities needed for policymaking in DCs government institutions, (b) the roles policy capabilities play in STI policy formulation at FMST and why, (Research Question [RQ]1²⁵) (c) how policy capabilities

²⁵ What roles do capabilities play in formulating STI policies at FMST and why?

were developed at FMST and why, (RQ2²⁶) (d) how, why and to what extent policy capabilities have evolved (changed over the years) at FMST, (RQ3²⁷).

I argue in this thesis that there is need for a comprehensive typology (as evident from Table 2.1 above) and taxonomy of capabilities for policymaking. Using FMST in Nigeria as the illustrative case for DCs, and examining Nigeria's 2012 national STI policy formulation, I address these questions, in order to enhance our knowledge and improve the prospects of better policy formulation and policymaking. Next, I focus attention on FMST, Nigeria.

2.4 Capabilities and Policymaking at FMST

It has been recognised, as far back as the early 1970's, that there is need to "develop capabilities [*referring to skills*] for the formulation of autonomous S&T policy on 'the most pressing needs and problems of Africa'" (Oldham, 1981, p.10), the continent with one of the highest concentration of DCs. Recent evidence suggest that four decades later, very little progress has been made in this regard – as international organisations and consultants still carry out the bulk of national STI policy formulations in Africa. Nigeria's 2012 STI policy formulation, assisted by UNESCO, is a recent example. This indicates that the capabilities needed for STI policy formulation are still not fully resident in Nigeria. Nigeria's 2012 STI policy incorporates highly advanced S&T sectors – such as biotechnology, space, nanotechnology and atomic energy (FMST, 2011) – inclusion of which calls for the relevant set of capabilities to be incumbent at FMST during the policy formulation. Despite the capability deficiencies at FMST, failures in formulation, non-synchronisation of S&T policies and sectors, and challenges outlined in preceding sections and Chapter 1, Nigeria's 2012 STI policy highlights the importance of incumbent capabilities as a pre-requisite to effective public policymaking.

According to Adubifa (1988) one of the reasons technology policies fail in Nigeria is because the capabilities [*again, referring to skills*] for policy formulation simply do not exist. This situation is echoed by other authors, which include UNESCO (2005), COVIDSET (2009), UNESCO (2010), NACETEM (2011), Siyanbola (2010, 2011a/b), Bubou et al. (2012) and Siyanbola et al. (2013). These authors address the lack of relevant

²⁶ How did policy formulation capabilities originally emerge at FMST and why?

²⁷ How have policy formulation capabilities evolved (changed) at FMST and why?

STI policymaking skills in DCs. While their studies offer policy recommendations targeted at individual capability developments that focus on S&T skills, they lack a thorough discussion on the roles, development and evolution of the full range of policy capabilities, especially the processes and routines that underpin policymaking, in particular, policy formulation in Nigeria or DCs. The emphasis on skills overshadows the importance of processes and routines and offers a persuasive argument as to why STI policymaking remains weak in Nigeria, Africa and DCs.

One of the most vital aspects of policymaking is to formulate and identify policy problems as clearly as possible. It is important to note the existence of scholarly work that highlight the origin of problems that new policies attempt to address. Policymaking, policy formulation or presidential agenda-setting, for example, do not occur in a vacuum. Rather, they originate in response to, for instance, external debates and national policy or development problems. Such problems have a history as outlined in the US, for example, by Kingdon's work (Kingdon, 1995, 2014) on "Agendas, Alternatives and Public Policies" or Hoppe's (2010) book, "The Governance of Problems" – which analyses issues related to problem definition, identification and problem-solving. Although I am aware of such important work that contributes to our understanding of policymaking processes, I am consciously not adopting them as the focus of this thesis, which instead concentrates on policy (formulation) capabilities, defined in terms of policy processes, routines and skills.

It is important to point out that in Nigeria, as in most other African countries, public policies are formulated in response to a very narrow set of development challenges or singular concerns. Vested interests and policy hijack (discussed later in Chapter 6) may help to explain this situation. Weaknesses in stakeholder engagement, inability of the public to clearly articulate its demands, and lack of accountability of policymakers and decision-makers also contribute to this problem. The overall impact of this situation is that policy options and processes are often not in response to societal needs but rather inspired in most cases by external concerns. Juma and Clark (1995, p.126) submit that "in such a system it is difficult to determine how policies get into the system, and can be even more frustrating to ascertain where, when, and how policies may eventually get out of the system".

“Under conditions of limited public accountability, [government agencies], politicians and civil servants wield enormous power in shaping the direction of public policies and determining” how public policies are formulated (Juma and Clark, 1995, p.130). Government policy institutions, such as FMST, are therefore expected to respond to the demands the more powerful stakeholders, especially politicians, and citizens alike through policy interventions. In Chapter 6, drawing from the empirical data, I show that these difficulties have implications for a balanced approach to policy formulation processes, such as, agenda setting if the relevant policy capabilities and frameworks are lacking. Related therefore to the challenge of problem formulation are other policy processes (and their corresponding routines). These include, setting policy priorities, selecting a policy course, deciding on policy instruments, constructing policy alternatives and developing policy strategies. In the case of Nigeria, FMST in the STI Governance Structure (Annex 1) reports to the executive arm of government, the Federal Executive Council, headed by the president. Consequently, it is vital that the capabilities to clearly define public policy problems, set the policy agenda, engage with such powerful stakeholders’ (such as the president) and formulate STI policies, are incumbent at FMST.

Another important point is the heavy top-down structure at FMST, both in organisational setting and operation. FMST headquarters, located in the Federal Capital Territory, Abuja, is supported by 36 State Ministries of S&T (SMST) spread across Nigeria, with each SMST located in one of the 36 states of the country. The SMSTs act like branch offices and representative arms of FMST. They oversee S&T activities at state and local government levels. This centralisation of activities at FMST presents various capabilities and policymaking challenges. One such challenge is that decision-making that inform STI policymaking are carried out at the top, i.e. FMST and the Federal Executive Council. Similarly, policymaking is initiated, coordinated, managed and formulated, again, at the top with the resultant effect that the outcomes are simply passed down to the states for implementation.

Top-down policymaking models have been widely criticised. Long and Long (1992), refer to them as “structural” approaches that implicitly assume the “correctiveness” of specific (and often times, externally generated (i.e. by international organisations) methods. Top-down models fail to account for the autonomous behaviour of a wide range of relevant stakeholders affected by the policy outcomes. This results from top-down

decisions taken as if policy processes and routines can be regarded as a kind of “black box”, independent of the exigencies of social complexities. Long and Long’s recommendation is to engage the direct and “reflexive” participation of relevant actors in important policy decisions. This is vital in Nigeria’s context where political affiliations, geographical location (North or South especially), ethnicity, religion and social imbalances exert pressure on policy agenda. Therefore, processes and routines that promote stakeholder engagement and representativeness are critical to successful policy formulation.

According to Juma and Clark (1995) top-down policymaking is a “mechanistic model” in which political authorities take policy decisions centrally “without much regard for the ways in which such decisions are likely to unfold in practice. Moreover, because very often policies are not properly rooted within the communities being affected by them, there is often resistance to their implementation which could have been avoided had the policy formulation process been more participative” (p.128). Such resistance may be avoided, in a bottom-up and inclusive policy formulation approach that is consultative, participatory and broadens out²⁸. Bubou et al. (2012) advocate the importance of skills to help policymakers to address relevant capability gaps. Hallsworth et al. (2011), on the other hand, maintain that the future of policymaking lies in decentralising decision-taking and replacing top-down with bottom-up mechanisms. It remains to be seen how this would, in practice, work at FMST.

There are various reasons why bottom-up policy approaches cannot work in current arrangements in Nigeria. These include the dearth of policy capabilities necessary, for example, in funding, leadership and management, stakeholder engagement (for instance in the coordination of the wide range of stakeholders involved) and the current civil service structure which stipulates policymaking as a task exclusively reserved for Ministries.

This thesis suggests that for the top-down approach to be effective, specific capabilities would be necessary to ensure, for example, coordination, management and linkage of the various agencies and State Ministries of Science and Technology (SMSTs) to the FMST

²⁸ For more on participatory approaches to policymaking that encourages “broadening-out” rather than “closing-down” and improving stakeholders’ engagement see for example, Stirling (2009) and Ely et al. (2014).

during policy formulation exercises. It is, therefore, arguable that incumbent policy capabilities will facilitate the contribution of, for example, SMSTs to the national STI policy process in meaningful ways. Some of these contributions could be in policy processes and routines for research (data, evidence gathering and analyses), proposing policy options, public awareness, stakeholder engagement and agenda setting.

Consequently, this thesis contributes to improving our understanding of the range of policy capabilities (processes, routines and skills) involved in policymaking at FMST and by so doing, examine what roles they played in formulating Nigeria's 2012 national STI policy. This helps to determine which capabilities are incumbent (i.e. present at FMST) and those that can be considered as core (i.e. critical) to policy formulation. Furthermore, the new insights aim to deepen our knowledge of additional capabilities FMST may seek to acquire, in addition to answering the research questions.

2.5 Theoretical Framework

Drawing from the literature reviewed on capabilities, the definitions and interpretations presented in Table 2.1 and the vital role of capabilities in policymaking discussed in preceding sections, Table 2.2 below encapsulates the theoretical framework for this thesis. By "formal" in Table 2.2, I refer to incumbent policy processes and routines that are explicit, documented, that is, written down or recorded at FMST in a form that is accessible for future reference and use. On the other hand, "informal" refer to incumbent policy processes and routines that are implicit, not documented, and not easily accessible. Although informal processes and routines may be utilised in policymaking, they remain as tacit knowledge and open to various interpretations, depending on the individual policymaker's idiosyncrasies and abilities. Informal policy processes and routines at FMST are not documented, written down or recorded in a form that is accessible for future reference and use. Information on these informal processes and routines, presented in Chapter 4 (Findings), were obtained from the interview programme at FMST.

Table 2.2: Theoretical Framework of Policy Capabilities

Level of Capabilities	Types	Theoretical Framework	Policy formulation capabilities (needed to support policymaking processes)
Organisational	Processes, Routines (Formal [<i>explicit</i>] & informal [<i>implicit</i>])	<p>Lindblom, 1959; Nelson and Winter, 1982; Sabatier, 1986; Nakamura, 1987; Kogut and Zander, 1992; Sabatier and Jenkins-Smith, 1993;</p> <p>Dosi et al, 2000; Eisenhardt and Martin, 2000; NAO, 2001; Pavitt, 2002; Lundvall and Borrás, 2005; Sabatier, 2007; Chaminade, et al., 2009;</p> <p>Feldman, 2000, 2003, 2008; Feldman and Rafaeli, 2002; Feldman and Pentland, 2003; Becker, 2004, 2005; Salvato, 2009;</p> <p>Di Stefano, 2010; Helfat and Peteraf, 2009; Borrás, 2011; Urama et al., 2011; Pentland, 2011; Rerup and Feldman, 2011;</p> <p>Salvato and Rerup, 2011; Pentland et al., 2012; Winter, 2012; Miller et al., 2012; Felin et al., 2012</p>	<p>Examples include:</p> <p>Understanding and defining the problem(s), issue framing; Agenda setting; Setting of clear priorities, policy goals and targets; Proposing policy options; Appraising policy options; Defining policy outcomes;</p> <p>Selecting a policy course; Deciding on policy instruments and tools; Constructing policy alternatives; Developing solutions; Evidence gathering and analyses (STI policy research);</p> <p>Exchange of ideas and knowledge; Stakeholders' identification; Deciding on stakeholders' roles; Collaboration (working with a network of other actors); Resolving tensions, mediation; Coordination; Risk analyses and management;</p>
Individual (policymaker)	Skills, Abilities	<p>Oldham, 1981; Adubifa, 1988; Lall, 1987, 1992; Leonard-Barton, 1992; Bell and Pavitt, 1995; UNDP, 1997; UNCTAD, 2003, 2008; Archibugi and Coco, 2004; World Bank, 2009</p> <p>Clark and Mugabe, 2004; UNESCO, 1986, 2005, 2010; UNIDO, 2005; Bell, 2009a/b; NEPAD, 2010, 2014; Mugabe, 2011; Andreoni, 2011; Bubou et al., 2012; AU, 2014; AOSTI, 2013</p>	<p>Consultation; Engaging in policy debates, public awareness and engagement; Inter-sectoral communication and communicating policy; Resource management; Leadership; Decision making; Evaluation of previous policies; Funding (securing); Funding (allocating)...</p>

Source: Author

Chapter Summary

In this chapter I started by re-introducing the aim of the thesis and research questions. This was followed by discussions on the policy process and the implications for DCs. The literature review on policymaking in DCs revealed that there is an overemphasis on the role of skills (individual capability) in policymaking to the neglect of the role of organisational capabilities (processes and routines) that underpin effective policymaking in policy institutions, such as FMST. This thesis addresses this “neglect” by investigating organisational capabilities in greater depth.

Next, I examined capabilities by building on the concepts of policy capabilities as processes, routines and skills. I then discussed capability challenges for policymaking in DC (Section 2.3) and at the FMST (Section 2.4). This, I argue, is useful in deepening our knowledge of the concept of capabilities thus improving our understanding of their roles (Research Question 1), development (Research Question 2) and evolution (Research Question 3) in DCs government institutions involved in policymaking. The insights – from the analysis of policy capability challenges at FMST in Section 2.4 – were helpful in (a) showing why this study is both important and interesting, and (b) providing justification for the choice of FMST as the illustrative case for the investigation of these issues, i.e. FMST’s similarities to other DCs policy contexts.

Based on the definitions and interpretations of capabilities, which drew from the wide range of literature reviewed, a theoretical framework for capabilities and policymaking was presented in Table 2.2. The theoretical framework informs the Chapter 3 (Conceptual Framework), in which I develop three constructs “skills capabilities”, “routines capabilities”, and “process capabilities”. I use these conceptual constructs to discuss capabilities in greater depth in the next chapter.

In the next chapter I present the conceptual framework for this thesis, based on the theoretical framework put forward and interpretations of capabilities discussed earlier. The conceptual framework operationalises the range of capabilities in terms of processes, routines and skills underpinning the roles (Research Question 1), emergence/development (Research Question 2) and evolution (Research Question 3) of policy formulation capabilities at FMST that this research investigates.

Chapter 3. Conceptual Framework

Introduction

In Chapter 2, I addressed the aim of this thesis, which is to examine the role of capabilities in formulating public policies in Developing Countries (DCs) government institutions. This thesis in addition explores the development (origins) of policy capabilities and their evolution (changes) over the years. It uses Nigeria's Federal Ministry of Science and Technology (FMST) as the illustrative case for the investigation of these issues. Also in Chapter 2, I reviewed the relevant body of literature drawn from capabilities, science, technology and innovation (STI), public policy and development studies. The chapter discussed the policy cycle and policy processes, implications for DCs, and capabilities, as they relate to policymaking in DCs and FMST. Building on definitions provided in Chapter 1, I examined the concept of policy capabilities as processes, routines and skills in Chapter 2. Also in Chapter 2, I discussed capability challenges for policymaking in DCs and at the FMST and a theoretical framework for capabilities and policymaking.

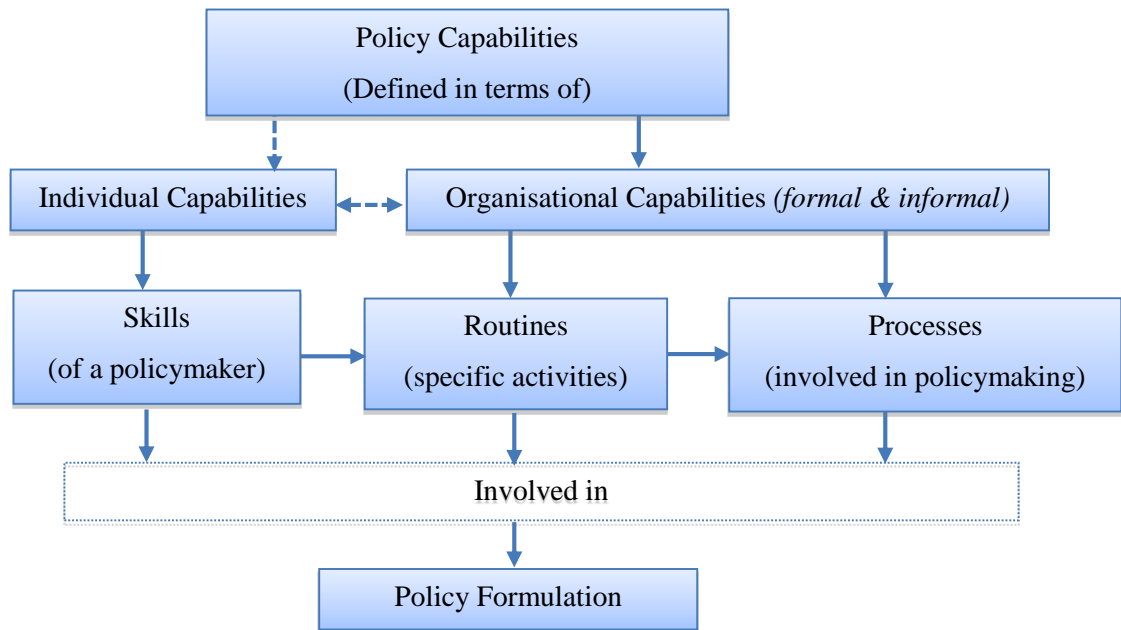
Drawing from the theoretical framework put forward in Chapter 2, I present in this chapter a conceptual framework of capabilities for policymaking. I use the conceptual framework to explain policy capabilities as they related to policy formulation at FMST. The conceptual framework provides the basis for the in-depth discussion of organisational (processes and routines) and individual (skills) capabilities. In the next section I start by discussing and presenting the conceptual framework.

3.1 Conceptual Framework of Capabilities for Policymaking

I use the conceptual framework to frame and examine capabilities in terms of policy processes and routines (formal and informal) and skills. In the remainder of the thesis I argue that policy processes and routines operate at the institutional level and therefore are "organisational (level) capabilities" whereas skills relate to a policymaker's abilities and consequently are "individual (level) capabilities". In Chapter 2, I showed, based on the literature reviewed, that skills refer to the abilities, knowledge and experience of policymaker's and are, therefore, complementary to processes and routines. Figure 3.1 below illustrates the conceptual framework. It shows that skills are used to carry out the activities involved in routines and processes. The dual-pointed broken arrow between individual and organisational boxes in the conceptual framework is used to indicate

complementarity between both capabilities while the solid arrows indicate direction of relationships and (inter)dependencies.

Figure 3.1: Conceptual Framework of Policy Capabilities



Source: Author

In the sections below, I examine policy processes, routines and skills, in greater depth.

3.2 Processes as Policy Capabilities

This section builds on the policy processes presented in the Theoretical Framework (Table 2.2, Chapter 2). Drawing from the framework I decompose the policy processes identified into four groups. This classification helps explain the basis for the selection of the policy processes for further investigation, data collection, analyses, and for more in-depth discussion.

3.2.1 Core Processes: The first group of policy processes are those I have classed as “core processes” (or core capabilities for policymaking). This group of processes are considered to be essential and critical to policy formulation – and so must be incumbent and carried out during policy formulation. Examples include: agenda setting, research, leadership and management, stakeholder engagement, and funding. UNIDO, (2005, pp.17, 47), highlights public funding as a critical process necessary for policy formulation in DCs. In the case of Nigeria, a Ministry’s anticipated projects for the next financial year,

used as the basis for budgeting, is submitted to the FEC for approval. Thereafter, FMST must secure and allocate a specific portion of that fund for S&T/STI policymaking, without which the policy formulation exercise cannot take place. In Table 3.1 below, I use Agenda Setting, which at FMST occurs at two (FEC and FMST) levels, as an example of a core policy process.

Table 3.1: Agenda Setting as a Policy Process

Set by FEC	Over-arching (national) policy agenda	The Economic Transformation Agenda of the Federal Republic of Nigeria; Nigeria's Vision 20:2020 [<i>set by the FEC - Federal Executive Council, which is headed by the President with Ministers as members</i>]
Set by FMST	General Policy Objective	Build a strong Science, Technology and Innovation capability and capacity needed to evolve a modern economy
	Specific Policy Objectives	The specific objectives are to: <ul style="list-style-type: none"> i. Facilitate the acquisition of knowledge to adapt, utilise, replicate and diffuse technologies for the growth of SMEs, agricultural development, food security, power generation and poverty reduction. ii. Support the establishment and strengthening of organisations, institutions and structures for effective coordination and management of STI activities within a virile NIS. iii. Promote activities for effective STI communication and ... iv. Create and sustain reliable mechanisms for adequate funding of STI activities in Nigeria.
	Policy priority area ²⁹	STI Promotion
	Rationale	There is need to popularise and inculcate STI culture in Nigerians for rapid socio-economic transformation.
	Objective	Create awareness in the society on the relevance of STI culture for the improvement of quality of life and sustainable economic development.
	Strategies	<ul style="list-style-type: none"> i. Encourage relevant stakeholders to provide students at primary and secondary schools, and technical colleges with broad-based curricula comprising relevant scientific knowledge and vocational skills. ii. Promote broad-based scientific knowledge and vocational skills for schools and colleges. iii. Provide policy incentives to Nigerian youths for career development in S&T fields. iv. Support programmes of the professional S&T bodies concerned with building STI capacity. v. Empower women in the utilisation of STI for economic development. vi. Encourage the establishment or strengthening of S&T Ministries at the State level.

Source: Adapted from Nigeria's National STI Policy, by FMST (2012a, p.14)

²⁹ The STI policy priority area, "STI Promotion" was selected for this illustration as it contains policy processes and routines (related to e.g. agenda setting, policy objectives and strategies, coordination, management, communication, and funding), skills and keywords (e.g. policy, S&T, STI, skills, knowledge, capacity building, development, etc.) relevant to this study and useful in explaining the argument of this thesis, e.g. See FMST (2012a) for more.

Table 3.1 above helps to illustrate the distinction between the (main) overarching agenda set by the FEC and the corresponding STI policy agenda (policy priority areas, objectives, rationale and policy strategies) set by FMST. Both levels are involved in setting Nigeria's STI policy agenda, thus helping to illustrate why this policy process is critical in policy formulation. I revisit this in Chapter 6 (Discussion).

Co-joined Processes: The second group are those policy processes that are largely similar in nature or function. I have termed this group “co-joined processes”. An example is “setting clear priorities” which can be joined with “setting policy goals”. This is because the processes and routines involved in “refining policy priorities” in order to make them clear are similar to (or can be arrived at by) “setting clear policy goals”. Although presented in this format to enhance clarity, the justification is based on the similarity in function between the policy processes and routine activities involved in operationalising the policy processes. Similarly, “engaging in policy debates”, “public awareness and engagement”, “inter-sectoral communication” and “communicating policy” policy processes are other examples where the case for resemblance and proximity can be established. I have therefore used “communication” in the broad sense as a collective term to co-join the four policy processes – “engaging in policy debates”, “public awareness and engagement”, “inter-sectoral communication” and “communicating policy”.

Intermediate Processes: The third group, “intermediate processes”, focus on processes that do not lead to an end in themselves but are a means to an end. For example, “policy monitoring and evaluation (M&E)” and “resolving tensions” belong to this group. Resolving tensions among working teams involved in policy formulation serves to ensure efficient team performance. It may improve working environment thereby enhancing a team's motivation and productivity in carrying out routine activities. However, it does not in itself lead to an end product. Furthermore, M&E routines³⁰ or reviewing of previous policies acts as a bridge to the formulation of a new policy. M&E, in this context, serves the purpose of providing inputs for the formulation of new policies. It is, therefore, not an end in itself but an intermediary step, which feeds into other policy formulation processes and routines.

³⁰ Specific activities carried out in reviewing previous policies; see section 3.3 for more discussions on routines.

Optional Processes: The fourth group deals with what I refer to in this thesis as “optional processes”. These policy processes are useful in policymaking but may not be necessarily required to be incumbent (i.e. present, resident) within the policy institution, e.g. FMST. I argue that other institutions drawn from within the NSI ecosystem or network of actors can (or may be able to) carry out this group of policy processes (and their corresponding routines). As a result, their value in a government policymaking institution such as FMST are somewhat diminished – since they can be carried out by another ministry or external agency (public or private). Examples of processes in this group include: (policy) research, M&E, and funding.

M&E, for example, can be performed by any actor (Dufour, 2010) suitably equipped and qualified; and not necessarily by FMST. What is vital to FMST is that it is able to, subsequently, utilise the outcome of such evaluations in its policymaking. It is therefore more important that the policy processes necessary, for example, the selection of the M&E agency, management, coordination and integration of the findings emanating from such M&E, are incumbent at FMST. Policy evaluation (or reviews) with a view to integrating the outcomes into the formulation of new policies can be far-reaching. It can for instance be extended to include the critical re-evaluation of existing policy formulation practices or the challenge of incumbent “best practices”³¹ in place. This requirement may be difficult to satisfy within governmental agencies due to structural implications (hierarchies and top-down governance) and bureaucracies. There may be some potential benefits, therefore, of having this group of policy processes carried out by qualified external non-bureaucratic agencies, which are independent and better equipped, for example, academia. This may improve the chances of achieving a more objective outcome in terms of policy goals.

In Nigeria, as with other DCs where the Ministry of Science and Technology structure is still predominant³², the top-down approach of governance means that the Federal Government (the Federal Executive Council, FEC³³, in the case of Nigeria) traditionally sets the overarching development policy, i.e. the national development, agenda. In which case it is not essential that the policy processes for setting the overarching agenda is

³¹ See Chapter 6 (Discussion) for more discussion on best practices as a policy formulation approach.

³² Other examples include Ghana, Kenya, Indonesia, Pakistan, South Africa, and so on.

³³ Council of Ministers. Described in Chapter 2, Section 2.4. Executive arm of Nigeria’s government.

incumbent at FMST, although desirable. The implication therefore is that the overarching policy agenda will be set, regardless of whether it is set by FEC, FMST, National Council³⁴ on S&T (NCST), another stakeholder group (e.g. National Planning Commission³⁵) or a policy entrepreneur. The role of FMST in such situations is therefore concerned with the development of the STI policy priorities, options, alternatives and strategies – all of which are necessary for realising the overarching development policy agenda set. In Chapter 6, I highlight some of the weaknesses with this approach and show that it impacts negatively on the development of policy capabilities.

The “Economic Transformation Agenda” (ETA) known as Nigeria’s Vision 20:2020 (NV20-2020, 2009) is an example of an overarching (national development) policy agenda set by the President. This national development policy by the presidency seeks to position Nigeria amongst the top 20 economies of the world by the year 2020. Respective Ministries under the government are therefore expected to formulate specific policy objectives, strategies and priority areas detailing how the Ministry would contribute towards the achievement of the transformation agenda. The 2012 national STI policy was therefore “designed to drive the ETA and deliver its objectives as an integral part of the NV20-2020” (FMST, 2012, p. 3). The aim of this agenda-setting approach in STI policy is therefore to spell out FMST’s priority areas, objectives and strategies towards actualising the ETA – as I presented in Table 3.1 above. As a result, policy processes such as “setting of clear policy objectives or priorities” and “proposing policy options”, within the given policy agenda set by FEC may be of more value to FMST than incumbent agenda setting processes.

As in M&E, discussed earlier, it is possible for institutions such as Universities and dedicated STI policy research units to carry out research or the training and development of the policy capabilities on behalf of FMST. Such an agency may well be specialised and better resourced than the FMST. In such instances, it may be more useful to have the incumbent processes, routines and skills for reviewing, coordinating and managing the activities of the external research agency, than to have the policy capabilities for research incumbent at FMST.

³⁴ Highest decision-making body in Nigeria on S&T issues. Headed by Minister of S&T, with the Permanent Secretary, State Commissioners of S&T and other stakeholders’ organisations as members.

³⁵ Nigeria’s Ministry responsible for coordinating national economic, growth and developmental goals.

To reiterate, optional policy processes are those that can be carried out by another agency, external to FMST. These policy processes are useful in policymaking but are not required to be incumbent, though desirable if they are incumbent. Therefore, being categorised as optional does not imply less important or unimportance. To the contrary optional policy processes can also be core, e.g. Research (and Evidence Gathering) policy process. I summarise the different groups of policy processes and the categorisations discussed in this section in Table 3.2 below.

Table 3.2: Summary of Process Capabilities for Policymaking

Process Capabilities	<i>Core processes</i>	<i>Co-joined processes</i>	<i>Intermediate processes</i>	<i>Optional processes</i>
Examples	<ul style="list-style-type: none"> • Agenda setting • Funding • Leadership and management • Consultation • Stakeholders' identification • Stakeholders' management • Setting of clear policy priorities and objectives • Coordination 	<ul style="list-style-type: none"> • Setting clear policy goals and objectives • (Setting of clear priorities, setting policy goals, refining policy priorities) • Communication (engaging in policy debates, public awareness and engagement...; Communicating policy) 	<ul style="list-style-type: none"> • Policy evaluation (review) • Resolving tensions (mediation) 	<ul style="list-style-type: none"> • (Policy) Research and Evidence gathering • Monitoring and evaluation (M&E) • Capacity building (e.g. skills training)

Source: Author

In Table 3.2 above, although communication, for instance, appear under co-joined processes, it is equally considered a critical process and therefore classified as a core process. Similarly, coordination, which currently is a core process, equally serves as an intermediate process. This situation in which a policy process may be discussed under one or more categories is helpful in emphasising the interconnectedness and relationships between the policy processes examined. In addition, it indicates that the classifications do not imply discreteness. They are used as a heuristic for analysis and discussion.

Furthermore, Table 3.2 outline some of the policy processes, which this study investigates further with a view to determining their roles in policy formulation, development and evolution at FMST. I define "Evolution" in this thesis in terms of innovation, that is, a new or different policy process, or improvements in the routines contained within incumbent policy processes. In summary, it refers to changes to a policy process

(Lundvall, 1992; OECD, 2005). A policy process (and its corresponding routines) that have not improved since its use in the formulation of Nigeria's first S&T policy of 1986 (or later introduction prior to 2012) at FMST is recorded in this thesis as "*Not Evolved*". For policy processes that have "*Evolved*", I differentiate between two types of evolution: incremental and radical innovation. Incremental innovation in this context refers to policy processes and routines that have received minor changes; while radical innovation relates to significant (transformational) change or complete overhaul of a policy process and its accompanying routines. I build on this distinction in subsequent discussions.

3.3 Routines as Policy Capabilities

Capabilities are "a precondition for effective policy design in developing countries" (UNIDO, 2005, p.16). As I have argued in preceding chapters and sections, the term "capabilities" has been used by various scholars to include organisational routines (Pentland and Feldman, 2005) and skills of individuals. The concept of organisational routine is a complex phenomenon and has been remarkably difficult to conceptualise in a rigorous way (Cohen and Bacdayan, 1994; Cohen et al., 1996; Feldman and Pentland, 2003; Berker et al., 2005). Felin et al. (2012, p. 1351) maintain that "while much progress has been made in understanding routines and capabilities, the underlying origins of these theoretical constructs have not received adequate attention". More work is therefore needed to explicitly tease out the role of routines in policymaking, how routines affect policy processes and skills (I discuss skills in Section 3.4), how routines emerge, how they change, and what impact they have on organisations (Berker et al., 2005, p.6) and policymaking. This thesis examines this issues and contribute to improving our knowledge and understanding of policy capabilities and policymaking.

In this thesis I also examine the roles that routines, as organisational capabilities, play in formulating public policies in a DCs government institution context. Routines, as with policy processes discussed in section 3.2 above, are important because they are a means to accomplish a goal and facilitate coordination within an organisation (Feldman and Rafaeli, 2002). This thesis therefore focuses on those organisational routines at FMST relevant to operationalising the policy processes (as defined in Chapter 1) examined such as agenda setting. But what are routines? Which routines are relevant to policy formulation at FMST, and by extension, in DCs government organisations? I explore routines in greater depth in the paragraphs below.

3.3.1 Routines – Deconstructing the Concept further

Before proceeding with the discussion of routines, as policy capabilities, it is important to highlight some of the basic definitions of the concept. The purpose is not to provide an exhaustive review³⁶ but rather to build on the more common definitions and current understanding of the concept. To reiterate, in Chapter 1, I defined routines as “repetitive, recognisable patterns of interdependent actions, carried out by multiple actors” (Feldman and Pentland (2003, p. 95). See also, for example Felin et al. (2012)). In addition, I explained that routines are not individual-level phenomena but instead collective and carried out at organisational level (Nelson and Winter, 1982, p. 107; Becker, 2004; Berker et al., 2005; Pentland, 2011; Felin et al., 2012). In these cases, the authors place the emphasis on the interactions which are collective actions, rather than the individuals interacting (Felin and Hesterly, 2007; Felin et al., 2012). Drawing on past research, Pentland (2011) suggest that organisational routines could be defined as patterns of interdependent tasks, thus helping to further clarify the nature of routines. This, the author argue, includes the relations between the actions that constitute routines, not just the relations between individual actors (Pentland, 2011).

Organisational routines (Pentland and Feldman, 2005) have been compared, metaphorically, to individual habits and behaviours or performance programmes and operating procedures (Nelson and Winter, 1982; Becker et al., 2005). By comparing organisational routines to a “gene”, Nelson and Winter (1982) implies a persistent feature of an organisation which stores genealogical information (organisational memory) that is passed from an individual, department or organisation to another (see also, Baum and Singh, 1994, p.3-4). This likening of organisational routines to genetic material is relevant to this study as it sheds light on the research questions, further explored and addressed in Chapter 6, Discussion.

The seminal work on routines by Nelson and Winter (1982) put the concept of routines firmly at the centre of organisation studies and analysis. It uses routines to refer to the repeatable ways in which tasks are carried out in organisations; a position adopted in this thesis. Routines, as capabilities, have also been defined in terms of tasks, patterns (Winter,

³⁶ For in-depth review of routines, see for example, Collis, 1994; Cohen et al., 1996; Feldman and Rafaeli, 2002; Feldman, 2000; 2003; Feldman and Pentland, 2003; Becker, 2004, 2005; Di Stefano et al., 2010; Pentland, 2011; Felin et al., 2012; Pentland et al., 2012.

1964; Becker, 2004); actions, (Cohen et al., 1996); activity, (Winter, 1990; Dosi et al., 2000); behaviour, (Winter, 1986; Bessant et al., 2001) and interaction (Zollo et al., 2002; Felin et al., 2012). Other authors (Pentland and Rueter, 1994; Betsch et al., 2001, Bapuji et al., 2012) argue that routines are recurrent. Cohen et al. (1996) refers to routines as organisational procedures while Cohen and Bacdayan (1994), Pentland and Rueter (1994), and Hodgson and Knudsen (2003) posit that routines are collective phenomena. A notable example of routine relevant to this thesis is coordination (Feldman and Rafaeli, 2002). In line with Feldman and Rafaeli (2002), Hodgson and Knudsen (2004) stress that routines have a strong coordinative dimension – referring to who should take which actions at which point in time (Felin et al., 2012).

Feldman (2000), Feldman and Pentland (2003) and Becker (2004), submit that routines are certainly repetitive; but they are not necessarily fixed or unchanging. This implies that routines can and do evolve (change over time, RQ3) (Pavitt, 2002) after their development (origins, or later introductions, RQ2) in organisations. These authors agree with those previously cited that routines are collective human activities and involve multiple actors; a key position adopted in this thesis. Although I focus on human actors (i.e. policymakers) in this thesis, it is important to point out that actors can also be non-human in nature. These are referred to as artefacts (see Feldman, 2000, 2003; Pentland and Feldman, 2003; Bapuji et al., 2012; Cacciatori, 2012).

In his in-depth review of literature on organisational routines, Becker (2004)³⁷ showed that routines are context-specific and context-dependent and that routine, as capabilities, are embedded in organisations. The specific context of this study is in policy formulation. As I discuss in Chapter 6, these concepts of context-specificity and context-dependency helps to improve our understanding of the roles (RQ1) that specific routines play in operationalising specific policy processes involved in formulating STI policies at FMST, a specific context. These attributes of routines, i.e. context-specificity and context-dependency, indicates that simply transferring a routine (and the routine tasks involved) from one organisation to another, e.g. through “best practices³⁸” is unlikely to yield the same result. This attribute also helps in explaining the development (i.e. origins of policy

³⁷ For earlier works, see for example: Teece and Pisano, 1994; Cohen et al., 1996; and Teece et al., 1997.

³⁸ I revisit best practice in Chapter 6, Section 6.3.3.5 as it has a bearing on the thesis findings.

capabilities, how and why, (RQ2) and evolution, i.e. changes observed in policy capabilities over the years (i.e. 1986 to 2012) at FMST (RQ3).

As the preceding paragraphs reveal, "researchers have chosen different terms and definitions for describing routines, contributing to making accumulation of our knowledge on routines difficult. What authors call "routines" often refers to slightly different things" (Berker et al., 2005, p.6). It is important to point out that earlier literature on routines has been riddled with ambiguities and inconsistencies (Becker, 2005)³⁹. Feldman and Pentland (2003, p. 95), for instance maintain that in spite of these ambiguities and inconsistencies, "there is considerable agreement in the literature that organisational routines can be defined as repetitive and recognisable patterns of interdependent actions, carried out by multiple actors"⁴⁰. Recent works by authors (such as Pentland et al., 2010; Felin et al., 2012) help to clarify the nature of organisational routines and provide a common point of reference for discussions on routines as they relate to organisational capabilities. This thesis contributes in this regards by examining routines as policy capabilities.

Feldman and Pentland (2003) add that routines may also be documented with a set of formal procedures or rules. Routines as "a set of formal procedures or rules" (p.3) is of importance to this thesis, because the execution of formal and/or informal routines (as repetitive and recognisable patterns of interdependent tasks or procedures) results in the operationalisation of policy processes (e.g. agenda setting, consultation or stakeholder identification) involved in policy formulation. For instance, this thesis explores questions such as: what were the routines (organisational tasks or procedures, formal or informal) carried out for policy processes such as consultation or agenda setting during the 2012 STI policy formulation FMST?

This thesis investigates the tasks involved in executing routines that result in the completion of policy processes and formulation of STI policy at FMST. By examining these routines the thesis contributes to providing explanations as to the roles that routines and policy processes, as capabilities, play in policy formulation, their development and evolution over the years at FMST. I build on this definition of organisational routines as

³⁹ For earlier works, see for example, Cohen and Bacdayan, 1994; Cohen et al., 1996.

⁴⁰ See also, for example, Di Stefano et al., 2010; Pentland, 2011; Felin et al., 2012, for more recent work which agrees with this definition.

repetitive and recognisable patterns of interdependent actions, carried out by (or involving) multiple actors. I emphasise the “collectiveness” of routines, a characteristic which highlights the organisational aspects, and differentiates routines from skills which deal with individual policymaker’s actions. A policy “action” refers to the specific tasks involved in accomplishing organisational routines (Feldman, 2000) during policy formulation.

3.3.2 Routines – the Selections Addressed

Building on the definition of organisational routines as repetitive, recognisable patterns of interdependent tasks carried out by multiple actors (Feldman and Pentland, 2003) during policy formulation at FMST, I focus on routines corresponding to the policy processes outlined in Table 3.2. Consequently, the routines, which this thesis addresses, include agenda setting, research (and evidence gathering), coordination, stakeholders identification and deciding on stakeholders’ roles, consultation, communication, leadership, decision-making, funding, monitoring and evaluation. I present the routines identified in this research to be relevant to policy formulation at FMST in Table 5.2.2 (Policy Routines), Chapter 5.

In this thesis I argue that for every policy process, there is a range of corresponding routines involving policymaking tasks, activities or procedures. That is, the policy process of agenda setting, for instance, has corresponding agenda setting routines. Table 3.3 below – which builds on Table 1.1, Chapter 1 – summarises the discussions and arguments put forward in this section, and helps to illustrate some of the specific tasks that comprise a policymaking routine, again using Agenda Setting policy process as an example. Although included in the table below, skills are discussed in greater depth in section 3.4.

Table 3.3: An Illustration of a Policy Routine and Routine Tasks

Policy Process	Agenda Setting routines (i.e. specific policy tasks) include:	Skills required to perform routines (tasks) include:
Agenda Setting Policy Process	<ul style="list-style-type: none"> • Idea generation, refining, testing (alternatives), research • Set up of committee(s) or working group(s) • Review of extant policies and research to identify gaps • Identify, select policy actors; policy instruments • Consultation with experts and stakeholder groups (from local and international agencies, relevant ministries, key sectors e.g. manufacturing, energy, transport, health)... • Set up of specific policy priorities objectives, strategies • Propose/appraise policy options; select a policy course • Construct policy alternatives - analyse problems, identify effective alternatives, redefine problems, select option(s) • Decision-making on e.g. policy objectives/strategies to adopt, actors/stakeholders to participate in agenda setting 	<ul style="list-style-type: none"> • Analytical • Coordination • Negotiation • Research, Learning • Absorptive capacity • Data analysis • Technical, ICT • Consultation • Leadership • Management, Admin. • Decision-making • Communication • Problem-solving

Source: Author

Tasks listed in Table 3.3 are not necessarily sequential; rather may be carried out independently, concurrently, or simultaneously. Order of listing does not imply priority, superiority or hierarchy.

Table 3.3 above provides example of a “core” process (Agenda Setting) and identifies routines involved and skills required. More examples of routines, and the specific policy tasks involved in the routines in addition to the justification for the selection of the routines, are discussed in subsequent chapters. In Section 3.4 following, I continue with the examination of the conceptual framework, now focusing on “skills capabilities” and the role they play in policy formulation.

3.4 Skills as Policy Capabilities

“The lack of realistic processes leaves too much in policymaking to chance, personality, and individual skill” – Hallsworth et al., 2011, p.5 (Institute for Government, UK)

This thesis, in addition to building on policy processes and routine as collective actions, also emphasise the skills of individual policymakers utilised in carrying out routines activities, necessary for accomplishing policy processes. “Skills are capabilities” that individual policymakers, as agents, require in order to execute organisational routines (Nelson and Winter, 1982, p. 73-95; Andreoni, 2011, p. 12). Performing a set of activities require capable agents endowed with the relevant skills. This thesis therefore addresses those skills that support policy formulation processes and routines. They include skills such as research (useful for evidence gathering), communication (necessary for

consultation and stakeholders' coordination), management (applicable in coordination, leadership and decision-making), learning (useful in innovation and change - evolution of capabilities) and various technical skills (also known as technological capabilities). I examine these further.

Richardson (1972) notes that organisations can be seen as carrying out large number of activities. These activities can be related to, for example, research and development (R&D) and design, execution, and coordination, which and in the context of this thesis, would apply to, for instance, the policy formulation processes or stakeholders. However, “we have to recognise that these activities have to be carried out by organisations with appropriate capabilities, or, in other words, with appropriate knowledge, experience, and skills” (p.888). Richardson’s definition stresses how the concept of capabilities refers to a form of know-how, namely appropriate knowledge, experience and skills (Richardson, 1972).

Assessments of policymaking and coordination capabilities in government have revealed that skills useful in policymaking are not well developed in ministries (OECD, 2007). Felin and Hesterly (2007) and Felin et al. (2012) posit that the role of the individuals is crucial to the understanding of skills as capabilities. This is because individuals, policymakers in this case, with the relevant skills carry out the tasks that constitute routines. I defined policymakers in Chapter 1 as civil servants such as scientific officers, chief scientific officers, principal scientific officers, science desk officers, researchers and directors at FMST (and those drawn from related Ministries), who were involved in the policy formulation exercise and carried out the policy routines. Below I discuss selected skills.

3.4.1 Analytical Capability as a Policy Skill

Although this thesis focus on the identification and examination of policy processes and routines, discussions of skills that contribute to policy formulation is helpful in advancing the thesis arguments. One of the critical activities that FMST carried out during the 2012 STI policy formulation was the review of extant S&T policies (Siyanbola et al., 2013). This called for skills that include research, analytical, ICT, management, leadership⁴¹,

⁴¹ Leadership as a skill refers to an individual’s ability to lead (i.e. individual capability); whereas, as a policy process with routines (organisational capability in this case), Leadership processes and routines

decision-making and other skills. Research and analytical skills for instance are utilised in policy processes, such as, data and evidence gathering for setting policy objectives, deciding on policy options, policy alternatives, or deciding on the choice of policy instruments, i.e. “policy mixes” (Borrás and Edquist, 2013). The outcome of these activities form a key part of the policy formulation. Although information gathering for policymaking still tends to be *ad hoc* at FMST as the findings reveal⁴²; I argue that the availability of policy capabilities at FMST, as defined in this thesis, is essential to improving the prospects of formulating effective policies.

Riddell (2007, in Borrás, 2011) sheds more light on analytical skills as a capability and treats analytical capability as a requirement of policymakers necessary for the analysis of readily available data, policies and procedures. Howlett (2009) argue that the recent political emphasis on fostering evidence-based policymaking requires actors, and especially governmental actors, to acquire a set of analytical capabilities in order to generate and make sense of the evidence that shall inform policymaking. Borrás (2011) on the other hand, advocates a very strong analytical capacity base both within government and non-governmental organisations and think-tanks. The author concludes that empirical evidence is yet to adequately reveal where the skills capability may be situated in DCs or how they have evolved. This thesis contributes in this regards in helping to fill these gaps in our knowledge of the roles that capabilities play in policymaking.

Other policy skills as capabilities relevant to this study include administrative capability, learning capability, absorptive capacity, reflexive capabilities, technical (ICT, technological) capabilities. Learning capabilities broadly refers to all formal [and informal] rules and regulations that allow learning in organisations (Borrás, 2011). I briefly discuss administrative, reflexive and technical skills and absorptive capacity.

relate to the civil service and FMST-wide structure and arrangements that results in e.g. leadership selection and recruitment, rotation, promotion. Similarly, management as a skill is confined with the ability to manage e.g. policy tasks, resources; while Management as a policy process occurs at organisational level. Lastly, a decision-maker is an individual with skills; whereas, decision-makers is a group (as defined in Chapter 1), making policy decisions at organisational levels.

⁴² See also, for example, ATPS, 2011; Hallsworth et al., 2011; AOSTI, 2013

3.4.2 Administrative Capability as a Management Policy Skill

Earlier in Chapter 2, I argued that administrative capability is a management skill required in institutions and that it relates to “government’s ability to develop, direct, and control resources to support the discharge of its policy and program responsibilities” (Donahue et al., 2000, p.384) and manage tangible or intangible⁴³ resources⁴⁴. According to Hou et al. (2003) administrative capability relates to the “policies, procedures, and resources governing administrative action and designed to improve government performance” (p.300). Common to both definitions is the notion of civil servants (as policymakers) controlling, designing and governing resources as well as actions towards public policy outcomes, in the case of FMST, the delivery of STI policies.

Government agencies formulate, enforce and change their own bureaucratic structures in order to fulfil strategic objectives. The degree of administrative skills has an impact on performance. This has a bearing on the ability to solve the problem of coordinating complex and crosscutting policy activities across departments. For DCs with weak institutions, this can amount to a daunting task. Hence administrative capabilities need to be more strategically organised, resourced and better understood in government institutions as it has a bearing on policymaking.

3.4.3 Reflexive Capability as a Policy Skill

Reflexive capability refers to the considerable variation, particularly regarding the time lapse between the overall identification of policy priorities and the actual definition of concrete lines of policy action. This diversity might be associated with the relative reflexive capability present within an organisation. It can refer to the ability of a wide set of actors within FMST and stakeholder organisations to make informed reflections about problems and solutions in relation to policymaking processes and routines. Borrás (2011) explains that in some countries there is a high degree of reflexive capacity on technology and innovation issues. Although the link between high reflexive skill and science policymaking might be difficult to establish, empirical evidence supports the fact that

⁴³ Not physical in nature e.g. intellectual property, patents, trademarks, copyrights, methodologies, goodwill, brand recognition.

⁴⁴ ‘Resources’ in this sense is used to mean the given fixed stock of different types of capital available at a certain point in time, and ‘administrative capacity’ is the managerial dimension of ‘using’ them appropriately (Borrás, 2011).

active reflexive skills were essential to the adoption of the new innovation policy paradigm in the late 1990s and all through the 2000s in some developed countries (Biegelbauer and Borrás, 2003). Nigeria is not amongst these countries, indicating capability deficiency in this area and a further justification for this study.

3.4.4 Technological Capability, Knowledge and Experience as Policy Skills

Another aspect of “skills capabilities” is the concept of technological capabilities, which has a vast array of literature that includes the works of Abramovitz (1986), Bell and Pavitt (1993a/b), Pavitt (1998), Archibugi and Coco (2004), Clark and Mugabe (2004), UNIDO (2005), Bell (2007, 2009a/b) and Dosi et al., 2008. Abramovitz (1986) uses the concept of capabilities to capture those “tenacious societal characteristics” that influence the responses of given societies to economic opportunities. In developing the catching up hypothesis, Abramovitz equates capabilities with managerial and technical⁴⁵ (technological) skills (Archibugi and Coco, 2004), which are essential in policymaking.

This systemic concept of capabilities has also been re-proposed in various contributions on technological capabilities or innovation systems (Lall, 1992), as well as in recent literature on business and management (Andreoni, 2011). Throughout the processes involved in policymaking in government ministries, diverse drafts are utilised and modified in accordance with the contributions of the various actors involved. Administrative and technical skills are essential. Others include, ICT (in terms of technical and computer skills), problem-solving and management (Freeman and Soete (1994), communication, teamwork and good work ethic (OECD, 2007), and learning (Borrás, 2011).

Archibugi and Coco (2004) in discussing technological capabilities addresses components that include: technology, the infrastructure⁴⁶ required to support such technologies and the skills needed to exploit the technologies created. This highlights the importance of skills and skill development. The authors maintain that technological capabilities have always been a fundamental component of economic growth and conclude that they are strongly associated with human skills. They maintain that new

⁴⁵ Such as computing and ICT skills are necessary for producing policy drafts, conducting research and evidence gathering, communication, management and various other policy formulation activities.

⁴⁶ In this sense refers to, for example, Internet penetration, broadband, computers, telephone, and electricity.

technological systems require capabilities (referring to skilled personnel) in a cumulative manner (See also for example: Bell and Pavitt, 1995; Pavitt, 1998; Juma and Konde, 2002; Dosi et al., 2008). Building on this line of reasoning, I argue that innovation in policymaking involves skills, knowledge, and the creation of new processes and routines, technologies and technological infrastructures (used by skilled and experienced people). These capabilities, as I have shown in the conceptual framework above, are therefore complementary rather than mutually exclusive or interchangeable. This is in line with Abramovitz (1989), and Archibugi and Coco (2004, p. 2), who argue that “first-rate infrastructures devoid of sufficiently qualified and skilled labour force is useless and vice versa”. This position, although viewed at country and institutional level, re-enforces the argument of this thesis that skills, without the necessary organisational processes and routines, is insufficient in policymaking.

3.4.5 Academic Qualification as a Policy Skill

Archibugi and Coco (2004) also discussed skills in terms of education and qualifications. While analysing the role of education and qualifications the authors posit that qualifications in science-related subjects is an important contribution to individual’s skills and the technological capability of a country. (Archibugi and Coco, 2004, p.8). Qualifications⁴⁷ (Dosi et al., 2000) help to capture learning-by-doing and learning-by-using (Archibugi and Lundvall, 2001; Archibugi and Coco, 2004). Consequently, this thesis reviews the qualifications of policymakers at FMST as part of the skills capability in order to determine the role this plays in in policy formulation at the institution.

This position is in line with earlier studies and literature into how tertiary education and qualifications help in the development of human skills (OECD, 2007). The policy formulation challenge requires a broad set of skills usually provided by a good advanced academic degree and supported by experience. Since most of the knowledge that organisations use, especially in DCs, come from the outside, their “absorptive capacity” (Cohen and Levinthal, 1990) – that is, their “ability to recognise the value of new external

⁴⁷ For more discussion on education and qualifications in DCs, with emphasis on Africa and their impacts on capabilities and policymaking, see for example, Froumin et al. (2007), World Bank (2009, 2010), UNDP (2008) and Larsen et al. (2009).

information, assimilate and apply it – becomes essential for innovation” and policymaking (World Bank, 2010, p.167).

3.4.6 “Absorptive Capacity” as Knowledge and a Policy Skill

UNIDO (2005), defines capabilities as skills, experience or knowledge; referring to policymaker’s skills as capabilities, as defined in this thesis. The authors argue for skills to be upgraded in order to formulate effective policies necessary for fostering development and economic growth. The concept of ‘absorptive capacity’, as used in this thesis, refers to the ability to draw from, assimilate and apply external knowledge and information, that is, draw on external sources of capabilities – processes, routines and skills relevant to policymaking. Absorptive capacity therefore refers to knowledge, which is defined as a key component of skills in the context of this thesis. UNIDO (2005) records that absorptive capacity, as knowledge, is a key enabler of policymaking and economic development and thus matters in the development and evolution of capabilities and public policies. Although first used in studies on firms, absorptive capacity applies in this study in that it emphasises the importance of knowledge as a policy-relevant skill (Radaelli, 1995).

This section has attempted to illustrate that skills are required in order to perform the repetitive tasks and activities involved in routines, which contribute to make up the policy processes outlined in Table 3.2. Drawing together the various analyses on what skills comprise of, I define skills for the purposes of this study, as the abilities, knowledge and experience of individual policymaker’s needed to formulate effective policies. I sum up the emerging insights on the skills as follows: (a.) skills are complementary to processes and routines and functions within the limits set by processes and routines within organisations; (b.) skills are necessary for carrying out the tasks embedded in specific organisational routines; (c.) the operationalisation of routines results in policy processes, and therefore are the bedrock of policies. I develop these arguments further in subsequent chapters.

Chapter Summary

In this chapter I started by presenting the conceptual framework of capabilities for policymaking. Following that I built on the concept of policy capabilities as processes, routines and skills – introduced in Chapters 1 and 2. Based on the conceptual framework, I developed three constructs “process capabilities”, “routines capabilities”, and “skills capabilities”. I used the constructs to further clarify the aim of the thesis.

The constructs also helped to enhance clarity in sections of the thesis where the use of policy “capabilities” fails to explicitly show what is being referred to (a policy process, policy routine or policy skill) or risked conveying a collective meaning, i.e. an aggregation of processes, routines and skills. Furthermore, I used the constructs in subsequent discussions to deepen our understanding of the (1) roles that policy capabilities played in formulating Nigeria’s 2012 national STI policy at FMST (Research Question 1), (2) development – origins of policy capabilities at FMST, (Research Question 2) and (3) evolution – incremental or radical changes in policy capabilities at FMST over the years, (Research Question 3).

The discussions in this chapter resulted in the classification of process capabilities into groups: core processes, co-joined processes, intermediate processes and optional processes. The purpose of this classification was to inform discussion. For example, it helps show that although the entire range of policy processes are useful in policymaking, some are required to be present (incumbent, resident in the policy institution) in order for policy formulation to take place. This group of policy processes I referred to as core processes (or core capability). However, the other group of policy processes, although desirable, are not necessarily required to be incumbent. Furthermore, this chapter elaborated on the routines and skill capabilities that this thesis will focus on. I explained that routines are recognisable, specific and independent tasks while skills refer to the abilities, knowledge and experiences of policymakers’ necessary for carrying out routines.

In the next chapter I explain and justify the thesis research design and the rationale for the choice of case study research methodology. In addition, I discuss the selection of FMST as the illustrative case study, and explain the data collection and data analysis strategies.

Chapter 4. Methodology

Introduction

In this chapter I provide justifications for the research design and the rationale for the choice of case study research methodology. I also discuss and explain the selection of FMST as the illustrative case study. Finally, I explain the steps taken to operationalise the concepts being investigated, collect data at FMST by means of semi-structured interviews and analyse the data gathered using the explanation building strategy. I reiterate the research questions.

4.1 Research Questions

They are:

- I. What roles do capabilities play in formulating STI policies at FMST and why?
- II. How did policy formulation capabilities originally emerge at FMST and why?
- III. How have policy formulation capabilities evolved at FMST and why?

To reiterate, this thesis focuses on organisational (policy processes and routines) capabilities for policymaking. As I have argued in previous chapters, the role of skills in policymaking is secondary and therefore considered less important in this thesis as skills serve to support the policy processes and routines within institutions. For this reason, the data collection strategy (see Section 4.3) focuses on processes and routines, with less emphasis on skills.

4.2 Research Design

“Every empirical study has an implicit, if not explicit, research design” (Yin, 2009, p. 24). The research design described in this section links the empirical data collected at FMST to the research questions. This helps to draw useful conclusions on policy capabilities and their roles in policymaking, development and evolution at FMST over the years, i.e. 1986 first national S&T policy formulation to 2012 national STI policy formulation. In Section 4.2.1, I provide the justification for a qualitative case study approach and explain why it is most applicable to answering the research questions posed in the thesis.

4.2.1 Rationale for Case Study Approach as the Research Design

This study investigates the role of capabilities in policy formulation by examining FMST's National STI policy exercise, which was completed in 2012, by using the case study methodology. Yin (2009, p.18) defines case study as “an empirical enquiry about a contemporary phenomenon set within its real world context – especially when the boundaries between phenomenon and context are not clearly evident” (see also, Yin, 2012, p.4). Despite the declared and elaborate goals of the STI policy, there was little available information on the role of capabilities in its policy formulation process, what capabilities were utilised or studies on what capabilities were perceived that could be further developed to improve the policymaking.

Yin (2009) also adds that case studies are particularly suited when “how” or “why” questions are being posed. Besides situations involving how or why questions, case studies are the preferred method when “the investigator has little control over events” and “the focus is on a contemporary phenomenon within a real life context” (Yin, 2009, p.2). Consequently, a case study research design was deemed most appropriate for this thesis. The characteristics of case studies as a method of exploring “elements of the social [world] through comprehensive description and analysis of a single situation or case of an individual, setting, group or event” (O’Leary, 2010, p.174) were vital in studying the role of capabilities in STI policy at FMST.

Stake (1995, p.64), had earlier noted that “two principal uses of case study are to obtain the descriptions and interpretations of others”, who in this research, are the policymakers who participated in, and observed the events that occurred during the STI policy formulation at FMST. Other authors (for example, Silverman, 2008; Yin, 2009, p.2; 2012, p.5), in support of Stake’s (1995) position, add that case studies are pertinent when the research addresses either a descriptive, “what is happening or has happened” or an explanatory question, “how or why did something happen”. This descriptive and interpretative feature of case studies provides the rationale for the use of this method in studying policy capabilities at FMST. The interview data collected was therefore based on participants’ explanation of the policy formulation activities and interpretation of the events that resulted in the national STI policy document. In this instance, participants’ explanations and interpretations were necessary to illuminate the research.

In spite of these advantages, case studies are vulnerable to accusations that the findings are not generalisable (Silverman, 2008; Yin, 2009, 2012, pp. 7-8). Although some scholars are critical of case study methodology, Flyvbjerg (2011, p. 302) argues that “much of what we know about the empirical world has been produced by case study research, and many of the most treasured classics in each discipline are case studies”. Flyvbjerg cites notable examples of case studies such as those of Galileo⁴⁸, Isaac Newton, Albert Einstein, and the works of Charles Darwin; all of which indicate that the ability of case studies to contribute to scientific developments and increased knowledge in social science studies is not in doubt. According to O’Leary (2010), case studies facilitate deep exploration which makes it possible to unearth “legitimate, valid, and worthwhile answers [which] might be held within a particular case” (p.174). Yin (2009, p.4) sums this up in “there’s no formula, but your choice depends in large part on your research question(s). The more that your questions seek to explain some present circumstances (for instance, ‘how’ or ‘why’ some social phenomenon works), the more that the case study method will be relevant”.

Finally, case study research approach can be used in theory-building and theory-testing in addition to supporting the testing of theoretical propositions and generalisations (Yin, 2009; Flyvbjerg, 2011, p. 305), which this study aims to accomplish. I discuss the propositions of this study in Section 4.4.3 below. I use case study in this thesis to gather evidence useful in answering the research question, rather than to test theoretical propositions. Yin (2009) also maintains a value of case study method lies in their generalisability to theoretical and analytical concern. The findings of this research are not expected to be generalisable to all government policymaking institutions in Nigeria or in DCs across the globe. Instead, the aim is to achieve contingent generalisations, in settings with conditions similar to FMST, that is, where a government ministry carries out the STI policymaking. This is in line with the five misunderstandings of case study research as addressed by Flyvbjerg (2006).

Besides the case study method, I considered other research strategies. Each method has its pros and cons. Yin (2009) explain that the choice of method should depend upon (1) the type of research questions, (2) the level of control the researcher has over the events, and (3) whether the phenomena being investigated the focus on contemporary or

⁴⁸ Galileo’s single case study led to the rejection of Aristotle’s law of gravity (Flyvbjerg, 2011, p. 302)

historical event. I could not use experimental research design as I had no control over the events or phenomenon being studied, i.e. which capabilities were utilised and the roles capabilities played in the policy formulation, how or why capabilities were developed or have evolved at FMST.

The survey method was rejected on the grounds that case studies are more suitable for investigating “how” and “why” research questions, which are largely qualitative in nature, deal with opinions, feelings and personal judgments. Historical method could not be applied as the research focuses on a recent event, the formulation of Nigeria’s National STI Policy, completed in 2012. Lastly, longitudinal approach was not adopted because there is a time constraint for the completion of a doctoral study. In addition, some policymakers and incumbents involved in the policy formulation exercise were no longer there to be interviewed. To help in these regards I used historical FMST documents on STI policy as these provided background information (Section 4.3).

Based on these arguments I conclude that case study research design was most appropriate for understanding what policy processes, routines and skills were involved in the 2012 national STI policy formulation exercise at FMST and the roles they played in it. It also enabled an investigation on how and why capabilities were developed, and finally, how they may have evolved over the years and why.

4.2.2 Units of Analysis and of Observation

I use the policy processes being investigated as the primary unit of analysis. This break down of policy capabilities into processes, routines and skills involved in STI policy formulation at FMST is in line with Yin (2009) who suggests that in the presence of more than one unit of analysis, you should choose those that will most likely illuminate your research questions. Yin submits that the unit of analysis can be some event or entity, however the important factor is that the unit of analysis should primarily be concerned with what is being studied. Yin further adds that as a general rule, the tentative definition of the unit of analysis should be related to the way the initial research questions have been defined. The entity being studied in this research is “policy capabilities” which in this thesis refers to (a) policy processes, (b) the routines involved in the policy processes and (c) the skills required to execute the routine activities.

Therefore, following Yin (2009), I argue that the main unit of analysis in this study is the policy processes, policy routines and policy skills involved in policy formulation at FMST. As I discuss in Sections 4.3 and 4.4, this breakdown of policy capabilities into processes, routines and skills, drawing from the conceptual framework, is used to guide data collection and analysis in structuring the findings and discussions that follow in Chapters 5 and 6 respectively. Yin (2009) notes that the decision as to what unit of analysis is eventually used can be revisited and changed at a later stage if new insights emerge during the data collection stage. In the case of this thesis, there was no need to revisit or change the units of analysis throughout the life cycle of the research. This subdivision into policy processes, routines and skills proved efficient in collecting and analysing the interview data and the secondary evidence gathered. Next I focus on the data collection.

4.3 Data Collection

Data collection was conducted in two phases: (1) a pilot case study; and (2) an interview programme that utilised semi-structured questions. I collected data for the research by interviewing staff within the relevant FMST departments and agencies involved in policymaking. Additional interview evidence was gathered from other Non-FMST organisations (referred to as “stakeholders”) whose staff participated in the formulation of the 2012 national STI policy. Members of the stakeholders group were invited by FMST to participate in specific processes or stages of the policy formulation exercise, for example, consultation, draft review, expert review or policy ratification stage. As a result, they provided partial interview responses useful in helping to corroborate and validate FMST interviewees’ responses. This is in line with Stake (1995) who submits that it is important to obtain the descriptions and interpretations of participants and observers in case study research.

The stakeholder organisations were drawn from: academia (Obafemi Awolowo University, Ile-Ife), industry and private sector organisations (Manufacturers Association of Nigeria), international development partners (World Bank, UNESCO and UNDP), news and media, and civil society organisations. Interview participants were therefore divided into two broad groups: FMST (which provided complete data) and Non-FMST (i.e. stakeholders, which provided additional but mostly partial data - depending on the policy formulation stage they were involved in). The criteria therefore I used in selecting

interviewees was based on (a) position, relevance and experience at FMST, (b) whether interviewee participated in the policy formulation, and (c) at what stage of participation.

To reiterate, data collection consisted of two phases: a pilot phases and interview programme by semi-structured questions. I describe both phases in Sections 4.3.1 and 4.3.2 respectively.

4.3.1 Pilot Case Study

I conducted a pilot case study with the aim of acquiring preliminary information that could help in the design of the questionnaire for the in-depth interviews. Because “a single case calls for intensive data collection at the same site” (Yin, 2009, p.75), having a good knowledge of FMST was critical to a successful data collection exercise. According to Yin, a pilot case study is useful in refining the data collection methodologies thereby improving the procedures to be followed, the specific actions required and contents of the data. The pilot case study at FMST was informative and assisted in refining the interview questions.

I carried out the pilot at FMST and Raw Materials Research and Development Council (RMRDC), an agency of FMST, in April 2013, both located in Abuja, Nigeria’s capital city. Other FMST related agencies and parastatals, see Annex 6, are distributed in various locations in Abuja and across the country. The pilot was also conducted at these locations in May 2013. The National Centre for Technology Management (NACETEM), for example, is based at Obafemi Awolowo University (OAU), Ile Ife, about 500km from Abuja. The contributions and relevance of these agencies to this study derive from the fact that key experts and policymakers are usually drawn from within them to work with FMST officials during policymaking exercises. This was the case in the 2012 national STI policy formulation (FMST, 2012). I revisit this point in Chapter 6 (Discussion) as it helped answer Research Question 2 (how have policy formulation capabilities developed in FMST and why); and Research Question 3 (how have policy formulation capabilities evolved in FMST and why).

The pilot case study involved the following:

a. Review of Secondary Sources of Data

In this stage, I reviewed secondary sources of data that provided additional insights on the roles, development and evolution of policy capabilities at FMST and policymaking in Nigeria's context. I started by identifying useful and accessible sources of information such as institutional and archival records, previous S&T policies (completed or drafts), progress reports and other policy publications, e.g. ministerial press briefings. The purpose was to analyse relevant STI-related government policies and documents at FMST since 1960⁴⁹ to 2012, which may have useful contextual bearing on the research. I was granted access to FMST archives and library, after completion of formal the procedure which involved an official application in writing. Although, an earlier (2011) draft of the STI policy was online via FMST website, other important documents, such as previous national S&T policies, were offline and could only be accessed through the relevant departments and officials.

The secondary sources consulted include:

- FMST S&T policy-related documents such as Nigeria's first national S&T policy (FMST, 1986) and subsequent national S&T policies (FMST, 2003); press and ministerial briefings, reports on key activities of the Ministry (FMST, 2006a; 2006b; 2007a; 2007b; 2012) and capacity-building documents at FMST (FMST, 2008). These documents helped to investigate how S&T policies were formulated at FMST, for instance, in terms of the stages involved, what policy capabilities (processes, routines and skills) were utilised and also to determine the gaps in policy capabilities. As a result, they shed light on the roles that capabilities played in the policy formulation, how and why policy capabilities at FMST may have developed or evolved over the years.
- FMST agencies and stakeholder organisations documents that contribute to our understanding of S&T policymaking, capability development and evolution in policymaking or policy capabilities at FMST, its agencies and stakeholders' organisations (World Bank, 2008; NACETEM, 2010a, 2010b, 2010c, 2010d).

⁴⁹ Nigeria gained its independence in 1960. FMST was established on 1st January 1980, as the successor to the National S&T Development Agency (NSTDA) which was established in 1976 (NCST, 2009).

- S&T Policy and Governance documents which contain information on policy formulation in Nigeria. This group of documents helped to illuminate the stages, steps and specific activities involved in S&T policymaking in the Nigerian context, the key actors and their roles (FMST, 2005, 2009).
- National policy documents drawn from within Nigeria's STI community. These include, for example, National Energy Policy (ECN, 2003), National ICT Policy (MoCT, 2012) and National Software Policy (NITDA, 2012). This group of documents help in deepening our knowledge of the activities involved in policymaking in the wider Nigerian context and contribute to our ability in explaining the roles that policy processes, routines and skills play in STI policy formulation at FMST.

The documentary review was also useful for my understanding of key terminologies as they apply to FMST and public policymaking in Nigeria. I learnt that the use of phrases such as “policymaking” and “policy design” or “policy formulation” as opposed to “policy review” had slightly different meanings in Nigeria. While “policy formulation” in this thesis refers to the development of a [new] policy document, the formulation of the 2012 National STI Policy was regarded by FMST and stakeholders' interviewees as a “policy review” exercise. According to interviewees, the justification for their use of “policy review” (rather than “policy formulation”) was based on the reasoning that the 2012 National STI Policy maintained a substantial amount of the generic nature and aspects of previous S&T policies formulated at FMST.

Other terms with potentially negative connotations (such as “effective” or words that could conjure ambiguous meanings for instance “science” implying the existence of a science policy) were also clarified thereby improving the chances of obtaining better responses and avoiding bias. I revisit this in Chapter 5, Section 5.2.1, and present more examples and detailed list of the terms in Table 5.2.0: Definition of Key Policy Terminologies.

b. Pilot Face-to-Face Interviews

This phase provided an opportunity to identify preliminary issues for subsequent exploration during phase two with the key informant interviews. It also helped to refine my planned procedures and methods for collecting, validating and analysing participant's

responses. The face-to-face meetings with policymakers, who were selected on the basis of their involvement in the policy formulation, was fundamental to understanding the culture, that is, day-to-day activities, work patterns, categories and hierarchies at the ministry (Silverman, 2008, pp.111-118). This was useful in various aspects of the investigation, for instance, in determining how and when best to schedule interview sessions. It also led to a better understanding of who the gatekeepers were and how to successfully deal with them in order to ensure maximum access to interview subjects and relevant documents.

c. Pilot Telephone Calls and Emails

In this stage of the pilot I first made telephone calls and then sent emails to schedule appointments for the interview programme. This was useful for establishing communication and gaining access to key officials and relevant sources of data. In order to successfully gather interview data and secondary evidence it was essential that prospective respondents understood the purpose of my study and the pilot phase of data collection. Personal phone calls and emails to them also helped to build trust.

d. Pilot Interviews

The objective of the pilot interviews was four-fold, to: 1.) assess what was known about policy capabilities at FMST in relation to policy formulation; 2.) have first-hand knowledge of FMST; 3.) refine the conceptual framework and interview questions; and 4.) ensure that the interview questions were suitable for the subsequent semi-structured interviews. The interview questions focused on the roles, development and evolution of policy capabilities and policymaking at FMST. I sought to establish what was known about policy processes, routines and skills, how they might be identified and examined, and the activities and steps involved in policy formulation at FMST.

In order to capture and analyse the preliminary data generated I developed and used a data collection sheet⁵⁰ (see Annex 7), which I completed on site during or immediately after the interviews. To guard against researcher bias, I shared the completed data sheets with the respondents at the end of the interview. This is in line with Stake (1995, p. 66) who notes that it is important for the interviewer to “reconstruct the account and submit

⁵⁰ The data collection sheet and guidance notes are useful in ensuring the validity and reliability of the research in addition to guarding against researcher bias (Yin, 2005, 2011).

it to the respondent for accuracy and stylistic improvement”. In the few instances where it was suggested that my initial interpretations were slightly incorrect or misleading I amended the data collection sheets, based on inputs provided by respondents, thereby improving the accuracy of the data. For instance, when I used the phrase “policy formulation” rather than “policy review”. Another clarification I received was on the differences in roles between Planning Research and Policy Analysis (PRPA), which is an FMST department at Abuja and National Centre for Technology Management (NACETEM), an agency under FMST. NACETEM, based at Ile-Ife, about 500km away from Abuja, was supervised by PRPA, with the DG/CEO of NACETEM reporting to the Minister (FMST) via PRPA’s Director⁵¹.

The pilot interviews each lasted between 20 – 45min. I interviewed a total of eleven (11) key officials, eight from FMST⁵² and three from the Raw Materials Research and Development Council (RMRDC). This enabled me to gather preliminary interview data, on policy capabilities. This phase of the pilot also helped me to better understand policy processes, routines and policy terminologies that are similar in conceptualisation or practice at FMST and in the Nigerian context. An example of such policy terminologies is the use of “priority setting” and “strategy setting” instead of “agenda setting” (FMST, 2012).

In summary, the pilot case study provided a useful opportunity for gaining access to the key interviewees and obtaining vital institutional records and policy documents. I was able to refine the interview questionnaires so that data collection procedures were “well targeted and workable” (Yin, 2012, p.173). I also used the pilot data captured to re-examine the questions for the interview programme, which is the second phase of the data collection.

The information obtained from the pilot was also useful in modifying the list of policy processes identified from the literature and which were used in the pilot and semi-structured interview questionnaires. For instance, Monitoring and Evaluation (M&E), and Research and Development (R&D) were added. While FMST interviewees stressed that M&E and R&D policy process were important to policy formulation at the institution,

⁵¹ I elaborate more on this in Table 4.1 (Section 4.3.2) and Chapters 5 and 6.

⁵² FMST in this instance refers to FMST departments and agencies (NACETEM, NOTAP).

my literature review did not specifically identify nor classify them as such, further demonstrating the usefulness of the pilot case study. I explain the M&E and R&D processes further in Findings and Discussion, Chapters 5 and 6 respectively. A complete list of the 21 policy processes and corresponding routines identified and examined is presented in the next chapter, Findings. Finally, the pilot phase of the research facilitated the identification of relevant documentary literature at FMST which provided preliminary evidence in support of the initial propositions underlying this study – that a set of specific capabilities are needed at FMST for the formulation of national STI policies.

In the next section I discuss the steps taken for the second phase of the data collection exercise.

4.3.2 Semi-structured Interviews

I conducted the interview programme in the months from May to August 2013 by means of a series of in-depth semi-structured interview questions. Respondents were grouped into two main classes: FMST (departments and agencies) and Non-FMST (other stakeholder groups involved in the policy formulation). The interviewees gave detailed personal accounts of the activities, steps and specific actions taken during the policy formulation. Participants' experiences and opinions as well as their observations and description of procedures during the policy formulation exercise were provided. The semi-structured interview format enabled participants to expand on the questions most pertinent to FMST and Nigeria's context.

Selection of Interviewees

The 2011 draft of the STI policy document (FMST, 2011) lists the people who participated in the policy formulation exercise (Annex 12). They are drawn from FMST departments and agencies and stakeholder organisations. I therefore developed my interviewees' list, based on the names of individuals and their respective organisations as provided in FMST (2011) and contacted interview participants accordingly. Consequently, I made efforts at the start of the fieldwork, using the list of the policymakers provided in FMST (2011), to seek out and interview key policymakers, practitioners and experts who were actively involved in formulating the policy. Careful

selection of the “best”⁵³ individuals drawn from this group was therefore critical to ensuring the credibility of the data since they possessed first-hand knowledge of the policy formulation. I considered them as best placed to provide information on the processes, routines and skills that were involved. By interviewing this group of respondents I was to capture their observations, knowledge, experiences and comments on the policy formulation.

To ensure representativeness, respondents were drawn from relevant participants at FMST and stakeholders (Non-FMST) institutions. In Annex 8, I provide a complete list of these organisations from which data were collected. I considered that views and information provided by these participants would be balanced. Stake (1995) posits that “interview is the main road to multiple realities” in that it provides a powerful data collection method for “discovering and portraying the multiple views of the case” study (p.64).

Semi-structured Interview Participants

FMST is made up of seven departments which supervise 20 agencies under them (see Annex 6). The majority of the staff involved in policymaking interviewed at FMST were drawn from the Policy Research and Planning Analysis (PRPA) department and National Centre for Technology Management (NACETEM). PRPA oversees the national STI policy formulation at FMST (Annex 6) and also supervises the activities of NACETEM. NACETEM is the FMST agency that “anchored” (did the bulk of the work involved in) the policy formulation. I interviewed four of the seven-member committee at NACETEM that was responsible for the management and coordination of the policy formulation exercise. Five out of the nine respondents I interviewed at FMST departments were director-level staff while four were scientific officers.

In addition to FMST participants who provided complete interview data on the policy capabilities that were identified and examined (full list is presented in the next chapter), I also interviewed participants from the following stakeholder groups who provided partial data on the following stages of the policy formulation they were involved in:

- *Academia*: stakeholders’ participation, management, consultation, draft development, R&D, M&E, policy ratification, expert reviews;

⁵³ “Those that best help us understand the case” (Stake, 1995, p.65).

- *Industry*: agenda-setting, selecting a policy course, stakeholders' participation, consultation, draft development, communication;
- *International development partners*: agenda-setting, evidence gathering and analysis, resource management, funding, deciding on stakeholder's roles;
- *News and media*: stakeholders' participation, consultation, draft development, communication, policy ratification⁵⁴;
- *NGO's and civil society*: agenda setting, consultation, communication, stakeholders' participation, policy ratification.

The interview questionnaire was organised in a way that reflects the key concepts of the thesis. Responses were grouped into processes, routines and skills based on the conceptual framework presented in Chapter 3 (Section 3.1), and in line with the research questions. Accuracy of information during data collection was enhanced by (a) interviewing stakeholder organisations thereby corroborating responses from FMST participants, and (b) review of FMST documents for further corroboration.

In-spite of the efforts made, it was unfortunately not possible to interview some of the scheduled participants such as the current and former permanent secretaries of FMST, and the former director of PRPA (who was in-charge of the department during the policy formulation). Despite these limitations, I was able to collect data from a total of 41 face-to-face interview participants that I believe provides objective accounts of the 2012 national STI policy formulation at FMST.

The interview method, like other sources of evidence-gathering discussed earlier, has its strengths and weaknesses. While data collection by interview can be “targeted” and “insightful⁵⁵”; this method has been criticised for reasons that include: the possibility of “bias due to poorly articulated questions”, “response bias”, “inaccuracies due to poor recall”, or “reflexivity – interviewee gives what interviewer wants to hear” (Yin, 2009, p. 102). Some of the practical steps I took to overcome these weaknesses include (a) re-examining the interview questions during the pilot phase of the study, (b) asking participants' follow-up questions, (c) asking the same question but worded differently,

⁵⁴ Policy ratification was carried out by the National Council on Science and Technology (NCST). It was a major event with about 500 individual participants in attendance. I discuss this further in Chapter 5 (Section 5.3).

⁵⁵ “Targeted – focuses directly on the case study topics” and “insightful – provides perceived causal inferences and explanations” (Yin, 2009, p. 102).

and (d) using interview response from other respondents (in addition to documentary evidence from other sources) to corroborate a participant's response. In cases where responses from other sources were contradictory rather than corroboratory to the response from an interviewee, I investigated the question further using follow up and differently worded questions, as explained above, and conducting repeat interviews.

I carried out a total of six repeat interview visits: two of the visits focused on enhancing clarity on the use of "policy formulation" and "policy review" by interviewees, thereby helping to establish the differences on how both terminologies are conceptualised and utilised at FMST. In two visits I sought to clarify the key stages in the policy formulation, presented in Chapter 5, Section 5.3; while the other two visits helped to address the addition of M&E and R&D processes and routines in the typology of policy capabilities proposed (Chapter 5).

I summarise the list of organisations and participants in the pilot and the interview programme in Table 4.1 below.

Table 4.1: Summary of Interview Participants and Data Collection

Interview Respondents Organisations / Participants						
Provided Complete Data		Provided Partial Data (Stakeholders)				
FMST		Non-FMST				
Departments*	Agencies**	Industry+	News & Media++	International Partners+++	Academia-	NGO's & Civil Society--
9	18	4	4	3	2	1

Source: Author's Interview Fieldwork Programme (See Annex 9 for complete list)

- * Planning, Research and Policy Analysis (PRPA), Technology Acquisition and Assessment (TAA), Chemical Technology and Energy Research (CTER), Physical and Life Sciences (PLS)...and five other departments (see Annex 2 and 6).
- ** National Centre for Technology Management (NACETEM), National Office for Technology Acquisition and Promotion (NOTAP), National Board for Technology Incubation (NBTI) ...and 15 other agencies (see Annex 6).
- + Manufacturers Association of Nigeria (MAN) secretariat staff and members.
- ++ The Guardian Newspaper, Vanguard Newspaper, Nigerian Union of Journalist.
- +++ UNDP, UNESCO, World Bank.
- Obafemi Awolowo University (OAU), Ile-Ife, Oyo State.
- Development Information Network (Devnet) Nigeria.

4.4 Data Analysis

The data analysis follows the “explanation-building” (Yin, 2012, p.176) strategy. Yin (2009, p.141) maintains that “here, the goal is to analyse the case study data by building an explanation about the case”. The following sub-sections describe the specific steps taken to analyse and interpret the interview and documentary data.

4.4.1 Data Screening

In this step, I transcribed the audiotapes and familiarised myself with both the in-depth interview data collected and the relevant documents. This was necessary for defining the initial coding structure, in preparation for the actual data analysis. First, I mapped, in very general terms at this stage, the responses provided into processes, routines and skills, in line with conceptual framework. Second, I carried out preliminary analyses to ascertain whether data collected adequately reflected policymaking at FMST and were therefore suitable for answering the research questions. The preliminary analyses also served as a guide to where and how I should proceed in the data analysis (Bazeley, 2007, p.68). For example, by sorting stakeholders’ interview responses on consultation and participation into broad categories, I was able to determine the extent of variation in the responses provided by FMST interviewees and therefore to determine whether this variation merited further investigation. Third, I carried out detailed data manipulation as I describe in the next section.

4.4.2 Data Manipulation

The second step involved data manipulation. In order to gain more insights on how the evidence collected helped illuminate the aim of the research, which is to explain the roles that capabilities play in STI policy formulation, the development and evolution of these capabilities at FMST; I embarked on a detailed manipulation of the interview data. In line with Stake (1995, p. 53), it was necessary for me to “review raw data under various possible interpretations” and “search for patterns of data (whether or not indicated by the issues)”, in order to, “seek linkages between [policy {*addition mine*}] activities, and outcomes”, as captured in the interview data.

This step enabled me to draw tentative conclusions and organise the relevant aspects of the interview data according to the main issues under investigation: processes, routines

and skills for policy formulation at FMST. This measure is in line with Yin (2009, p.129) who suggests that “a helpful starting point is to ‘play’ with your data”.

Therefore, in order to manipulate and better understand my data I followed the approach recommended by Yin (2009, p.129), which involves:

1. “Putting information into different arrays
2. Making a matrix of categories and placing the evidence within such categories
3. Creating data displays – flowcharts and other graphics – for examining the data
4. Tabulating the frequency of different events
5. Examining the complexity of such tabulations and their relationships
6. Putting information in chronological order or using some other temporal scheme”.

I used NVivo, a computer-assisted qualitative data analysis software and data manipulation tool to organise and code sections of the interview data collected. NVivo was able to perform some of the bullet points above while I carried out the rest of the activities manually. In particular, NVivo was helpful in locating and matching key words and phrases (bullet points 1 and 2), as well as conducting searches and for showing where and when multiple combinations of information relevant to the codes can be found (bullet points 4 and 5).

In order to get the best out of the software NVivo, I followed the guidelines for coding suggested by Bazeley (2007, pp. 67-68). The guidelines include, maintaining a broad view of the data, identifying texts that are particularly relevant to the areas you need to focus on, identifying sequences and sorting answers according to questions that were asked. I coded the data into broad categories of processes, routines and skills; placing responses captured under the relevant policy process. Within each policy process I identified the routines and skills used in carrying out the routines. I also used the data captured to clarify the key stages involved in the policy formulation, map the policy capabilities involved within each stage, create a flowchart, and further examine the chronological order of events.

By using NVivo to organise sections of the data, I was able to summarise the responses from each group of interview questions thereby putting the evidence into tables and useful order for analysis. Nevertheless, “you cannot use the software’s outputs themselves as if they were the end of your analysis” (Yin, 2009, p.129). I subsequently, therefore,

followed the steps prescribed by Yin (2009) for building an explanation of the roles that capabilities played in the policy formulation at FMST, the development of these capabilities and their evolution over the years at FMST. I present the results and findings in the next chapter.

4.4.3 Explanation Building

This research employs the explanation building data analysis technique, which is “a special type of pattern matching” (Yin, 2009, p.141). Nevertheless, unlike pattern matching, in explanation building technique, “the explanation may not have been fully stipulated at the beginning of the study” (p.143). “To ‘explain’ a phenomenon is to stipulate a presumed set of causal links about it, ‘how’ or ‘why’ something happened” (Yin, 2009, p. 141). Yin maintains that explanation building technique is particularly suited in case studies where the phenomenon under investigation cannot be precise and the causal links may be complex and difficult to measure in any precise manner.

Furthermore, this analytic technique is most suitable in cases “in which the explanations have reflected some theoretically significant propositions” (Yin 2009, p.141), as I have outlined earlier in previous chapters and sections. To reiterate, this research is based on the theoretical propositions that (1) specific sets of organisational capabilities (policy processes and routines) and individual capabilities (skills) play important roles in policy formulation and are therefore required in government institutions such as FMST; and that, (2) skills serve to support policy processes and routines. These theoretical propositions inform the thesis’ aim, conceptual framework and research questions which seek to explain (a) the role of capabilities in policy formulation at FMST, (b) how and why these capabilities were developed, and, (c) to what extent the capabilities may have evolved at FMST and why.

In order to analyse the empirical interview data collected at FMST and secondary evidence, using the explanation building technique, I followed the steps outlined by Yin (2009, p. 143), which involves a series of iterations shown below:

1. Making an initial proposition (a theoretical statement) about the role of capabilities in policy formulation at FMST [*as outlined in preceding paragraph above*]
2. Comparing the findings of the case study against the proposition put forward
3. Revising the proposition in line with the findings emanating from the data and evidence gathered
4. Comparing other specific details of the case study against the revision
5. Comparing the revision to the facts of the secondary data reviewed
6. Repeating this process as many times as needed. [*I repeated this process two times*]

By applying this iterative data analysis technique to the evidence collected I was able to identify and examine the roles played by the policy processes, routines (and skills in general) involved in formulating Nigeria's 2012 national STI Policy at FMST. In order to operationalise this analytic technique, I compared the interview findings at various stages of the examination, with the initial thesis propositions. Following the comparisons of the findings of the case study against the propositions put forward, I identified the specific roles played by policy processes, routines (and less of skills) in formulating Nigeria's 2012 national STI Policy at FMST.

The comparisons and analyses that followed revealed that the findings emanating from the interview data and secondary evidence gathered are in line with the theoretical propositions advanced. However, to improve the robustness of the research and conclusions drawn from the data, it is important to revise the theoretical propositions and test rival (alternative) explanations – a key step (3 above) in the explanation building technique outlined (Yin, 2009, p.143). Therefore, to satisfy this step of the analysis, I revised the initial proposition into variations that include (a) policy processes and routines do not play significant roles in policy formulation, (b) processes and routines may be important but not essential and therefore may not be required, in the sense policies can be formulated on the basis of skills alone.

In Step 4, I then re-examined the findings using the revised propositions as a basis to further investigate:

- A. How and why specific policy processes and routines were utilised in the policy formulation exercise, i.e. the role(s) played by the policy process or routine. Using Agenda Setting as an example, I examined, if Agenda Setting plays any role(s), if yes, how significant were roles? If did not play any role(s), why?
- B. Was the Agenda Setting policy process (and routines) required, i.e. essential or could another or other policy process have replaced it, played the same role and produced similar or better results. Again using Agenda Setting as the example for Step 4 analyses, I found that Agenda Setting policy process (and routines) played significant roles, were required, could not be replaced by other policy processes. In addition, I found that Agenda Setting process must be incumbent (i.e. present) at FMST and therefore it is a core policy capability. In contrast, the analysis revealed that there are policy processes and routines, such as Setting Policy Priorities, which although played significant roles are related to Agenda Setting and so not essential to be incumbent although desirable if they are;
- C. Similarly, I examined how and why the policy processes and routines were developed at FMST; following the same line of interrogation, i.e. testing the proposition against rivals;
- D. Based on the interview responses provided, I determined to what extent (radical or incremental) policy capabilities may have evolved (RQ3) at FMST and why; having established roles (RQ1) and development (RQ2) of the policy capabilities;
- E. As a next (second) round in repeating the process I investigated if different actors, activities or procedures were employed, what impact could these have made on the roles, development or evolution of the policy processes and routines examined.

Exploring rival propositions was a vital aspect in the data analysis. I revisit rival explanations in Chapter 6 and further discuss how they were addressed in this thesis. I present the findings of the data analysis in Chapter 5.

As I stated in Chapter 1 (Introduction) and the preceding sections, this study focuses on organisational capabilities (i.e. policy processes and routines) for policy formulation at FMST. This is reflected in the significantly less interview data collected on individual

capabilities (skills), as skills play supporting role as argued above. In line with this objective, therefore, the data analysis concentrates on policy processes and routines and less emphasis on skills, reflecting the data captured. Nevertheless, due to the considerably large number of unique activities contained in individual routines identified, I analysed routines in a more selective manner, which will be explained in Chapters 5 and 6.

I collected data on skills during the interview questions. However, because this study focuses on processes and routines, with skills playing a supporting role; it was not necessary to dedicate any major section to skill. I rather integrated discussions on skills into processes and routines. In analysing skills therefore, I focused only on data useful in improving our understanding of the roles that skills play in carrying out tasks contained in policy routines. In this context therefore, I investigated which skills were relevant to carrying out the policy routines identified in the policy processes examined.

In addition to the interview data captured at FMST, I also analysed policy documents and compared the interview findings to the facts of the secondary data (Step 5). I reviewed the secondary data for frequencies of policy processes, routines and skills, paying particular attention to how the information contained in these documents might contribute to deepening our knowledge of policy formulation. The review of policy documents helped to establish recorded accounts of how policy capabilities may have developed, evolved and the roles that policy capabilities played in previous policymaking at FMST. Stake (1995, p.68) explains that “gathering data by studying documents follows the same line of thinking as interviewing” and that documents can be key repositories of evidence.

Chapter Summary

This thesis seeks to deepen our understanding of the role of capabilities in policymaking. This chapter provides justifications for the thesis research design, the rationale for the choice of case study research strategy, and the selection of FMST as the illustrative case study for the investigation of these issues. I discussed the steps taken to carry out the pilot (first phase) and the interview (second phase) of data collection through semi-structured interviews at FMST. I explained how emphasis was placed on methodological versatility and how/why certain formal procedures were followed to improve accuracy, ensure the credibility of the case study data collection exercise and validity of the research. Arguments for the use of secondary sources of evidence, by systematic search and

incorporation of relevant policy documents, were advanced. I explained how data triangulation (and corroboration) were achieved by capturing interview data from FMST and non-FMST (stakeholder's) participants and secondary data by review of policy documents.

I also revisited the theoretical propositions underpinning this study by arguing that specific set of capabilities are needed in government institutions in order to formulate policies aimed at supporting socio-economic development. This proposition, which informs the theoretical orientation, guides the case study data collection and analysis. It also helps to focus attention on relevant data while ignoring others. Yin (2009, p. 131) posits that “theoretical propositions stemming from ‘how’ and ‘why’ questions can be extremely useful in guiding case study analysis”.

The chapter concludes by describing the steps taken to operationalise the data analysis methodology, which is based on the explanation building technique.

In the next chapter I present the findings of the thesis.

Chapter 5. Findings

Introduction

In this chapter, I present the findings of the research. Section 5.1 rehearses the research and interview questions. Section 5.2 presents the interview findings on policy processes, routines and skills. I provide preliminary discussions in this chapter with in-depth discussion of the findings reserved for the next chapter. In Section 5.3, I use the findings to develop and present the key stages involved in policy formulation at FMST, and demonstrate how the fieldwork data addresses the research questions (RQ) in line with the conceptual framework.

5.1 Research and Interview Questions Revisited

Three Research Questions (RQs) are addressed.

- i. What roles do capabilities play in formulating STI policies at FMST and why?
- ii. How did policy formulation capabilities originally emerge at FMST and why?
- iii. How have policy formulation capabilities evolved at FMST and why?

In line with the RQs outlined above, the interview questions focused on three key areas of policy capabilities as presented in Table 5.1.1 below.

Table 5.1.1: Interview Questions – an Overview of Thematic Areas

Roles played by capabilities	Development of capabilities	Evolution of capabilities
Identification of policy capabilities utilised in the policy formulation	Origins of policy capabilities, when, how, why introduced	Evolution of policy capabilities since introduction or 1986 use
Mapping of capabilities used in policy formulation	Difficulties in the development of the policy capabilities	Changes in policy formulation capabilities – which, how, why
Roles played by policy capabilities in formulating 2012 STI policy	Measures taken to continue the development of policy capabilities	Levels of evolution of policy capabilities (incremental or radical)

Source: Author's interview questions and fieldwork data at FMST

Next, I present the findings I gathered at FMST by means of a targeted interview programme, which used a semi-structured questionnaire.

5.2 Data Presentation

In this section, I present the findings in line with the conceptual framework explained in Chapter 3, which decomposes capabilities into policy processes and routines on one side and policy skills on the other side. Section 5.2.1 deals with policy processes and routines while Section 5.2.2 focus on policy skills.

5.2.1 Policy Processes and Routines

In Chapter 4, Methods (Section 4.3) I explained my use of preamble questions during the pilot phase of the fieldwork at FMST to clarify what the interviewees understood as policy processes and routines. This step was necessary to ensure that interview participants would provide appropriate responses to the interview questions asked during the fieldwork. This also helped to ascertain that the terminologies I used to capture the interview data during the interview programme were the exact terms used at FMST and in the Nigerian governance, administrative and policy contexts.

In Table 5.2.0 below in the next page, I present the terminologies.

Table 5.2.0: Definition of Key Policy Terminologies

Terminology	Use and understanding at FMST and in Nigeria's context	References
Polymaking	The activities involved in the formulation (design, production), implementation, monitoring, review, evaluation of a policy	FMST (1986; 2003; 2011; 2012a)
Policy formulation	The design and production of a new policy, marked departure from existing policies, e.g. S&T to 2012 STI policy	FMST (2011, p. v, 28; 2012a, pp. viii-ix, 53)
Policy review	Production of a policy at FMST based on the use [and retention] of key sections of an existing/extant policy	FMST (2003; 2012a)
[S&T / STI] Policy	A “blueprint” [guideline] document of government's intentions to guide national development [using science and technology, and since 2012, science, tech. and innovation]	FMST (1986, p. 1; 2012a, p. 3)
Policy strategies	Carefully articulated plans, steps, actions and methodologies for achieving the stated policy intentions [objectives]	FMST (1986; 2011; 2012a)
Policy priorities	Key sectoral areas of policy focus	FMST (2011; 2012a)
Policy objectives	Intended goals and outcomes of a policy document	FMST (1986, 2011)
Agenda setting	The processes involved in arriving at the policy objectives, priorities and strategies	FMST (1986, 2011)
Stakeholders	Non-FMST actors impacted by the policy outcome	FMST (2011; 2012a)
Consultation	“Opportunities for various actors to articulate their views and make inputs into the new policy” document	FMST (2011; 2012a, p. vii)
Communication	Steps taken to inform policy actors and the wider public of progress <i>ex-ante</i> , during and <i>ex-post</i> policymaking exercises	FMST (1986; 2012a)
Collaboration	Processes involved in working with a network of other actors	FMST (2012a)

Source: Based on author's interview data at FMST and FMST (FMST, 1986, 2003, 2011, 2012a/b) policy documents.

As Table 5.2.0 above shows, there are close similarities between the terms “policy review” and “policy formulation” in the Nigerian context. In Chapter 4, Section 4.3.1, I explained that the rationale behind the use of the term “policy review” at FMST was based on the argument by FMST staff that the 2012 National STI Policy maintained a substantial amount of the generic nature of extant S&T policies at FMST. Although some interview respondents at FMST referred to the 2012 policy as a “policy review” exercise, I have

retained “policy formulation” in this thesis for various reasons. First, the majority of interviewees noted that the policy exercise they undertook resulted in the production of a new policy document, as opposed to marginal improvements on the previous S&T policy. Furthermore, my examination of the 2012 STI policy and previous S&T policies reveal this is the case thus confirming my retention of the term “policy formulation” in this thesis.

Therefore, the term “policy formulation” better describes the policy activities that were carried out – as reflected in the use of “policy formulation” in the STI policy. Secondly, the use of the term “policy review” in this research might be misleading to a broader audience – by implying a different phase of policymaking. Contained in the 2012 policy document itself, we find several pages and sections in which the 2012 STI policy document is referred to as “new policy” (FMST, 2012, p. v, vii-ix). In FMST (2012, p.53) we also find the term “policy formulation” used to describe the policy exercise and activities. In summary, although the theoretical framework drew from developed countries’ literature, the steps I employed during data collection helped to ensure that the policy processes and routines I selected for further investigation and inclusion in the typology (see Table 5.2.1 following), are those with the same connotation and meanings at FMST and in Nigeria’s context. These policy processes and routines are those utilised in the policy formulation and relevant to policymaking at FMST.

The theoretical framework (Chapter 2, Section 2.5, Table 2.2), lists 28 identified policy processes. The pilot interview and review of policy documents at FMST reveal that 21 of these policy processes are relevant to policymaking at FMST, and which were utilised in formulating the 2012 STI policy and therefore forms the basis for the development of the typology of policy processes. Subsequently, I focused the semi-structured interview programme at FMST on the 21 policy processes (presented in Table 5.2.1 below).

Table 5.2.1: Typology of Policy Processes at FMST

Policy Processes		
1. Agenda setting	8. Exchange of ideas	15. Communication
2. Setting policy priorities	9. Coordination	16. Resource management
3. Selecting a policy course	10. Stakeholder's Identification	17. Leadership and Management
4. Deciding on policy instruments ⁵⁶	11. Deciding on stakeholder's roles	18. Decision-making
5. Constructing policy alternatives	12. Collaboration	19. Funding (for policy formulation)
6. Developing policy strategies	13. Risk (analysis and management)	20. Monitoring and Evaluation (M&E, <i>ex-ante</i>)
7. Research and Evidence gathering	14. Consultation	21. Research and Development (R&D)

Source: Author's interview fieldwork data at FMST

Summary of Findings on Organisational Routines

Organisational routines are the building blocks of organisational capabilities (Nelson & Winter, 1982). Organisational routines “therefore, hold one of the keys to understanding organisational change” and fostering innovation. “Organisational routines are units of analysis that capture change on a micro-level, and then allow us to ‘zoom in’ and make change” (Becker et al., 2005, p.1).

In Table 5.2.2 below I summarise the interview findings on routines, as these form an integral part of capabilities as defined in this thesis. I show some of the tasks involved in the routines examined. The information provided in Table 5.2.2 below is based on a mapping exercise used to identify individual routines, within the policy processes, that became evident from the interview data. The mapping forms an important part of the data analysis and a schematic overview is presented in Appendix 7b. I draw from information provided in Table 5.2.2, and use the insights in subsequent sections and in Chapter 6, to illustrate that the carrying out of these routines results in the completion of policy processes which themselves are the essential components of a public (in this case, STI) policy.

⁵⁶ I provide explanation for the inclusion of this policy process in subsequent paragraphs.

Table 5.2.2: Policy Routines

1: Agenda Setting Routines	2: Setting Policy Objectives/Priorities Routines	3: Selecting a Policy Course Routines
<ul style="list-style-type: none"> • Set up committee(s)/working group(s) • Research, review extant policies • Consult, develop draft, communicate 	<ul style="list-style-type: none"> • Develop specific policy priority areas • Consult widely, test and refine proposed priorities • Select and set policy priorities in line with agenda 	<ul style="list-style-type: none"> • Propose policy option(s) from range of choices • Appraise policy options(s) for suitability • Select a policy course / direction
4: Deciding on Policy Instruments Routines	5: Constructing Policy Alternatives Routines	6: Developing Policy Strategies Routines
<ul style="list-style-type: none"> • Identify possible policy tools • Test, refine, consult on suitability • Ratify, endorse tool(s), use in PF 	<ul style="list-style-type: none"> • Analyse the policy problem(s) • Identify alternatives, redefine problem • Select 'best' feasible policy option(s) 	<ul style="list-style-type: none"> • Propose policy objectives and strategies • Use data/evidence to test and refine strategies • Consult, set objectives and strategies, use in PF
7: Research and Evidence Gathering Routines	8: Exchange of Ideas Routines	9: Coordination Routines
<ul style="list-style-type: none"> • Identify data needs at different levels • Identify gaps in previous S&T policies • Collect primary (and secondary) data 	<ul style="list-style-type: none"> • Identify new ideas, innovation sources • Design idea capture and storage mechanisms • Refine, select and use ideas in new PF 	<ul style="list-style-type: none"> • Set rules/norms for actors participation • Keep actors motivated, engaged • Promote efficiency, inclusivity
10: Stakeholders Identification Routines	11: Deciding on Stakeholders Roles Routines	12: Collaboration Routines
<ul style="list-style-type: none"> • Identify stakeholder organisations • Identify external / NSI stakeholders (policy actors) • Consult, make contacts, select actors 	<ul style="list-style-type: none"> • Determine actors interests, capacities • Outline areas of desired contributions needed • Assign roles based, e.g. items one and two above 	<ul style="list-style-type: none"> • Outline areas of desired collaborations, why • Research and refine identified stakeholders list • Select stakeholders (actors), initiate partnerships
13: Risk (Assessment and Management) Routines	14: Consultation Routines	15: Communication Routines
<ul style="list-style-type: none"> • Identify possible sources of p. formulation risks • Assess, rank risks likelihood to occur and impacts • Set up, implement risk mitigation, mgt. measures 	<ul style="list-style-type: none"> • Identify stakeholders, target audience • Develop consultation protocols to use • Clarify objectives and methods 	<ul style="list-style-type: none"> • Identify (major) stakeholders and target audience • Clarify objectives, methodologies, costs, message • Design/select communication media, techniques
16: Resource Management Routines	17: Leadership and Management Routines	18: Decision-making Routines
<ul style="list-style-type: none"> • Identify resource (e.g. staff, funds) requirements • Develop resource management action plan(s) • Decide on allocation, monitoring, etc. strategies 	<ul style="list-style-type: none"> • Set overall strategy and direction • Mobilise and manage resources, risks, etc. • Decision-making, supervision, etc. 	<ul style="list-style-type: none"> • Consider several alternative PF possibilities • Clarify decision-making channels, leadership • Decide on course of action among choices
19: Funding Routines	20: Monitoring and Evaluation (M&E) Routines	21: Research and Development (R&D) Routines
<ul style="list-style-type: none"> • Budget, secure, allocate, manage funds • Identify complementary funding sources • Prepare funding bids, consult with donors 	<ul style="list-style-type: none"> • Develop perf. indicators in relation to priorities • Research, collect data and evidence for new PF • Monitor previous policies, reports, etc. 	<ul style="list-style-type: none"> • Examine methods, capabilities, identify gaps • Design, conduct R&D, test outcomes, clarify • Document, recommend for use in future PF

Source: Author's interview fieldwork data at FMST. PF: Policy Formulation

Incumbent Policy Processes and Routines

In order to understand the roles that capabilities play in policymaking, it was useful to first map the policy processes and routines. This helped to establish “incumbency”, a term I use to describe policy processes and routines that are present at FMST for policymaking. A key part of the interview programme at FMST was therefore to identify incumbent capabilities, as this has a bearing on the utilisation, roles, development and evolution of policy capabilities at FMST.

Formal and Informal Policy Processes and Routines

Building on the conceptual framework I decompose incumbent capabilities into formal (explicit) or informal (implicit), utilised or not utilised. In Chapter 2, Section, 2.5 I defined formal (explicit) and informal (implicit) policy processes and routines and provided the distinction between both. To reiterate, by “formal” I refer to incumbent policy processes and routines that are documented, that is, written down or recorded at FMST in a form that is accessible for future reference and use. On the other hand, “informal” processes refer to incumbent policy processes and routines that are not documented, not easily accessible, remain as tacit knowledge and open to various interpretations, depending on the individual policymaker’s idiosyncrasies and abilities. Information on these informal processes were obtained from the interview programme.

Following this definition of “formal” and “informal”, I have categorised the 21 processes as informal. This is because although the policy processes were used in the policy formulation, none of them were formalised. Consequently, no policymaker or staff at FMST had a “blueprint” on the processes. The interview fieldwork revealed that individuals – whoever, usually senior by official rank, was in charge at the policy formulation stage or claimed to be the “expert” – dictates what needs to be done. One week later, for example, another individual (or team) may carry out the same policy activity in a slightly or completely different manner with little attention paid to what was already done the previous week.

The reason for this *ad hoc* and unsystematic approach is that policy processes and routines are not documented (i.e. formalised, as I define it in this thesis). For example, Consultation, as a policy process, was carried out during the policy formulation exercise.

However, it is not documented anywhere at FMST (a) who is or should be consulted, and why, (b) from what sectors, (c) for how long, (d) in what order, or (e) at what stage of the policy formulation. It was also not clear from the interview or policy documents, for example, how long a policy draft must remain in the public domain for feedback from stakeholders or the wider public before FMST withdraws it, incorporates comments (if need be) and produces a revised draft.

One implication of this informal approach is that processes and routines are left to individual to interpret (or misinterpret), use or not use; resulting likely in misunderstandings, contentions and conflicts in the policy formulation. An interviewee expressed the need for formalisation thus:

“We have had instances whereby during policymaking some stakeholders raised objections on who should spear-head specific operations or refused to work with other stakeholders. This highlights the importance of formal processes and routines, mediation, management, and leadership in policy formulation” - Chief Scientific Officer, NITDA⁵⁷.

Formalisation, would at least provide some guidelines, not necessarily every detail, but some direction and clarity, for example, to researchers and scientific officers who carry out the routines on the ground. Formalisation should also stipulate what counts as the minimum requirement, for example, in consultation. For instance, would two meetings in Abuja and Lagos (as was done, two cities, in two states) be sufficient consultation in a country of 37 states? Is that a reasonable minimum requirement? A formal guideline would help answer such questions.

The findings revealed that similar practice, as described with Consultation, apply to other processes and routines. In Research for example, although carried out, it is not clear whether policy research – data and evidence collection and analyses to inform policy – should be based on primary and/or secondary data; how to go about it (methodology), why, scope, duration, data sources, mechanisms for data/evidence verification, procedures and quality checks, why these could be suggested in some document when policymakers think that such guidelines would be helpful to less senior scientific officers or staff involved in research. Therefore, scientific officers in charge of the policy

⁵⁷ National Information Technology Development Agency, Abuja, Nigeria

formulation routines (presented in Table 5.2.2 above) did whatever they felt were right, feasible, and within resource constraints – e.g. knowledge, time, and budget.

If however some formalised arrangement that captures the routines in an accessible format is put in place, whoever is involved in the policy formulation in the future will be able to understand how and why certain policy routines were carried out, and decide to continue with them, change or improve areas identified to be weak, obsolete or irrelevant. This will contribute to policy learning and policy innovation (Mulgan, 2003; Mulgan and Albury, 2003). It will also support further development (Research Question 2) and evolution (Research Question 3 - changes, innovation) in the policy capabilities at FMST.

In summary therefore, although the terminologies laid out in Table 5.2.0 were used in previous policy documents, hence facilitating a common understanding between me and interview respondents, there were no details for the processes and routines. Hence I have categorised them as informal. I present the findings in Tables 5.2.3 and 5.2.4, which shows that the 21 policy processes at FMST are informal of which 15 (about 71%) are incumbent and six are non-incumbent.

Utilisation of Policy Processes and Routines

Table 5.2.3 below presents a summary of interview data captured at FMST which shows that the 21 policy formulation processes identified and examined were informal. Another insight from the table is that 13 incumbent policy processes were utilised in formulating the STI policy. In Table 5.2.4 following I present these capabilities and discuss them in subsequent sections. The findings also reveal that while some policy processes and routines (e.g. Constructing Policy Alternatives, M&E and R&D) were non-incumbent, others (Research and Evidence Gathering, and Collaboration) were incumbent but partially utilised in the policy formulation.

By partial utilisation, interviewees referred to policy processes in which the routines were insufficiently operationalised. An example of a partial use of a process can be seen in the Research process. In this case, the FMST policymakers explained that the Research policy process was based on secondary evidence only, as opposed to a combination of primary data and (supported by) secondary evidence. Interviewees indicated that the Research policy processes should involve the production of primary data, and utilise secondary data only in areas where primary data were unavailable, insufficient or unreliable.

Nevertheless, the 2012 STI policy was formulated on the basis of secondary data only, carried out by means of desktop research. Interview respondents revealed that this was a weakness, incomplete and partial execution of a Research policy process and routines involved. In Table 5.2.3, I present data captured on the unitisations of policy processes while in Tables 5.2.3 and 5.2.4, I use “P” (for partial) to represent the group policy processes that interviewees maintained were partially carried out.

Table 5.2.3: Utilisation of Policy Processes at FMST

Policy processes (Total: 21)							
Informal (21)				Formal (0)			
Incumbent (15)		Non-incumbent (6)		Incumbent (0)		Non-incumbent (0)	
Utilised (13)		Utilised (1)	Unutilised (5)	Utilised	Unutilised	Utilised	Unutilised
Fully (11)	Partial (2)	Partial		N/A	N/A	N/A	N/A

Source: Author’s interview fieldwork data at FMST

Attributes of Policy Processes and Routines at FMST

The interview data revealed that policy processes and routines at FMST are incumbent or non-incumbent as explained above, formal or informal and are either utilised in the policy formulation or not (Table 5.2.3). In addition, the findings help to illustrate the policy processes and routines utilised in the 2012 STI policy formulation and their perceived levels of importance by FMST and non-FMST (i.e. Stakeholder) interviewees (Table 5.2.4). I draw from the theoretical underpinnings for classifying policy processes into incumbents, formal and informal, and determination of their importance and summarise these findings in Table 5.2.4 below.

Table 5.2.4: Attributes of Policy Processes at FMST

Policy Processes		Incumbent (Y/N)	Utilised in Policy Formulation (Y/N/P)	Level of Importance (FMST)			Level of Importance (Non-FMST)		
				Less Important	Important	Critical	Less Important	Important	Critical
1.	Agenda setting	Y	Y			X		X	
2.	Setting policy priorities	Y	Y			X			X
3.	Selecting a policy course	Y	Y		X			X	
4.	Deciding on policy instruments	N	N	X					X
5.	Constructing policy alternatives	N	P		X			X	
6.	Developing policy strategies	Y	Y		X			X	
7.	Research	Y	P			X		X	
8.	Exchange of ideas	N	N	X					X
9.	Coordination	Y	Y			X		X	
10.	Stakeholder identification	Y	Y			X			X
11.	Stakeholders' roles	Y	Y	X			X		
12.	Collaboration	Y	P		X				X
13.	Risk management	N	N		X			X	
14.	Consultation	Y	Y			X			X
15.	Communication	Y	Y		X				X
16.	Resource management	Y	Y		X		X		
17.	Leadership	Y	Y			X			X
18.	Decision-making	Y	Y		X		X		
19.	Funding	Y	Y			X			X
20.	M&E	N	N		X		X		
21.	R&D ⁵⁸	N	N		X			X	

Source: Author's interview fieldwork data at FMST

Y = Yes; N = No; P = Partial. Non-incumbents are also informal, by default

⁵⁸ While Research is used for evidence gathering for a specific (e.g. 2012 STI policy formulation) exercise, R&D relates to the continuous study and experimentation on policy capabilities, frameworks and methodologies aimed at uncovering possible areas of improvements. R&D is therefore expected to be regular and on-going.

In addition to non-incumbency at FMST, Deciding on Policy Instruments, as a policy process, was stripped from the 2012 STI policy document. The reasoning behind this, according to some interviewees is due to the relatively recent realisation by FMST policymakers that this policy process is more closely related to implementation. Implementation processes are now produced in a separate document. S&T policies prior to 2012 had combined policy formulation and implementation processes into one document. An Assistant Chief Scientific Officer at PRPA (FMST) in explaining why this change was necessary adds *“the policy is now a two-piece document – the policy itself, that is, formulation; and the implementation. We felt we needed to remove the implementation and have a policy document smaller in size”*. Data gathered during further interviews with NACETEM (FMST) directors affirmed this statement.

Stakeholder respondents, however, saw this evolution (separating formulation from implementation) as a setback. A stakeholders’ interviewee from academia, submitted that the separation *“creates an opportunity for different stakeholder organisation to interpret the policy in the way they see it, thereby resulting in ambiguity and possibilities for manipulations”* – (Professor, OAU, Ile-Ife). Secondly by having the policy formulation phase completed, launched and released to the public, before formulation of the implementation strategies was initiated meant that there was about a two-year lag – an approach the respondent maintains was counter-intuitive and retrogressive. A Manufacturer’s Association of Nigeria’s (MAN) interviewee, in signaling his rejection of this separation, added *“FMST claims this change was based on best practice, but best to who, best to us in Nigeria or Iran, or India?”*

Further, in responding to the importance of Deciding on Policy Instruments as a policy process, the interviewee stressed that:

“Our members are interested in Nigeria’s policy priorities and what policy instruments the government uses in achieving these priorities. Policy priorities and instruments impact on our businesses and investment decisions. In our opinion, they should be kept”

Core Policy Processes

Another finding of the interview programme is “core policy processes” that interview respondents considered to be critical in policymaking and must be incumbent at FMST for policy formulation. The findings reveal that five out of the 21 policy processes outlined in the typology are core. In emphasising the need for this group of processes, the FMST Director and head of Planning Research and Policy Analysis (PRPA) department added:

“Yes, there is a lot we should do. However, as you can see, we have many limitations. We do not have all the people we need in-house, or the finance for regular training in policy areas. Even a consistent leadership to follow through on policy formulation projects and activities is a challenge. We must therefore categorise, prioritise and focus on the essentials”.

In Table 5.2.5 below, I outline the findings of the interview programme, which shows the core processes (Agenda Setting, Research, Stakeholders Engagement, Leadership and Funding) as identified by interview respondents based on groups and position from across the range of FMST and non-FMST actors in the policy formulation process.

Table 5.2.5: Core Policy Processes Identified by Interview Respondents

Core Process	FMST				Non-FMST (Stakeholders')
	Departments (9)	Agencies (18)	Management, Directors, FMST (11)	Scientific Staff, FMST (16)	
Agenda setting	9	14	9	8	10
Research	5	12	6	14	9
Stakeholders Engagement	7	11	7	12	12
Leadership	9	15	10	13	11
Funding	8	9	9	11	7

Source: Author's interview fieldwork data at FMST

Routines and Skills Associated with Core Policy Processes

In this section I summarise and present the findings on the routines associated with each of the five core policy processes described above (Tables 5.2.5.1 to 5.2.5.5). The tables show the routines, skills relevant to carrying out routines, and routines which interviewees noted were not adequately carried out during the policy formulation thereby requiring

further development and/or evolution. I start with Agenda Setting routines in Table 5.2.5.1 below.

Table 5.2.5.1: Agenda Setting Processes, Routines and Skills

Agenda Setting Policy Process	Agenda Setting Policy Routines (routine tasks involved)	Skills (relevant to carrying out routines)
Related ⁵⁹ policy processes:	<u>Routine activities carried out</u>	<ul style="list-style-type: none"> • Research • Analytical • Learning • Management • Decision-making • Technical (ICT / Computer-related) • Negotiation • Coordination • Communication • Interpersonal
– Setting policy priorities	<ul style="list-style-type: none"> • Set up Committee(s)/working group(s) • Generate, exchange, and refine ideas • Consult, develop draft, communicate 	
– Selecting a policy course	<ul style="list-style-type: none"> • Develop priorities, objectives and strategies • Produce draft(s) policy 	
– Deciding on policy instruments	<u>Routine activities not (sufficiently) carried out</u>	
– Constructing policy alternatives	<ul style="list-style-type: none"> • Appraise/select options, course, instruments • Identify alternatives, analyse, incorporate • Ensure agenda is research and evidence-led 	
– Developing policy strategies	<ul style="list-style-type: none"> • Solicit/incorporate stakeholders' drafts • Consult more widely 	

Source: Author's interview fieldwork data at FMST

In Table 5.2.5.2 below I outline the routines involved in carrying out Research policy processes, as captured from FMST interview findings.

Table 5.2.5.2: Research Policy Processes, Routines and Skills

Research Policy Process	Research Policy Routines (routine tasks involved)	Skills (relevant to carrying out routines)
Related policy processes	<u>Routine activities carried out</u>	<ul style="list-style-type: none"> • Data collection • Analytical, data • Conceptual thinking • ICT/Computer • Methodical • Coordination • Reflexive • Management • Decision-making • Learning
– Exchange of ideas,	<ul style="list-style-type: none"> • Identify gaps in previous S&T policies • Review other countries policies (desktop survey) • Analyse related policies and documents⁶⁰ 	
– M&E and	<u>Routine activities not (sufficiently) carried out</u>	
– R&D	<ul style="list-style-type: none"> • Identify data needs at different levels • Gather primary/ secondary data; review/validate • Evaluate policy link to socio-economic needs • Promote policy learning also (not “best practices” only, as is currently being done) • Critically review incumbent and extant policies • Support co-creation, other processes e.g. R&D 	

Source: Author's interview fieldwork data at FMST

⁵⁹ I revisit *Related policy processes* in the next chapter and provide explanations on the classification.

⁶⁰ Policy recommendations for example from Economic Summit Group, a think-tank committed to Nigeria's development and global competitiveness or the 2005 Nigeria/UNESCO STI Reform Project, which formed the basis for Nigeria's 2012 national STI policy formulation.

In Table 5.2.5.3 below, I outline the routines and some of the skills involved in accomplishing Stakeholder Engagement policy processes, as captured from FMST interview findings.

Table 5.2.5.3: Stakeholder Engagement Processes, Routines and Skills

Stakeholder Engagement Policy Process	Stakeholder Engagement Policy Routine (routine tasks involved)	Skills (<i>relevant to carrying out routines</i>)
Related policy processes: – Stakeholders identification – Stakeholders roles – Consultation – Communication – Coordination – Collaboration	<p><u>Routine activities carried out</u></p> <ul style="list-style-type: none"> • Identify stakeholder organisations and individuals • Assign specific roles to selected stakeholders • Consult, communicate, coordinate <p><u>Routine activities not (sufficiently) carried out</u></p> <ul style="list-style-type: none"> • Set criteria for stakeholder's selection • Re-map Nigeria's (STI) policy ecosystem, identify and use new policy entrants, outside existing network • Engage stakeholders early in the formulation exercise • Set up clear leadership and management structures • Entertain variations in policy formulation approaches allow e.g. co-creation in draft developments and change • Set up ideas exchange and feedback mechanisms 	<ul style="list-style-type: none"> • Administrative • Interpersonal • Communications • Consultation • Leadership • Management • Mediation • Negotiation • ICT/Computer • Research • Learning

Source: Author's interview fieldwork data at FMST

This in addition highlights the value of the statement below, which underscores the importance of stakeholder engagement and why this policy process is considered a core capability for policy formulation at FMST.

“Identification of stakeholders and engagement is critical to policymaking at FMST because we have to carry them along. Otherwise, we risk failures. There are recent cases in other ministries, for example the Ministry of Aviation, where stakeholders revolted and that led to the rejection and termination of the national policy on Aviation. Without effective stakeholder engagement we are likely to fail” – Deputy Director, Research and Statistics, FMST.

In Table 5.2.5.4 below I outline the routines and some of the skills involved in carrying out the Leadership and Management policy processes, as captured from FMST interview findings. In line with the preceding tables on core policy processes, I show the policy process, routines, and skills relevant to the routines. In addition, the table outline the Leadership and Management routines which interviewees noted were not adequately carried out during the policy formulation thereby requiring further development and/or evolution in order to better exploit their roles in policy formulation.

Table 5.2.5.4: Leadership and Management Processes, Routines and Skills

Leadership Policy Process	Leadership Policy Routine (routine tasks involved)	Skills (relevant to carrying routines)
Related policy processes:	<u><i>Routine activities carried out</i></u>	<ul style="list-style-type: none"> • Initiative • Motivation • Coordination • Administrative
– <i>Decision making</i>	<ul style="list-style-type: none"> • Set and provide overall strategy and direction • Mobilise and manage resources • Decision-making, general mgt., supervision 	<ul style="list-style-type: none"> • Decision-making • Negotiation • Mediation • Communication • Consultation • Management
– <i>Resource management</i>	<u><i>Routine activities not (sufficiently) carried out</i></u>	
– <i>Risk analysis and management</i>	<ul style="list-style-type: none"> • Clarify decision-making paths amongst the three levels of leadership • Promote bottom-up, not top-down approach • Broaden-out, ensure inclusivity, participation • Ensure risk analysis and management 	

Source: Author's interview fieldwork data at FMST

“Everything at FMST depends on Leadership. If the ministry is getting it right, check the leadership. For example, we need Leadership for Funding processes to function. Policy formulation is number one out of FMST's eight mandates. However, depending on the leadership (Permanent Secretary [PS] and Minister), any other mandate can be prioritised. A PS might decide to simply play to the gallery and maintain the status quo rather than initiate radical changes or formulate a new S&T policy” – Chief Scientific Officer, FMST.

The above statement echoes the interview responses provided by three of FMST Directors, who insisted that without effective Leadership policy processes and routines playing their roles at FMST no policymaking effort can succeed. In the following two tables, I summarise the interview findings on the roles (Table 5.2.6) that policy processes and routines play in formulation at FMST. The development of the policy processes and routines are examined in Table 5.2.7.

Finally, in Table 5.2.5.5 below I outline the routines and some of the skills involved in carrying out the Funding policy process, as captured from FMST interview findings.

Table 5.2.5.5: Funding Policy Process, Routines and Skills

Funding Policy Process	Funding Policy Routine (routine tasks involved)	Skills (<i>relevant to carrying out routines</i>)
Funding (for policy formulation) process	<u><i>Routine activities carried out</i></u>	<ul style="list-style-type: none"> • Administrative • Finance • Negotiation • Interpersonal
	<ul style="list-style-type: none"> • Budget, secure, allocate, manage funds • Identify complementary funding sources • Prepare funding bids, consult with donors <u><i>Routine activities not (sufficiently) carried out</i></u> <ul style="list-style-type: none"> • Build fundraising skills amongst staff • Explore alternative income streams • Ensure regular and reliable funding sources • Wide and regular stakeholder engagement • Maintain constant dialogue with donors (local and international), not simply in times of need 	<ul style="list-style-type: none"> • Consultation • Management • Initiative • Motivation • Coordination • Leadership

Source: Author's interview fieldwork data at FMST

Although it was not possible for me to obtain data on the exact amount of financial contributions to FMST for Nigeria's 2012 STI policy, due to secrecy and confidentiality issues, FMST interviewees attest to such funding support and maintain that without them, the policy formulation would have been impossible. Mbeza (2000) reveals that in Malawi, a similar African country where international funding was the bedrock of its S&T policy review, UNESCO contributed 70% funding (USD70, 000) while the Government of Malawi provided 30% (USD30, 000). AOSTI (2013) records that while Nigeria has "about US\$500,000 dedicated to STI policy; it was not possible to establish the exact budgetary allocation to STI policy activities in South Africa" (p.20). This demonstrates some of the challenges in obtaining financial figures on S&T activities in Africa and highlights the importance of formal organisational capabilities. In responding to the policy formulation challenges encountered at FMST and how they were overcome, a Chief Scientific Officer (CSO) at PRPA, FMST, speaking on funding added that:

"Funding was the mother of them all. Although capacity building was one of the challenges we faced, if there is funding, capacity building will not be an issue. Funding was the major challenge. Policy formulation exercise in Nigeria is capital intensive. It was budgeted for since 2003 – 2009 by FMST, but because no money was released, it could not happen" – CSO at PRPA, FMST.

In summary, the findings presented in Tables 5.2.2 and 5.2.5.1 to 5.2.5.5 above help to illustrate the roles that policy routines play in policy formulation. In Chapter 6, I provide further insights on how the routines outlined above contribute to deepening our knowledge of policy processes and discuss their implications to policymaking at FMST and in DCs. In Table 5.2.6 below, I summarise the findings gathered on the roles that policy processes played in the formulation of Nigeria's national 2012 STI policy at FMST.

Table 5.2.6: Roles Played by Processes and Routines in Policy Formulation

		Roles (<i>used to/in</i>) – [involve Routines]		
Policy Process		FMST Departments (e.g. PRPA)	FMST Agencies (e.g. NACETEM)	Non-FMST Stakeholders’ (e.g. MAN)
1.	Agenda setting	Set up of policy agenda (referred to as ‘policy rationale’) and strategies at FMST (2012) in response to the overarching national agenda (set at the presidency, by FEC)	Understand the policy directives set up by presidency and FMST departments; translate policy directives into specific policy actions, processes, and routines.	As a way to determine the overarching policy aims, thrusts, and directions of the Federal Government and its Ministries
2.	Setting policy priorities	Decision-making of what economic and development sectors to focus, agenda setting	Setting up of clear and specific policy objectives (i.e. policy priority areas)	Target specific development sectors
3.	Selecting a policy course	Responding to national policy and development agenda set by the Federal Government, e.g. NV20:2020 or Transformation Agenda	Proposing or appraising <i>ex-ante</i> policy options before and during policy formulation	In order to determine policy direction
4.	Deciding on policy instruments ⁶¹	Determination of policy implementation tools, such as tax incentives, on-the-job training, etc. strategies to achieve policy outcomes	Similar use as in FMST Departments. In addition, seen as tools for policy review, research and M&E	Indicate policy priorities, course and impacts that shape decision-making. Essential to policy formulation in stakeholders view, therefore retained
5.	Constructing policy alternatives	E.g. in deciding alternative development sectors to target, and selection of ‘best’ policy option(s)	Problem analyses and redefinitions, and identification of policy alternatives	Understanding decision-makers choice of policy direction, priorities, course
6.	Developing policy strategies	Leadership and management decision-making on the strategic intents of the policy	Developing specific implementation activities for external institutions	Breaking down the overarching policy aim, achieve sector-specific relevance

⁶¹ Policy instruments, similar to other policy processes, were decided during policy formulation, but not included in 2012 STI policy; now in the policy implementation document.

7.	Research	<i>Ex-ante</i> evidence gathering and analyses for setting policy objectives and policy agenda	Same as in FMST Department	Capture and analyse data to inform policy formulation direction, learning
8.	Exchange of ideas	Ideas and knowledge exchange with NSI actors, engaging stakeholders ⁶² , enhance learning	Ideas and knowledge exchange with NSI actors, and research tool	Improving knowledge of government's strategic direction, lobbying tool
9.	Coordination	Leadership and management tool for keeping track of policy actors involved in formulation	Ensuring ease of data collation and management of stakeholders' inputs	Keeping up-to-date information on the activities of NSI actors involved
10.	Stakeholders identification	Determination of stakeholder's to (or not to) invite into the policy formulation exercise	Critical to operationalizing routine activities involved in policy formulation	To facilitate their stakeholders' involvement, ensure participation
11.	Stakeholders' roles	Assigning of specific functions to stakeholder's, supports leadership, management, coordination	Improving clarity on stakeholder's roles and responsibilities, ease of operation	Enhancing clarity of functions and management of stakeholders
12.	Collaboration	Determination of types, levels, nature, etc. of partnerships and cooperation with actors e.g. other science-using ministries and departments	Collaborative work with actors (e.g. other 'science-using' ministries, departments, agencies and interest groups)	Ensuring stakeholders policy proposals and intents find their into the policy document, agenda control mechanism
13.	Risk management	Risk assessment and management	Assess/reduce policy formulation failures, e.g. funds depletion, stakeholder conflicts	Same as in FMST Agencies
14.	Consultation	'Carry stakeholders along' and obtain stakeholders approval	Disseminate and obtain information, development and review of drafts, etc.	Providing a platform for inputs into policy formulation and feedback

15.	Communication	Inform stakeholders and public, unidirectional	Engage with policy, actors, stakeholders and public, seek input	Obtain information on government's policymaking activities, priorities
16.	Resource management	Determine, allocate and manage resources (personnel, funds, equipment, etc.)	Ensure supply of resources and support policy formulation activities, delivery	Same as in FMST Agencies
17.	Leadership and Management	Provide direction, overall strategy, senior management, decision-making, resources, etc.	Guidance, support and management; serve as the hub of activities, nerve centre	Same as in FMST Department
18.	Decision-making	Inform change of strategies / tactics, re-direct resources.	Determine course of action, e.g. on funding, actors or agencies to work with	Same as in FMST Agencies
19.	Funding (for policy formulation)	Securing funding from Federal Government budgetary provisions and international donors	Secure funding from FMST departments, allocate funds e.g. for <i>ex-ante</i> research, data collection or organising consultations	Securing and allocating funding for policy formulation activities
20.	Monitoring and Evaluation (M&E) <i>ex-ante</i>	<i>Ex-ante</i> research and evidence gathering by FMST for leadership, management, planning, and agenda-setting	Capture data on previous policies, for use as inputs in new policy formulation	<i>Ex-ante</i> research and evidence gathering for decision-making, impact monitoring
21.	Research and Development (R&I)	Experimentation, improvements, change, acquire new knowledge, foster organisational learning	Search for new/improved policy processes, routines and skills, frameworks, method...	Same as in FMST Department

Source: Author's interview fieldwork data at FMST

Table 5.2.7: Development of Policy Processes at FMST

Process and Routines	How Developed	Why Developed (<i>In order to...</i>)
1. Agenda setting	Imitation, i.e. by principle of ‘best practices’ based on review of S&T/STI policies of India, Brazil, South Africa, Chile, Vietnam, Singapore and Malaysia	Help determine the overarching policy aims, thrusts, priorities, direction
2. S. policy priorities	Based ‘best practices’ as in agenda setting, national agenda, consultants dictates	Target specific development sectors
3. S. policy course	In response to national policy and development agenda set by the Federal Govt.	Determine policy direction
4. Deciding on policy instruments	Not developed, current practices have grown out of imitation, as in agenda setting, and as dictated by senior mgt. and director-level staff, extant ministry culture	N/A
5. Constructing policy alternatives	Not developed, current practices have grown out of imitation, as in agenda setting, and as dictated by senior mgt. and director-level staff, extant ministry culture	N/A
6. Developing policy strategies	Informed by desktop research and based ‘best practices’ as in agenda setting, guidance from external “experts” and consultants	Decompose policy aim into specific policy objectives and priorities
7. Research	Partially, not yet fully developed. Desk-top research implemented	Data and evidence gathering and analyses
8. Exchange of ideas	Not developed, current practices based on informal interactions at seminars, events	N/A
9. Coordination	By informal contacts, personal networks, meetings at events, use of ministry structure	Ease collation and mgt. of feedback/inputs
10. Stakeholders identification	Sectoral network analysis and mapping; and through industry unions, trade associations and personal expert contacts	Improve stakeholders’ participation, support research, consultation, communication, etc.
11. Stakeholders’ roles	Follows top-down leadership and management structure as practised since 1986	Enhance clarity, support mgt. of stakeholders
12. Collaboration	Not developed, driven by top-down FMST’s leadership and management structure	N/A
13. Risk management	Not developed, practiced, utilised or considered important - extant ministry culture	N/A
14. Consultation	Through industry unions, trade associations and personal expert contacts	‘Carry stakeholders along’, obtain their approval
15. Communication	Similar to consultation, through industry unions, associations and personal contacts	Inform stakeholders and public, seek input
16. Resource mgt.	Based on FMST’s general management approach to every other project/activity	Support p. formulation activities, mgt, delivery
17. Leadership & Mgt.	Top-down policy formulation leadership and management structure	Serve as the hub of activities, control point
18. Decision-making	Follows top-down structure from senior mgt. as practised since 1986 formulation	Inform change of strategies, re-direct resources.
19. Funding	Dependent on Federal Government budgetary allocation and international donors	N/A, alternative sources not yet developed
20. M&E	Not developed, mentioned in policy documents but not carried out, no p. process	N/A
21. R&D	R&D for policy formulation not developed due to extant ministry culture	N/A

Source: Author’s interview fieldwork data at FMST (“S.” – stands for “setting”)

The interview data summarised in Table 5.2.7 above reveal that in spite of the acknowledged roles that capabilities play in policy formulation (as laid out in Table 5.2.6), weakness remain in the development of policy capabilities at FMST.

“Capacity-building at FMST have been abysmal; hardly any tangible progress recorded in this area. There are slight improvements in skills in the sense that some FMST departments are now headed by “experts” [meaning staff with academic qualifications] e.g. an engineer heading TAA, a Pharmacist heading PLS. This was not so in the past; scientists did not necessarily head science-oriented ministries. However, many challenges remain, especially in policymaking. To be effective, trainings need to be strategic, regular, demand-driven, and initiated by staff” – Director, CTER⁶³, FMST.

The above statement is echoed by the director at TAA Department at FMST, who stress that: *“The transition from Military to Civilian rule in Nigeria took too long to happen. In addition, shortage of finance means that only generic training, mostly in administration, takes place. Specialised training is almost not available, except a few provided by international development partners – e.g. UNESCO prior to the STI policy formulation. FMST must design and carry out targeted development of policymaking capabilities”.*

The interview response above by TAA Director – who has substantial knowledge of policymaking at FMST, having worked at the Ministry for about 20 years – makes an important link between the development and evolution of policy capabilities at FMST. It attributes weaknesses to systemic factors that also include leadership, and finance.

In Chapter 3 (Section 3.2) I defined evolution in terms of innovation, that is, a new policy formulation process or routines, or changes/improvements in incumbent (existing) policy processes and routines (Lundvall, 1992; OECD, 2005). A policy process that has not improved since its use in the formulation of Nigeria’s first S&T policy of 1986 (or later introduction prior to 2012) at FMST is recorded as *“Not Evolved”*. With regards to processes that have *“Evolved”*, I group these into (1) incremental innovation (i.e. processes that have received minor changes) or (2) radical innovation (i.e. significant change). I use this distinction in subsequent chapters. I present the findings in Table 5.2.8 below, showing processes that have evolved and reasons for the evolution observed.

⁶³ CTER: Chemical Technology and Energy Research; TAA: Technology Acquisition and Assessment

Table 5.2.8: Evolution of Policy Processes at FMST

	Policy Process	Evolved	Not Evolved	Why? (Policy Formulation [PF] processes have [not] evolved due to...)
1.	Agenda setting		X	Persistence of FMST's tradition of S&T policy formulation in response to the serving president's vision/agenda
2.	Setting policy priorities	X		Improved appreciation of the need to focus policy on broad development areas as opposed to few prioritised sectors
3.	Selecting a policy course		X	Culture of 'best practice', i.e. review "similar" countries' national S&T policies and adopt similar policy course, without sufficient consideration of the differences in national contexts, environment, ecosystems and capabilities
4.	Deciding policy instruments		X	As in inception, still based on the use of traditional tools (legal and regulatory instruments in addition to economic incentives) resulting in instruments that are inflexible, sector-specific, backward-looking, and ultimately ineffective
5.	Constructing policy alternatives		X	Perceived as not important policy process for various reasons chief amongst which is agenda setting. Once the federal government sets the overarching national agenda, S&T policy follows suit, alternatives not considered
6.	Developing policy strategies		X	Still carried out by FMST in its entirety, in spite of the evidence in support of the value addition by increased stakeholders' involvement and active participation in this policy process
7.	Research		X	Ad hoc, unsystematic. Started with the use of secondary data in first S&T policy formulation, 1986. Same tradition has continued and remained till date. 2012 policy formulation was based on desktop research (secondary data)
8.	Exchange of ideas		X	Still occurs informally at personal levels during meetings, seminars and conferences. No defined policy process yet in place means such knowledge gathered are mostly lost thereby impacting negatively on (policy) learning
9.	Coordination	X		NACETEM's influence, positive. Still based on FMST's top-down leadership, mgmt., and institutional structure
10.	Stakeholders identification		X	No policy process in place with clearly defined criteria set. Still based on soliciting and receiving nominations of "policymakers" from professional associations, unions and personal connections who may then become lobbyists
11.	Deciding on Stakeholders' roles		X	Stakeholders' roles, inputs and role descriptions still seen as FMST's (government) exclusive responsibility thus following the traditional belief that government formulates policies for others (private sector) to implement

12.	Collaboration	X	Incremental evolution due to improved appreciation of stakeholders' role; FMST's heavy-handedness persists
13.	Risk assmt., mgt.	X	Contrary to the evidence, risk assessment and risk management still not considered as important in PF
14.	Consultation	X	Has remained largely same, a one-way traffic in which FMST invites stakeholders when it deems fit and exchanges ideas on its terms, conditions and timetable. Evolution a result of improved appreciation of stakeholders' role
15.	Communication	X	Similar to consultation above: a one-way traffic during which FMST sends info to stakeholders (e.g. draft policy document) when it deems fit and expects feedbacks, a passive mechanism. Evolution reason, same as consultation
16.	Resource mgmt.	X	Resources assigned and managed by senior leadership, top-down structure/approach, discourages innovation
17.	Leadership and Management	X	Still heavily top-down leadership and management structure, ministry culture, power, and politics. Incremental evolution observed is due to FMST's decision to delegate low-level (operational) leadership and mgt to NACETEM
18.	Decision-making	X	FMST-level leadership and mgt still take entire responsibility and make PF decisions, as done since inception. Incremental evolution due to FMST's decision to delegate low-level (operational) leadership/mgt. to NACETEM
19.	Funding	X	Highly embedded culture ("lock-in") of dependence on national budget allocation of funds, inimical to evolution
20.	M&E, <i>ex-ante</i>	X	Perceived as unimportant to policy formulation. Contained in policy documents, but rarely carried out, lip service
21.	R&D	X	Perceived as not important in policy formulation, hence non-incumbent, and so neither developed nor evolved

Source: Author's interview fieldwork data at FMST

Another finding from the interview data are the fresh insights they offer into the relationships among policy processes. The findings indicate that there is a need for a logical re-categorisation of the 21 policy processes, resulting in the development of a *Taxonomy of Policy Processes* proposed. In Chapter 6 (Section 6.1), I present the taxonomy and discuss it in greater depth. I also make clear distinctions between the taxonomy (which is based on the interview data at FMST) and the typology (which is based on existing literature, as presented in the theoretical framework). In Section 5.2.2 below I focus on skills (individual capabilities). I present and briefly discuss data captured from the interview programme, which show the roles skills play in policy formulation.

5.2.2 Policy Skills

In Chapters 2 and 3, I put forward the theoretical underpinnings that inform the argument made in this thesis that skills are complementary and serve to support policy processes and routines. I revisit this relationship between processes and routines, on one hand, and skills on the other hand in Figures 6.1 and 6.2 (Chapter 6). In the preceding sections of this chapter, I provided examples of skills alongside processes and routines thus deepening our understanding. The development of formal technical skills in Nigeria can be traced to colonial era. This culminated at independence in 1960 at which point Nigeria inherited a network of research institutes from the British colonial government. Formal University education started after independence (Ladipo, 2011; Oyewale, 2013). Records show that by 2013, Nigeria had in excess of 68 (S&T) National Research Institutes, 75 polytechnics, 128 Universities, Colleges of Education and many other tertiary education institutions (Bamiro et al., 2008; NBTE, 2013; NUC, 2013). These numbers have increased steadily, in line with population growth, university establishment and student enrolment, rising from 104 students in 1948 to 1,096,312 in 2006/7 (Bamiro et al., 2008; Oyewale, 2013). Furthermore, growth in scientific outputs is also well documented (Lebeau et al., 2000).

In Tables 5.2.2 (Policy Routines) and 5.2.5.1 to 5.2.5.5, I presented the findings captured at FMST which help illuminate the skills-set required in carrying out the tasks involved in routines. The skills identified as relevant to policy formulation at FMST include: analytical, research, management, decision-making, technical, negotiation, coordination, communication, and interpersonal skills. I have argued in this thesis that skills are necessary for carrying out the activities contained in routines, which in turn lead to the

operationalisation of policy processes. In Chapters 1, 2 and 3, I provided the theoretical underpinnings for situating skills as secondary in the conceptual framework. I explained that because skills serve to carry out the routine tasks they operate within the confines of processes and routines and therefore are complementary in nature.

In this section I present interview data gathered at FMST, which reveal that predominant emphasis regarding skills is placed on (a) (individual policymaker's) skills, while neglecting incumbent policy processes and routines within which skills operate, (b) the development of policy implementation as opposed to policy formulation capabilities, and (c) skills development for senior and director-level staff essentially concerned with management, instead of policymakers primarily responsible for carrying out the majority of the policy processes and routines.

“Skills development at FMST is ineffective. Training programmes are not based on the new knowledge the staff is likely to acquire but rather on personal and financial remunerations. This is the major problem with bridging the identified skills gaps. Specialised skills development (of e.g. policymaking, PRPA or CTER⁶⁴, ICT, Technology acquisition) is more effective. Government must critically consider individual's skills level during recruitment and selection and ensure staff are placed in areas they can function well; otherwise we will not make progress in this area. For example, medical doctors and pharmacists doing administration jobs and struggling with policymaking is bad for the country” - Deputy Director, Research and Statistics, FMST.

The interview findings and evidence from secondary data show that the total number of staff at FMST's Headquarters in Abuja is 478 and is classified according to grade levels – 359 are scientists, management or director-level staff; while 119 are support staff (Table 5.2.9; FMST, 2012b; Annex 10). The interview responses reveal that no current staff participated in the 1997 S&T policy formulation. This finding supports the lack of skills policy formulation at FMST. An FMST interviewee summarised the skills gap:

⁶⁴ FMST Department: PRPA – Planning, Research and Policy Analysis; CTER – Chemical Technology and Energy Research.

“Neither FMST nor NACETEM has the requisite skills. FMST cannot effectively formulate the national STI policy on its own, judging from the current levels of skills e.g. in policy research, conceptualisation and development of policy frameworks and methodologies, problem-solving, negotiation and mediation, high-level stakeholder engagement, skills for securing funding, leadership and management of policymaking. This is why we had to get help from the outside” - Chief Scientific Officer at PLS, FMST

Contrary to the above statement, some interview responses indicate widespread perception at FMST that a staff position of senior or management grade level equates to possession of skills. This practice of equating civil service grade levels to skills is borne out of extant Ministry culture (Table 5.2.7 above). One implication of this practice is that skills-upgrade exercises focus on senior, management and director-level staff, at the expense of the (junior) scientific officers who carry out the majority of the policy formulation routines. Consequently, the findings reveal that current FMST staff lack the full range of skills necessary for effective policymaking. The 2012 STI policy formulation therefore depended to a large extent on skills from non-FMST experts (external ministries and agencies and consultants) for its actualisation; as opposed to incumbent skills at FMST that this thesis advocates. These insights demonstrate that grade levels, such as management or director, do not automatically equate to availability of incumbent policy skills.

Table 5.2.9: FMST Staff Classified According to Grade Levels

Grade Levels	Description	Number of Staff
03-06	Support staff	119
07-14	Scientific Officers, Assistant/Chief Scientific Officers, and Management officer	312
15-17	Assistant Directors, Deputy Directors, Directors	47
Total		478

Source: FMST, 2012b

Another theme underlying the responses provided by FMST interview participants were the assumption that postgraduate qualifications (i.e. MSc and PhDs) in STEM⁶⁵ disciplines, or short capacity-building training (i.e. seminars, workshops or conferences) is sufficient to equip and qualify staff as policymakers. In responding to the availability of policy skills at FMST, a Principal Scientific Officer added: “we have enough people

⁶⁵ Science, technology, engineering and mathematics.

well trained and with PhD's from practically every top university in the world. So skills availability [*referring to PhD certifications, regardless of the field of study*] is of less problem when compared to the Ministry's ability to harness these skills in policymaking" (*italics, mine*).

While this statement typifies the views held at FMST, comments by (Deputy Director for Research and Statistics, FMST; Chief Scientific Officer, PLS, FMST; Director, TAA⁶⁶, FMST and Director, NDSTD, FMST), highlighted weaknesses in policy processes and routines required to "harness skills". I argue that such simplistic yet widely held view of the linear relationship between skills and policymaking negates the evidence to the contrary which supports the notion that policymaking is complex, involves multiple actors and requires a carefully articulated set of organisational and individual capabilities – as discussed in Chapters 2 and 3.

In spite of the increases in the number of universities, tertiary institutions and student enrolment over the years, discussed above, the findings reveal gaps in policy capabilities, thereby necessitating "capacity-building" exercises in the months leading up to the 2012 policy formulation. However, as Table 5.2.10 below shows, these capacity-building exercises focus on skills, ignoring policy processes and routines. These findings are in line with the interview response by Principal Chief Scientific Officer at NACETEM, who stated that skills alone in terms of educational qualifications have not translated into improvements in policymaking at FMST.

"There's quite a number of people in Nigeria who have skills, many MSc, PhDs, and Professors, yet no products! If you ask me, there is only 30-40% skills level for policymaking in Nigeria. Upgrade of staff skills is necessary. However, if staff acquire these knowledge and skills, then what? This is where processes for effective leadership selection, management and coordination of policymaking activities becomes vital to ensure that these skills are harnessed"

⁶⁶ Technology Acquisition and Assessment; NDSTD - Niger Delta S&T Development, FMST Department & Agency.

The interview data indicate that the dominant qualifications⁶⁷ of policymakers at PRPA and NACETEM⁶⁸ are predominantly scientific and technical, with no staff identified at either PRPA or NACETEM with advanced (MSc or PhD) certificate in, for example, public policy or social science related policy fields. Policymakers can be drawn from a wide range of disciplines, not limited to STEM, social sciences or public policy. However, the results of the interview programme indicate that the lack of staff with specific knowledge in public policymaking, policy frameworks and policy processes had significant negative impacts on the policy formulation in aspects that include the choice of policy frameworks, research methodologies, and stakeholder engagement⁶⁹.

Another implication of the lack of policy expertise was in the formalisation and further development of policy capabilities. NACETEM, between 1980 and 1990, had one PhD-level staff as compared with twenty PhDs between 1991 and 2012 in STEM disciplines and technology management (NACETEM, 2010b/c; 2011; FMST, 2012a/b). Similar increase in staff with postgraduate certifications was also observed at PRPA and across other FMST departments and agencies. Nevertheless, the critical mass of staff with policy-related qualifications remain low.

Furthermore, in spite of the rise in staff number and skills (educational qualifications), interview programme results presented above, in Tables 5.2.5 (Development of Policy Processes) and 5.2.6 (Evolution of Policy Processes) indicate significant gaps in the development and evolution of policy capabilities at FMST. As Table 5.2.6 reveals, evidence gathering for policy formulation at FMST started as desktop research in the first S&T policy of 1986. The interview findings reveal that the 2012 STI policy was also based on secondary data collection by desktop research. Similarly, consultation, communications, funding and other policy processes have remained largely unchanged since 1986 (Table 5.2.7). These insights support the proposition of thesis that skills alone are insufficient in policymaking and for ensuring the continuous development and evolution of policy capabilities. Policy processes and routines are essential.

⁶⁷ The commonly used indicator of policy skills-set at FMST and within Nigeria's wider policymaking context.

⁶⁸ FMST department and agency respectively that was responsible for the STI policy formulation.

⁶⁹ Covers: Stakeholder identification, Deciding Stakeholders roles, Consultation, Communication, Coordination, and Collaboration policy processes

The findings also reveal that majority of NACETEM staff who handled the STI policy formulation were fresh graduates with little or no prior experience of policymaking either at FMST or elsewhere. This study acknowledges that graduates may know the tools for policymaking at a theoretical level⁷⁰ and it is possible to acquire skills on the job, as reflected in the definition of skills to include experience. Table 5.2.9 nevertheless shows that the bulk of policymaking training focus on policy implementation, capacity building in skills and target director-level staff; while the majority of the scientific staff, responsible for the policy formulation, had little or no additional training (FMST, 2012b).

This is particularly important since the interview response revealed that no current staff at NACETEM had been involved in the formulation of previous S&T policies at FMST in the 1980s, 1990s or 2000s. Lack of prior policy formulation knowledge and experience meant that most FMST (PRPA and NACETEM) staff, involved in this formulation exercise, were learning on the job. It is reasonable to expect that the policymakers responsible for shaping the policy are capable and sufficiently equipped with the right set of skills. The interview findings indicate this was not the case; a result which shows that non-FMST experts and consultants played key roles in the policy formulation, in addition to the use of external consultants.

In summary therefore, the main point of this section was to present a brief account of what the problems with skills training are and the implication for policymaking at FMST. As Table 5.2.9 below shows, twelve policymaking skills development courses were organised by FMST between 2010 (leading up to the policy formulation exercise) and 2012 (FMST, 2012b). FMST interview and policy data reveal that majority of these courses focused on policy implementation with only a handful specific to policy formulation. This insight from the interview finding reveal that policy formulation was considered less important at FMST when compared with policy implementation. Furthermore, the courses focused more on skills, thereby indicating one reason why processes and routines may have played less roles, not developed or evolved.

⁷⁰ If they have been taught the relevant policy subjects

Table 5.2.10: Policymaking Skills Training at FMST: 2010 – 2012

	Course title	Objective(s)	Focus	Targeted audience	Type	Capabilities	Organiser	Location
1.	National Summit on Science and Technology	Strengthen R&D in Nigeria's policy ecosystem	Implementation	Stakeholders: public, private sectors; development partners	Conference	Skills	FMST / UNDP	FMST, Abuja, Nigeria
2.	Consultation	Improve the policy on STI	Implementation	Public and organised private sector	Forum	Skills	FMST / NACETEM	Lagos, Abuja
3.	Validation of STI Policy Outcomes	Validate the outcomes of the STI Policy	Formulation	Major S&T and policy stakeholders	Workshop	Routines, Skills	FMST / NACETEM	Geopolitical Zones (6)
4.	STI Policy Stakeholders	Obtain feedback, input into the draft policy	Formulation	STI policy stakeholder group	Conference	Skills	FMST / NACETEM	Abuja, Nigeria
5.	Implementation of STI Policy	Skills acquisition in the art of policy implementation	Implementation	Staff development programme for scientific officers and engineers	Training	Skills	FMST / Indian Gov't	India
6.	STI Policymaking	Inputs into the STI Policy	Implementation	Mid to senior level (GL10) staff and above	Seminar	Skills	FMST	Abuja, Nigeria
7.	Ex-ante policy review	Revision of the national S&T policy	Review, Implementation	FMST staff and major policy stakeholders	Workshop	Skills	FMST	Abuja, Nigeria
8.	Extra-ordinary NCST ⁷¹ meeting	Interactive sessions with NCST members	Implementation	State govt., officials commissioners, etc.	Workshop	Skills	FMST	Lagos, Nigeria
9.	Consultation	Consultative meetings on draft STI policy	Formulation	STI policy actors FMST and stakeholders	Meetings	Process/ Routines, Skills	FMST / UNDP	Abuja, Nigeria
10.	Project Steering & Mgt. Cm'ttes.	Enhance leadership, mgt. and coordination	Implementation	Private and public sector policy actors	Meetings	Routines, Skills	FMST	Abuja, Nigeria
11.	Policy implementation	Acquire skills for policy implementation	Implementation	FMST level 15+ staff (Directors)	Training	Skills	FMST	Accra, Ghana
12.	International STI Conference	Stakeholder engagement	Implementation	Selected Nigeria's policy stakeholders	Conference	Skills	RMRDC	Abuja, Nigeria

Source: Author's interview fieldwork data at FMST; FMST (2012b).

⁷¹ National Committee on Science and Technology

Interview data also shed light on the major activities and stages that were involved in formulating Nigeria's 2012 STI policy. This helps to improve our understanding of the capabilities utilised at various policy stages and the roles they played. In Section 5.3 below, I present interview findings gathered at FMST on the key stages and briefly discuss how this helps to address the Research Questions (RQs).

5.3 Policy Formulation Stages at FMST

In order to deepen our knowledge of the roles that capabilities (processes, routines and skills) played in formulating Nigeria's 2012 STI policy at FMST, we need to examine the policy processes and routine activities involved in formulating the policy. This examination yields interesting insights into the steps taken during the policy formulation exercise and the capabilities deployed. Interview data captured at FMST shed light on the major policy stages and routines carried out in each stage of the policy formulation. The findings provide information useful in determining the sequence of events; that is, which processes and routines were executed first, which were carried out simultaneously and which came last. To enhance clarity, I group the policy activities into five key stages⁷², in a chronological order, starting with *Key Stage 1*.

5.3.1 Key Stage 1: Decision to Formulate Policy and Committee Set up

Interview data captured at FMST indicate that the first stage of policy formulation at FMST starts with idea generation and a decision to formulate a new (or review an existing) policy. This decision is taken by the government – either at the presidency or at ministry (FMST) level (FMST, 2012). In government ministries, such as FMST, the minister takes this decision, in conjunction with senior management team (civil servants) comprised of the permanent secretary and heads (directors) of the various departments and agencies (FMST, 2007a).

⁷² These stages are not necessarily concurrent but rather fluid and interrelated. This subdivision serves to structure and facilitate the discussions, highlight the capabilities involved in each stage and the roles they played in the formulation.

In highlighting the important role of Leadership and Management process, a director at FMST explains that:

“Between 2003 and 2011 there was no policy formulation. We attribute this gap to constant leadership changes. Since Turner Isoun⁷³ left, I have worked with three ministers and various permanent secretaries who were changed over very short periods of time. This results in continuity challenges; a series of false starts and stops in policymaking. If a clear leadership process for policy formulation is in place and well documented at FMST, these changes would have far less negative impacts on our activities”.

FMST is guided by eight operational mandates⁷⁴. Top of this list of mandates, is the formulation and coordination of the national S&T (now STI) policy. Interview findings reveal that a minister is at liberty to pursue any or all eight mandates during his tenure in office, in whatever order of priority. On appointment and resumption of office as a minister, it is customary in Nigeria for the minister to embark on a retreat with the senior management team (FMST, 2007a). The retreat accords the minister the opportunity to plan and debate project and policy ideas with senior management team, with a possibility of reaching consensus on what project and policies to implement. This calls for capabilities for leadership and management, consultation, communication, negotiation, for example. Therefore, the inputs and advice from the departmental directors at this stage is highly influential in the policy direction, policy priorities and policy course the minister takes while in office.

With the decision to formulate the new STI policy made, the next step involves the setup of an internal committee. This internal committee of about five persons, usually less than 15, is given the terms of reference, which defines the overarching policy agenda setting

⁷³ Former (and longest-serving) Minister of FMST, served from 2000 to 2007.

⁷⁴ 1.) Formulation, monitoring and review of the National Policy on Science, Technology and Innovation to attain the macro-economic and social objectives of Vision 20:2020 as it relates to science and technology; 2.) Acquisition and application of Science, Technology and Innovation contribution to increase agricultural and livestock productivity; 3.) Increasing energy reliance through sustainable Research and Development (R&D) in nuclear, renewable and alternative energy sources for peaceful and development purposes; 4.) Promotion of wealth creation through support to key industrial and manufacturing sectors; 5.) Creation of Technology infrastructure and knowledge base of facilitate its wide application for development; 6.) Application of natural medicine resources and technologies for health sector development; 7.) Acquisition and application of Space Science and Technology as a key driver of economic development; and 8.) Ensuring the impact of R&D results in the Nigerian economy through the promotion of indigenous research capacity to facilitate technology transfer (FMST website: <http://www.scienceandtech.gov.ng/index.php/78-featured/106-article-e>, accessed, 08/03/2015).

criteria. It outlines the committee's responsibility of coordinating and managing the policy formulation exercise with a view to delivering the policy document (NACETEM, 2011). This committee, made up of staff from NACETEM, reports to the permanent secretary⁷⁵ who oversees the critical aspects of the policy formulation exercise, such as, setting the committee tasks and skills determination. It is also the permanent secretary's duty to ensure that the policy formulation exercise is inclusive (i.e. engage stakeholders and NSI actors, participatory), allocate resources (personnel, office, equipment, funds), analyse risk, and guard against failures.

The interview findings reveal that examples of policy processes and routines involved in *Key Stage 1* include: leadership selection, management, decision-making and agenda setting, risk analysis and management, consultation, communication, coordination and funding, as identified in Table 5.2.2, policy routines.

Next, I explain the activities, policy processes and routines involved in *Key Stage 2*.

5.3.2 Key Stage 2: Policy Formulation Committee activities

The Policy Formulation Committee (PFC), made up of eight staff drawn from NACETEM, was headed by the Director General and CEO of the agency. Although the PFC received terms of reference, which defined the broad intentions of the policy, interview responses gathered reveal that the committee's influence on the policy document was profound – e.g. in maintaining informal policy capabilities or helping in their formalisation (Table 5.2.2), influencing the roles played by policy capabilities (Table 5.2.4) or in mapping the capabilities that incumbent, developed or evolved and recommending areas of further capabilities development to senior management.

First, PFC duty of coordinating and managing the policy formulation exercise mean that it is responsible for translating the policy aims into specific policy priorities and strategic objectives that provides the basis for stakeholders' engagement⁷⁶ activities. The results are that, PFC exerted considerable influence on the policy direction and drafts, for example, in the choice of actors engaged with, why, at what stage of the policy

⁷⁵ The chief admin/operating, FMST. Supervises the committee, provides overall management and direction.

⁷⁶ Includes activities such as identification of stakeholders (based on set criteria), assign specific roles to stakeholders, coordination of stakeholders activities, organise and carry out consultation as and when, etc.

formulation exercise, and what views are solicited. The implication of this dominance in the policymaking approach at FMST and one that is dependent on informal processes and routines, means that the policy formulation exercise is or can be prone to manipulation and hijacked by powerful actors.

Second, PFC is responsible for gathering the evidence used in the policy formulation. This was another area of profound impact as observed in the 2012 STI policy formulation. In the 2012 STI policy formulation exercise during which no primary data was collected, PFC decided on what secondary data and evidence counted as “scientific facts” (and authority) used to legitimatise⁷⁷ the policy. More so, such scientific facts selected by PFC was used to inform other policy processes and routines such as agenda setting, setting of policy priorities or selecting a policy course.

Third, PFC using the research data collected, develops the first policy draft.

“We use draft policies for national stakeholders’ meetings and consultations, feedback and coordination of the policymaking exercise. Capabilities are essential for the development of these drafts” – Director, NITDA.

Policy drafts at FMST form the basis for Stakeholder’s Engagement, further development (i.e. iterations of the policy document), reviews and stakeholders’ inputs. Therefore, PFC’s policy activities have far-reaching impacts on policy formulation in various other ways, which include, framing the policy problems and solutions, deciding what might be considered alternative solutions and constructing the policy pathways based on its understanding of policy processes (Scoones, 2010) and policymaking. More importantly, the interview findings further reveal that PCF’s role was critical to the formalisation of capabilities by documenting and specifying the policy processes, routines and skills involved in each stage of the exercise. As I discuss in the next chapter, PFC’s activities contribute in great measure to the embeddedness and (in)formalisation of policy formulation processes and routines. These result in lock-in⁷⁸ effects (Bergek et al., 2008), which significantly have an important bearing on the utilisation, roles, development and evolution of policy capabilities.

⁷⁷ Ensure “social acceptance and compliance with relevant institutions” (Bergek et al., 2008, p. 416)

⁷⁸ See Chapter 6, Section 6.3.3 for more on lock-in

In spite of the PFC's responsibilities and influence on the policy processes, the findings (Table 5.2.2) show that there is no formal, criteria-based policy processes and routines for selecting members of this committee. On the basis of this finding, the reasons for the lack of formalised policy processes and routines for members selection at FMST, after 25 years of S&T policymaking history, include (a.) preference for informal policy processes and routines borne out of extant culture, negative routines and lock-in effects, (b.) absence of a framework necessary for mapping policy capabilities, (c.) poor conceptualisation that equates policy capabilities to skills thus ignoring organisational processes and routines within skills function, and (d.) the lack of ability to develop, formalise and implement formal policy capabilities due to skills shortage. I discuss the implications of this finding in Chapter 6.

Examples of policy processes and routines involved in *Key Stage 2* include: agenda setting, setting of policy priorities, constructing policy alternatives, developing policy strategies, R&D and M&E as identified in Table 5.2.2, on policy processes and routines.

"M&E is very weak. I will give it a score of 2 on a scale of 1-10. In some cases, we start it and then it is discarded". M&E is necessary for us to know whether what we are doing is impacting the society in the right way, if we need to change our strategies or tactics, if we are wasting energy on something not useful, or whether we should direct our resources on other things – Chief Scientific Officer, NITDA

Next, I explain the activities involved in *Key Stage 3* – policy drafts and stakeholders' engagements.

5.3.3 Key Stage 3: Policy Drafts and Stakeholders' Engagement

In this stage the policy draft developed by PFC is used as the basis for stakeholders' engagement with a view to soliciting and incorporating feedback into the policy document. Stakeholders' engagement process starts with the identification and selection of stakeholder organisations and policy actors drawn from Nigeria's NSI (see Annex 1). The PFC (FMST) selects and invites the stakeholders into the policy formulation exercise in order to contribute in various capacities and at different stages. Thereafter selected stakeholders are assigned specific roles, supervised and their activities coordinated. This stage involves significant number of reviews and iterations, as the case may require, in order to produce various versions of the policy draft before a final version is agreed upon

by Nigeria's STI governance stakeholders at the National Council of Science and Technology (NCST⁷⁹) meeting. PFC carries out the policy processes and routines, described in this stage, which include the coordination and management of the policy activities.

Examples of policy processes and routines involved in this stage include: agenda setting, setting policy priorities, deciding on policy instruments, constructing policy alternatives, developing policy strategies, consultation, communication, stakeholder identification and engagement and coordination. In the section below, I turn to the activities involved in approving the policy draft in *Key Stage 4* – ratification.

5.3.4 Key Stage 4: Policy Draft Ratification and Legalisation

In this stage the final version of the policy draft is ratified, that is, officially approved, during a National Council for Science and Technology (NCST⁸⁰) meeting. NCST is the apex S&T policy organ in Nigeria. It is chaired by the Minister of S&T, with Commissioners in charge of S&T in Nigeria's 36 states and the Federal Capital Territory, as members. The activities that occur here involve the S&T policy governance and regulation community and a wide spectrum of stakeholders. The 12th NCST meeting for example had 470 delegates in attendance (Ewa, 2013; NCST, 2013) drawn from the FMST, State Ministries of S&T, National Assembly and stakeholder organisations mentioned in Key Stage 3. The 2012 national STI ratification exercise involved hundreds of delegates and extensive deliberations at NCST meetings, over a number of days. The debates focused on the content of the policy draft, such as the policy priorities, objectives and strategies. At the end of the meeting, consensus positions from working groups and individuals drawn from the NCST meeting participants, are presented to the Council for adoption (or rejection).

⁷⁹ I discussed NCST briefly in Chapters 3, Section 3.2 and Chapter 4, Section 4.3.2

⁸⁰ The Council deliberates on S&T issues of national interest and gives appropriate recommendations to the government (FMST, 2007; 2012; Oyewale, 2013).

In addition to NCST and FMST, the National Assembly⁸¹ is another public policy and regulation arm of the government. It is made up of two chambers: senate and representatives, each with a committee on S&T (Oyewale, 2013). NCST's ratification paves the way for the National Assembly to enact the appropriate law(s) that authorises the document as a national policy and provides the legal frameworks, for example, necessary for the setup of relevant agencies and authorisation of budget lines, for operationalising the policy. With the policy formulation failure of 2003 attributed in part to the National Assembly's inability to pass the relevant laws, an FMST interviewee submitted that:

“As major stakeholders in our policymaking, our parliamentarians need to have the necessary capabilities otherwise our policymaking will always fail. Everything comes to their desk. If they don't know what to do, they can push it aside, or it could become a bill that they will not read or pass. So the capacity development of our parliamentarians is critical. Every other group could play their part, but if the parliamentarians do not know what to do, the efforts will amount to waste” – Director, NACETEM, FMST.

The interview findings reveal that the ratification stage acts as a consultation process. For instance, each association (e.g. Academy of Science) member, attends the ratification meeting – an action that denies the organisation the right to “complain” at a later date that its group was not represented. The findings reveal that contrary to the policy formulation rationale, which is to ensure that stakeholder's inputs are captured and considered; the ratification exercise is driven from the policy implementation viewpoint, which is: “when it is time to implement, stakeholders' are more likely to get behind and support the policy because they heard, knew about it or ‘contributed’ to it” (Principal Scientific Officer, FMST). This deviation from the primary focus of engaging stakeholders with aim of improving the policy formulation exercise provides further justification of FMST neglect of policy formulation stage as a critical phase in policymaking. Ratification is therefore used, first and foremost, to secure stakeholders “buy in” in the hope that they will “support the policy at implementation phase” (Director, NITDA). Interview findings from

⁸¹ The National Assembly is Nigeria's bicameral legislature and the highest elective law-making body of the country. It consists of the 109-member Senate and the 360-member House of Representatives (www.nassnig.org). The two chambers of the Assembly have S&T Committees that advise members on matters relating to S&T. The Senate Committee on S&T has 12 members, while the House of Representatives Committee on S&T has 25 members (Salami, 2002; Oyewale, 2013).

stakeholders' respondents contest and refute this approach, arguing that it is a classic case of tokenism and "ticking the boxes". An interviewee added:

"We were only invited during the ratification stage at which point all we could do was 'rubber stamp' what was already in the document. With ministers, permanent secretaries, commissioners and hundreds of other delegates and dignitaries present, who am I or what room is there to add, change or oppose anything at that stage? It was a waste of time, effort and money. If they [FMST] wanted our inputs, we would have been invited to contribute earlier in the exercise" – Journalist, Guardian Newspapers, participant, NCST ratification

Examples of policy processes and routines involved in this stage include: stakeholder engagement, agenda setting, and setting of policy priorities, deciding on policy instruments, constructing policy alternatives, and developing policy strategies.

Finally, I examine the activities involved in signing the policy into law in *Key Stage 5*.

5.3.5 Key Stage 5: Signing STI Policy into Law

The legislative (National Assembly) and Executive (Presidency) arms of governments in Nigeria must endorse a national policy before it can be implemented. This ensures that relevant legislations, funding mechanisms and other requirements are put in place. In this stage, the ratified draft policy is reviewed by the Federal Executive Council (FEC⁸²), made up of all federal ministers and headed by the president. The aim here is to offer government ministers heading other ministries the opportunity to independently analyse the policy in line with activities of their respective ministries.

Following which ministers may make contributions for modifications, or raise concerns and objections on issues that conflict with their specific ministry's objectives or activities. Oyewale et al. (2013, p. 22) notes that the inclusion of the S&T activities of cognate ministries⁸³ in the STI policy provoked objections from these ministries. As a result, "lobbying and meetings of high-level officials of FMST with the concerned ministries" were carried out in order to secure FEC's approval. The interview findings reveal that

⁸² To reiterate, FEC is the Council of Ministers headed by the president. It is the highest government decision-making body in Nigeria.

⁸³ E.g. Ministry of education, environment, health, and transport

risks of delays and potentials for policy failures are significantly increased at this stage, highlighting the role of capabilities such as risk, management and leadership.

In order to resolve the tensions between the respective ministries and settle the differences highlighted in the draft policy processes, routines and skills for coordination, mediation, and negotiation (Kuhlmann, 2001) are useful in the governance of innovation policymaking, in addition to risk, management and leadership. I discuss these further in Chapter 6.

On completion of the ministerial feedback session, the president signs the policy into law. Thereafter, the policy document is printed and launched in a flamboyant ceremony - the official presentation of the policy document to the public. This helps to create public awareness, signals the end of policy formulation and transitions the policymaking exercise into policy implementation phase. I summarise the five key policy formulation stages in Table 5.3 below.

Table 5.3: Summary of Key Policy Formulation Stages at FMST

Policy Stage	Main activities involved
Key Stage 1	Decision to formulate policy and set up of relevant committee(s)
Key Stage 2	Policy Formulation Committee activities – research, develop first draft policy document
Key Stage 3	Policy Draft is used for stakeholder engagement, as the basis of further development
Key Stage 4	Policy Draft is ratified (by NCST) and legalised (by National Assembly)
Key Stage 5	Final Policy Draft approved by FEC is signed into law ⁸⁴ by the president

Source: Based on author's interview fieldwork data at FMST.

Key Stages 4 and 5 are critical to policy formulation in Nigeria because technocrats at the ministry give way to politicians and the risk of policy formulation failure is heightened, sometimes, exponentially. Historically, this is the stage where most policy formulation failures occur due to political influence and interferences, such as, delays from the legislative or executive arms of government or refusal to approve final draft of the policy documents and enact relevant laws. The 2003 policy formulation exercise failed at this stage as a result of parliamentarians' inability to approve it. A Chief Scientific Officer at

⁸⁴ Policy formulation processes end at this stage and signals the start of policy implementation. Policy implementation is beyond the scope of this study and is therefore not addressed in this thesis.

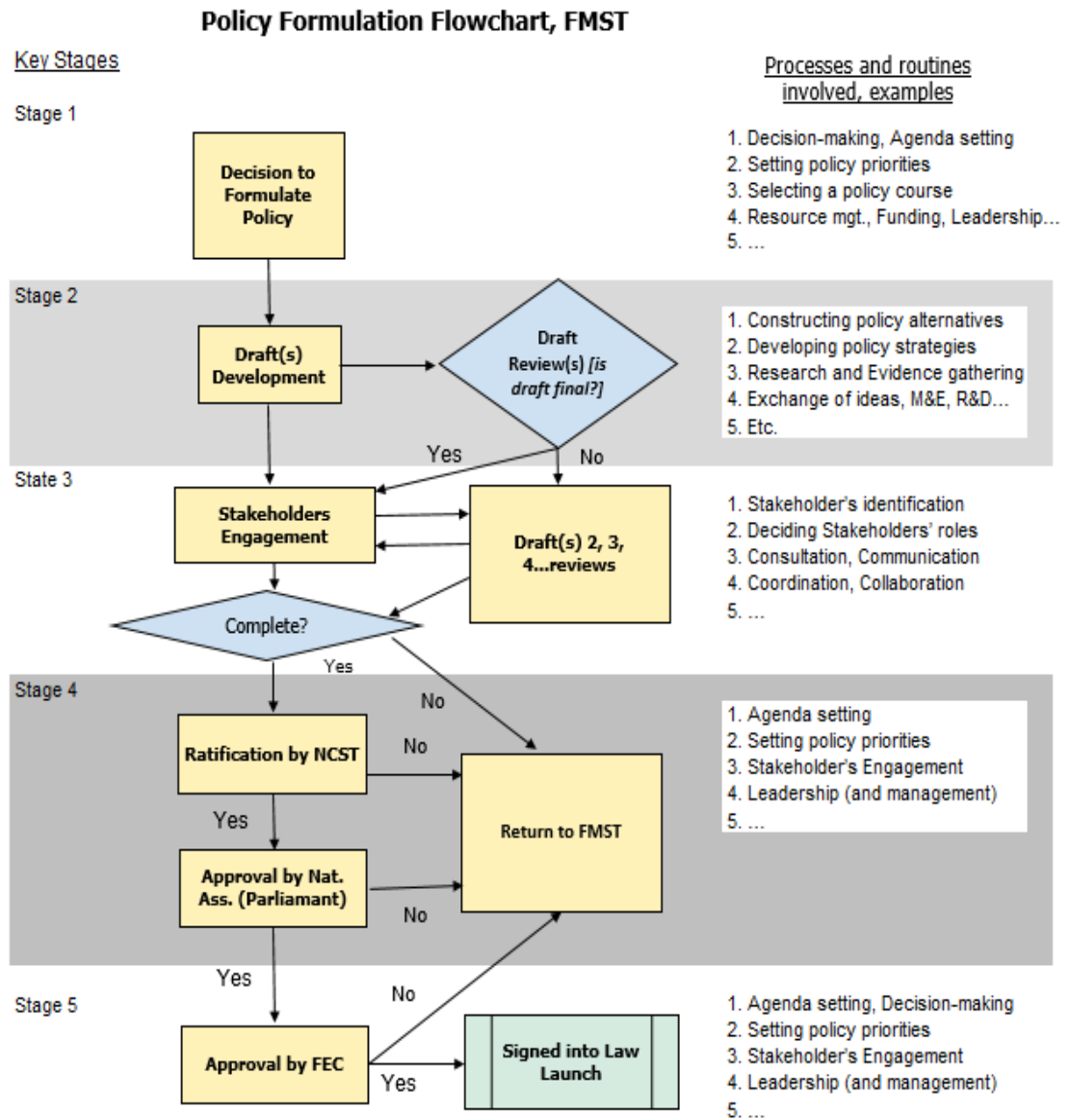
NITDA, in his interview response stressed the need for capabilities and risks posed at these stages, adding that:

“There have been instances where policy formulation drafts submitted to the Federal Executive Council took so long to be approved that the information contained in the policy document becomes obsolete, requiring another review, although the previous review has not been accepted nor adopted. Unfortunately, in the 2003 case, this problem was not overcome. Without effective leadership, management, and stakeholders’ engagement processes, required to secure the necessary political will, the risks of failure are enormous”.

The interviewee further added that “there was an instance during which, in spite of the negotiation and mediation efforts, the conflicts remained unresolved and the policy exercise was abandoned”. The above statements highlight the role of mediation which in this policy formulation exercise was initiated and handled at the two levels of management and leadership identified and discussed in preceding sections: FMST and NACTEM. FMST deals with high level, inter-ministerial and issues related to the presidency while NACTEM manages the operational and lower-level conflicts directly linked to the policy formulation exercise.

Examples of policy processes and routines involved at this key stage include leadership, decision-making, risk analysis and management and stakeholders’ engagement. These insights, based on the interview data captured at FMST, help to establish the order of events that forms the basis for the development of a suggested *Policy Formulation Framework* presented in Chapter 6 and *Policy Formulation Flowchart* (Figure 5.1). Figure 5.1 below encapsulates the key formulation policy stages at FMST in a flowchart.

Figure 5.1: A Flowchart of Key Policy Formulation Stages at FMST



Source: Author's interview fieldwork data at FMST

Chapter Summary

In this chapter, I have summarised and presented the findings, based on the interview response data captured at FMST and policy documents reviewed. 28 policy processes were identified in Chapter 2, 21 of which were observed to be relevant at FMST and subsequently investigated. Of the 21 policy processes, interviewees identified five to be core processes. These are: Agenda Setting, Research, Stakeholders Engagement, Leadership and Management, and Funding; while six (Deciding on policy instruments, Constructing policy objectives, Exchange of Ideas, Risk, M&E and R&D) were non-incumbent. From the 21 processes (1) 14 (70%) were utilised in formulating the STI policy, (2) five (Deciding on Policy Instruments, Exchange of Ideas, Risk, M&E and R&D) were not, (3) while two (Research and Collaboration) were partially utilised.

The findings reveal that policy processes and routines at FMST are informal (i.e. undocumented) and remain tacit knowledge residing in individual policymakers' memory or experience. This, I explained, has significant implications on the roles played by policy capabilities, the development of policy capabilities and the evolution of policy capabilities e.g. by inhibiting organisational memory (Halbwachs and Coser, 1992), organisational learning (Schout, 2009) and Policy learning (Borrás, 2011). Furthermore, although there is marked acknowledgement of the important roles that policy capabilities play in policy formulation at FMST, policy capabilities have largely remained underdeveloped and have not evolved beyond their rudimentary levels since inception at FMST or use in the formulation of Nigeria's first S&T policy in 1986.

The findings also reveal marked differences in opinions of incumbent and core capabilities between FMST and non-FMST respondents as shown in Table 5.2.2. While FMST respondents make claim to the availability and utilisation of policy capabilities, emphasising some capabilities to be core (e.g. Agenda setting, Coordination); stakeholders interview responses, on some capabilities, paint a contradictory picture, indicating variations in the capabilities they consider to be core to policy formulation at FMST.

Furthermore, because FMST equates capabilities with skills, this results in the perception assumption that policy capabilities are incumbent at the institution. The implication is (a) neglect of policy processes and routines (b) efforts to build and further develop policy

processes and routines are undermined or ignored (c) the evolution of capabilities is stunted, and (d) policymaking is negatively affected – as illustrated by the continued policy failures recorded. In Chapter 6, I discuss the implications of these findings and relate them to the research questions.

Chapter 6: Discussion

Introduction

This chapter draws together the insights from the case study and data captured during fieldwork at FMST to answer the three Research Questions (RQs), which are:

- I. What roles do capabilities play in formulating STI policies at FMST and why?
- II. How did policy formulation capabilities originally emerge at FMST and why?
- III. How have policy formulation capabilities evolved at FMST and why?

To reiterate, I examined Nigeria's 2012 national STI policy formulation exercise to help map out the policy capabilities (processes, routines and skills) involved in STI policy formulation in a developing country (DC) context. In the sections below I provide insights on policy capabilities and policy formulation in line with the conceptual framework proposed in Chapter 3. I discuss the findings and answer the Research Questions advanced. Section 6.1 addresses Research Question 1; Section 6.2, Research Question 2; and Section 6.3 addresses Research Question 3. Section 6.4 draws together the discussions of the preceding three sections by presenting a new policy framework. In Section 6.5, I revisit rival explanations and discuss how they have been addressed in this thesis.

To enhance clarity in the discussions that follow and for the rest of the thesis, I capitalise policy processes (for example, "Research", "Agenda Setting" or "Stakeholder Engagement") in order to differentiate them from when used as part of a sentence. For instance, "Research" as a policy capability is different from "research" which refers to an activity when used in a sentence. I begin by addressing Research Question 1.

6.1 Research Question 1: *What Roles do Capabilities Play in Formulating STI Policies at FMST and Why?*

This question examines the roles that the identified policy processes, routines, and skills played in formulating Nigeria's 2012 national STI policy at FMST. Analyses of these findings yield insights into the importance, utilisation, incumbency, and ultimately the roles of policy capabilities at FMST. A key finding is the absence of formal policy processes (and their corresponding routines). The findings reveal that the 21 policy processes (explained in Chapter 5) at FMST were informal, except for Funding which presents a unique case (of being formal and informal).

Formal and Informal Policy Processes and Routines

In Chapters 2 and 5 I defined formal processes and routines as those that have been documented while informal policy processes and routines are undocumented but are practised or used in policy formulation. For example, the findings reveal that policy processes (and their routines) have remained informal over the 35 years (1986-2012) of policymaking at FMST. This has implications for policymaking at FMST as it results in the failure to formulate effective STI policies. As I have argued in this thesis, informality of policy processes and routines increases the risk of continued policymaking failures – through lack of clarity (on the part of policymakers and decision-makers), agenda control, and policy hijack. In addition, informality hampers the prospects of further development and evolution of policy capabilities. It may also reduce opportunities for strengthening organizational and collective memory (Halbwachs and Coser, 1992). Furthermore, it leads to a situation of constantly reinventing the wheel in that each new group of policymakers attempt to figure out what policy processes, routines, skills and methodologies were utilised in previous policy formulation exercises. Two possible reasons help explain this finding: (1) weak or absent policy skills, as explained in Chapter 5; (2) extant organisational culture and practices within which policy capabilities were equated to skills (neglecting policy processes and routines) or informally determined by individuals.

The findings reveal that FMST policymakers did not inherit a formal set of policy processes and routines or a framework that can help them identify and map policy capabilities. As a result, an organisational culture of informality persists in the implementation of policy processes and routines. Another insight that can be gathered from these findings is that it discloses a history and “preference” for informal policy processes and routines, thus indicating little or no appetite for formalisation. The finding also helps to explain why the plethora of studies that assume a universalistic approach to policymaking based on established institutional settings and clearly defined formal policy processes and frameworks would be impractical (and most probably difficult) to operationalise at FMST.

The attribute of routines as being collective, “a set of formal procedures or rules” that act like genetic codes thus embodying organisational knowledge (Feldman and Pentland, 2003; Becker, 2005; Felin et al., 2012), is of importance in this respect. The implication

is that policy (processes and) routines can be formalised⁸⁵, thereby facilitating policy learning, further development of policy capabilities (RQ2) and evolution (i.e. innovation, changes/improvements) in policy process (RQ3). However, routines can also be utilised in their informal state, as practised at FMST, with the risk of possible misinterpretation, manipulation or hijacking by more powerful policy actors (Sabatier, 2007; Majone, 2008). I argue that formalisation and a framework can help to guard against such risks, militate against policy formulation failures and improve effective policymaking.

Informal policy processes and routines can also result in abuse and lack of clarity on the policymaker's part, leading to inconsistencies in the understanding of policy tasks and how they should be carried out. In such situations policymakers resort to negative organisational practices due to lock-in effects and established rigidities (Bergek et al., 2008), the effect of which can hamper the roles (RQ1), development (RQ2) and evolution (RQ3) of policy capabilities. There is therefore a need for new (or a reconfiguration of existing) policy frameworks for FMST and DCs similar to Nigeria in order to help improve their applicability. The findings also reveal that policymakers perceived some policy processes, informal as they currently are, as core to the policy formulation. These are referred to as *Core Policy Processes* in this thesis, while others are non-core. To reiterate, core policy processes have been emphasised by interviewees as those critical to policy formulation and therefore must be incumbent at FMST. In the next section I discuss core and non-core policy processes.

Core and Non-core Policy Processes

Interview responses helped to identify five core processes: (1) Agenda Setting, (2) Research, (3) Stakeholders Engagement, (4) Leadership and Management, and (5) Funding. This group of policy processes was regarded as critical to policy formulation and therefore must be incumbent at FMST in order for STI policy formulation to succeed. However, the findings also reveal that the remaining sixteen policy processes were non-core. The significance of this finding for policymaking in Nigeria is that it is not necessary for non-core policy processes to be incumbent in order to formulate policy. This finding

⁸⁵ That is, written down, documented or organised in formats that are stored for easy access and future use (as defined in Chapter 5, Section 5.2.1)

helps to re-categorise the 21 policy processes contained in the typology⁸⁶, thus helping to separate core policy processes from non-core. The insights contribute to addressing RQ1, which aims to deepen our understanding of the roles that policy capabilities play in formulating STI policies at FMST and why. An implication of this finding for policymaking is the effect it has on policy formulation. It reveals that core policy processes (and routines) are prioritised and implemented differently (e.g. utilised more frequently) than non-core policy processes and their corresponding routines.

The findings also reveal important relationships among policy capabilities, showing that some policy processes share similarities in their routines and skills. For example, the Agenda Setting policy process share routines and skills involved in other policy processes such as Setting Policy Priorities, Selecting a Policy Course, Deciding on Policy Instruments, Constructing Policy Alternatives and Developing Policy Strategies. In other words, to set a Policy Agenda, set Policy Priorities or set Policy Strategies (three separate policy processes), there is a need to generate, exchange, and refine ideas, and consult with stakeholders (the same as in Agenda Setting routines) – all of which require skills that include research, management, negotiation, communication and decision-making. These similarities in routines and skills therefore mean that it is possible to also group policy processes on the basis on these relationships. One implication for this grouping on the effectiveness of policy formulation is that it helps to explain why the presence or utilisation of a core policy process (e.g. Agenda Setting) at FMST results in lesser interest for the non-core policy processes (e.g. Setting Policy Priorities, or Selecting a Policy Course) related to Agenda Setting. By ignoring the non-core processes, which themselves play unique and important roles, policy formulation is rendered less effective.

These implications, as explained above, affect how processes and routines are implemented at FMST. It is the ways that processes and routines are implemented that in large part explain why the formulation of STI policies at FMST has encountered a succession of failures. The findings further reveal that the development of a core policy process (e.g. Agenda Setting), mean that less interest is shown for the development of “non-core” policy processes (e.g. Setting Policy Priorities), which are related to Agenda Setting. Consequently, non-core policy processes and routines are less likely to be

⁸⁶ Discussed in Chapters 2 and 3 (theoretical framework and conceptual framework respectively) and created in Chapter 5, Section 5.2, Table 5.2.1, and page 3.

developed, play lesser roles in policymaking as a result of lesser utilisation and are therefore less likely to evolve. I build on these findings and further explain their implications for policy formulation in subsequent sections of this chapter.

Drawing together the findings on formal/informal policy processes, and core and non-core processes therefore, I provide below a taxonomy of policy processes (which contain their respective routines and skills, as presented in Chapter 5). In the taxonomy I focus on policy processes. In Chapter 5, I presented the findings on routines and skills. I elaborate further on these findings in subsequent sections below. To reiterate, the 21 policy processes examined at FMST were identified to be informal. Thus there is no need for further separation of policy processes into formal or informal in the taxonomy. The taxonomy helps to clarify the re-classification of policy processes at FMST into: (a) core (in bold) and non-core, and (b) related groups, based on the roles the policy processes played in formulating the STI policy. To give greater clarity, I present the Typology (introduced in Chapter 2) and Taxonomy of Policy (Formulation) Processes (Table 6.2.1 below) as this enhances the distinction between the typology and taxonomy. As I explained in Chapters 1 and 2, the Typology is based on the definitions and interpretations of processes, routines and skills in existing literature, as captured in the theoretical framework presented in Chapters 2. The reclassification presented in the Taxonomy, on the other hand, is the result of the empirical data captured at FMST during the fieldwork which took place in 2013. Table 6.2.1 also helps to illustrate the relationships between core and non-core policy processes and summarises the discussions in this section. It shows that the core policy processes (except Funding) have non-core policy processes related to them.

The taxonomy is significant to future policymaking in various ways. First, it shows that developments in the core policy processes can potentially result in improvements in the related non-core processes – a net positive impact on effective policy formulation. Conversely weaknesses in the core policy processes may also result in deficiencies in the related non-core processes – a net negative impact on effective policy formulation. Second, the insights from the taxonomy also highlight the fact that in cases where resources (e.g. funds, personnel, time) are scarce, managers of policy institutions in the first instance, decide to focus capabilities development initiatives on policy processes

deemed to be core to the policymaking institution, while the development of non-core (non-incumbent and less utilised) policy processes may take place at a later date.

Table 6.2.1: Typology and Taxonomy of Policy Processes

Policy Process			
Typology	Taxonomy	Brief explanation of grouping of policy processes	
1. Agenda setting	Agenda setting	The policy processes (numbers 2 - 6 under Agenda Setting) are closely related to Agenda Setting policy process in that this group of policy processes either: contribute to, help shape or are inputs into agenda setting.	
2. Setting policy priorities	Setting policy priorities		
3. Selecting a policy course	Selecting a policy course		
4. Deciding on policy instruments	Deciding on policy instruments ⁸⁷		
5. Constructing policy alternatives	Constructing policy alternatives		
6. Developing policy strategies	Developing policy strategies		
7. Research (and Evidence gathering)	Research (and Evidence gathering)	The common thread that runs through these policy processes (numbers 7 – 10) is research and the role it plays in evidence-based / evidence-informed policymaking, exchange of ideas that could inform policy, M&E or R&D.	
8. Exchange of ideas	Exchange of ideas		
9. Monitoring and Evaluation (M&E)	<i>Ex-ante</i> Monitoring and Evaluation (M&E)		
10. Research and Development (R&D)	Research and Development (R&D)		
11. Stakeholder identification	Stakeholder identification (Engagement)	The dominant feature of this group is the centrality of stakeholders and the important role that they play in policymaking. For instance, Stakeholders have to be identified, assigned specific tasks, consulted and communicated with during policy formulation. They also need to be effectively coordinated in order to adequately capture their inputs. Finally formulation involves collaboration.	
12. Deciding Stakeholder roles	Deciding Stakeholder roles		
13. Consultation	Consultation		
14. Communication	Communication		
15. Coordination	Coordination		
16. Collaboration	Collaboration		
17. Leadership and Management	Leadership and Management	Leadership and management forms the main ingredient of this group and the basis for relationship that exists amongst the processes, routines, and skills involved in this group.	
18. Decision making	Decision making		
19. Resource management	Resource Management ⁸⁸		
20. Risk (analysis and management)	Risk (analysis and management)		
21. Funding (for policy formulation)	Funding (for policy formulation)	Necessary for implementing all other policy processes.	

Source: Author's interview fieldwork data at FMST. *Core Policy Processes in Table 6.2.1 above are highlighted in bold texts

⁸⁷ Although related to implementation, policy instruments are decided during policy formulation at FMST and therefore included as a policy process based on interview data presented in Chapter 5, Section 5.2.1 tables.

⁸⁸ It was not clear from the data captured at FMST how the resources were managed, particularly because the processes and routines involved were not documented (i.e. informal).

Building on Table 6.2.1 above, with respect to Agenda Setting for example, 100% of interview respondents at FMST departments stress that the Agenda Setting policy process is a core capability and must be incumbent (i.e. present). This percentage is, however, lower for other groups, such as FMST Agencies (78%), FMST Scientists (50%) and stakeholders (non-FMST) (71%). The significance of this finding to policymaking is that these differences in opinion reflect interviewees' particular views of the roles that capabilities play in policy formulation. For instance, for industry stakeholders, the outcome of Setting Policy Priorities and Deciding on Policy Instruments processes are more relevant to their activities and therefore critical in their opinion when compared with Agenda Setting policy processes – which in their opinion simply result in broad statements. This finding reveals that the various actors viewed policymaking through different sectoral lenses, and with a tendency to prioritise different policy processes, routines or policy formulation stages (Borrás and Edquist, 2013). This finding, therefore, highlights the importance of formal policy processes and routines, methodologies and frameworks in place at FMST and DC institutions responsible for policymaking. Such formal policy processes, routines, and frameworks can support attempts to unify or navigate trade-offs between the various streams of opinions, perceptions and preferences from policy actors.

While the typology indicates that all 21 policy processes are useful in policy formulation, the findings reveal that policy formulation at FMST is based around the five policy processes and routines identified as core in the taxonomy. In line with the results presented in Chapter 5, I interpret this finding as a distinctive policymaking approach at FMST that is based on a paradigm of *“concentrate on the essentials, pick and choose whatever else we think we need and leave out the rest”*. Such a paradigm pays little regard to how the capabilities left out might contribute to the success of the formulation or the quality and robustness of the policy.

Role of Policy Capabilities

In answering RQ1, and for the remainder of this section, I focus on the role of the five core policy processes – Agenda Setting, Research, Stakeholder Engagement, Leadership and Management, and Funding – for various reasons. First, focus on the core processes facilitates discussion of the related non-core processes. Second, the core and related non-core processes share similarities between some of their routines and skills. An in-depth

discussion of the 21 policy processes therefore would result in significant repetition of the routines and skills that cut across related policy processes, hence the focus on core processes. Third, focus on the core policy processes helps to maintain brevity, structure and answer the RQs in an organised manner.

6.1.1 Agenda Setting Policy Processes and Routines

“The agenda was “set” by the minister ‘knowing what he was looking for’. The Minister receives advice from various sources (e.g. departmental directors), decides on the direction, i.e. what's important for the country, and thereafter passes these on to the Policy Formulation Committee headed by the Permanent Secretary – Chief Scientific Officer, PRPA, FMST”.

The above quote reflects the importance of Agenda-setting at FMST. However, while the findings reveal various roles that Agenda Setting processes and routines – and indeed the other processes and routines discussed in subsequent sections – play in policy formulation, an important contribution of this thesis lies in the way these roles are implemented at FMST, i.e. selectively and determined informally, often resulting in failures in STI policy formulation.

Agenda Setting as a pre-decision policymaking process attempts to “trace the causal paths along which public issues travel”, and to anticipate which policy aims and objectives may eventually be included in the policy agenda (Majone, 2008, p.228). The routines (as presented in Table 5.2.5.1, Chapter 5) carried out in Agenda Setting at FMST involve problem definition and deciding which of the identified policy problems are priorities. With policy problems defined and the overarching priorities set by the Federal Executive Council (FEC) and Minister, a policy course is determined, policy alternatives and instruments are considered by the Policy Formulation Committee (PFC), and policy strategies to achieve the policy objectives are developed by the PFC. Majone (2008) states that problem definition and selecting policy priorities are closely interrelated with agenda setting. The interview findings gathered at FMST show that Agenda Setting as a policy process was incumbent, informal and utilised, core, and played an important role in formulating Nigeria’s 2012 national STI policy at FMST.

There is no generally accepted methodology for Agenda Setting (Lindblom, 1959; Sabatier, 2007; Majone, 2008). This methodological challenge has not received sufficient

attention in Nigeria (Ayoola and Ayoola, 2011) and has been largely ignored by current literature (Majone, 2008, p. 228). As a result of informal Agenda Setting processes and routines, policy formulation can be subject to hijack, control and manipulation by powerful political or policy actors with vested interests (Sabatier, 2007; Majone, 2008). Legislative committees for instance, exercise this form of power (Bates, 1990). In FMST and the wider Nigerian context agenda control has been used by powerful actors, such as parliamentarians (Oyewale, 2013). A recent occurrence of this kind of behaviour was in the 2003 national S&T policy formulation at FMST, during which the National Assembly failed to approve the policy, resulting in a failure to complete the policy formulation processes. A methodological approach for Agenda Setting therefore would be, for example, to have the three main policy actors (FMST/Government, Academia and Industry) produce separate drafts which are then harmonised by a group of representatives from the three actors. Such an approach could help in formalising the processes involved while also reducing the risk of hijack, control and manipulation by a more powerful political or policy actor with vested interests.

Another challenge largely overlooked in Agenda Setting is that individuals or institutions, such as FMST, might hold exclusive power over the agenda. The Findings reveal that FMST held exclusive power and a monopoly over agenda setting. The significance of this finding to policymaking is that in the absence of formal Agenda Setting processes and routines, Majone (2008, p.229) found that “a monopoly agenda setter can achieve almost any desired result”. Consequently, this thesis takes the view that incumbent and formal Agenda Setting processes at FMST with clearly defined routines are necessary for STI policy formulation. In attesting to government’s (i.e. FMST in this case) monopoly in Agenda Setting, the Director at Technology Acquisition and Assessment (TAA), FMST, states:

“The National STI Policy is formulated in tandem with the national agenda set by the federal government, the presidency. FMST by law formulates the STI policy. The STI policy is very important because it gives direction to the ministry” – Director, TAA Department, FMST (2013)

Uncertainties in policy formulation processes, routines and stages, are one factor that enables policy hijack. Pavitt (2002, p.1) noted that one very important use of routines is in "dealing with the tasks of co-ordination and integration and of reducing uncertainty

through learning". Formalisation of policy capabilities using a framework and clearly stating which actor does what, and at what stage of the formulation, can help in reducing uncertainties and mitigating the risks of policy hijack, control and manipulation by powerful policy actors.

Agenda Setting, like other policy processes, involves multiple and iterative routine tasks. The tasks include: review of extant S&T policies, the interpretation and translation of the national development and transformation agenda (NV20: 2020) with a view to understanding how it can be supported by STI, the generation and refining of policy ideas; and specifying policy priorities, objectives and strategies, consultation and development of policy drafts. It also provides the basis for setting the overarching policy aim, referred to as the “policy rationale” in the STI policy (FMST, 2012). These roles reflect Majone’s view (2008), that wrong policy priorities during Agenda Setting may entail severe opportunity costs.

The implications of this finding for future policymaking in Nigeria and DCs are often many. For instance, it highlights the importance of wider consultation in order to also capture inputs from rural areas as opposed to the consultation carried out which focused on Lagos and Abuja – large urban and capital cities. In addition, it also helps to emphasise the important role of, problem definition, priority setting, research and evidence-led policymaking. African Union’s recently formulated STI strategy for Africa summarises this challenge in “very limited evidence-based development [*i.e. policy formulation*] takes place in Africa” (STISA-2024, 2014, p.18). A deeper understanding and application of policy capabilities as discussed in this thesis contributes to addressing this challenge. Next I discuss Research policy processes and routines.

6.1.2 Research Policy Processes and Routines

The findings reveal that the Research process mainly involves secondary data and desktop research, and that on-going research e.g. through Monitoring and Evaluation (M&E) is absent. The use of secondary data can be explained by the tradition that started at FMST during the first national S&T policy formulation (FMST, 1986). This practice has remained to date⁸⁹. One implication of this finding for policymaking is that it helps explain the persistence of *ad hoc* and unsystematic approaches to Research at FMST. It

⁸⁹ See also FMST, 2011; NACETEM, 2011; Siyanbola et al., 2013.

shows that the need for policy research only arises when there is a call to initiate policymaking. At that point, there is a demand for data and evidence needed to underpin policymaking, often resulting in unsatisfactory outcomes, as illustrated in the number of apparently failed STI policies since 1986. Although the Planning Research and Policy Analysis (PRPA) department at FMST was set up for this purpose, in practice its activities do not include policy research but rather are confined to the publication of documents such as policy briefs, bulletins and ministerial press releases⁹⁰. The absence of dedicated Research policy processes and routines at FMST mean that policy research is not conducted in an organised manner with data designed to inform policy recorded and analysed at regular intervals over the years in anticipation of policy formulation.

The findings also show that although only secondary data was collected and utilised⁹¹, Research policy processes (which include R&D, M&E and Exchange of Ideas) and routines play active roles in *ex-ante* data and in evidence gathering and analyses – hence the reasoning behind the setting up of the PRPA department at FMST. It was evident from the findings that the undertaking of Research contributes to routines involved in other processes such as Agenda Setting. This reveals that Research therefore plays a role in e.g. identifying policy and development gaps, capability and knowledge gaps and in the development of policy drafts. These findings reflect the views of scholars (such as Freeman, 1982; Pavitt, 1984; Dosi, 1988; Galli and Teubal, 1997; Bergek et al., 2005) who posit that Research is important in knowledge creation and experimentation in S&T policymaking. Freeman (1982), Pavitt (1984) and Dosi (1988) emphasise the contribution of ‘science-based’ research in knowledge creation and innovation. Nevertheless, the informal, ad hoc and selective approach to Research implementation at FMST results in the underutilization of this core policy process with the result that policy formulation is rendered less effective.

The benefits of policy research go far beyond the collection and utilisation of primary data. It also applies to the source and quality of the secondary data used as this contributes to the determination of policy processes, such as, Policy Priorities, Policy Instruments, and Policy Agenda. Another insight from the findings relate to the weaknesses in

⁹⁰ FMST, 2006a, 2006b; 2007b offers useful examples.

⁹¹ The findings are in line with Siyanbola et al. (2013 p. 4) who report that research for the STI policy involved S&T policy review, desktop survey and analyses of S&T policies of other countries.

Research. One such weakness is the absence of clearly defined criteria or a systematic procedure⁹² for verifying the secondary data and evidence obtained from external sources prior to their use in policy formulation. This potentially impacts on the validity and integrity of the underpinning research. This finding therefore suggests that such a capability (the Research and Evidence Verification policy process) has to be developed.

An important source of the weaknesses observed in the implementation of Research in policymaking at FMST lies in the approach to policy research. This approach is based on a simplistic logic and reasoning that evidence produced anywhere can be utilised in policy formulation without careful considerations to issues such as context, relevance and applicability. The implication is that opportunities for policy learning are ignored or missed. Therefore, in FMST [or similar policy institutions in DCs] with little or no capabilities for policy research; policy frameworks will have to be configured to take these realities into consideration – that is to recognise that public policies may not (necessarily need to) be evidence-based, evidence-led or evidence-informed, as practised or at least expected in developed countries. These findings help to explain why interviewees maintain that some routines were not adequately carried out, resulting in the adoption of so called “best practices” – utilised in the absence of sufficient empirical data that captures the concrete realities in Nigeria. These results highlight the importance of Research in effective policymaking.

As a pre-decision policy process, the outcomes of Research processes and routines help to inform the activities of other processes identified in this thesis, thereby highlighting the important roles of Research for other policy processes in which research is required. For instance, Agenda Setting processes depend largely on the outcomes of the Research process. Research, by being informal, means that policy research – the use of data and evidence in policy formulation – was fraught with difficulties and the potential for manipulation. This reflects what Sabatier (2007) had argued namely that the potential for manipulation includes political manipulation by policy actors, ambiguity, assumptions and lack of a “guiding logic”.

A more significant implication of this finding for policy formulation processes in FMST and in other DCs is the way that Research policy processes are implemented: (a.)

⁹² That is, Research routines, summarised in Table 5.2.5.2, Chapter 5.

selectively (by focusing on secondary data and evidence), (b.) in an *ad hoc* and unsystematic manner (due to the lack of a guideline or framework with clearly defined routines), (c.) a lack of processes and routines for secondary data and evidence verification, and (d.) research conducted on a need-based approach which means that Research processes and routines only commence during policy formulation; as opposed to a system that encourages and incorporates regular collection and analyses of data and evidence in anticipation of policymaking at some future date.

In this thesis I highlight the importance of research and knowledge for policymaking. To do this, I point to some of the literature in this area, such as, the work of Kuhlmann (2003) and Shapira and Kuhlmann (2003) on strategic intelligence for science, technology and innovation. Other literature in this domain include, for example, the work on “Contested Boundaries in Policy-Relevant Science”, “Norms for Evaluating Regulatory Science” and “The Practices of Objectivity in Regulatory Science” by Jasanoff (1987, 1989), Jasanoff et al. (1995). Furthermore, various works by Brian Wynne (e.g. Wynne 1992, 1995, 2010) contribute to the debates in this area. In Wynne (2010), for example, the author focuses on the relationships between scientific knowledge and public policy issues.

The insights from these scholars help in advancing our understanding of how scientific research is communicated and translated (or not) into public policies and policy processes. While I do not go into great depths on these literature (as this is not the core focus of the thesis), I note that the various literature⁹³ in this domain help to address the role of knowledge in policymaking, including research and evaluation. Therefore, they contribute to improving our understanding of policymaking and how the processes involved in policymaking help in shaping policy formulation. The specific contributions that this thesis makes in the area of Research policy processes and scientific knowledge in policymaking are uniquely positioned within the wider literature exemplified by these scholars and the literature outlined.

Next, I discuss Stakeholder Engagement policy processes and routines.

⁹³ And others, see also, for example, Jasanoff (1990), Wilsdon et al. (2005) and other literature more specific to DCs, for example, Scoones (2002)

6.1.3 Stakeholder Engagement Policy Processes and Routines

The implementation of Stakeholder Engagement processes and routines starts with the identification of stakeholders and inviting them into the policy formulation exercise. Besides FMST policymakers, the stakeholders who participated in the STI policy formulation were drawn from industry, academia, cognate ministries, international development partners, news and media and civil society. Except for funding, FMST was responsible for the entire policy formulation processes – which include stakeholder identification, selection, assigning of roles, coordination, leadership and management, research – highlighting the government’s dominance. According to Siyanbola et al. (2013, p.4), the policy formulation exercise “adopted an all-inclusive participatory approach”, “stakeholders in Nigeria’s national innovation system and experts and development partners were actively [but selectively] engaged”. While FMST policymakers and authors⁹⁴ state that the formulation exercise was effective, inclusive and sufficiently engaged NSI actors, stakeholder interview responses differed in this regard, revealing this was not the case:

“FMST engages with us when they want, how they want, at what stage they want and why they want. Industry involvement was low. For instance, we were not invited during the development of policy drafts” – Director, Nigerian Breweries Limited.

The above response is in line with Siyanbola et al. (2013, p.4) who report that stakeholders were only engaged in some stages and activities such as review and feedback on the new draft policy. Another insight from the finding relates to FMST’s (Policy Formulation Committee) identification and selection of non-FMST stakeholders, based on a simple set of criteria. For organisations, the criterion was, which sector or industry association they belong to; while for individuals the criterion was, “has s/he been involved in policymaking or does s/he possess the ‘right’ academic qualification”? As a result of this approach, opportunities for the use of the Research in experimentation and detailed mapping of policy actors and networks, and possible identification of potentially new policy entrants or routines were not fully exploited.

One implication of this outcome, therefore, was that only the usual networks were invited, resulting in the continued participation of the same actors (Mytelka, 1989) and the usual

⁹⁴ See for example Oyewale et al., 2013; Siyanbola et al., 2013

roles for Research. Later in sections 6.2 and 6.3 I discuss the wider significance of this finding, showing how it negatively impacts on the implementation, development and evolution of policy capabilities. Similar to the Stakeholder Identification process, Deciding on Stakeholders roles, Consultation and Collaboration policy processes were carried out through industry unions, trade associations and personal contact with policymakers and experts.

Stakeholder Engagement policy processes and routines were used by FMST in a tokenistic manner, i.e. to “carry stakeholders along”, obtain their approval and legitimise the policy formulation exercise. The significance of this finding for policymaking in Nigeria and DCs are many. First, it reveals that in spite of mounting evidence, acknowledgement of Stakeholder Engagement as core capability and the roles stakeholders play policymaking, the use of this group of policy processes was driven by the fear of failure rather than the desire for improvements in the quality of the policy formulation exercise and effectiveness of the STI policy. Second, it helps explain why the implementation of some Stakeholder Engagement routines (outlined in Table 5.2.5.3, Chapter 5) was not adequately carried out – since the intention was more to complete the tick box exercise. Used effectively, Stakeholder Engagement policy processes and routines could have, for instance, helped to carefully map Nigeria’s (STI) policy ecosystem, or to identify and use new policy actors outside of the existing network, thereby improving policymaking.

In the section below, I discuss Leadership policy processes and routines involved.

6.1.4 Leadership and Management Processes and Routines

In Chapter 1, I defined policymakers (as scientific officers) and decision-makers (as those concerned with the leadership and management of policymakers and the policy formulation exercise). To reiterate, decision-makers⁹⁵ and the Decision-making policy process (which works in tandem with Leadership and Management policy processes) operate at organisational levels⁹⁶, and therefore are policy processes and routines. However, the possession of a leadership or management skill relates to an individual’s

⁹⁵ Defined in Chapter 1, this refers to the senior management and leadership team at FMST (permanent secretary, minister, and directors), National Council on Science and Technology (NCST), National Assembly (NA, i.e. parliamentarians) and the Federal Executive Council (FEC).

⁹⁶ FMST, NACETEM, NCST, NA, FEC in this context.

ability, for instance, to lead or manage a policy process, formulation stage or carry out policy routines. This distinction is important as it explains the rationale behind “Leadership and Management” as a policy process with routines and “leadership or management” as skills useful in policymaking.

As a core capability, Leadership and Management were instrumental to every aspect of the policy formulation at FMST. It governed the routines involved in the other policy processes, with significant impacts on the roles played by policy capabilities. In Chapter 5, Section 5.3, I presented the findings, which show that the implementation of Leadership and Management policy processes cut across the five key policy stages at FMST. In key Stage 1 for example, the decision to initiate the formulation of the STI policy, secure and allocate funds, and set up relevant committee(s) involved Leadership and Management policy processes and routines. In Key Stage 5, the findings reveal that Leadership and Management at the Presidency level were necessary for the approval and signing of the new policy into law.

The implementation of Leadership and Management policy processes (and routines, outlined in Table 5.2.5.4, Chapter 5) at FMST operates at three levels: the executive arm of Nigeria’s Government (Presidency), the Ministry (FMST) level⁹⁷ and FMST Agency (NACETEM) level. The FMST level was concerned with the overall policy formulation leadership direction, while the NACETEM-level, with lower authority, dealt with operational management of the day-to-day formulation activities. This finding has significant implications for policymaking at FMST and in DCs in that it highlights the complexities and increased risks of failure arising from three separate levels of leadership and management structure required for policy formulation to take place. It also shows that without effective leadership and management that are favourable to policymaking, (and operating in parallel at the various levels of government), policy formulation will neither be initiated nor completed. Outlining the Leadership and Management policy processes and routines involved in the policy formulation, will therefore help to define the specific roles of each level and better identify the weak links where the risks of failure are highest and address them. This finding helps explain why respondents stress that Leadership and

⁹⁷ Led by the Minister, Permanent Secretary and Directors of departments. NACETEM is led by a CEO/DG.

Management is a core policy process.

“We have had instances whereby during policy formulation some of the stakeholders raised objections on who should lead specific operations or refused to work with other stakeholders. This is why capabilities such as leadership, management and negotiation lie at the heart of policymaking in order to help us resolve such problems” – Chief scientific officer, NITDA.

The above statement is in line with the need for effective Stakeholder Engagement, Mediation, and Research policy processes discussed earlier, further demonstrating the inter-connectedness of policy capabilities. In commenting on the role of decision-makers, in Leadership and Management policy processes, an interviewee adds:

“Some Permanent Secretaries (PSs) take S&T policymaking more serious than others, based on their interests and passion for this mandate. PSs dictate the pace at which other directors and offices down the ladder function and therefore influences, and to a very large extent, the Ministry’s outcome in formulating (or not formulating) S&T policies. If the PS and Minister want the policy done in a fast track and accelerated manner, they set the tone and every other staff within the ministry must keep pace or else you will be booted out of the system. The Minister is the link to the Presidency, which we cannot do without. Leadership therefore plays a key role. Leadership is critical to S&T policymaking at FMST” – Director, TAA⁹⁸, FMST (2013).

In Chapter 1, I presented background information that chronicled the history, development and key S&T policymaking failures at FMST. A major feature of this historical perspective is the constant closures and reopening, mergers, and frequent leadership changes that preceded the current structure in the Ministry. Interview findings reveal that this has a bearing on FMST’s policymaking approach and the resultant leadership pattern characterised by frequent changes in directors. One reason for this lies in the fact that directors and key scientific staff (policymakers’) are still rotated on a six-monthly cycle. Interviewees stressed that this practise has negative implications for policymaking in that (1) it can lead to difficulties in retaining and managing

⁹⁸ Technology Acquisition and Assessment Department, FMST Department.

organisational knowledge⁹⁹ (Nonaka, 1994; Pentland, 1995; Dosi et al., 2000), (2) reduce opportunities for organisational learning (Dosi et al., 2008), and (3) weaken collective memory as Maurice Halbwachs¹⁰⁰, in the 1950s, argued in his seminal work. More recent literature, such as, Halbwachs and Coser (1992) and others¹⁰¹ have reaffirmed the importance of collective memory in organisations. A director at PRPA, FMST summarised this thus:

“I am new in this position and was not part of the formulation exercise. Leadership setup in the civil service means that I am moved every six months in order to advance my career. This does not allow heads of departments like me to initiate and complete policy projects, with timeframes of 2-3 years, maybe even longer. This has to change.”

The implication therefore for policymaking is a need for a change in practice towards a leadership and management processes in order to ensure they enhance the continuity and longevity of departmental directors responsible for policymaking, permanent secretaries and ministers. Such change can also be extended beyond decision-makers to policymakers responsible for key policy processes and routines or with certain skills necessary for critical tasks such as framework development or formalisation of policy capabilities. The findings also suggest that such a change will likely influence Leadership and Management policy processes and routines for example by fostering a sense of stability in a way that incentivises decision-makers to initiate and complete policymaking (in the context of this thesis, policy formulation) exercises.

In the section below, I discuss Funding policy process and the routines involved.

6.1.5 Funding Policy Processes and Routines

The Funding policy process, a core capability, is related to all other processes examined in this thesis. Although traditionally associated with policy implementation, the interviews reveal that funding is a major determinant whether a policy is formulated at FMST or not.

⁹⁹ Dosi et al., 2002 define ‘organisational knowledge’ as “primarily a shorthand for the knowledge of the individuals belonging to the organisation” and refers to organisational learning as “a social phenomenon and cannot be reduced to the individual learning processes of the members of the organisation” (p.8).

¹⁰⁰ Now edited, translated and with an introduction by Lewis A. Coser in Halbwachs and Coser (1992).

¹⁰¹ See for example, Connerton (1989), Wertsch (2002) and Casey (2009).

“The role of Funding is critical. Without funds you cannot formulate any national policy in Nigeria” – Director, Niger Delta Science & Technology Development (NDSTD), FMST.

In Section 6.1 above I stated that Funding presents a unique case in that it is both formal and informal. In this thesis, I identify and discuss two classes of Funding for policy formulation: “securing” and “allocating” funds. The findings reveal that although the processes involved in securing funds (from federal government national budgets and external donors¹⁰²) may be formal¹⁰³; the processes and routines which occur at FMST, that is, “allocating” funding at FMST to policy formulation activities, remain informal and are not documented anywhere at FMST. For example, it was not clear from the interview or policy documents how much was provided by FMST department (PRPA) to the FMST agency (NACETEM) that carried out the majority of the policy formulation routines, how NACETEM disbursed the funds it received, at what stage, and by what criteria. Similarly, it was not possible to gather evidence on how much external donors contributed to the policy formulation, the processes involved in securing those funds and under what conditions the funds were secured by FMST or allocated to NACETEM.

The implementation of Funding policy processes and routines (outlined in Table 5.2.5.5, Chapter 5) operate at two Leadership and Management levels: securing on the one hand at FMST and FEC leadership levels, and allocating on the other hand at FMST, PRPA, and NACETEM leadership levels. The routines associated with Securing involve tasks carried out by FMST in order to acquire funds for S&T activities (which include policymaking). FMST in turn allocates policy formulation funds to PRPA, and NACETEM, which was responsible for the operational details, and disbursing of funds for specific policy formulation routines. The challenges associated with Funding are not peculiar to FMST or Nigeria, but rather common in Africa and DCs (UNESCO, 2009; FMST, 2011). A significant number of countries in Africa are incapable of formulating S&T policies based on funding from the nation state alone (STISA-2024, 2014). As a result, there is a situation of next to total dependence on financial support from

¹⁰² That is international agencies such as UNESCO, UNDP and World Bank

¹⁰³ That is, there are steps, practices, laws, guidelines, forms and budgetary activities that occur at national level which must be followed before funds from the Central Bank of Nigeria, are transferred to federal ministries (e.g. FMST for S&T activities). However, these processes occur at national level and outside of FMST and therefore are beyond the scope of this thesis. I focus on Funding processes at FMST specific to policy formulation.

international donors in order carry out STI policymaking activities. Annex 4 and 5 show a map of those countries in Africa supported by UNESCO, for example.

The significance of this finding for future policymaking at FMST is that, with funding as a major limiting factor, there is a need for mapping and development of the policy capabilities involved, as a step towards finding a long-term solution. Another implication is that this challenge highlights the potential for policy learning and adapting from developed countries, thereby necessitating changes to policymaking approaches currently practised at FMST (and in DC more generally). Such changes might involve leaner but more efficient policy formulation methodologies or new funding mechanisms with greater prospects of financial sustainability. Difficulties with Funding at FMST are further compounded by two factors: the size of budgetary allocations and the budgetary cycles. Commenting on funding, an FMST Director laments:

“Budget cycles mean that policymaking cannot simply resume anytime. Reliable funding mechanisms must be put in place. Funds were so scarce that in order to print 1000 copies of the policy, we had to seek support from international development partners – UNDP, UNESCO, World Bank”

The director further explains that:

“FMST has one of the lowest budgetary allocations from the Federal Government. We have no dedicated funds for policymaking, or to develop policy processes as you describe. What is critical is that we identify the most important processes and focus on them”.

The funds allocated for the STI policy formulation were spent on routines that include organising consultations, capacity building (training, seminars, workshops), and development of policy drafts, transportation, logistics and honoraria. Consistent policies have been put forward by the federal government stipulating annual budgetary allocation such as 2.5 - 5% funding for S&T with an additional 1% contribution from State governments (FMST, 1986; Lebeau et al., 2000). Other recommendations have been made, for instance, for the establishment of National S&T Development Funds (FMST, 1986), and The National Science Research Foundation (FMST, 2006b). These initiatives to fund S&T activities have not been implemented due to the lack of a well-thought-out funding structure with detailed processes and routines captured in a framework.

Various authors (such as Lebeau et al., 2000; Okonjo-Iweala, 2012; and Oyewale, 2013) have shown that in spite of consecutive government commitments, the allocation of funds to the S&T sector has remained at about 0.2% and never reached 1%¹⁰⁴ of the annual budget. These secondary sources confirm the presence of formal Funding processes at national level for securing funding. However, they also highlight defects in policy formulation and implementation (Sanni et al., 2001), resulting in a failure to achieve the recommended 1% annual GDP investment in S&T activities. Weaknesses, therefore, in Funding, Leadership and Management policy processes and routines were the major reasons interviewees gave for the 10-year delay in STI policy formulation prior to 2012. Budgetary allocations have always been reported to be insufficient to carry out Ministerial activities, a situation not unique to FMST. The implication to policymaking therefore is that in order for FMST to formulate STI policies at regular and planned (e.g. three or five-year intervals), it is imperative that Funding policy capabilities are put in place. The dearth of Funding capabilities also explains why some policy routines were not adequately carried out, resulting in an inability, for example, to ensure reliable and sufficient funding for the 2012 national STI policy formulation at FMST.

In the next section, I discuss skills and their role in supporting the Policy Formulation processes and routines examined.

6.1.6 Individual Capabilities - Skills

In Chapters 2 and 3, I put forward the theoretical underpinnings that inform the argument made in this thesis that skills are complementary and serve to support policy processes and routines. The findings reveal that there continues to be a shortage of skills needed to implement the policy processes and routines at FMST. The continued focus on academic qualification mean that staff with policy skills are those considered to have the “right” and in most cases advanced academic qualifications. There continues to be less emphasis on experience and on-the-job learning necessary for knowledge acquisition in policymaking. Another insight from the findings relate to the greater emphasis placed on policy implementation when compared with policy formulation. The result is that capacity-building exercises mostly target implementation as opposed to formulation skills. Routines and experience are helpful (Felin and Foss, 2011).

¹⁰⁴ The percentage of national GDP that should be invested in R&D, as recommended by African Union.

Bergek et al. (2008) found that when there is need for skills, policymakers and organisations resort to staff with PhDs. Although Bergek et al. (2008) emphasise the importance of skills, the authors fail to specify what these skills are. The significance for policymaking is that by improving our knowledge of the policy routines and routine tasks involved in policy formulation, this thesis extends the results by Bergek et al. (2008) in providing fresh insights on the skills useful in formulating STI policies in government institutions. The findings outline what these skills are (e.g. administrative, research, analytical, management, technical [ICT and computer-related], negotiation, and interpersonal) and clarify the roles¹⁰⁵ that skills play in policymaking, using examples based on empirical data. Another insight in this regard, as expressed by interview participants, is the lack of appreciation for incumbent policy skills at FMST, but rather a dependence on external skills.

“We do not look at it like we need skills per se, because we can always source for skills from the outside (i.e. national/international locations)” – Chief Scientific Officer, NITDA.

As discussed in the preceding sections, absence of policy skills explains why some policy formulation processes and routines were not carried out (or inadequately carried out). The result was that policy processes (and their corresponding routines) played less roles in formulating Nigeria’s 2012 national STI policy. In addition, policy processes have not developed (see Section 6.2 below) and have not evolved (see Section 6.3 below). These insights also help to explain persistent use of consultants in FMST’s policymaking (see Section 6.3.3) as a result of lack of incumbent policy skills.

Summing up Research Question 1 Answers

This section has described the important role that capabilities play in policy formulation. I have also explained their implementation, which has highlighted the problems that could be mitigated or remedied by formalising policy processes and by creating an appropriate framework. The insights discussed in this section contribute to answering Research Question 2 and Research Question 3, which the sections below will discuss.

¹⁰⁵ For example, in policy research (the collection and analysis of policy-relevant data and evidence), communicating with stakeholders, mediation and conflict resolution, leadership, management, and coordination of policy processes and routines.

6.2 Research Question 2: How did Policy Formulation Capabilities Originally Emerge at FMST and Why?

“Our priority is to identify the capabilities most important to us and focus on them. Yes, there is a lot we should do, however as you can see we are very limited in infrastructure, finance and abilities to deliver in all aspects at the same time. We have to be selective” – Principal Chief Scientific Officer, PLS Department, FMST.

In the paragraphs below, I discuss the development of policy capabilities at FMST in line with the findings presented in Chapter 5, thus addressing RQ2. In keeping with the format in Section 6.1 above, I discuss the core capabilities to structure the discussions that follow.

Agenda Setting – Drawing from the findings I explained above that the development of this core policy process, results in less appetite for the development of “non-core” policy processes (e.g. Setting Policy Priorities) related to the Agenda Setting policy process. In Section 6.1.1 above, I differentiated between two types of policy agenda in Nigeria’s context: (a.) the overarching agenda set at the presidency level, to guide national development goals; and (b.) the policy agenda set at the Ministry (e.g. FMST) level. In the case of FMST, the aim of the 2012 STI policy agenda therefore was to spell out the role that STI can play in helping to achieve the overarching agenda. This results in a policy formulation methodology that only acts in response to national overarching agenda which are in most of the cases, are sector-specific. The significance to policymaking is that such a national policy agenda¹⁰⁶ does not address STI specifically, and therefore, the capabilities for the policy agenda tend not to be developed. Such national agenda therefore, which are simply presidential statements, do not follow the processes and stages involved in policy formulation and by extension the development of relevant policy capabilities do not take place.

The findings also show that Agenda Setting policy processes and routines at FMST have developed by imitation, i.e. “best practices”¹⁰⁷, as a way of deconstructing the overarching national development policy goals into specific STI-focused policy priorities and objectives. One implication of this development approach to policymaking is that imitation impedes the further development of incumbent (i.e. those currently present)

¹⁰⁶ An example of which is for Nigeria to become one of the top 20 economies in the year 2020 (Agenda 20:2020). They are simply bold presidential statements to “inspire” more than 30 federal Ministries.

¹⁰⁷ I discuss “best practice” in greater depth in subsequent paragraphs and in Section 6.5.3.

policy capabilities – as long as DCs continue in the line of thinking that it is sufficient to simply imitate what has been done in developed countries, the processes of which are arguably more suited to these countries.

Research (and Evidence Gathering) – The aim of Research policy processes is to capture and analyse contemporaneous policy-relevant data, information and evidence to inform current policy formulation. The results show that Research (and Evidence Gathering) policy processes and routines have not significantly developed at FMST. This is the outcome of a practice started during the first S&T policy formulation in 1986, which relied on secondary data (Section 6.1.2 above). This tradition has continued with the result that (a) the 2012 STI policy formulation was based on secondary data by desktop research only (FMST, 1986; NACETEM, 2011; Siyanbola et al., 2013) and (b) the role of primary data in policy research at FMST, and as a way of improving data validity and integrity, were ignored. Therefore, the three processes in Research (Exchange of ideas, M&E and R&D) policy processes have not developed, in spite of the acknowledgment of the important roles that they play in policymaking. This finding has significant implication for future policymaking at FMST and in the wider DCs contexts. It reveals that until Research policy capabilities are sufficiently developed, policy research and evidence used to inform STI policies will likely not address attendant issues with which the policies will need or should deal with.

Stakeholder Engagement – The development of the policy processes and routines in this group was driven by two main factors (a.) the top-down leadership style and management structure at FMST, which maintains a monopoly over S&T policy formulation as expressed in the tight agenda control discussed in Section 6.1.1 above; and (b.) non formalised contacts with policy actors e.g. by email and word of mouth invitations. Although the use of ICT (e.g. website) is gradually being introduced for the purpose of announcing the policy formulation exercise, this falls short of formal Stakeholder Engagement policy processes and routines to ensure that all relevant stakeholders are involved in the process. Clearly specified routines will enhance the transparency of and criteria for the identification and selection of stakeholders, thereby reducing the possibilities for agenda control and in turn help to increase the potential for effective policymaking. Transparency and the establishment of criteria for the engagement of stakeholders will facilitate stakeholders' participation and management, and have a

greater probability of “carrying stakeholders along”, obtaining their consent on policy drafts, legitimising the resulting policy, and easing the collation of stakeholder inputs that will be used for analysis and consideration.

The significance of poor and inadequate development of Stakeholder Engagement capabilities means that policy formulation in Nigeria and many other DCs will continue to be top-down rather than participatory and inclusive. Another implication is that policies will likely neglect or risk not addressing issues, such as sustainability, poverty, exclusion and inequality, which is prevalent in many DCs (Muchie et al., 2003; Scoones et al., 2007; Cozzens and Kaplinsky, 2009; Lorentzen and Mohamed, 2009; Lundvall et al., 2009; Arocena and Sutz, 2010; Cozzens, 2010; UNCTAD, 2011; Adebawale, 2012; Cozzens and Sutz, 2012; Gupta, 2012; UNDP, 2014).

Leadership and Management - Three (Leadership and Management, Decision-making and Resource Management) policy processes in this group follow the hierarchical and top-down structure. An innovation in this regard would resemble what Kuhlmann (2001) described in which FMST would play more of a coordinating, mediation and negotiating role in the policymaking; as opposed to the current practice of formulating the policy and “handing it down” to the State Ministries of S&T and other stakeholders to implement. The fourth member of the group, Risk (analysis and management) process, has not been developed. In this top-down approach, policy formulation, key policy stages and stakeholders involved are chosen by FMST directly. This practice, resonant in Stakeholder Engagement as argued above, reveals how the absence of Stakeholder Engagement, and Leadership and Management processes can have conceivable negative implications on the roles (discussed in Section 6.1 above), development, and evolution (discussed in Section 6.3 below) of policy capabilities by stifling opportunities for co-creation of policy drafts, for example, and collaboration with stakeholders’ in other formulation stages.

Furthermore, regarding Leadership and Management policy processes and routines, these serve as a centralised decision-making apparatus, which control strategic directions and resources. As major political actors (such as, parliamentarians) are involved in the decision-making process, it is imperative that the policy processes in this group are formalised and the routines clearly spelt out in order to mitigate against the risk of policy formulation failures, for instance, through conflicts (for instance, with other ministries),

and political manoeuvrings or hijack (by for example parliamentarians). Above I have explained that the current practice is unfavourable to policymaking and argued for a change in the leadership style. Such a change would recognise and adopt Leadership and Management processes and routines that, for example, exempt key officials (e.g. Director of PRPA) from the six-monthly civil service rotation, as currently practiced. This has significant implications for policy formulation, which typically requires about two years from start to finish at FMST.

Funding (*for policy formulation*) – Currently, this policy process and the routines involved are dependent on government budgetary allocation and international donors; with FMST having very little control over the outcomes (for example, certainties of when funding will be available for scheduled policymaking). The findings reveal that alternative funding sources and mechanisms are yet to be developed as a result of (1) decades of FMST’s dependence on government funding (which has been consistently proven to be insufficient, thereby inhibiting policymaking) and occasional additional funds from international donors; and, (2) lock-in¹⁰⁸ effects which now act as a blocking mechanism (Oyewale, 2013). Neither government funding nor funds from international donors can, on their own, adequately finance policy formulation. This therefore necessitates the development of processes and routines that can help ensure reliable funding of policy formulation at FMST. The informal process and routines employed during the policy formulation, in order to find alternative sources and complement government funding, were at best chaotic, unsystematic, short-term and based on ad hoc arrangements. Furthermore, they proved to be unsustainable and unable to support long-term planning. In expressing the funding challenge and weaknesses in skills relevant to obtaining funding from national budgets, an interviewee responded thus:

“Data collection was unscientific, the formulation was rushed through, without sufficient thought and attention to details. This is the reason for constant policy somersaults in Nigeria. However, the biggest problem remains finance for policymaking; we do not yet have people skilled in securing funding for S&T activities” – Deputy Director, NOTAP, FMST.

¹⁰⁸ I discuss “lock-in” and blocking mechanisms in greater depth in Section 6.3.3.2

The interview response above highlights capability gaps in Funding and in other aspects of policy formulation. Analysis of secondary data shows that the findings of this research are in line with FMST (1986, 2007), Bamiro et al. (2008) and Okonjo-Iweala¹⁰⁹ (2012), who concluded that funding for S&T activities in Nigeria is inadequate. However, this thesis offers additional insights into how the funding challenge affects policymaking at FMST and thereby Nigeria's overarching development goal. More importantly, the thesis findings shed more light on the role of capabilities in finding lasting solutions to funding STI policymaking. I argue that FMST can better tackle this challenge by improving its understanding of the processes, routines and skills involved in securing and allocating funding for STI policymaking. The significance to future policymaking is that the development of Funding policy capabilities can contribute towards addressing the chronic under-funding of S&T (policymaking) activities that have plagued Nigeria for the past five decades. This will help ensure regular policy formulation at FMST and foster socio-economic development.

Summing up Research Question 2 Answers

In this section, I have discussed the findings and used them to provide insights on the development of policy capabilities. I have also explained how the implementation and lack of policy capabilities, pose significant risks to effective policymaking, some of which I have highlighted. Furthermore, I discussed how the findings reveal that FMST focuses on the development and utilisation of policy capabilities they consider essential in their context and relevant to their perceived short-term needs. Capabilities perceived to be less important or “non-core” to policymaking, therefore, have fewer chances of development, are underutilised, play less of a role in policy formulation (discussed in Section 6.1 above), and are less likely to evolve (discussed in Section 6.3 below). The insights provided in this section also contribute to answering Research Question 3, which I discuss in the sections below.

¹⁰⁹ Nigeria's former two-term Finance Minister & Coordinating Minister for the Nigerian Economy (2011-2015)

6.3 Research Question 3: *How have Policy Formulation Capabilities Evolved (i.e. Changed) at FMST (since the first S&T policy formulation in 1986) and Why?*

The addition of “innovation” to the title of Nigeria’s 2012 S&T policy represents an aspirational step designed to help launch the concept of innovation into the main S&T, public, political and economic discourses of the nation. Evolution in this thesis is based on the broad definition of innovation provided in the Oslo Manual which refers to “new or improved processes”, that is, “newness to the organisation or geographical location” (OECD, 2005, p.8). In this context, I focus on new, improved or changed policy formulation processes and routines at FMST. I also extend this definition to include “organisational innovation”¹¹⁰ which according to (OECD, 2005) “may result in significant improvements” in performance (p.8).

A policy process (or routine) that has not changed since its use in the formulation of the first S&T policy of 1986 (or later introduction, prior to 2012) at FMST is recorded in this thesis as “*Not Evolved*”. With regards to processes that have “*Evolved*”, I differentiate between two types: incremental and radical innovation. Incremental innovation refers to a process that has received marginal or “more of the same” change, whereas radical innovation refers to a significant degree of change – i.e. transformational change or even a complete overhaul. The findings (presented in Chapter 5, Section 5.2) reveal that seven policy processes “*Evolved*” while fourteen policy processes were classified as “*Not Evolved*”. Of the evolved group, none of the innovations exhibited a significant degree of change; therefore, they are deemed to be incremental innovation. Importantly, these policy processes remain informal.

In Section 6.3.1 below, I discuss how the policy processes have evolved at FMST.

6.3.1 Policy Processes that have Evolved

In summarising the findings, this thesis highlights the reasons for the incremental innovation observed in the policy processes and routines that evolved. To reiterate, the seven processes identified as having evolved are: Consultation, Communication, Setting policy priorities, Coordination, Collaboration, Leadership and Management, and

¹¹⁰ Defined as “the introduction of significantly changed organisational structures; the implementation of advanced management techniques; or the implementation of new or substantially changed corporate strategic orientations” (OECD, 2005, p.36-37)

Decision-making; all of which experienced incremental innovation (as presented in Chapter 5, and Table 5.2.8). In addressing Consultation and Communication policy processes the findings reveal that these have remained largely the same – controlled by FMST, passive, non-collaborative and non-interactive in approach – and based on one-way traffic in which FMST invites stakeholders when it deems fit, exchanges ideas on its terms, conditions and timetable, and expects feedback. Therefore, the innovation observed is considered incremental (marginal).

The incremental innovation results from the improved appreciation of the role of stakeholders in the 2012 national STI policy formulation. This was demonstrated in various ways. As discussed earlier, one way was through improved appreciation of stakeholders' role in the ratification of the STI policy, in which FMST involved 540 delegates. However, in spite of this improved awareness of the role of stakeholders' in policymaking at FMST, the lack of formal Stakeholder Engagement policy processes with clearly defined routines did not result in perceptible upstream stakeholder engagement. Clearly defined routines for the identification and selection of the relevant stakeholders based on a clear criterion could have in turn reduced this large number of stakeholders to a number of relevant participants for the STI policy. It is plausible to argue that 540 delegates is a very large group of participants. However, such a large size also has a greater potential of militating against the benefit of obtaining some kind of consensus over the policy goals. The implementation of this Stakeholder Engagement process is aptly described by one of the delegates, who summarised the outcome of the process as:

“The policy ratification exercise was chaotic and extremely expensive. Costs for logistics (transportation, food, hotel, etc.), per diems and honorariums were paid. Planning was inadequate, and management was unwieldy. If every delegate was given one minute to contribute on all the points under deliberation, we would have spent weeks, maybe months, in the ratification exercise alone. I think that 50 key delegates, carefully selected, would have been more productive than 540, the majority of whom played no role” – Professor, Obafemi Awolowo University (OAU), Nigeria.

A significant insight that can be gleaned from the above statement is the need for an organisational capability dedicated to the ratification stage. I refer to this as “*Ratification policy process*”. Such a policy process would identify and itemise the routines necessary for ratifying a policy. This insight also calls for further development and evolution of

policy processes and routines such as Stakeholder Engagement.

The incremental innovation recorded in Leadership and Management processes and routines relate to FMST's decision to delegate the bulk of the operations and management of the policy formulation exercise to NACETEM, its agency, while retaining a supervisory role. This more-of-the-same change is an incremental innovation, since the leadership and management continue to reside with FMST. The evolution can also be regarded as an organisational innovation. Similarly, the Decision-making policy process, although still under FMST's control, received contributions from NACETEM. This again is regarded as an incremental innovation because FMST retains responsibility for the decision-making. Instead a radical innovation in this regard would be, for example, the establishment of an independent decision-making team made up of representatives from the major policy stakeholders (FMST and non-FMST). Such a diverse team can help to improve the possibility of wider participation by ensuring that more diverse stakeholders are involved in the policy processes (Scoones, 2010; Stirling, 2012).

The evolution described above relates to specific policy processes and routines. Below I discuss the main factors that have influenced the evolution of policy capabilities in more general terms. They include:

- a) *International pressure*: The need to “be like other nations”, and to attract international finance and foreign direct investments, and support from donor agencies to meet development aspirations. Interviewees described examples where donors have demanded an up-to-date national S&T policy as a condition for international collaboration. A UNESCO S&T interviewee stated: “in order for UNESCO to finance projects in Nigeria, the country is frequently given stringent policy and finance-related conditions¹¹¹”.
- b) *Competition*: FMST is in constant competition with other “science-using” ministries, such as the Ministries of Agriculture, Energy, Communications, Aviation, and Transport, to name some of the most relevant. These ministries produce competing national policies. In order for FMST's national S&T/STI policy to be relevant, it must formulate policies which external ministries can “buy into” and relate to their specific needs. The result therefore is greater efforts

¹¹¹ E.g. prescribed key performance indicators, possession of an up-to-date S&T policy and on finance, part contribution of “matching” funding.

towards improvements in policymaking, for example improved attempts at stakeholder participation. Nevertheless, due to the lack of a guiding framework and clarity on what policy processes and routines should be deployed at each stage, these efforts, although well-intentioned, generally produce suboptimal results.

- c) *Politics*: One of the positive outcomes of the uncompleted 2003 S&T national policy was an increase in the awareness of the role of politics (the political class, parliamentarians) and the need to strengthen policy processes and routines related to Stakeholder Engagement. This heightened awareness was demonstrated by the extra efforts made to engage the parliamentarians in the 2012 STI policy formulation. The findings reveal that prior to the 2012 formulation, the practice at FMST was to complete the final policy draft and then involve the parliamentarians at very late stages of policymaking e.g. legalisation. The evolution recorded in this regards, driven particularly by the failure of the 2003 policy formulation, was to recognise the importance of the legislature and to engage the parliamentarians earlier in the policy formulation stages. This was critical to ensuring that the parliamentarians endorsed the final draft, and then recommended it to the president for formal approval.
- d) *Capabilities*: Although “capabilities” are still used at FMST in the narrow sense of skills (i.e. the possession of academic qualifications), the findings indicate greater appreciation of the need for policy capabilities and their roles (FMST, 2007).
- e) *From S&T to STI Policy*: Another driver of the incremental innovation observed in the 2012 national policy formulation exercise was the move from S&T to STI policy with the emphasis on the “I” in “STI”. Two reasons help to explain this departure from S&T to STI are the desire: (1) for a bold statement that gives collective ownership to the policy, enhances its acceptance, improves operability, and avoids a potential policy somersault; (2) to join the league of “innovation nations”. However, one of the unintended consequences is the need to contextualise innovation in the policy and the underpinning capabilities required to both promote and support the innovation aspirations articulated in the policy.

In the section below, I discuss the policy processes that have not developed nor evolved.

6.3.2 Policy Processes that have not Developed/Evolved

In the findings I showed that 14 out of the 21 policy formulation processes at FMST have not evolved. Starting with *Agenda Setting*, for example, the findings reveal that the Ministry's tradition of formulating national S&T policies in response to the serving president's vision (or national development agenda) persists. The implication is that this results in a politically induced, reactionary and passive approach to setting policy agenda that does not promote active development or evolution of policy capabilities. With respect to Selecting a Policy Course, the findings reveal that one reason the policy process and routines involved have not evolved is due to the culture of imitation and "best practice"¹¹². Following this approach, policy directions are determined, for example, based on a course India or another country has chosen to follow.

The interview data reveal that in the majority of the cases the same factor was responsible for the lack of development and evolution of policy capabilities at FMST. The explanations I provide in this section for the weaknesses in the development and evolution of capabilities contribute to deepening our understanding of why seven processes did evolve. Consequently, I combine the reasons for the weaknesses in the development and evolution of policy capabilities, discuss them in Section 6.3.3 below and provide further explanations as to why policy processes have not adequately developed and evolved at FMST.

6.3.3 Reasons for Weaknesses in Development and Evolution of capabilities

Analyses of the data reveal that the development of policy capabilities at FMST has not followed a specific pattern, structure or methodology. Building on the findings, I discuss the factors that help explain why policy capabilities have not developed or evolved at FMST. I start by discussing leadership and management.

a) Leadership and Management

In Section 6.1.4 above, I argued that there is need for improvement in Leadership and Management policy processes and routines at FMST in order to strengthen their roles in policymaking as these policy processes significantly impact on policymaking in various ways. One significance of this insight to policymaking at FMST lie in the management

¹¹² See Section 6.3.3.4 for more discussion on best practice

of policy formulation. For instance, FMST does not stipulate a set number of years during which a new S&T policy must be formulated. As a result, the conditions (such as, availability of funds, timing and staffing (i.e. framework conditions¹¹³) for policymaking are not predetermined, but are rather decided by the management. The implication is that Leadership and Management processes and routines that are favourable to policymaking are therefore essential in order for the management to decide on questions such as: (a.) is there a need for a new (or revision to an old) S&T policy and if yes? (b.) when should begin the policy formulation? (c.) which funding sources are potential available for the intended policy formulation exercise? and (d.) is need for capacity-building exercises and if yes, when should these begin? Weaknesses therefore in this regard mean that the development of policy capabilities is not approved. This group of policy processes, like funding, were found to have clear impacts on policy formulation, and the development and evolution of policy capabilities at FMST.

b) Lock-in and Blocking Mechanisms

Another factor identified to be responsible for the lack of evolution is the concept of “lock-in”, which acts as a “blocking mechanism” to the development and evolution of policy capabilities at FMST. Lock-in in this context refers to the insistence on continuation of incumbent routine practices in the hope that they will eventually yield better results. Lock-in is a systemic failure that impedes innovation (UNCTAD, 2013, p.7-8). Bergek et al. (2008) refer to blocking mechanisms as “highly embedded routines”, practices and power structures that stifle organisational innovation. Such organisational culture and routines need to be identified (North, 1994; Bergek et al., 2005) and adjusted, or “aligned” (Freeman and Louca, 2002) in order to foster capabilities development and evolution. Nevertheless, organisational alignment is a challenging task, which in itself requires capabilities (Bergek et al., 2008). The prevalence of informal processes and routines at FMST further increases the difficulties of addressing these challenges arising from lock-in effects and blocking mechanisms. These insights also relate to literature on core capabilities and core rigidities (Leonard, 1992; Leonard-Barton, 1998). Literature on

¹¹³ For example, in Europe, financial incentives, innovation promotion programmes, research and technology centres, “innovation-oriented infrastructure” (Kuhlmann, 2001, pp.962-963). OECD (2005) define framework conditions as “the general conditions and institutions which set the range of opportunities for innovation” p.19

core capabilities and core rigidities argue that while core capabilities are useful, they also have downsides in that they can become core rigidities thereby inhibiting innovation.

Two examples can be used to illustrate the impact of lock-in and blocking mechanisms. First is the persistent tradition of formulating national S&T policies in response to a president's vision. While this approach may suit the political class, it has negative impacts on the development and evolution of capabilities, e.g. by failing to stimulate a demand for policy formulation capabilities and opportunities for experimentation. A second example is provided in the "panel (i.e. committee) approach", which started with the 1986 S&T policy (Lebeau et al., 2000) and has continued since then. The implication is that a few "technical experts" often referred to as "egg heads" are appointed as "policymakers" and left to "get the job" done, i.e. formulate the policy. Such a practice therefore relies on the skills of a select few without paying sufficient attention to the role of policy processes and routines or the benefits of wider stakeholder participation – thereby discouraging the development and evolution of policy processes and routines at FMST.

Furthermore, the findings also indicate that Leadership and Management are relevant here as a blocking mechanism. A recent case occurred between 2000-2007, during which the longest serving FMST minister, Professor Turner Isoun, focused on developing Nigeria's Space Mission (Isoun, 2002, 2005; FMST, 2011) – without a careful articulation of how the project's fit into the national development agenda or articulated in an up-to-date national S&T policy. The key insight and significance to future policymaking is that a Minister's leadership latitude to set their S&T priorities/goals and the steps involved in asserting these goals, as illustrated in FMST, can result in authoritative behaviour with little regard for policymaking processes. Leadership and management therefore in this sense act as a blocking mechanism to the development and evolution of policy capabilities. The development, formalisation of incumbent policy capabilities and a guiding framework can help to minimise this risk.

c) Perceived Relative Importance of Policy Processes at FMST

In Chapter 5, drawing from the findings I argued that the perception of the relative importance of policy processes and routines at FMST meant that there was a lack of appreciation of the roles of some processes and routines in policymaking. While this thesis found no empirical evidence in support of this perception, the findings reveal that

this group of non-core capabilities perceived to be “less important” (e.g. “Exchange of ideas” and “Stakeholders role”) were rarely utilised and accorded little consideration. The focus of capabilities development at FMST, therefore, is skewed towards policy implementation with the implication that policy formulation capabilities are less likely to be developed and evolve; for similar reason, implementation was perceived to be more important than formulation.

d) Best Practices by Imitation

Best practice is one of the “mechanisms for trans-national learning designed to let policymakers and stakeholders ‘learn from each other’ in order to improve policymaking (Borrás, 2011). Similar mechanisms include, ‘benchmarking’, ‘peer review’, ‘mapping and trend charts’ – all of which aim at trans-national policy learning” (Bennett and Howlett, 1992; Borrás, 2011, p.5). However, in Nigeria’s context, “best practice” means policy formulation by imitation, an attempt to fix gaps or “failures” in policies by copying practices in other countries (NACETEM, 2011). Although best practice by imitation can be a form a learning by doing (Becker, 2005a), it only explains mechanisms and takes less account of context. Therefore, the emphasis on best practice at FMST mean that it adopts mechanisms without careful consideration to the appropriateness of the adoption, or failure to consider the relevance of the mechanisms to the Nigerian context.

A practice is “best” in specific contexts, locality or environment. Borrás (2011) argues that a generic identification, analyses or imitation of best practices devoid of the context of “*the system*” and accompanying policy learning is unlikely to yield the desired results – as the findings from FMST highlight. This finding, which shows one of the main reasons why policy capabilities have not developed and evolved at FMST, is in line with Siyanbola et al. (2013, p.4) who report that the 2012 STI policy formulation took its cue from practice in other countries including India, Brazil, South Africa, Singapore and Malaysia. The evidence captured showed that best practice has not advanced the development and evolution of policy capabilities at FMST; rather it acts as a blocking mechanism to capabilities development, evolution and policy learning. Next I discuss policy learning further in the section below.

e) Policy Learning not taking place at FMST

In Chapter 2 (Section 2.2) I explained that one example of a dynamic capability is an organisation's ability to learn new practices, processes or routines; showing that learning, as a capability, is interactive (Lundvall, 2005), dynamic (Teece et al., 1997), and involves the integration and reconfiguration of capabilities. Learning also involves experimentation aimed at continuously improving organisational performance (Teece et al., 1997; Eisenhardt and Martin, 2000; Pablo et al., 2007). In Chapter 3 (Section 3.3) I discussed the importance of routines as capabilities in accomplishing policy tasks. Policy learning in this context relates to knowing who knows what within an organisation, as this impacts on organisational (i.e. collective) learning and the development of policy capabilities. Drawing from relevant literature I explained that routines encode organisational knowledge, thus acting as key components of organisational learning, capabilities development and change (evolution) (Feldman and Pentland, 2003).

Two types of learning relevant to the arguments of this thesis, which apply to both policymakers and policymaking, are: interactive learning (Lundvall, 2005, discussed above) and policy learning (Borrás, 2011). In discussing policy learning, I draw from the insights provided by Borrás (2011), who defines innovation policy learning as “as the specific process in which knowledge is used in the concrete development of policy formulation and implementation within the policymaking process” (p.3). Although studies of policy learning in STI policy continue to be scarce (Borrás, 2011), there is sufficient evidence in the policy literature that underlines the importance of policy learning for inducing policy change (innovation) (Borrás, 2011).

Bennett and Howlett (1992) and Borrás (2011) describe three interdependent levels of learning – government learning, lesson-drawing and social learning. The most relevant to this research is government learning, which relates to State officials learning about policy processes in policymaking and by so doing, generating organisational innovation and change. In spite of the acknowledgment of the potential of learning in policy processes and routines at FMST, the use of policy learning in enhancing the roles, development and evolution of policy capabilities at FMST has not been achieved. Instead, dependence on imitation of policy (i.e. “best”) practices of other nations to the neglect of context and the use of external experts and consultants persist.

f) Funding (for Policy Formulation) and Resource Constraints

“Funding was a key challenge during the policy formulation. International Development Partners helped out by providing some thousands of dollars, which funded specific aspects like meetings, training and printing of the policy” – Deputy Director, PLS, FMST.

The first national S&T policy contained a chapter dedicated to *“Financing of Science and Technology activities”*, which stressed the importance of establishing Funding processes and mechanisms for funding S&T activities (FMST, 1986, p.29; Lebeau et al., 2000). In spite of this emphasis on incumbent capabilities for Funding at FMST since the 1986 S&T policy, interview data and FMST policy-relevant documents (FMST, 2011, 2012) reveal significant gaps in securing regular funding for STI policy formulation. Similarly, the processes and routines involved in Funding have remained undocumented (i.e. informal) thereby rendering them almost inaccessible. Funding policy processes and routines have not adequately developed nor evolved due to various factors that include “lock-in” practices favouring the culture of dependence on national budgetary allocation and contributions from international donors. These practices are inimical to the development and evolution of policy capabilities. The implication for future policymaking is that it is imperative to develop Funding processes and routines at FMST as a way of improving the prospects of policymaking and ensuring that policy formulation can be carried out at regular and planned (e.g. three or five years) intervals.

g) Consultancy Approach to Policymaking

Another important reason for the lack of development and evolution is the use of consultants and experts¹¹⁴ in policy formulation (Lebeau et al., 2000; Siyanbola et al., 2013, p.4). The findings show that this practice, with its roots in the formulation of Nigeria’s first national S&T policy, is entrenched at FMST, resulting in dependence on external skills and outsourcing of policymaking activities. It follows the notion that *“whenever there is need to review or formulate a policy, we can always access skilled individuals from outside FMST if necessary” – Principal Chief Scientific Officer, NITDA.* Experts and consultants utilised in formulating the 2012 STI policy were drawn from within Nigeria, Nigerians in the Diaspora and from the international community

¹¹⁴ “Consultants and external experts” in this thesis refer to non-FMST staff and policymakers, deemed by FMST to have the requisite skills. Sometimes the experts are popularly referred to in Nigeria as “egg-heads”.

(Oyewale et al., 2013; Siyanbola et al., 2013). One implication of this approach is a lack of motivation to develop and ensure incumbent policy capabilities at FMST, which limits the range of capabilities utilised in policymaking. Another factor relates to individual learning and knowledge (Cohen, 1991) versus collective memory (described in Section 6.3.3.2 above). The resultant effect is less effective policymaking and failures in STI policy formulation.

h) Weaknesses in Policy Skills – Absorptive Capacity

“A very small percentage of the staff eventually end up doing the actual work as the majority are grossly unqualified or deficient in specific policy skills-sets. Skills development is essential, especially since we have realised that the quality of graduates from the Universities is very low, as a result of the degradation in education” – Director, Technology Acquisition and Assessment Department (TAA), FMST.

Although this thesis focuses on organisational capabilities (i.e. policy processes and routines), the interview findings at FMST also reveal that policy skills lacking at FMST include: research and (interactive) learning (Braun et al., 2003; Lundvall, 2005; Borrás, 2011), administrative (Donahue et al., 2000; Hou et al., 2003), analytical (Riddell, 2007; Howlett, 2009), leadership, management and reflexive skills (Borrás, 2011), negotiation (Lall, 1992) and absorptive capacity (Cohen and Levinthal, 1990).

I have discussed research, learning, administrative, analytical, leadership, management, reflexive and negotiation/mediation skills in preceding sections and chapters of this thesis. Here I focus on absorptive capacity. Absorptive capacity is important in science policymaking institutions in that it helps to develop the capabilities to “recognise, assimilate and exploit knowledge created elsewhere” for innovation purposes and to utilise such knowledge in policymaking (Mayer-Krahmer, 1997, p.311)¹¹⁵. One implication of the thesis findings for future policymaking at FMST and in DCs is that it highlights the lack of (and the need to focus on) absorptive capacity. Improvements in absorptive capacity can greatly enhance the prospects of development, evolution, and formalisation of policy capabilities.

¹¹⁵ See also for example: Cohen and Levinthal (1990), Bell and Pavitt (1993, 1995), Edquist (2004), Bergek et al. (2005, 2008) and Borrás (2011).

i) Absence of a Policy Formulation Framework

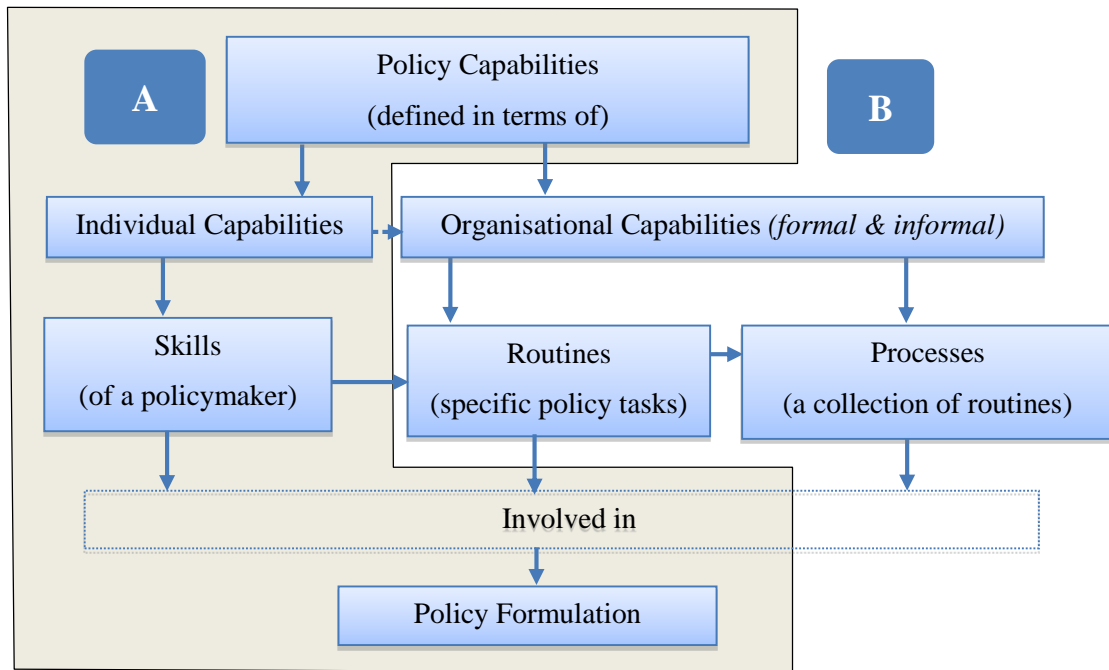
An important theme that emerged from the interview findings is that in the absence of a framework with clearly articulated policy capabilities to guide policy formulation, rigidities such as the recourse to best practice, *ad hoc* policy approaches (to e.g. Research and Funding), guesswork, confusion and muddling through (Lindblom, 1959; Godin, 2009) are bound to continue. The interview findings further reveal that the absence of a framework at FMST meant that both policymakers' and decision-makers alike were at various times in a quandary as to what the next steps were meant to be. One reason for the lack of a framework is that policy capabilities have not been properly identified (and less so, formalised, i.e. documented in an easily accessible format). One benefit of a framework and the formalisation of policy capabilities is that they can potentially improve guidance for future policymakers. The implication of this finding therefore for future policymaking in Nigeria and in DCs is that a framework is essential for the detailed conceptualisation, identification and mapping of the policy processes, routines and skills involved in policy formulation. To accomplish this requires policy skills (upgrades).

Drawing from the interview and secondary data, I present a framework in the section below – *Framework of Policy (Formulation) Capabilities*, which I argue will contribute to effective policymaking in Nigeria and in DCs.

6.4 Framework of Policy Formulation Capabilities

In Chapter 3 I presented the Conceptual Framework (Figure 3.1) used to guide the data collection and analysis. Drawing from the findings presented in Chapter 5, I revisit and revise the Conceptual Framework (Figure 6.1 below), in line with the data captured at FMST. Building on the framework, Figure 6.1 below shows the current practice in policy formulation at FMST (*Shaded Area, "A"*), which importantly highlights the capability gaps as identified from the fieldwork. The gaps (*Unshaded Area, "B"*) represent the contribution to existing knowledge of policymaking in Nigeria and in DCs. In this thesis, I argue for the need for "A" and "B", as a condition for achieving effective policy formulation.

Figure 6.1: Conceptual Framework of Policy Capabilities – Revisited



A (Shaded Area): the current practice in policy formulation (and policymaking) at FMST

B (UnShaded Area): the policy capability gaps at FMST identified from the fieldwork which this thesis addresses.

Source: Author

The examination of policy capabilities and policy formulation at FMST, using the above framework yields interesting results, as I have discussed in the sections above. I argue that a framework is critical to understanding the relationships between organisational capabilities (policy processes and routines) and individual capabilities (skills) in policymaking. The framework helps to illustrate that, while skills are useful in policy formulation, their role lies in carrying out routine tasks that make up policy processes. Another use of the framework is that it helps to illustrate how skills “feed into” routines and therefore play a supportive role. Furthermore, the framework provides a mechanism for explaining the different roles that policy processes, routines and skills play in policy formulation, thereby helping to show greater clarity in the definition and conceptualisation of policy capabilities as used in this thesis. It is received wisdom that challenges in policymaking can be better managed if there is a framework to help clarify the roles of the policy processes, routines and skills, and to guide the activities involved (Lindblom, 1959; Sabatier, 2007; Hallsworth et al., 2011; Nowlin, 2011).

In discussing the attributes of "more promising frameworks", Sabatier (2007, p.8) lists four guidelines, stating that a policy framework must:

1. Do a good job of meeting the criteria of a scientific theory; that is, its concepts and propositions must be relatively clear and internally consistent, and be fairly broad in scope (i.e., apply to most of the policy process in a variety of political systems).
2. Be the subject of a fair amount of recent conceptual development and/or empirical testing that scholars view as a viable way of understanding the policy process.
3. Be a positive theory seeking to explain much of the policy process. The theoretical framework may also contain some normative elements, but these are not essential.
4. Address the broad sets of factors that political scientists looking at different aspects of public policymaking have traditionally deemed important: conflicting values and interests, information flows, institutional arrangements, and variation in environment.

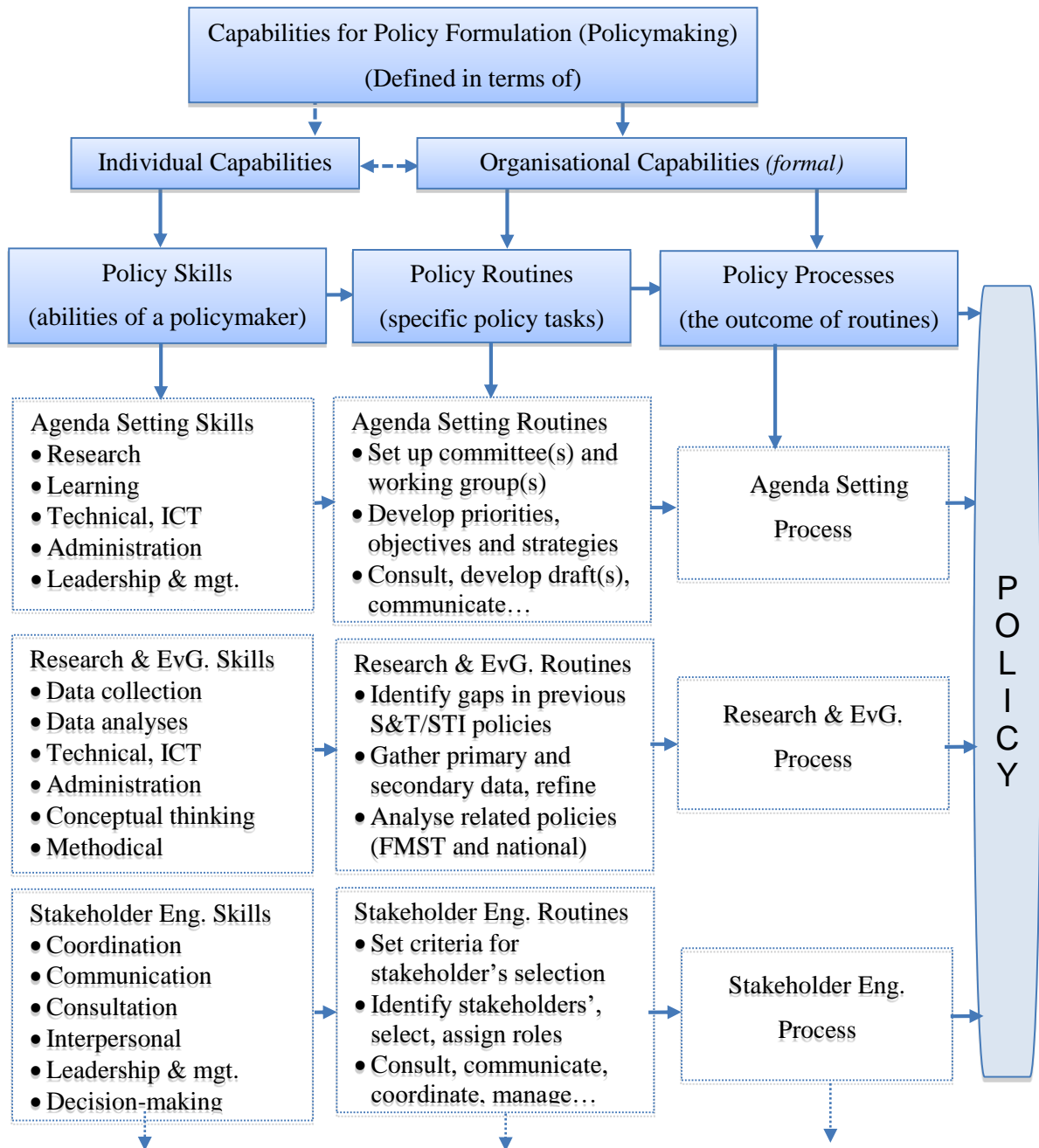
The Revised and Extended Framework of Policy Capabilities (i.e. The Framework of Policy Capabilities) I propose below in this section satisfies the four criteria advanced by Sabatier (2007), see also Nowlin (2011). The Framework (1) is based on scientific theory (of capabilities, processes and routines) and propositions (Chapters 2 and 3), (2) has been subject of recent conceptual development, (3) seeks to explain much of the policy process drawing from the theoretical and conceptual frameworks and (4) addresses broad aspects of public policymaking that include values and interests, institutional (such as FMST, NACETEM, FEC) arrangements, and variations in environment, and politics (i.e. the role of the political class, parliamentarians).

I briefly explain the different elements that constitute *The Framework* (Figure 6.2 below) proposed. In describing the elements (Figure 6.2), the first box on the top indicates that the Framework specifically relates to *Capabilities for Policy Formulation*, in this case at FMST. The next level of boxes show that capabilities are defined in terms of individual capabilities (skills) and organisational capabilities (processes and routines) which have to be formal. The arrows show that individual and organisational capabilities are interlinked and complementary, with individual capabilities "feeding into" (i.e. helping to carry out the activities contained in) organisational capabilities (routines and policy processes).

In the Framework I present three processes (out of the 21 policy processes examined) and some of their corresponding routines and skill sets. I use the three policy processes to illustrate the revised and extended framework, since it is not practical or realistic to present all 21 policy processes in the framework. The selection of the three policy processes does not imply superiority or preference; rather they simply serve to help illustrate the framework and how policy processes, routines and skills relate to each other in terms of the roles they play in policymaking.

In the white boxes I point out examples of specific skills relevant to carrying out routine tasks. The extended Framework (Figure 6.2) shows how the combination of various routines results in a policy process. I do not attempt to provide an exhaustive list of routines and skills in the Framework for reasons that include: (1.) they have been discussed in respective sections above and in preceding chapters, particularly in Chapter 5 (Findings), (2.) need for “elegance” and brevity in the framework, and (3.) earlier arguments that policymaking is a dynamic exercise during which circumstances change, rendering some policy capabilities obsolete and necessitating the evolution of incumbent policy capabilities or the development of new policy capabilities.

Figure 6.2: Framework of Policy Capabilities



EvG – Evidence Gathering; Eng – Engagement

Source: Based on Author's Interview Data.

A significant contribution of this framework is that it helps to explain why continued focus on skills, to the neglect of organisational policy processes and routines (Becker et al., 2005), means that changes (i.e. innovation/evolution) in STI policy capabilities at FMST (and indeed Africa and the wider DCs) will be difficult to understand, capture, analyse or formalise.

In Chapter 5 (Findings) I described the policy formulation stages as captured at FMST and summarised the policy processes involved in Figure 5.1 (A Flowchart of Key Policy Formulation Stages, page 30). Although 21 policy processes (and their routines) are examined in this thesis, with five referred to as core policy processes; I have used three policy processes in the framework as examples to elaborate on the relationship between processes, routines and skills, thus demonstrating how the revised and extended framework contributes towards deepening our understanding of policy capabilities. Based on the framework therefore, a policy process (e.g. Agenda Setting Process) is accomplished when the routine tasks have been fully carried out, using relevant skills.

The findings reveal that before a policy agenda is set, committees and working groups are created; and policy objectives, strategies, priorities, and other vital components are clarified, debated and negotiated with stakeholders (i.e. consultation). These constitute agenda setting routines. Therefore, to achieve this policy process requires the undertaking of routines involving relevant skills as exemplified in the framework above. Finally, the framework helps to elaborate that the undertaking of multiple processes is necessary for the successful completion of a policy. The arrows at the bottom of the framework serve to clarify that the framework is not limited to the three processes in the example and that other policy processes and routines can be incorporated.

The contribution of the policy capabilities framework is (a) how it differs from the conceptual framework that was adopted from existing literature and (b) why it is more suitable for Nigeria and DCs. The framework differs from the conceptual framework in several respects: First, it is an extension and elaboration of the key components of the conceptual framework. Second, it clearly identifies the specific routines and skills involved in individual policy processes (which the conceptual framework does not do), thus highlighting its usefulness in the further identification, mapping and formalisation of policy capabilities (processes, routines and skills). Third, it helps in deepening our

understanding of the relationships between policy processes, routines and skills, e.g. in helping to understand which routines and skills are common (i.e. shared) by which policy processes. Pertinently this proposed Framework is more suitable for Nigeria and DCs in that, although it advocates formal policy capabilities, it can also be used to capture and explain informal capabilities, thereby providing a helpful tool for the identification of policy capabilities and effectively formalising those capabilities.

Summing up Research Question 3 Answers

In this section, I have discussed the findings and used them to explain policy processes that have evolved, and those that have not, and provided reasons for weaknesses in the development and evolution of capabilities at FMST. I have also addressed specific factors that have influenced the (development and) evolution (or lack thereof) of policy capabilities recorded and how these factors affect the implementation of policy capabilities at FMST. Furthermore, I presented and discussed the Framework of Policy Capabilities. I argued that the suggested Framework makes an important contribution to policymaking, and discussed how it differs from the conceptual framework and why it is more suitable for Nigeria and DCs. In the next section I discuss rival explanations.

6.5 Rival Explanations

In Chapter 4 (Section 4.4.3), I argued that the explanation-building analytic technique is most suitable in cases “in which the explanations have reflected some theoretically significant propositions” (Yin 2009, p. 141). I also explained that this thesis is based on two theoretical propositions: (1) that specific (sets of) organisational capabilities (policy processes and routines) and individual capabilities (skills) – as opposed to skills alone – play important roles in policy formulation and are therefore required for policymaking in government institutions such as FMST; and that, (2) skills serve to carry out routine tasks and therefore support policy processes and routines in a complementary manner (as presented in Figures 6.1 and 6.2 above). These theoretical propositions informed the conceptual framework and research questions, which examine the (a.) roles (RQ1), (b.) development (RQ2) and (c.) evolution (RQ3) of policy capabilities at FMST.

In addressing the first proposition, two alternative explanations might be considered. One is that policy processes and routines are not required for policymaking. Alternative interpretation is that skills alone are sufficient for policymaking, and therefore policy

processes and routines are none essential components of policy capabilities. Building on the findings presented in Chapter 5 and the illustrations advanced above using Figures 6.1 and 6.2, I have demonstrated that policy processes and routines play a major role in effective policy formulation. This is evidenced by the failure of STI policy formulation at FMST over the years¹¹⁶, which in large part is due to FMST's dependence on skills. The findings have helped to show that skills are only a part of policy capabilities. This substantiates the argument in support of the first theoretical proposition, leading us to, thus, reject the rival explanation.

In relation to the second proposition, a possible alternative explanation could be that skills are of equal or higher importance than processes and routines and therefore cannot play a supporting role in relation to policy processes and routines. Similarly, using the findings I rule out this rival proposition based on the arguments that this could not be the case since (a) the various sources of policy capabilities are complementary, as argued by various authors (Nelson and Winter, 1982; Abramovitz, 1989; Dosi et al., 2000; Archibugi and Coco, 2004); thus revealing that the failure of STI policies at FMST has been a function of the lack of processes and routines, and (b) skills serve to carry out the activities contained in policy processes and routines – and not the other way around. This is in line with Pavitt (1998, 2002), who observed that failures in organisational innovation are less the result of skills and more of organisational processes and routines. This finding re-inforces the role of skills in carrying out policy processes and routines (as illustrated in Figures 6.1 and 6.2), thereby strengthening the argument of this thesis that skills, without the necessary processes and routines – formal (and/or informal) (Pavitt, 2002) – are insufficient in policymaking.

The significance therefore of this finding for policymaking in Nigeria and DCs more generally is that it is necessary to develop the full range of policy capabilities (processes, routines and skills) in order to formulate effective STI (and public) policies. In order to achieve this, a framework of policy capabilities is necessary to help contextualise, identify, map and formalise policy capabilities.

In the next section I summarise the main insights that have emerged from this chapter.

¹¹⁶ As noted in preceding sections, this refers to 1986 to 2012 period at FMST.

Chapter Summary

In this chapter I started by reiterating the research questions put forward in this thesis.

Drawing from the findings I addressed each research question. In answering Research Question 1 on the role of capabilities (RQ1) in Section 6.1, I started by discussing the attributes of policy capabilities that include formal versus informal, incumbency, utilisation, core and non-core capabilities. I used the insights gathered to discuss the 21 policy processes and routines examined and, building on that, presented a taxonomy of policy capabilities, which outlines the core capabilities for policy formulation at FMST. Thereafter, I re-examined organisational capabilities (policy processes and routines) at FMST and established that they are informal.

In Sections 6.2 and 6.3, I focused the discussion on the five core capabilities and used them to structure the discussion of policymaking, thereby explaining the development and evolution of policy formulation capabilities at FMST. While Research Question 2 relates to how and why policy capabilities originally emerged at FMST, Research Question 3 deals with how policy capabilities have evolved (i.e. changed) over the years at FMST. Policy processes and routines that have not changed since their use in the formulation of Nigeria's first S&T policy in 1986 at FMST are recorded as not evolved. I discussed the policy processes that have evolved and the reasons why they evolved; in addition to policy processes that have not (adequately) evolved and provided reasons why they have not evolved.

In this chapter I re-visited the conceptual framework (advanced in Chapter 3). This helped to explain the gaps that exist (i.e. the neglect of policy processes and routines), thereby highlighting the various contributions of this thesis to theory, policy and practice. I also proposed and discussed the Framework of Policy Capabilities (Figure 6.2), which outlines specific policy processes, routines and skills in light of the thesis findings (Chapter 5) based on interview data captured at FMST. Finally, I addressed the rival propositions of this thesis and rejected them based on the suggested theoretical and conceptual frameworks, the findings presented in Chapter 5 and in-depth discussion that followed in this chapter.

Using the findings, as discussed in the preceding sections, I explained how policy processes play important roles in policymaking at FMST, and why they have not

developed or evolved. A significant insight from the findings is in the way that policy processes and routines are implemented at FMST – informally, selectively, unsystematically and on an ad hoc basis. The mode of conduct of these policy processes, together with their informality, explains to a large degree the persistent failures of S&T policies at FMST over the years. This informal, selective, unsystematic and ad hoc implementation approach to processes and routines at FMST also helps to explain why policy capabilities have played suboptimal roles in policy formulation, remain underdeveloped and mostly have not evolved. These insights highlight the contributions that this thesis makes: the need for formalisation and an appropriate framework to guide effective policymaking.

In the next chapter, Conclusions, I set out the contributions of this thesis.

Chapter 7. Conclusions

Introduction

“We are going to run our economy based on Science and Technology...because there is now nowhere in this World that you can move your economy without science and technology. For the next four years we will emphasise so much on science and technology because we have no choice, without that we are just dreaming” Dr. Goodluck Ebele Jonathan, President, Federal Republic of Nigeria, 2010-2015, In Birnin Kebbi, Kebbi State, Nigeria, 2011 (FMST, 2011)

This thesis has analysed the roles that policy capabilities (i.e. policy processes, routines and skills) play in policy formulation. It has in addition examined the development and evolution of these policy capabilities. To achieve these objectives, it uses Nigeria’s Federal Ministry of Science and Technology (FMST), which recently in 2012 completed the formulation of a national STI Policy for the investigation of these issues. The use of FMST helps to deepen our understanding of the roles, development and evolution of policy capabilities in developing countries (DC) contexts.

I explained the methodology in Chapter 4, presented the findings in Chapter 5 and provided in-depth discussions on the findings in Chapter 6. In this chapter I address the theoretical implications of these findings and highlight the contributions of this thesis to academic literature that will help deepen our understanding of the roles, development and evolution of policy capabilities in policymaking, particularly in developing countries. In this chapter, I also outline the limitations of the thesis and finally offer suggestions for future research.

7.1 Contribution to Theory

The contributions of this thesis provide new insights on the roles that capabilities play in policy formulation, the development and evolution of such capabilities. This helps to deepen our knowledge of the relationship between capabilities and policymaking thereby contributing to scholarly conversations that enrich our understanding of policy capabilities (in terms of processes, routines and skills) in policymaking. I have shown in this thesis that policy processes and routines (as organisational policy capabilities), are critical components of capabilities (and therefore necessary for effective policy formulation). These findings, therefore, aim to change the course of scholarly conversations on policy formulation, policymaking and capabilities from a focus on skills

(individual capabilities) to a broader focus on policy capabilities – processes, routines and skills. These findings are in line with Huff (2009) who describes contributions that aim to (a) provide deeper insights, or (b) change the course of scholarly debates.

The contributions this thesis makes to theory and scholarly conversation is through a more fine-grained explanation of the range of capabilities utilised in policymaking, the roles that capabilities play in policy formulation, how they are implemented, and the development of these capabilities and their evolution over the years (i.e. 1986 to 2012) at FMST. Specifically, these contributions will be of relevance to developing countries. In the section below I briefly summarise the implications of the findings and relate them to the four theoretical contributions that this thesis makes.

1. The findings presented in this thesis contribute to deepening our understanding of the relationships between processes and routines (organisational capabilities) and skills (individual capabilities) in policymaking. By decomposing capabilities into processes, routines and skills, the findings of this thesis provide useful micro-foundations for improving our understanding of capabilities in policymaking and for further research in this area. Therefore, in line with the findings I suggest a change in the focus on capabilities debate and research that equates capabilities in policymaking to skills. I argue that organisational policy processes and routines must be an essential component of capabilities research, development and application in policymaking.
2. Informal Policy Processes and Routines: Policy capabilities (processes, routines and skills) play important roles in policy formulation, which contributes to policymaking; and that policy processes and routines, at organisational level, are critical to policy formulation. However, the findings also reveal that policy processes and routines at FMST in Nigeria are informal, the majority of which are underdeveloped, and have only marginally evolved (or not evolved) since their introduction or utilisation in the formulation of Nigeria's first national S&T policy in 1986. Informal processes are not a widely investigated domain in STI or policy studies. This thesis has argued that such informal processes in large part explain the weaknesses in policy formulation at FMST and failures in Nigeria's STI policies. While this finding makes a contribution to theory it also helps to emphasise the importance of further research in this area.

3. Implementation of Processes and Routines: A more significant insight from the findings is in the way that policy processes and routines are implemented at FMST – informally, selectively, unsystematically and in an ad hoc manner. Using Research policy processes for example, the specific routines that must be followed in policy research to inform policymaking were not evident from the interviews or documented anywhere at FMST (therefore informal). The focus on secondary data by desktop research (as opposed to the use of primary and secondary data) reveals selectivity, while the unsystematic practices involved in Research policy processes mean that the secondary data used in policymaking were not subjected to careful interrogation, robustness checks and verification. Furthermore, the findings revealed that Research (like other policy processes) is conducted in an ad hoc manner. The mode of conduct of these policy processes and routines, together with their informality, therefore, help to explain in large degree the failure of S&T policies at FMST and in Nigeria. These factors also reveal some of the reasons why policy capabilities have played suboptimal roles in policymaking, have not developed and have only marginally evolved over the years. An understanding therefore of the mode of implementation of policy processes and routines sheds light on these factors responsible for failures in policymaking.
4. Taxonomy of Policy Capabilities: The typology of capabilities, which draws from literature, suggest that a whole range of generic policy processes are involved in policymaking. However, the taxonomy, based on empirical evidence captured at FMST, reveal that 21 policy processes are relevant for policy formulation at FMST, with five considered to be core. This insight is useful in enriching our understanding of the roles, development and evolution of policy processes in various ways. One implication of this finding for policymaking at FMST (and in DCs in general) is that policy processes considered to be a non-core play less roles in policy formulation, are less utilised, are less likely to be developed and less likely to evolve. In developed countries it may be realistic (expected or even essential) to assemble the entire range of policy capabilities, as presented in the theoretical framework and typology. However, at FMST in Nigeria, the focus is first on the core policy processes perceived to be critical to policy formulation. Thereafter, other policy processes in the taxonomy may be considered. This selective approach to the implementation of policy processes, and the neglect of

non-core policy processes help to explain the persistent failures in S&T policy formulation at FMST, in addition to the weaknesses in roles, development and evolution of policy capabilities described in preceding sections and chapters of this thesis.

5. Policy Framework and Policy Formulation Stages: The findings reveal that policy capabilities have been inadequately conceptualised at FMST to mean skills and therefore do not adequately take policy processes and routines into account. A framework, such as Figures 6.1 and 6.2 (Chapter 6), proposed in this thesis can help in this regard. The suggested *Framework of Policy Capabilities* is, therefore, useful in improving our understanding of policy processes, routines and skills and how they relate to each other in policymaking. The framework can also serve as a tool for mapping and guiding the development and evolution of policy capabilities, thereby helping to optimise the roles that capabilities play in policymaking. Furthermore, the framework contributes to changing the course of scholarly conversation and research on the definition and conceptualisation of policy capabilities (1) at FMST, Nigeria and (2) in similar DCs government policy institutions. The fresh insights provided in the framework (and indeed the other contributions, to a lesser extent) may also contribute to the scholarly conversations and research on the definition, conceptualisation, formalisation and implementation of policy capabilities in developed countries.

In outlining the information generated by applying this framework in the case of Nigeria the findings reveal that the framework can also be used to analyse policy capabilities at FMST in each stage of the policy formulation. It could help answer questions such as were the policy capabilities used in formulating FMST's S&T policy of 1986 the same as those used in 2012 STI policy formulation? If not what changes have taken place, how and why? What innovation in policy capabilities, policymaking or policies should we expect in ten or twenty years' time and how best should we prepare for these shifts? Having shown that universalistic frameworks would be impractical and unrealistic to apply at FMST (and DCs), the Framework and Flowchart of Policy Formulation Stages are, therefore, important contributions to theory in that although they focus on formal capabilities, they can also be used to identify, formalise and explain informal capabilities.

With the contributions to theory, academic literature and scholarly conversations addressed, in Section 7.2 below I briefly discuss the implications of these contributions for policy and practice.

7.2 Implications for Policy and Practice

The thesis findings contribute to capabilities; science, technology and innovation (STI), and policy studies. They offer a more in-depth understanding of the unique roles that policy capabilities play in policy formulation. The findings yield empirical evidence which reveals that the lack of policy capabilities results in FMST's inability to effectively carry out the full range of activities that are necessary in order to formulate STI policies, in line with its ministerial mandate. This has wide implications for policy and practice at FMST and potentially other government policymaking institutions in DCs with similar characteristics, for example, are at the same developmental stage as Nigeria, particularly in Africa.

The thesis findings provide new insights relevant both to FMST and a wide range of stakeholders interested in capabilities, STI and public policymaking in DCs. An important implication of the finding is that it contributes to efforts towards tackling the dearth of policy capabilities at FMST (and in similar government institutions in Nigeria and DCs context). The status quo at FMST is that few staff are selected and sent to short capacity-building training sessions – seminars, workshops or conferences – for a few days to one week. Because these capacity-building exercises are mostly carried out in locations external to the institution (i.e. FMST in this instance), participants are further drawn away from the organisational policy processes and routines that should be part of the new knowledge to be acquired. On completion of the short training sessions, course participants are expected to be “experts” in policymaking.

This scenario depicts the lack of appreciation, and in most cases, total disregard, of the importance of incumbent (i.e. present) organisational policy processes and routines within which skilled staff will function – on return to their institution, post capacity-building exercises. As the thesis findings reveal, policy processes and routines play important roles in policy formulation. Therefore, in order to improve policy formulation at FMST, policy processes and routines are required and must be incumbent.

In the sections below, I draw from the contributions to theory as a basis for suggesting recommendations for policy and practice that could foster improvements and steer FMST (and DCs) towards achieving a more effective policymaking.

- i. Reconceptualise Policy Capabilities: Reconceptualise policy capabilities based on the Framework (Figures 6.1 and 6.2, Chapter 6) suggested to include policy processes, routines and skills. Thereafter use the Framework to identify and carefully map the range of policy capabilities needed for policy formulation (or policymaking in the wider context). This mapping will help ascertain which of the identified policy capabilities are incumbent at FMST, formal or informal, utilised in policy formulation (how, why, at what stage, weaknesses observed) or unutilised (in that case, why not). In addition, the capabilities identification and mapping can also support further efforts at determining core capabilities or refining those identified in this thesis. Reconceptualisation may also help in the identification of additional capabilities that FMST should seek to acquire while enhancing the further development and evolution of incumbent policy capabilities.
- ii. “Capacity-building” – Seminars, Workshops and Conferences: Recognise that while short seminars, workshops and conferences on skills are useful and welcome; they are insufficient to adequately build policy capabilities – in that they focus on skills while neglecting policy processes and routines. This is especially so, as these one-off seminars are devoid of on-going support and the development of practical policymaking experience within the actual contexts they are likely to be used. Another lapse identified in this approach is that the short training sessions are ad hoc, and implemented right before the start of a policy formulation exercise. As a result, they are not strategic, i.e. not in FMST’s long-term planning, or well thought out. Furthermore, they do not provide for the new knowledge acquired to be refined and sufficiently tested (e.g. for suitability, applicability and robustness) prior to their use in impending policymaking exercises.
- iii. Formalise Policy Processes and Routines: Formalise all (or most) policy processes and routines as this will help to ensure that the roles, development and evolution of policy capabilities are more adequately determined, monitored and exploited. Formalisation could in addition enhance the prospects of policy learning especially, but also organisational learning in general, enhance collective memory

and foster innovation in policymaking. Formalisation will also – in conjunction with the application of the Framework of policy capabilities proposed – help reduce the reasons provided in Section 6.3.3 (Chapter 6) as to why policy capabilities have not adequately developed and evolved at FMST. Furthermore, formalisation could make it easier to identify current (and potential) roles that specific policy capabilities might play in policymaking; thereby helping to ensure that capability development strategies better suit organisational policy practices present in policy institutions). Finally, formalisation can help to mitigate the risks of policy hijack by powerful policy actors, individuals or interest groups. Figure 5.2 (Policy Formulation Stages), Table 6.2.1 (Taxonomy of Policy Capabilities) and Figure 6.2 (Framework of Capabilities) are therefore useful in these respects.

- iv. Targeted Development of Policy Formulation Capabilities: In line with the taxonomy, framework and policy stages advanced, the thesis findings help to demonstrate that capabilities development can be targeted at individual or a group of capabilities involved in policy formulation exercises. The implication is that the 21 policy processes (alongside their routines and required skills sets) can be developed individually, in groups (as presented in the taxonomy) or in conjunction with selected policy processes. Furthermore, by differentiating between core and non-core capabilities, managers' in-charge of capabilities may choose to prioritise, for instance, the development of core capabilities. This is important and particularly useful as it aids decision-making in situations where resources (e.g. funds, time, personnel, and political will) may be limited, thus rendering the development of the full range of policy capabilities impractical or prohibitive.
- v. Track the Evolution of Policy Capabilities: Establish mechanisms to track which policy capabilities evolved and those that are not evolving; the rate of evolution and the reasons why capabilities evolve or not. This can help both management and staff in identifying highly embedded negative routines (lock-in effects) that influence and shape key parts of organisational culture thereby hampering innovation, roles, development and evolution of policy capabilities. Effective knowledge of policy capabilities (and the management thereof) is essential to addressing core rigidities thereby ensuring that they do not inhibit innovation (in policymaking, in this particular context).

While the points above further highlight the contributions of this thesis in how policy capabilities are implemented at FMST, they also contribute to explaining the reasons behind failures observed in FMST's S&T policymaking. Next I discuss the limitations.

7.3 Limitations of the Research

In Chapter 6, I ruled out the possibility of alternative (i.e. rival) explanations. I argued that the mode of implementation and deficiencies in policy capabilities observed at FMST are valid explanations for S&T policy formulation failures recorded. I also used the findings to explain why capabilities for policy formulation have played lesser roles in policy formulation, and have not developed nor evolved significantly over the years at FMST. This I argued is in spite of the consensus amongst interview respondents that capabilities play important roles in policy formulation. However, the findings of this research, the conclusions and implications advanced in preceding sections should be considered in light of the limitations discussed below.

Single Case Study: One of the criticisms of single case study method relates to the small sample size, reliability (Yin, 2009, 2012), which in the case of this research, refers to interview data captured at one institution, in one country. In order to guard against bias and improve the reliability and validity of the research, I collected additional data from stakeholder organisations. Finally, where applicable, I validated the responses with secondary sources (details provided in Chapter 4, Methods). Although the breadth of the data collection provided solid evidence needed to answer the research questions and draw valid conclusions, I recognise that the depth of the data collected was limited as it is difficult to collect such data from interviews. Furthermore, the research could have benefited from multiple case studies involving higher number of participants drawn from more organisations or a longitudinal study that tracks the roles, development and evolution of policy capabilities in consecutive policy formulation over a number of years.

Selective Use of Data on Routines and Skills: The focus on policy processes and routines, selective use of data on routine tasks (due to the large number of possible entries) and less attention to skills meant that I carried out limited data gathering and analysis on skills. More attention to skills data gathering could have contributed to the depth of data collected and further enriched the new insights on processes and routines, policy formulation and policymaking.

Research Design and Data Collection Methodology: Some other research design, such as active research or data collection by direct observation in conjunction with interviews, involving data collection at multiple points or over the entire policy formulation exercise may have been appropriate for the research questions posed in this thesis. However, given the limited time for the completion of a PhD thesis and financial implications, these options were not feasible. In addition, not being physically present during the policy formulation exercise and so having to depend on interview data from participants has its setbacks. I cannot rule out the possibility that interviewees may have missed out information due to bias, poor reflexivity or weak memory. There is also the possibility that useful information about some policy capabilities may have been intentionally suppressed or exaggerated.

Generalisations: Although results may be transferable, case studies provide little basis for generalisable conclusions, especially from a single case (Yin, 2009, 2012). Consequently, this research aims to provide contingent generalisations, that is, to suggest that the findings may be transferable to other Ministries in Nigeria, or DCs contexts, especially in Africa, that are generally similar to Nigeria – for example based on the Ministry of Science and Technology structure and where the ministry handles science, technology or innovation policymaking.

Politics and Power: I do not rule out the possibility that my inability to effectively explore the influence of politics and power dynamics in the policy processes, especially in some key stages of the policy formulation, may have had some implications on the outcomes. In line with the aim of the thesis and research questions, I have focused on the roles, development and evolution of policy capabilities at FMST. The implication is that I paid less attention to the political manoeuvrings and tensions between the interests of powerful policy actors in Nigeria's policymaking ecosystem and STI governance structure. This may have resulted in a narrow and partial view of the situation on ground and around the political processes involved. I acknowledge that this is a major issue, which deserves rather more attention than it may have received in this thesis thereby necessitating further research.

In the section below, I briefly discuss other areas of future research.

7.4 Directions for future research

Further research could:

- i. Re-examine the suggested typology and taxonomy of capabilities and investigate their applicability in other ministries in Nigeria. It may also be useful to compare the taxonomy of policy capabilities with those obtainable in other African, DCs or developed (e.g. EU, G7 or OECD) countries – thereby helping to improve the robustness and applicability of the framework.
- ii. Examine the differences observed in responses between FMST and Non-FMST (stakeholders) interviewees in greater depth and identify further lessons that could be learnt. The new insights could further contribute towards deepening our knowledge of capabilities, stakeholder engagement and policymaking at FMST and DCs contexts.
- iii. Study the routines and skills involved in each policy process in more depth, starting with the core capabilities, with a view to refining or extending the suggested list of capabilities. I do not claim the typology and taxonomy suggested to be a global, complete and final set of policy capabilities, but rather those relevant to FMST based on the findings. Therefore, I acknowledge that further research in this area will help in advancing the requisite knowledge. For example, in studying Stakeholder Engagement examine (a) the dynamics between each stakeholder group and their willingness (or not) to cooperate and co-create and how this affects policymaking; (b) how each stakeholder utilises (or not) the invited policy space; (c) how consensus decisions are arrived at; (d) the influence of politics and power on policy capabilities and impact on the resultant policy. Knowledge gleaned may contribute towards refining the suggested typology, taxonomy and framework with possibility of extending the applicability of the framework to other government ministries. It may also be necessary to conduct such studies in a variety of institutional settings and capture data from other sectors, ministries and agencies.
- iv. Investigate the interactions among policy processes (and routines) since this thesis examined organisational capabilities largely as independent constructs. This will be useful in order to better understand how policy capabilities influence one another in terms of rate, direction, and intensity during policy formulation. It can be assumed that a policy process influences another or several processes, routines

and skills. Insights may help in assessing the relative strengths and influence of policy process on others and on the policy formulation as a whole. This could have important bearing on the roles, development, evolution and management of policy capabilities.

- v. Seek to explore policy skills in greater depth – because this thesis focused on policy processes and routines thereby addressing skills selectively. Knowledge gained may be used to extend the thesis findings.

Chapter Summary

In this thesis I have argued and shown why and how a deeper grasp of the roles that capabilities play in policy formulation (including in the broader context of policymaking) is important. I have also provided insights on how the development and evolution of policy capabilities in policy institutions contribute to a finer understanding of the policymaking process. The findings will arguably be of close relevance and interest, in particular, to developing countries.

The significance of the thesis findings for policymaking, beyond showing that policy processes and routines are informal, lies in the way these processes and routines are implemented at FMST. The findings reveal that the development of a core policy process (e.g. Agenda Setting), results in less interest for the development of “non-core” policy processes (e.g. Setting Policy Priorities) which are related to Agenda Setting. Consequently, non-core policy processes and routines are less likely to be developed, play lesser roles in policymaking as a result of lesser utilisation and are, therefore, less likely to evolve. I have also explained how the interview data reveal that in the majority of the cases the same factor was responsible for the lack of development and evolution of policy capabilities at FMST. It is therefore the ways that processes and routines are implemented that in large part, explain why the formulation of STI policies at FMST has encountered a succession of failures. These have implications on the roles, development and evolution of policy capabilities and future policymaking practices at FMST.

Using empirical interview data gathered at FMST, I have demonstrated that policy formulation must be understood as a non-linear, analytical, iterative and problem solving exercise. Policy is the result of a complex interplay of processes, routines, skills, perceptions, narratives and discourses, involving various stakeholders and actor networks

with sometimes conflicting interests and influence, promoting or resisting aspects of the policymaking. Policymaking therefore demands incumbent capabilities. Deeper understanding of the capabilities involved has the potential of improving policy formulation, enhancing policy learning and policy change, enabling innovation in policymaking, and consequently fostering socio-economic development.

This thesis of the roles that capabilities play in formulating STI policies in Nigeria, yields insights on how best FMST and similar agencies in DCs can be better supported in improving the quality of their public policies and strengthening their policymaking processes. This will aid efforts in building capabilities for policymaking, or improving policy practices and processes, skills appraisals, and performance management.

Although this research investigates capabilities at FMST, the findings could also contribute towards capability and policy studies in other government ministries in Nigeria. I have, in this thesis, examined the concrete policy formulation realities and lessons from Nigeria. However, it may be possible to make contingent generalisations to government policymaking institutions in other DCs, especially in Africa, with similar characteristics to Nigeria.

And finally...

“Policy is not made once and for all; it is made and re-made endlessly. Policymaking is a process of successive approximation to some desired objectives in which what is desired itself continues to change under reconsideration” (Lindblom, 1959, p. 86).

In the face of such constant change and dynamic environments typical of policymaking, with particularly difficult conditions in DCs, these findings explain why a distinctive policy formulation framework based predominantly on formal policy processes and routines would be more suited for FMST, Nigeria and similar DCs institutions. Formalised processes and routines, policy stages with clearly defined actors and roles, methodologies and frameworks could also help to avoid the possibility of “hijacking” the policy exercise or specific policy formulation stage(s), processes and routines by more powerful policy actors. Furthermore, formalisation of policy processes and routines in FMST, and DCs in general, will reduce policy formulation failures, increase the prospects of more effective policymaking and enhance innovation in policymaking.

References

- Abramovitz, M., 1986. Catching Up, Forging Ahead, and Falling Behind. *Journal of Economic History*, 46, 385-406.
- Abramovitz, M., 1989. *Thinking About Growth and Other Essays on Economic Growth*. New York: Cambridge University Press.
- Adebowale, B.O. A., 2012. Innovation policies, institutions and performance: why Malaysia overtook Nigeria in the oil palm industry. *Int. J. of Technological Learning, Innovation and Development*, Vol. 5, Nos. 1/2.
- Adubifa, A. O., 1988. *Technology Policy Failures in Nigeria*. IDRC (International Development Research Centre), Manuscript Report 186e
- Aju, A., 1994. *Industrialisation and Technology Innovation in an African Economy*. Lagos: Regional Centre for Technology Management
- Albuquerque, E., Suzigan, W., Kruss, G. and Lee, K., (eds.) 2015. *Developing National Systems of Innovation: University–Industry Interactions in the Global South* Cheltenham, UK: Edward Elgar Publishing Limited.
- Andreoni, A., 2011. Productive Capabilities Indicators for Industrial Policy Design. UNIDO (United Nations Industrial Development Organisation) Development, Policy, Statistics and Research Branch, Working Paper 17/2011
- AOSTI (African Observatory of Science, Technology and Innovation), 2013. Science, Technology and Innovation Policy-making in Africa: An Assessment of Capacity Needs and Priorities, AOSTI Working Papers No. 2
- Archibugi, D. and Coco, A., 2004. A New Indicator of Technological Capabilities for Developed and Developing Countries (ArCo). *World Development*, 32, 4, 629-654.
- Archibugi, D. and Lundvall, B. (eds.), 2001. *The Globalizing Learning Economy*. Oxford: Oxford University Press.
- Arocena, R. and Sutz, J. 2010. Research and Innovation Policies for Social Inclusion: Is there an emerging pattern? Paper submitted to the Globelics Conference 2010. Available at: http://umconference.um.edu.my/upload/43-1/papers/261%20RodrigoArocena_JudithSutz.pdf (Accessed: 18 October 2014)
- ATPS (African Technology Policy Studies Network), 2011. Building Africa's Science, Technology and Innovation (STI) Capacity Today for Sustainable African Development Tomorrow. Nairobi: ATPS.
- Aubert, J., 2004. *Promoting Innovation in Developing Countries: A Conceptual Framework*. Washington, DC: World Bank Institute.

- Ayoola, G. B. and Ayoola, J. B., 2011. Emerging Issues for the Formulation of Policy on Agri-Input Delivery System in Nigeria. In: Behnassi, M., Sidney, D. and Sanni, Y. (eds.), *Global Food Insecurity: Rethinking Agricultural 357 and Rural Development Paradigm and Policy*. The Netherlands: Springer
- Bamiro, O. A., Mikailu, A.S., Obiaga, T. and Nyagba, S., 2008. *Review of Nigeria's Science, Technology and Innovation System, Consolidated Draft Report*, 2008 Nigeria-UNESCO Project.
- Bapuji, H., Hora, M. and Saeed, A. M., 2012. Intentions, Intermediaries, and Interaction: Examining the Emergence of Routines. *Journal of Management Studies*, 49, 8, 1586–607.
- Baum, J.A.C. and Singh, J. V. (eds.), 1994. *Evolutionary Dynamics of Organisations*. Oxford: Oxford University Press.
- Bazeley, P., 2007. *Qualitative Data Analysis with NVivo*. London: Sage Publications
- Becker, M. C. and T. Knudsen, 2005. The Role of Routines in Reducing Pervasive Uncertainty. *Journal of Business Research*, 58, 746–757.
- Becker, M. C., 2004. Organizational Routines: a Review of the Literature. *Industrial and Corporate Change*, 13, 4, 643–677
- Becker, M. C., 2005a. A framework for applying organizational routines in empirical research: linking antecedents, characteristics and performance outcomes of recurrent interaction patterns. *Industrial and Corporate Change*, 14, 5, 817–846
- Becker, M. C., 2005b. Organizational Routines: Some Clarifications. *Cambridge Journal of Economics*, 29, 249–262.
- Becker, M. C., Lazaric, N., Nelson, R. R. and Winter, S. G., 2005. Applying organizational routines in understanding organizational change. *Industrial and Corporate Change*, 14, 5, 775–791
- Bell, M. 2013. Inclusive Growth, Innovation and Technology: Interdisciplinary Perspectives. SPRU DIG-IT Workshop Presentation, Thursday 2 May, “Innovation, Participation and Inclusive Growth: Reflections on Latin American and African Experience”, SPRU, University of Sussex UK. Available at: <https://www.sussex.ac.uk/webteam/gateway/file.php?name=bell-dig-it.pdf&site=25> (Accessed: 18 August 2014)
- Bell, M. and Pavitt, K., 1993a. Technological Accumulation and Industrial Growth: Contrasts between Developed and Developing Countries. *Industrial and Corporate Change*, 2, 2, 157-210
- Bell, M. and Pavitt, K., 1993b. Accumulating Technological Capability in Developing Countries. Washington DC: World Bank.
- Bell, M. and Pavitt, K., 1995. *The Development of Technological Capabilities*. Washington DC: World Bank

- Bell, M., 2006. Time and technological learning in industrializing countries: how long does it take? How fast is it moving (if at all)?. *International Journal of Technology Management*, 36, 1/2/3, 25-39.
- Bell, M., 2007. Technological learning and the development of production and innovative capacities in the industry and infrastructure sectors of the least developed countries: what roles for ODA UNCTAD. The Least Developed Countries Report 2007, Background Paper No. 10.
- Bell, M., 2009a. *Innovation Capabilities and Directions of Development*, STEPS Working Paper 33, Brighton: STEPS Centre
- Bell, M., 2009b. *Innovation Statistics and Innovation System Models: Policy Tools and Policy-making in Developing Countries*, STEPS Working Paper 34, Brighton: STEPS Centre
- Bennett, C. J. and Howlett, M., 1992. The lessons of learning: reconciling theories of policy learning and policy change. *Policy Sciences*, 25, 3, 275–294.
- Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S. and Rickneiv, A., 2005. Analysing the Functionality and Dynamics Technological Innovation Systems – a Scheme of Analysis. *Research Policy*, 37, 407-429
- Bessant, J., Caffyn, S. and Gallagher, M., 2001. An evolutionary model of continuous improvement behavior. *Technovation*, 21, 67–77.
- Betsch, T., Haberstroh, S., Glöckner, A., Haar T. and Fiedler, K., 2001. The effects of routine strength on adaptation and information search in recurrent decision making. *Organisational Behaviour and Human Decision Processes*, 84, 23–53.
- Biegelbauer, P. and Borrás, S. (eds) 2003. *Innovation Policies in Europe and the US: the New Agenda*. Aldershot: Ashgate.
- Borrás, S. and Edquist, C. 2013. *The Choice of Innovation Policy Instruments*. WP 2013/04. CIRCLE, Lund University, Sweden
- Borrás, S., 2011. Policy Learning and Organizational Capacities in Innovation Policies. *Science and Public Policy*, 38, 9, 725–734.
- Borrás. S., 2009. *The widening and deepening of innovation policy: what conditions provide for effective governance*. CIRCLE Working Paper 2009/2, Lund University.
- Bubou G. M., Ejim-Eze, E. E. and Okrigwe F. N., 2012. Promoting Technology and Innovation Management Expertise in Africa: The Case of NACETEM, Nigeria. *Journal of Emerging Trends in Economics and Management Sciences*, 3, 1, 15-24

- Bubou, G. M. and Ini, E.E., 2009. Technology Development Capacity Building: Critical Issues of Strategic Management of Research and Development (R&D) and Innovation in Nigeria. Paper presented at the First Science and Technology Exposition: Exposition of Local Raw Materials for Investment, organised by the Raw Materials Research and Development Council (RMRDC), at Yenagoa, Bayelsa State, 8th – 11th December. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1528767 (Accessed: 10 September 2014)
- Cacciatori, E., 2012. Resolving Conflict in Problem-Solving: Systems of Artefacts in the Development of New Routines. *Journal of Management Studies*, 49, 81585
- Carden, F., 2009. *Knowledge to Policy*. London: Sage
- Casey, E. S., 2009. *Remembering: A Phenomenological Study*. Indiana: Indiana University Press.
- Clark, N.G. and Mugabe, J., 2004. Initiatives for Strengthening Science and Technology Policy in the field of Environment and Development: the case of the African Centre for Technology Studies Capacity Development Programme. *International Journal of Technology Management and Sustainable Development*, 3, 2, 75-89
- Cohen, M. and P. Bacdayan, 1994. Organisational routines are stored as procedural memory: evidence from a laboratory study,' *Organisation Science*, 5, 554–568.
- Cohen, M. D., 1991. Individual Learning and Organisational Routine: Emerging Connections. *Organisation Science*, 2, 135–139
- Cohen, M. D., Burkhart, R., Dosi, G., Egidi, M., Marengo, L., Warglien, M. and Winter, S. G., 1996. Routines and other Recurring Action Patterns of Organisations: Contemporary Research Issues. *Industrial and Corporate Change*, 5, 653–698.
- Cohen, W.M. and Levinthal, D.A., 1990. Absorptive Capacity: a new Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35, 1.
- Collis, D. J., 1994. Research note: How valuable are organizational capabilities? *Strategic Management Journal*, 15 (s1), 143-152.
- Connerton, P., 1989. *How Societies Remember*. Cambridge: Cambridge University Press.
- COVIDSET, 2009. Revitalising Science, Engineering and Technology Research and Deployment for Sustainable Development in Africa. Action plan produced by participants at the 3rd Conference of Vice-Chancellors, Provosts and Deans of Science, Engineering and Technology. Kampala, Uganda, 23-25 November 2009. UNESCO 2010. Available at: http://ansticonference.unon.org/resourses/COVIDSET_2009%20Report.pdf (Accessed 8 April 2012)

- Cozzens S. E. and Sutz, J., 2012. Innovation in Informal Settings: A Research Agenda. Available at: <http://www.crdi.ca/EN/Lists/Publications/Attachments/1130/IID%20Framework%20July%2029.pdf> (Accessed: 13 December 2014)
- Cozzens, S. E. 2010. Innovation and Inequality. In: Kuhlmann, S., Shapira, P. and Smits, R. (eds.), *The Co-Evolution of Innovation Policy: Innovation Policy Dynamics, Systems, and Governance*. Cheltenham: Edward Elgar.
- Cozzens, S. E. and Kaplinsky, R., 2009. Innovation, poverty and inequality: cause, coincidence, or co-evolution? In: Lundvall, B., Joseph, K. J., Chaminade, C. and Vang, J (eds.), *Handbook of Innovation Systems and Developing Countries*. Cheltenham: Edward Elgar.
- Di Stefano, G., Peteraf, M. and Verona, G., 2010. Dynamic Capabilities Deconstructed: a Bibliographic Investigation into the Origins, Development, and Future Directions of the Research Domain. *Industrial and Corporate Change*, 19, 1187–204.
- Dolowitz, D. P. 2009. Learning-by-Observing. Information Use in the Policy Transfer Process. In: Borrás, S., 2011, Policy Learning and Organizational Capacities in Innovation Policies. *Science and Public Policy*, 38, 9, 725–734.
- Donahue, A. K., Selden, S.C. and Ingraham, P.W., 2000. Measuring Government Management Capacity: a Comparative Analysis of City Human Resources Management Systems. *Journal of Public Administration Research and Theory*, 10, 2, 381–412.
- Dosi, G., Faillo, M. and Marengo, L., 2008. Organizational Capabilities, Patterns of Knowledge Accumulation and Governance Structures in Business Firms: An Introduction. *Organization Studies*, 29, 8-9, 1165-1185
- Dosi, G., Nelson, R. and Winter, S. (eds), 2000. *The Nature and Dynamics of Organizational Capabilities*. Oxford: University Press
- ECN (Energy Commission of Nigeria), 2003. *National Energy Policy, Federal Republic of Nigeria*. Abuja: Energy Commission of Nigeria, The Presidency
- Edquist, C., 2004. Systems of innovation: Perspectives and challenges. In: Fagerberg, J., Mowery, D. C. and Nelson, R.R. (eds.), *The Oxford Handbook of Innovation*. Oxford University Press, Oxford.
- Edquist, C., 2011. Design of innovation policy through diagnostic analysis: identification of systemic problems (or failures). *Industrial and Corporate Change*, 20, 6, 1725–1753
- Eisenhardt, K. M. and Martin, J. A., 2000. Dynamic Capabilities: What Are They? *Strategic Management Journal*, 21, 1105-1121.

- Ely, A., Van Zwanenberg, P. and Stirling, A., 2014. Broadening out and opening up technology assessment: Approaches to enhance international development, co-ordination and democratization. *Research Policy* 43, 505– 518
- Ewa, I. O. B, 2013. Transforming science and technology in Nigeria via the triple helix model of innovation, mid-term report, (2011-2013) of the Honourable Minister of Science and Technology, Federal Ministry of Science and Technology. Available at: <http://fmi.gov.ng/wp-content/uploads/2013/06/Ministry-of-Science-and-Tech.pdf> Accessed: 3 June 2014.
- Fagerberg, J. and Verspagen, B., 2009. Innovation studies – The emerging structure of a new scientific field. *Research Policy*, 38, 218–233
- Fagerberg, J., Landström, H. and Martin, B. R., 2012. Exploring the emerging knowledge base of ‘the knowledge society’. *Research Policy*, 41, 1121– 1131
- Feldman, M. S. and Pentland, B. T., 2003. Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly*, 48, 94–118.
- Feldman, M. S. and Rafaeli, A., 2002. Organisational routines as sources of connections and understandings. *Journal of Management Studies*, 39, 309–331.
- Feldman, M. S., 2000. Organisational routines as a source of continuous change. *Organisation Science*, 11, 611–629.
- Feldman, M. S., 2003. A performative perspective on stability and change in organizational routines. *Industrial and Corporate Change*, 12, 727–752.
- Felin, T. and Foss, N., 2009. Organizational routines and capabilities: historical drift and a course-correction toward microfoundations. *Scandinavian Journal of Management*, 25, 157–67.
- Felin, T. and Foss, N., 2011. The endogenous origins of experience, routines, and organizational capabilities: the poverty of stimulus. *Journal of Institutional Economics*, 7, 231–56.
- Felin, T. and Hesterly, W. S., 2007. The knowledge-based view, nested heterogeneity, and new value creation: philosophical considerations on the locus of knowledge. *Academy of Management Review*, 32, 195–218.
- Felin, T., Foss, N. J., Heimeriks, K. H. and Madsen, T. L., 2012. Microfoundations of Routines and Capabilities: Individuals, Processes, and Structure. *Journal of Management Studies*, 49, 8, 1351-1374 joms_1052 1351..1374
- FGN (Federal Government of Nigeria), 2008. The Nigerian Information and Communication Technology for Development (ICT4D) Plan (2008-2011): ICT\$D in the Economic Sectors of Nigeria, Towards the Realization of Vision 20-2020.
- Flanagan, K., Uyerra, E. and Laranja, M., 201. Reconceptualising the ‘policy mix’ for innovation. *Research Policy*, 40, 702–713

- Flyvbjerg, B., 2006. Five Misunderstandings About Case-Study Research. *Qualitative Inquiry*, 12, 2, 219-245
- Flyvbjerg, B., Case Study, 2011. In: Denzin N. K. and Lincoln Y. S., eds., *The Sage Handbook of Qualitative Research* (4th ed.), Thousand Oaks, CA: Sage, pp. 301-316.
- FMST (Federal Ministry of Science and Technology), 1986. National Science and Technology Policy. FMST, Abuja
- FMST (Federal Ministry of Science and Technology), 2003. National Science and Technology Policy. FMST, Abuja
- FMST (Federal Ministry of Science and Technology), 2005. *Technology Incubation Programme in Nigeria: Policy, Function and Operational Guidelines*. FMST, Abuja.
- FMST (Federal Ministry of Science and Technology), 2006a. *Activities of the Federal Ministry of Science and Technology presented to Mr. President by Honourable Minister of Science and Technology, Abuja*. FMST, Abuja.
- FMST (Federal Ministry of Science and Technology), 2006b. *National Science Foundation (NSF): Blueprint*. FMST, Abuja.
- FMST (Federal Ministry of Science and Technology), 2007a. Report of the Ministerial Retreat, 2nd – 3rd November 2007, Effurun, Delta State. Siddwell Productions, Nigeria
- FMST (Federal Ministry of Science and Technology), 2007b. Communiqué of the 10th National Council on Science and Technology, Minna, Nigeria State. FMST, Abuja.
- FMST (Federal Ministry of Science and Technology), 2008. Some Acquired Technologies and Innovations Through R&D and Capacity Building Activities of the Federal Ministry of Science and Technology. FMST, Abuja.
- FMST (Federal Ministry of Science and Technology), 2009. Report and Communiqué of the 11th National Council on Science and Technology (NCST). FMST, Abuja.
- FMST (Federal Ministry of Science and Technology), 2011. Nigeria's Science, Technology and Innovation Policy, 2011 Draft. Abuja: FMST. Available at: <http://workspace.unpan.org/sites/internet/Documents/UNPAN048879.pdf> (Accessed: 24 November 2014)
- FMST (Federal Ministry of Science and Technology), 2012a. *National Science, Technology and Innovation Policy, 2012 Edition*. Abuja: FMST
- FMST (Federal Ministry of Science and Technology), 2012b. FMST Annual Report. Abuja: FMST
- FMST (Federal Ministry of Science and Technology), no date. *Presidential Standing Committee on Inventions and Innovations (PSCII)*. FMST, Abuja.

- Freeman, C. and Louca, F., 2002. *As Time Goes By: From the Industrial Revolutions to the Information Revolution*. Oxford: Oxford University Press
- Freeman, C. and Soete, L. 1994. *Work for All or Mass Unemployment? Computerised Technical Change into the Twenty-first Century*. London: Pinter
- Freeman, C., 1982. *The Economics of Industrial Innovation*. 2nd ed. London: Pinter
- Freeman, C., 1987. *Technology Policy and Economic Performance: lessons from Japan*. London: Pinter.
- Freeman, C., 1991. Technology, Progress and the Quality of Life. *Science and Public Policy*, 18, 6, 407-418.
- Godin, B., 2009. The Making of Science, Technology and Innovation Policy: Conceptual Frameworks as Narratives, 1945-2005. Available at: <http://www.csiic.ca/PDF/TheMakingOfScience.pdf> (Accessed: 5 October 2014)
- Gupta, A. K., 2012. Innovations for the poor by the poor. *Int. J. Technological Learning, Innovation and Development*, 5, 1/2, 2012, 28–39
- Halbwachs, M. and Coser, L. A., 1992. *On Collective Memory*. Chicago: University of Chicago Press.
- Hallsworth, M., Parker, S. and Rutter, J., 2011. *Making Policy in the Real World*. London: Institute for Government
- Helfat C., Finkelstein S., Mitchell W., Peteraf M.A., Singh H., Teece D., and Winter S., 2007. *Dynamic Capabilities: Understanding Strategic Change in Organizations*. New York: Blackwell Publishing
- Helfat, C. and Peteraf, M., A., 2009. Understanding dynamic capabilities: progress along a developmental path. *Strategic Organisations*, 7, 1, 91-102
- Hill, M., 2009. *The Public Policy Process* (5th ed). Abingdon: Routledge.
- Hodgson, G.M. and Knudsen, T., 2004. The firm as an interactor: firms as vehicles for habits and routines. *Journal of Evolutionary Economics*, 14, 281
- Hoppe, R., 2010. *The Governance of Problems: Puzzling, Powering and Participation*. Bristol: The Policy Press.
- Hou, Y., Moynihan, D. P. and Ingraham, P. W., 2003. Capacity, management, and performance: exploring the links. *American Review of Public Administration*, 33, 3, 295–315
- Howlett, M., 2009. Policy analytical capacity and evidence-based policy-making: lessons from Canada. *Canadian Public Administration*, 52, 2, 153–175.
- Howlett, M., 2011. *Designing Public Policies: Principles and Instruments*. Abingdon: Routledge.

- Huff, A., 2009. *Designing Research for Publication*. London: Sage
- Intarakumnerd, P., Chairatana, P. and Tangchitpiboon, T., 2002. National innovation system in less successful developing countries: the case of Thailand. *Research Policy*, 31, 1445–1457
- Isoun, T.T., 2002. *A Science Agenda From An African Perspective*. ATPS (African Technology Policy Studies Network) Special Paper Series No. 14. Nairobi: ATPS
- Isoun, T.T., 2005. Advising Governments on Scientific Issues of Critical Importance: a Front Item on the Agenda. Paper Presented at the World Conference on Science (WCS) Follow-up Symposium: Harnessing Science for Society, March 2-5.
- Jasanoff, S. 1987. Contested Boundaries in Policy-Relevant Science. *Social Studies of Science*, 17, 2, 195-230
- Jasanoff, S., 1989. Norms for Evaluating Regulatory Science. *Risk Analysis*, 9, 3, 271-273.
- Jasanoff, S., 1990. *The Fifth Branch: Science Advisers as Policymakers*. Cambridge: Harvard University Press.
- Jasanoff, S., Markle, G., Petersen, J.C. and Pinch, T. (eds), 1995. *Handbook of Science and Technology Studies*. London: Sage.
- Juma, C. and Clark, N., 1995. Policy research in sub-Saharan Africa: an exploration. *Public Administration and Development*, 15, 121-137.
- Juma, C. and Konde, V., 2002. Industrial Applications for Biotechnology: Opportunities for Developing Countries. *Environment: Science and Policy for Sustainable Development*, 44, 6
- Kingdon, J. W., 1995 (2nd ed.). *Agendas, Alternatives and Public Policies*. New York: HarperCollins.
- Kingdon, J. W., 2014 (2nd ed., updated, Pearson New International Edition). *Agendas, Alternatives and Public Policies*. Harrow: Pearson Education Limited.
- Kogut, B. and Zander, U., 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. *Organisation Science*, 3, 383–397.
- Kraemer-Mbula, E. and W. Wamae (eds), 2010. *Innovation and the Development Agenda*. Ottawa: OECD/IDRC.
- Kuhlmann, S., 2001. Future governance of innovation policy in Europe — three scenarios. *Research Policy*, 30, 953–976
- Kuhlmann, S., 2003. Evaluation as a source of ‘strategic intelligence’, In: Shapira, P. and Kuhlmann, S. (eds) *Learning from Science and Technology Policy Evaluation: Experiences from the United States and Europe*. Cheltenham: Edward Elgar.

- Ladipo, M.K., 2011. Welcome Address Presented by Dr. M. K. Ladipo, Rector, Yaba College of Technology, Yaba, to the Council of Heads of Polytechnics and Colleges of Technology in Nigeria during its meeting held at Yaba College of Technology, Yaba on 20 September
- Lall, S., 1987. *Learning to Industrialise: The Acquisition of Technological Capability by Developing Economies*. London: MacMillan
- Lall, S., 1992. Technological capabilities and industrialization. *World Development* 20, 2, 165-186
- Lebeau, Y., Onyeonuru, I. and Uka, F. K., 2000. Science in Africa at the dawn of the 21st century, European Commission, DG XII, Country Report: NIGERIA. [Online]. Available at: http://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers07-09/010033552.pdf (Accessed: 3 March 2014)
- Leonard, D., 1992. Core capabilities and core rigidities: A paradox in managing new product development. *Strategic management journal*, 13, 2, 111-125.
- Leonard-Barton, D., 1998. *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*. Harvard: Harvard Business Press.
- Lindblom, C. E., 1959. The Science of "Muddling Through". *Public Administration Review*, 19, 2, 79-88
- Lindblom, C. E., 1979. Still Muddling, Not Yet Through. *Public Administration Review*, 39, 6, 517-526.
- Lorentzen, J. and Mohamed, R., 2009. *Where Are the Poor in Innovation Studies?* Paper presented at 7th Annual Globelics Conference, Dakar, Senegal, 6-9 October. Available at: https://smartech.gatech.edu/bitstream/handle/1853/36668/1238509827_TM.pdf?sequence=1 (Accessed: 21 November 2014)
- Lundvall, B. (ed.), 1992. *National Systems of Innovation. Towards a Theory of Innovation and Interactive Learning*. London: Pinter
- Lundvall, B. 2005. National Innovation Systems - Analytical Concept and Development Tool. Paper presented at the DRUID Tenth Anniversary Summer Conference 2005, Copenhagen, Denmark, June 27-29. Available at: <http://www.druid.dk/conferences/Summer2005/Papers/Lundvall.pdf> (Accessed: 15 July 2013)
- Lundvall, B. and Borrás, S., 2005. Science, Technology and Innovation Policy. In: Fagerberg, Jan, Mowery, David C. and Nelson, Richard R. (eds.). *Innovation Handbook*. Oxford: Oxford University Press.
- Lundvall, B., Joseph, K. J., Chaminade, C. and Vang, J. (eds.), 2009. *Handbook of Innovation Systems and Developing Countries*. Cheltenham: Edward Elgar.

- Majone, G., 2008. Agenda Setting. In: Moran, M., Rein, M. and Goodin, R. E. (eds). *The Oxford Handbook of Public Policy*. Oxford: Oxford University Press
- Martin, B. R., 2012a. The Evolution of Science Policy and Innovation Studies. *Research Policy*, 41, 1219–1239
- Martin, B. R., 2012b. Innovation Studies: Challenging the Boundaries. In: Lundvall Symposium on the Future of Innovation Studies, 16-17 February 2012, Aalborg University, accessed: May 20, 2015, <http://sro.sussex.ac.uk/38701/>
- Mbeza, H. F., 2008. Review of Malawi's Science and Technology Policy Malawi (2002). Available at: http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/sc_workshop_botswana_malawi_en.pdf (Accessed: 6 November 2014)
- Meyer-Krahmer, F., 1997. Science-based technological and interdisciplinarity: challenges for firms and policy, In: Edquist, C. (ed.), *Systems of Innovation, technologies, institutions and organizations*. London: Pinter
- Miller, K. D., Pentland, B. T. and Choi, S., 2012. Dynamics of performing and remembering organizational routines. *Journal of Management Studies*, 49, 1536–1558.
- MoCT (Ministry of Communication Technology), 2012. National Information and Communication Technology (ICT) Final Draft Policy, Federal Republic of Nigeria. www.nitda.gov.ng/downloads/NEW_ICT_POLICY.pdf (Accessed 11 September 2014)
- MoCT (Ministry of Communication Technology), no date. National Information Technology (IT) Policy, Federal Republic of Nigeria. www.nitda.gov.ng/downloads/NATIONAL_IT_POLICY.pdf (Accessed 10 January 2013)
- Morlacchi, P. and Martin, B.R., 2009. Emerging challenges for science, technology and innovation policy research: a reflexive overview. *Research Policy*, 38, 4, 571–582.
- Muchie, M., Gammeltoft, P. and Lundvall, B-A. (eds.), 2003. *Putting Africa First: The making of African Innovation Systems*. Aalborg: Aalborg University Press
- Mugabe, J., O., 2011. Science, Technology and Innovation in Africa's Regional Integration: From Rhetoric to Practice. *ACODE Policy Research Series*, No. 44, 2011. Kampala.
- Mulgan, G. and Albury, D., 2003. *Innovation in the public sector*. Available at: <http://www.childrencount.org/documents/Mulgan%20on%20Innovation.pdf> (Accessed: 11 May 2014)
- Mulgan, G., 2003. Government, knowledge and the business of policymaking, background paper at Facing the Future Conference, Canberra, 23-24, April 2003
- Mytelka, L. K., 1989. The Unfulfilled Promise of African Industrialization. *African Studies Review*, 32, 3, 77-137.

- NACETEM (National Centre for Technology Management), 2010a. *The Nigerian National Innovation System: Issues on the Interaction of the key Elements*. Monograph Series (Nos 1). Ile-Ife, Nigeria: NACETEM
- NACETEM (National Centre for Technology Management), 2010b. *Postgraduate Occupation of Nigerian Women in Science & Technology*. Monograph Series (Nos 2). Ile-Ife, Nigeria: NACETEM
- NACETEM (National Centre for Technology Management), 2010c. *Technological Entrepreneurial Attitude in Nigerian Tertiary Institutions*. Monograph Series (Nos 3). Ile-Ife, Nigeria: NACETEM
- NACETEM (National Centre for Technology Management), 2010d. *Assessment of Innovation Capability in the Manufacturing Sector in Nigeria System*. Monograph Series (Nos 4). Ile-Ife, Nigeria: NACETEM
- NACETEM (National Centre for Technology Management), 2011. *Assessment of research and development (R&D) productivity in Nigerian universities*. Policy Project Report. Ile-Ife, Nigeria: NACETEM
- NACETEM (National Centre for Technology Management), 2014. Capacity Building. Available at: <http://www.nacetem.gov.ng/activities/capacity-building.html> (Accessed: 20 September 2014)
- Nair-Bedouelle, S., 2009. The Science, Technology and Innovation Policy Review Process at UNESCO. Available at: <http://www.uis.unesco.org/StatisticalCapacityBuilding/Workshop%20Documents/ST%20Workshop%20dox/Mombasa%202009/UNESCO-%20STI%20policy.pdf> (Accessed: 25 July 2014)
- Nakamura, R. 1987. The Textbook Policy Process and Implementation Research. *Policy Studies Review* 7, 142–54.
- Nakamura, R. T. and Smallwood, F., 1980. The Politics of Policy Implementation. In: Juma, C. and Clark, N., 1995. Policy research in sub-Saharan Africa: an exploration. *Public Administration and Development*, 15, 121-137.
- NAO (National Audit Office), 2001. *Modern Policy-Making: Ensuring Policies Deliver Value for Money*. London: The Stationery Office
- NBTE (National Board for Technical Education), 2013. Approved Federal Polytechnics in Nigeria”, Obtained from: <http://www.nbte.gov.ng/institutions.html>. Accessed: 29 January 2013.
- NCST (National Council on Science and Technology), 2009. Report and Communique of the 11th National Council on Science and Technology. Abuja: FMST
- NCST (National Council on Science and Technology), 2013. Resolutions of the 12th Meeting of the National Council on Science and Technology (NCST), Held from 18th – 22nd March, 2013 at Premier Hotel, Mokola, Ibadan, Oyo State. Abuja: FMST

- Nelson, R. and Winter, S., 1982. *An Evolutionary Theory of Economic Change*. Cambridge: Belknap Press
- Nelson, R. R., 1993. *National Innovation Systems: a Comparative Analysis*. Oxford University Press, USA.
- Nelson, R. R., 2002. Technology, Institutions, and Innovation systems. *Research Policy*, 31, 265–272.
- Nelson, R. R., 2015. Preface to *Developing National Systems of Innovation: University–Industry Interactions in the Global South* by Albuquerque, E., Suzigan, W., Kruss G. and Lee K. (eds.). Cheltenham, UK: Edward Elgar Publishing Limited.
- Nelson, R.R., 1992. National Innovation Systems: a Retrospective on a Study. *Industrial and Corporate Change*, 2, 347-374.
- NEPAD (New Partnership for Africa's Development), 2006. *Africa's Science and Technology Consolidated Plan of Action*. Pretoria: NEPAD.
- NEPAD (New Partnership for Africa's Development), 2007. *Governing Science, Technology and Innovation in Africa, Building National and Regional Capacities to Develop and Implement Strategies and Policies*. Available at: www.nepadst.org/doclibrary/pdfs/gstia_june2007.pdf (Accessed: 15 May 2012)
- NEPAD (New Partnership for Africa's Development), 2010. *African Innovation Outlook I*. Pretoria: NEPAD
- NEPAD (New Partnership for Africa's Development), 2014. *African Innovation Outlook II*. Pretoria: NEPAD
- Niosi, J., 2010. *Building national and regional innovation systems: Institutions for economic development*. Cheltenham: Edward Elgar Publishing.
- NITDA (National Information Technology Development Agency), 2012. *National Software Policy*. NITDA, Abuja.
- Nonaka, I., 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, 5, 1, 14-37.
- North, D. C., 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
- Nowlin, M. C., 2011. Theories of the Policy Process: State of the Research and Emerging Trends. *The Policy Studies Journal*, 39, S1, 41-60
- NUC (National Universities Commission), 2013. List of Nigerian Universities and Years Founded, Obtained from: http://www.nuc.edu.ng/pages/universities.asp?ty=1&order=inst_name (Accessed: 13 February 2013)
- NV20-2020, 2009. *Nigeria's Vision 2020: Economic Transformation Blueprint*. Abuja: National Planning Commission

- O'Leary, Z., 2010. *The Essential Guide to Doing your Research Project*. London: Sage.
- OECD (Organisation for Economic Cooperation and Development), 2007. *The Role of Ministries in the Policy System: Policy Development, Monitoring and Evaluation*. SIGMA Papers, No. 39, OECD Publishing.
- OECD (Organisation for Economic Cooperation and Development), 2001. *Citizens as Partners: Information, Consultation and Public Participation in Policy-making*.
- OECD (Organisation for Economic Cooperation and Development), 2012. *Innovation for Development: A Discussion on the Issues and an Overview of Work of the OECD Directorate for Science, Technology & Industry*. Paris: OECD.
- OECD (Organisation for Economic Cooperation and Development), 2013. *Innovation and Inclusive Development*. Conference Discussion Report, Cape Town, South Africa, 21 November, 2012. February 2013 Revision. Paris: OECD.
- OECD (Organisation for Economic Cooperation and Development), 2014. *OECD Work on Science, technology and industry*. Paris: OECD.
- OECD/Eurostat, 2005. *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*, Paris: Organisation for Economic Co-operation and Development
- Okonjo-Iweala, N. (2012) Science and Technology – The Key TO Nigeria's Transformation, Speech by Dr. Ngozi Okonjo-Iweala, Coordinating Minister for the Economy and Honourable Minister of Finance. At the 2nd Prof. Bart Nnaji Biennial Lecture Series, Enugu State University of Science & Technology, Agbani, Enugu, July 7, 2012. Available at: https://docs.google.com/document/d/1OI_T9svkIwSxucF-le0-BcEsbY7kWw3XmKTpSY7E6Vo/edit?pli=1 (Accessed: 8 August 2014)
- Okonkwo, E. M. and Akpa, A. U. 2010. Science, Technology and Innovation Systems – Current Status in Nigeria. Available at: <http://slideplayer.com/slide/6320283/>
- Olaoye, O., 2010. Why Policies Fail in Nigeria: An Evaluation of Agriculture Policies Made from 1972-1985. *OIDA International Journal of Sustainable Development*, 1, 1, 84-86
- Oldham, C.H.G., 1981. *Priorities for science and technology policy research in Africa*. Report of a seminar held at the University of Ife, Ile-Ife, Nigeria, 3-6 December 1979. Ottawa: IDRC
- Oyelaran-Oyeyinka, B., 2006. Science, Technology and Innovation Capacity for Development and Competitiveness in Nigeria, paper submitted to National Planning Commission for NEEDS2, UNU-MERIT, The Netherlands.
- Oyelaran-Oyeyinka, O., 1998. Technological capability building in the South: lessons and opportunities for Sub-Saharan Africa. UN. ECA Meeting of the Advisory Board on Science and Technology (3rd: 2000, Oct. 2-4: Addis Ababa, Ethiopia)

- Oyewale, A. A., 2010. *The Nigeria National Innovation System: Issues on the Interactions of the Key Elements*”, Monograph Series (No 1), National Centre for Technology Management (NACETEM), Federal Ministry of Science and Technology, Obafemi Awolowo University, Ile-Ife.
- Oyewale, A. A., Adebowale B. A and Siyanbola W. O., 2013. STI Policy and the Dilemma of Implementation: Experience from a Developing Country. Ile-Ife, Nigeria - National Centre for Technology Management, Obafemi Awolowo University.
- Oyeyinka, B. O., 2012. Institutional capacity and policy for latecomer technology development. *Int. J. Technological Learning, Innovation and Development*, 5, 1-2
- Pablo, A.L., Reay, T., Dewald, J.R. and Casebeer, A.L., 2007. Identifying, Enabling and Managing Dynamic Capabilities in the Public Sector. *Journal of Management Studies*, 44, 5, 687-708.
- Pavitt, K., 1984. Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory. *Research Policy*, 13, 6, 343-373.
- Pavitt, K., 1998. Technologies, Products & Organisation in the Innovating Firm: what Adam Smith tells us and Joseph Schumpeter doesn't. *Industrial and Corporate Change*, 7, 3, 433-452.
- Pavitt, K., 2002. Innovating Routines in the Business Firm: What Corporate Tasks Should They be Accomplishing? *Industrial and Corporate Change*, 11, 1, 117-133.
- Pentland, B. T. and Feldman, M. S., 2003. Reconceptualizing Organizational Routines as a Source of Flexibility and Change. *Administrative Science Quarterly*, 48, 94-118
- Pentland, B. T. and Feldman, M. S., 2005. ‘Organizational routines as a unit of analysis,’ *Industrial and Corporate Change*, 14, 5, 793-815
- Pentland, B. T. and H. Rueter, 1994. Organisational routines as grammars of action. *Administrative Sciences Quarterly*, 39, 484-510.
- Pentland, B. T., 1995. Grammatical models of organizational processes. *Organizational Studies*, 6, 541-556.
- Pentland, B. T., 1995. Information systems and organizational learning: the social epistemology of organizational knowledge systems. *Accounting, Management and Information Technologies*, 5, 1, 1-21.
- Pentland, B. T., Feldman, M. S., Becker, M. C. and Liu, P., 2012. Dynamics of organizational routines: a generative model. *Journal of Management Studies*, 49, 1484-508.
- Pentland, B., 2011. The foundation is solid, if you know where to look: comment on Felin and Foss. *Journal of Institutional Economics*, 7, 279-93.

- Pianta, M., 1995. Technology and growth in OECD countries, 1970–1990. *Cambridge Journal of Economics*, 19, 1, 175–188.
- Radaelli, C. M., 1995. The Role of Knowledge in the Policy Process. *Journal of European Public Policy*, 2, 2, 159–183.
- Rafols, I., Leydesdorff, L., O'Hare, A., Nightingale, P., and Stirling, A., 2012. How journal rankings can suppress interdisciplinary research: A comparison between Innovation Studies and Business & Management, *Research Policy*, 41, 1262–1282
- Rath, A., Bazán, M., Kraemer-Mbula, E., Oldham, G., Prada, F., and Sagasti, F., 2010. Evaluation of UNESCO's Strategic Programme Objective 4: Fostering Policies and Capacity-Building in Science, Technology and Innovation. UNESCO.
- Rerup, C. and Feldman, M. S., 2011. Routines as a source of change in organizational schemata: the role of trial-and-error learning. *Academy of Management Journal*, 54, 577–610.
- Richardson, G. B., 1972. The Organisation of Industry. *Economic Journal*, 82, 883–96.
- Sabatier, P. A. (ed.) 2007. *Theories of the Policy Process*. New York: Perseus Books.
- Sabatier, P. and Jenkins-Smith, H. (eds.), 1993. Special Issue: Policy Chance and Learning: An Advocacy Coalition Approach. Westview press: Boulder, CO
- Sabatier, P., 1986. Top-Down and Bottom-Up of Policy Implementation: A Critical and Suggested Synthesis. *Journal of Public Policy*, 6, 21-48
- Sako, M., 2004. Supplier development at Honda, Nissan and Toyota: comparative case studies of organizational capability enhancement. *Industrial and Corporate Change*. 13, 2, 281-308
- Salvato, C. and Rerup, C., 2011. Beyond collective entities: multilevel research on organisational routines and capabilities. *Journal of Management*, 37, 468.
- Salvato, C., 2009. Capabilities unveiled: the role of ordinary activities in the evolution of product development processes. *Organization Science*, 20, 384–409.
- Sanni, S.A., M.O. Ilori, A.O. Opaleye and A.A. Oyewale, 2001. Nigeria's Technology Policy: is it Adequate in the Globalizing World? *Technovation*, 21, 237-243.
- Schout, A., 2009. Organizational learning in the EU's multi-level governance system. *Journal of European Public Policy*, 16, 8, 1124–1144.
- Scoones, I., 2002. Science, Policy and Regulation: Challenges for Agricultural Biotechnology in Developing Countries. IDS (Institute of Development Studies) Working paper 147
- Scoones, I., 2010. *Avian Influenza: Science, Policy and Politics*. London: Earthscan

- Scoones, I., Leach, M., Smith, A., Stagl, S., Stirling, A. and Thompson, J., 2007. *Dynamic Systems and the Challenge of Sustainability*. STEPS Working Paper 1. STEPS Centre, Brighton.
- Shapira P. and Kuhlmann S. (eds), 2003. *Learning from Science and Technology Policy Evaluation: Experiences from the United States and Europe*. Cheltenham: Edward Elgar.
- Silverman, D. 2008. *Interpreting Qualitative Data – Methods for Analysing Talk, Text and Interaction*. 3rd ed. London: Sage Publications
- Siyanbola, W. O, 2010. Development of Science, Technology and Innovation Indicators Nigeria's Progress Report. A Report Presented at the Regional Workshop on Capacity Building STI Policy Reviews and S&T Statistics and Indicators for West Africa Bamako, Mali, 10 –14 May
- Siyanbola, W. O, 2011b. Presentation on: Research Capacity Strengthening: Learning from Experience. Delivered at: Wellcome Trust, London, 19-20 September.
- Siyanbola, W. O., 2011a. State of Nigeria's Science, Technology and Innovation Policy. Paper presented at: UNESCO Supported Capacity Building Workshop on Science, Technology and Innovation (STI) Policy, 23rd November.
- Siyanbola, W. O., 2011c. STI Governance in Nigeria: the Role of Parliament. A paper presented at the launching of African Inter-Parliamentary Forum on Science, Technology and Innovation (AIP-STI) on 2nd of May, at Addis-Ababa, Ethiopia
- Siyanbola, W.O., Olaopa, O.R. and Hassan, O.M., 2013. Designing and Implementing a Science, Technology and Innovation Policy in a Developing Country: Recent Experience from Nigeria. *Industry and Higher Education*, 27, 4, 1–9
- Smits, R. and Kuhlman, S., 2004. The rise of systemic instruments in innovation policy. *International Journal of Foresight and Innovation Policy*, 1, 2–3, 4–32.
- Soares, M. C. C. and Cassiolato, J. E. 2013. Innovation Systems and Inclusive Development: Some evidence based on empirical work. Available at: <http://www.cdi.manchester.ac.uk/newsandevents/documents/SoaresCassiolatoPreWorkshopPaper.pdf> (Accessed: 13 July 2014)
- Stake, R., 1995. The art of case study research. Thousand Oaks, CA: Sage
- Steedman, D. W., 1990. The internalization of the policymaking process. In: Juma, C. and Clark, N., 1995. Policy research in sub-Saharan Africa: an exploration. *Public Administration and Development*, 15, 121-137.
- STEPS Centre, 2010. *Innovation, Sustainability, Development: A New Manifesto*. STEPS Centre, Brighton.
- Stiglitz, J., 2012. *The Price of Inequality*. London: Penguin Books.

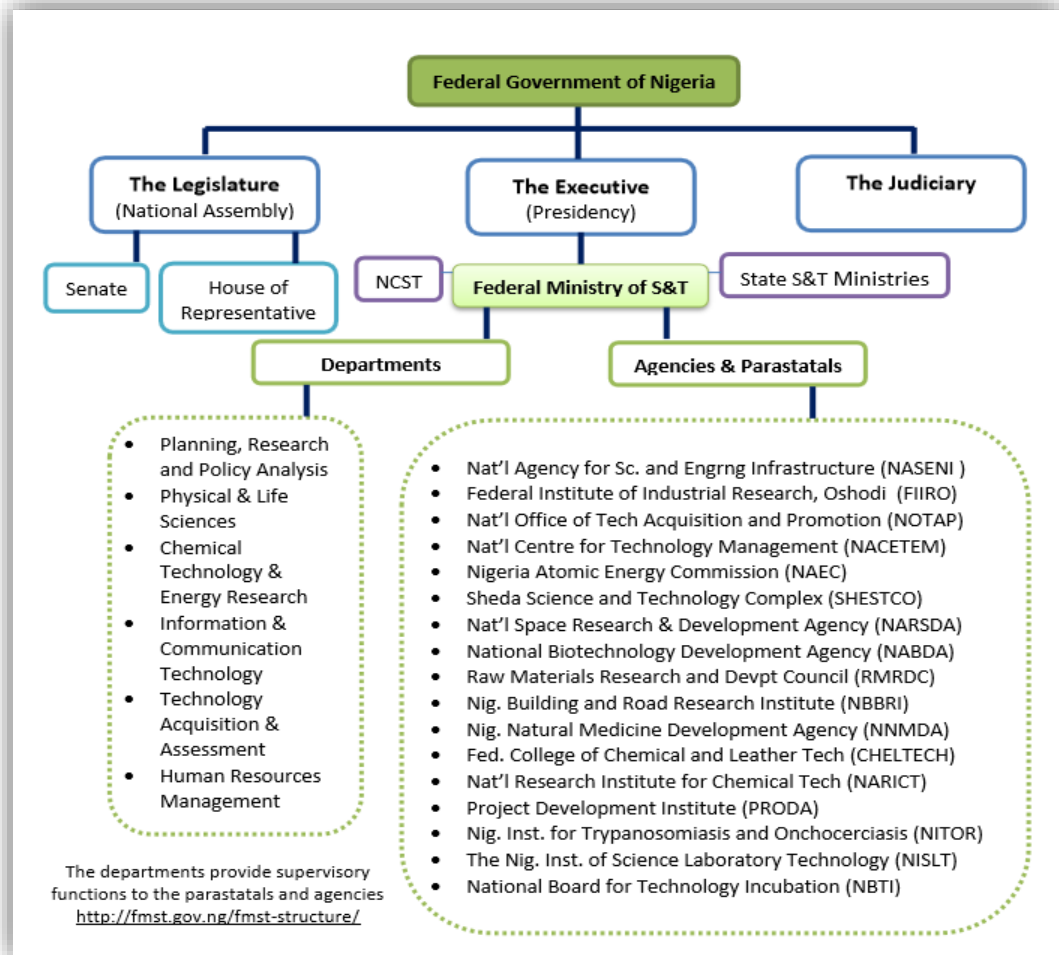
- Stirling, A., 2009. *Direction, Distribution and Diversity! Pluralising Progress in Innovation, Sustainability and Development*. STEPS Working Paper 32, Brighton: STEPS Centre
- STISA-2024 (Science, Technology and Innovation Strategy for Africa-2024), 2014. Addis Ababa: African Union Commission
- Subramaniam, M. and Youndt, M., 2005. The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal*, 48, 3, 450-463.
- Sutcliffe, S. and Court, J., 2005. *Evidence-Based Policymaking: What is it? How does it work? What relevance for developing countries?* London: Overseas Development Institute
- Sutz, J., 2012. Measuring innovation in developing countries: some suggestions to achieve more accurate and useful indicators. *Int. J. Technological Learning, Innovation and Development*, 5, 1-2
- Teece, D., Pisano, G. and Shuen, A., 1997. Dynamic capabilities and strategic management. *Strategic Management Journal*, 18, 7, 509–533.
- UNCTAD (UN Conference on Trade and Development), 2003. Africa's Technology Gap. United Nations Conference on Trade and Development. Geneva: UNCTAD
- UNCTAD (UN Conference on Trade and Development), 2006. The Least Developed Countries Report 2006: Developing Productive Capacities. Geneva: UNCTAD
- UNCTAD (UN Conference on Trade and Development), 2007. The Least Developed Countries Report 2007: Knowledge, Technological Learning and Innovation for Development. United Nations Conference on Trade and Development, Geneva
- UNCTAD (UN Conference on Trade and Development), 2008. Science, Technology and Innovation Policy Review of Angola' United Nations Conference on Trade and Development
- UNCTAD (UN Conference on Trade and Development), 2013. A Framework for Science, Technology and Innovation Policy Reviews. Geneva: UNCTAD.
- UNCTAD (United Nations Conference on Trade and Development), 2011. Pro-poor technology, innovation and entrepreneurship policies. TD/B/C.II/MEM.1/12. Geneva. 8 November.
- UNCTAD (United Nations Conference on Trade and Development), 2014. *Innovation policy tools for inclusive development*. Geneva: UNCTAD.
- UNDP (United Nations Development Programme), 1997. *Human Development Report 1997*. Oxford: Oxford University Press.
- UNDP (United Nations Development Programme), 2014. *The impacts of social and economic inequality on economic development in South Africa*. New York: UNDP

- UNESCO, 1986. *Comparative study on the national science and technology policy-making bodies in the countries of West Africa*. Paris: UNESCO
- UNESCO, 2003. Future Directions for National Reviews of Science, Technology, and Innovation in Developing Countries. Workshop Report. 23-24 April 2003, Paris, France.
- UNESCO, 2005. *Science Report 2005*. Paris: UNESCO
- UNESCO, 2006. Science, Technology and Innovation Policy: The Role of Parliaments. Science, Technology and Innovation Policy Working Paper, June 2006
- UNESCO, 2009. Science, Technology and Innovation Policy Initiative: Responding to the Needs of Africa
http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/sc_sti_initiative_africa_en.pdf. Accessed: 10 March 2014
- UNESCO, 2010. *Science Report 2010*. Paris: UNESCO
- UNESCO, 2012. Participants from 40 African countries follow training in collecting and using STI indicators. Available at: <http://www.unesco.org/new/en/natural-sciences/science-technology/sti-policy/africa/training-in-collecting-and-using-sti/> (Accessed: 24 April 2012)
- UNIDO, 2005. *Capability building for catching up*, Industrial Development Report 2005. Vienna: UNIDO.
- UNU-MERIT (United Nations University – Maastricht Economic and social Research and training centre on Innovation and Technology), 2014. Design and Evaluation of Innovation Policy in Developing Countries (DEIP) course held in Kenya, from 6-10 October 2014. Policy Brief Number 1, 2015, written by Michiko Iizuka, Philippe Mawoko and Fred Gault. <http://www.merit.unu.edu/innovation-for-africa-series-deip-kenya-2014/> (Accessed: 13 April 2015)
- Urama, C. k, Ezech, A. C., Sibanda, L. M. and Amoako, K.Y., 2011. Strengthening Linkages between Policy Research and Policymaking: A communiqué of the consultative workshop on strengthening the Linkages between Policy Research and Policymaking for African Development held at the Sarova Whitesands Beach Resorts and Spa, Mombasa, Kenya in February 2011. Journal: Science Africa Vol. 15 March - April 2011.
<http://www.wfsj.org/files/file/resources/documents/ScienceAfrica/sia15.pdf>
- WEF (World Economic Forum), 2014. *The Global Competitiveness Report 2014-2015*, edited by, Klaus Schwab and Xavier Sala-i-Martin. Geneva: Geneva: World Economic Forum.
- Wertsch, J. V., 2002. *Voices of Collective Remembering*. Cambridge University Press.
- Wilsdon, J., Stilgoe, J. and Wynne, B., 2005. *The Public Value of Science: or how to ensure that science really matters*. London: DEMOS

- Winter, S. G. and Szulanski, G., 2001. Replication as Strategy. *Organization Science*, 12, 730-743
- Winter, S. G., 2000. The Satisficing Principle in Capability Learning. *Strategic Management Journal*, 21, 981-996
- Winter, S. G., 2003. Understanding Dynamic Capabilities. *Strategic Management Journal*, 24, 991-995
- Winter, S. G., 2012. Capabilities: Their Origins and Ancestry. Special Issue: Micro-Origins of Organizational Routines and Capabilities, *Journal of Management Studies*, 49, 8, pages 1402–1406.
- World Bank, 2008. *Curricula, Examinations, and Assessment in Secondary Education in Sub-Saharan Africa*. Africa Human Development Series. The World Bank, Washington.
- World Bank, 2009. *Accelerating Catch-up: Tertiary Education for Growth in Sub-Saharan Africa*. Washington DC: IBRD/World Bank
- World Bank, 2010. *Innovation Policy: a Guide for Developing Countries*. No. 54893. International Bank for Reconstruction and Development/World Bank. Washington, D.C.
- World Bank, 2013. China: Inclusive Innovation for Sustainable Inclusive Growth. Document of the World Bank No. 82519. TA-P128575-TAS-BB. Washington, D.C. October.
- Wynne, B. 1992. Uncertainty and environmental learning: Reconceiving Science and Policy in the Preventive Paradigm. *Global Environmental Change*, 2, 111-127.
- Wynne, B., 1995. Public Understanding of Science, In: Jasanoff, S., Markle, G., Petersen, J.C. and Pinch, T. (eds). *Handbook of Science and Technology Studies*. London: Sage.
- Wynne, B., 2010. Strange Weather, Again: Climate Science as Political Art. *Theory, Culture and Society*, 27, 2-3, 289-305.
- Yin, R. K., 2009. *Case Study Research. Design and Methods* (4th ed.). Sage: London.
- Yin, R. K., 2011. *Qualitative Research from Start to Finish*. The Guildford Press: London.
- Yin, R. K., 2012. *Applications of Case Study Research 3rd Ed*. London: SAGE
- Young, E. and Quinn, L., 2002. *Writing Effective Public Policy Papers: A Guide To Policy Advisers in Central and Eastern Europe*, Budapest: LGI
- Zollo, M. and Winter, S. G., 2002. Deliberate Learning and the Evolution of Dynamic Capabilities. *Organization Science*, 13, 339–351.
- Zollo, M., Reuer, J. J. and Singh, H., 2002. Interorganizational Routines and Performance in Strategic Alliances. *Organization Science*, 13, 701–713.

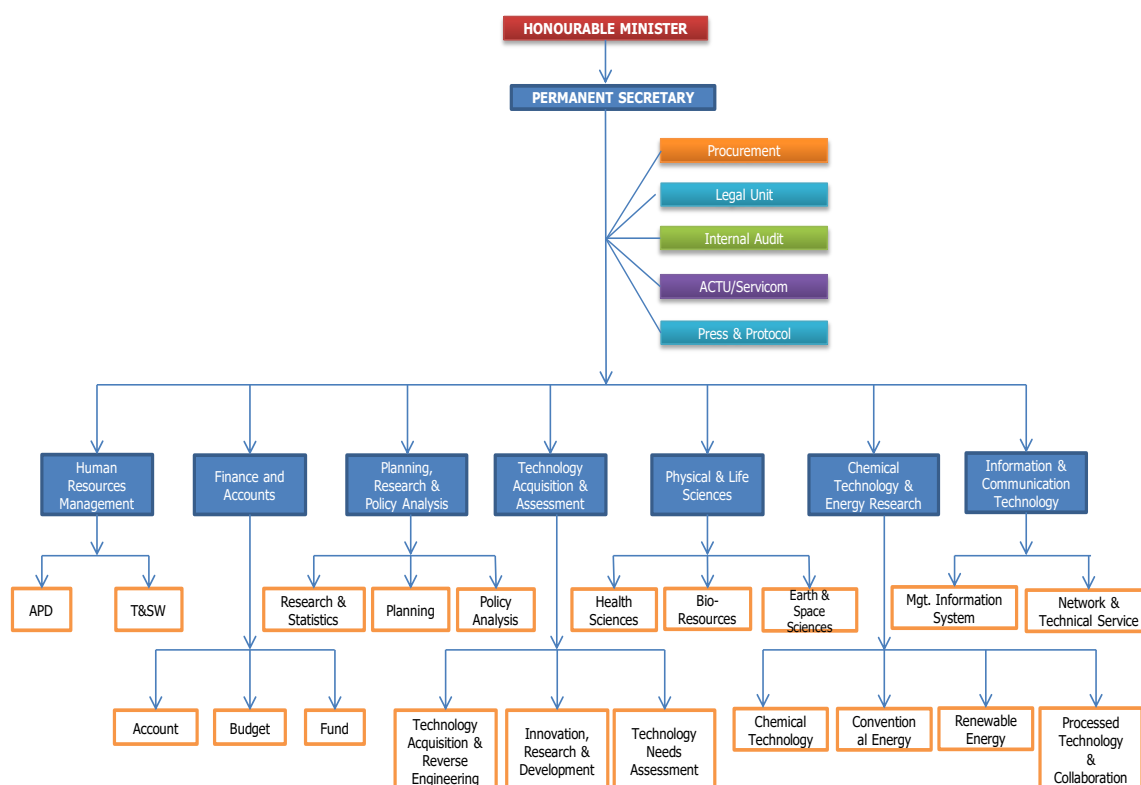
Appendix

Annex 1: FMST and Nigeria's STI Governance



Adapted from: Siyanbola (2011c), FMST (2012a) and FMST (2012b)

Annex 2: Organogram of Federal Ministry of Science and Technology (FMST)



Legend:



1. PRPA – Planning, Research & Policy Analysis Department
2. HRM – Human Resource Management Department
3. CTER – Chemical Technology & Energy Research Department
4. F&A – Finance & Account Department
5. PLS – Physical & Life Science Department
6. TAA – Technology Acquisition & Promotion Department
7. HMST – Honourable Minister’s Office
8. PRO – Procurement Unit

Others: Legal – Legal Unit, ICT – Information & Communication Technology Department, PS – Permanent Secretary’s Office.

Source: FMST (2012b)

Annex 3: FMST and STI in Nigeria – Major Historical Developments

 Federal Republic of Nigeria National Centre for Technology Management (NACETEM) Federal Ministry of Science and Technology 	
Major Historical STI Developments in Nigeria (1)	
YEAR	MILESTONE
1966	Establishment of National Council for Scientific Industrial Research (NSCSIR)
1970	1st real Federal Organ for Science and Technology administration – Nigerian Council for Science and Technology, (NCST) with 4 research councils, viz: ARCN, MRCN, NSRCN and IRCN.
1976	Recommendation of S&T policy to guide national development, especially rural and industrial development. The need for- all in charge S&T body re-emerged.
1977	Formation of National Science and Technology Development Agency (NSTDA)
1980	Formation of FMST with six departments and 22 research institutes
<div>14</div> <div>14 © Siyanbola, 2011</div>	

 Federal Republic of Nigeria National Centre for Technology Management (NACETEM) Federal Ministry of Science and Technology 	
Major Historical STI Developments in Nigeria (2)	
1984	FMST merged with Federal Ministry of Education to become the Federal Ministry of Education, Science and Technology
1985	FMST separated from Education; regained autonomy
1986	First National Policy on S&T launched, leading to the establishment of the National Council for Science and Technology (NCST) and the National Science and Technology Development Fund (NSTF) in 1987
1988	Establishment of the Raw Materials Research and Development Council (RMRDC)
1992	FMST scrapped; replaced by the National Agency for Science and Engineering Infrastructure (NASENI). NACETEM was established to develop human capacity in the management of STI.
<div>15</div> <div>© Siyanbola, 2011</div>	

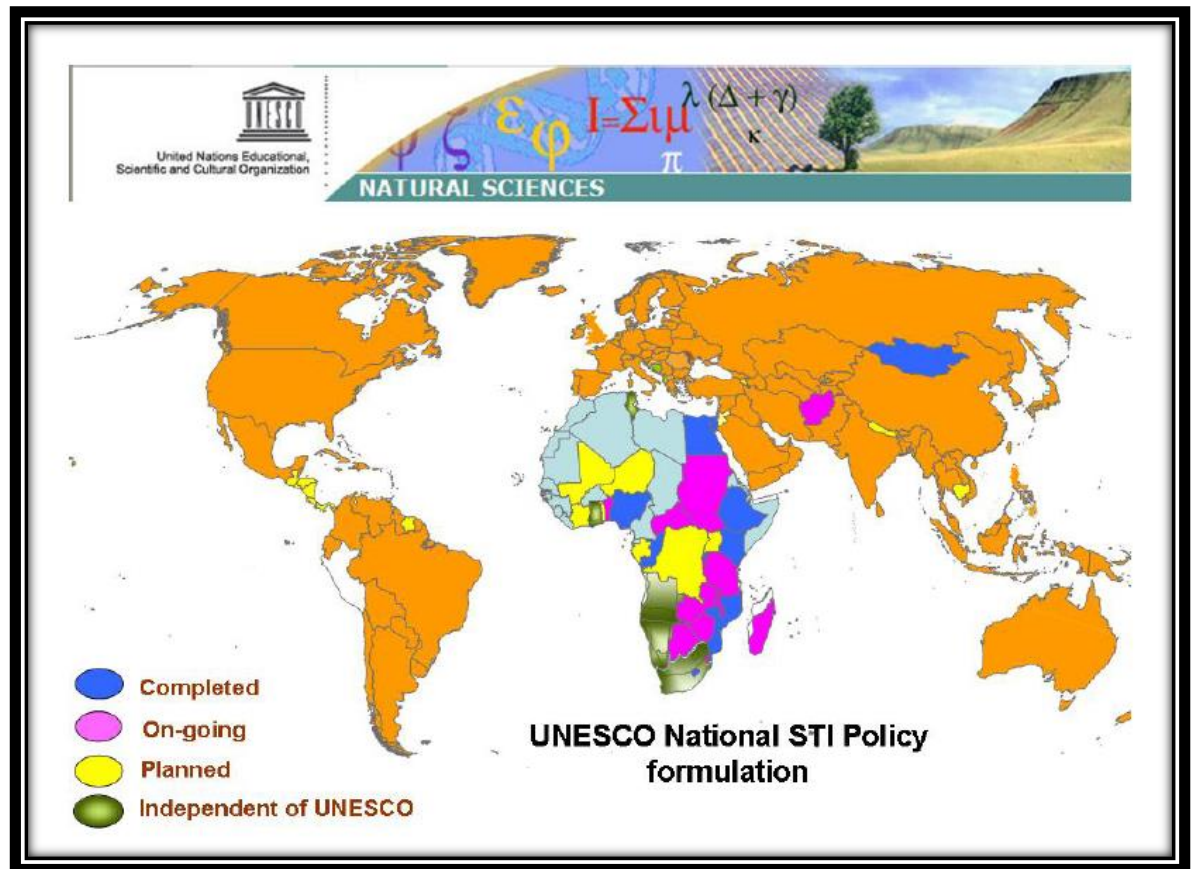


Major Historical STI Developments in Nigeria (3)

1995	FMST again re-established with NASENI subsumed under it
1997	The 1986 National S&T Policy was reviewed leading to the production of the second S&T policy
1999	Return of Democracy: Federal Government of Nigeria initiated the reform of the S&T system in collaboration with UNESCO and the Government of Japan.
2003	Another attempt to review the 1997 S&T policy.
2007	First communication satellite (NIGCOMSAT) launched
2010	Reform of STI system Concluded; Commencement of STI Policy review by the FMST and NACETEM

Source: Siyanbola (2011c)

Annex 4: UNESCO National STI Policy Formulation



Source: UNESCO (2009)

(<http://www.uis.unesco.org/StatisticalCapacityBuilding/Workshop%20Documents/ST%20Workshop%20dox/Mombasa%202009/UNESCO-%20STI%20policy.pdf>)

Annex 5: Current Status of UNESCO STI Policy (STIP) Review in Africa

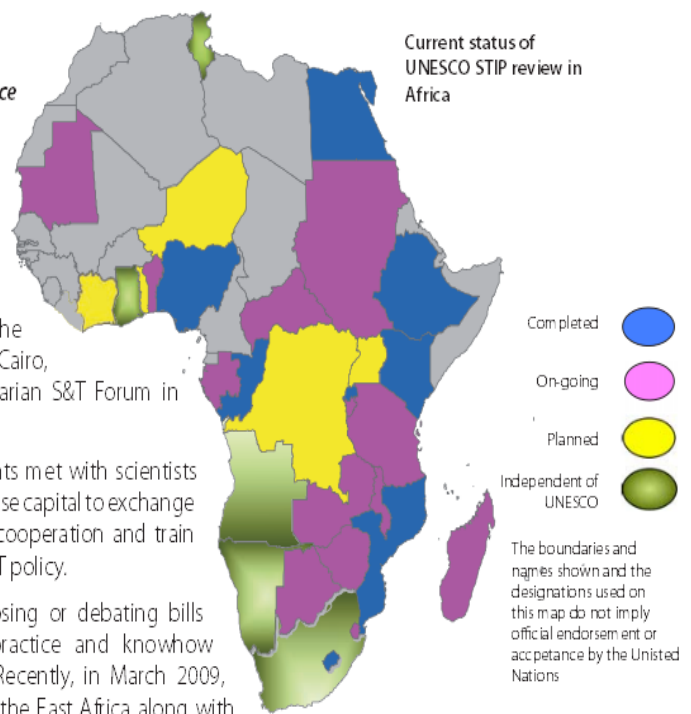
Tanzania, Togo, Uganda, Zambia and Zimbabwe.

CPA objective: build a critical mass of science policy advisors

UNESCO recognizes that both scientists and policy makers are "essential policy advisors," and therefore convenes regional science policy fora with scientists and parliamentarians. Since STI Policies Formulated 2003, the following parliamentary fora were organized in Africa: the Arab Science and Technology Policy Forum (Cairo, December, 2004) and the Nigerian Parliamentary S&T Forum in Abuja (June 2006).

In March 2008 parliamentarians and civil servants met with scientists and representatives of civil society in the Congolese capital to exchange ideas on how to structure inter-parliamentary cooperation and train parliamentarians and government officials in S&T policy.

African parliamentarians responsible for proposing or debating bills on science-related issues, exchanged best practice and knowhow in STI policy-making and science legislation. Recently, in March 2009, representatives of the Scientific Committees of the East Africa along with representatives of the Pan-African Parliament, the Spanish Commission for



Source: UNESCO.ORG

(http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/sc_sti_initiative_africa_en.pdf)

Annex 6: FMST – List of Coordinating Departments and Agencies (Parastatals)

Coordinating Departments		Parastatals	
1.	Department of Planning Research and Policy Analysis (PRPA)	I.	National Centre for Technology Management (NACETEM)
		II.	The Nigerian Institute of Science Laboratory Technology (NISLT)
2.	Department of Technology Acquisition and Assessment (TAA)	I.	Raw Materials Research and Development Council (RMRDC)
		II.	National Office of Tech Acquisition and Promotion (NOTAP)
		III.	National Agency for Science and Engineering Infrastructure (NASENI)
		IV.	Federal Institute of Industrial Research, Oshodi (FIIRO)
		V.	Project Development Institute (PRODA)
		VI.	National Board for Technology Incubation (NBTI)
		VII.	Nigerian Building and Road Research Institute (NBBRI)
3.	Department of Physical and Life Sciences (PLS)	I.	National Space Research & Development Agency (NARSDA)
		II.	National Biotechnology Development Agency (NABDA)
		III.	Nigerian Institute for Trypanosomiasis and Onchocerciasis (NITOR)
		IV.	Sheda Science and Technology Complex (SHESTCO)
		V.	Nigerian Natural Medicine Development Agency (NNMDA)
4.	Department of Chemical Technology and Energy Research (CTER)	I.	National Research Institute for Chemical Tech (NARICT)
		II.	Federal College of Chemical and Leather Tech (CHELTECH)
		III.	Nigeria Atomic Energy Commission (NAEC)
		IV.	Energy Commission of Nigeria (ECN)
5.	Department of Information and Communications Technology (ICT)	I.	National Information Technology Development Agency (NITDA)
		II.	Nigerian Communication Satellite (NigComSat) Limited

Source: National Science and Technology Week (NASTECH) programme, 2010.

Annex 7a: Data Collection Sheet

Capabilities for STI formulation in DCs using FMST Nigeria as the illustrative case –
Chux Daniels, SPRU.

Interview details

S/N	Date	Time	Place	Title	Name	Position / Job Function	Notes / Comments
S/N	Date	Time	Place	Title	Name	Position / Job Function	Notes / Comments

Annex 7b: Summary of Interview Responses – Capabilities Mapping Exercise

Interview Question(s) and Content	Interview Responses - how they were used in mapping policy capabilities at FMST							Row Summaries, Consolidations
	FMST		Non-FMST (Stakeholders)					
	Departments	Agencies	Industry	Intl Devpt. Partners	News / Media	Academia	NGOs / Civil Society	
Identification, Incumbency and Roles of Policy Capabilities (Processes, Routines and Skills)								
Identification of policy (formulation) processes and routines at FMST								
Processes and routines utilised at FMST for policy formulation								
Roles played by processes and routines in formulating STI policies at FMST								
Importance of processes in policy formulation at FMST								
Effectiveness of policy formulation processes and routines								
Origins, Development and Evolution of Policy Capabilities (Processes, Routines and Skills)								
Development of policy formulation processes and routines at FMST								
Difficulties in the development of policy capabilities								
Measures taken to continue the development of policy capabilities								
Difficulties in the implementation of policy capabilities								
Evolution of policy capabilities, how								
Reasons for evolution, why								
Core [and Additional] Policy Processes								
Processes that must be present at FMST for STI policy formulation								
Additional processes that FMST may seek to acquire and why								
Policy formulation stages and steps at FMST								

Source: Author

Annex 8: List of Data Collection Organisations

S/N	Name	Affiliation & Designation	Interviewees
1.	Federal Ministry of Science and Technology (FMST)	Government Ministry, represents the Executive Arm of Government in Nigeria	See departments below
2.	Planning, Research and Policy Analysis (PRPA)	A Department within FMST, overseas policy formulation within the FMST	5
3.	Technology Acquisition and Assessment (TAA)	A Department within FMST	1
4.	Chemical Technology and Energy Research (CTER)	A Department within FMST	1
5.	Physical and Life Sciences (PLS)	A Department within FMST	2
6.	National Centre for Technology Management (NACETEM)	FMST Agency/Parastatal	4
7.	National Information Technology Development Agency (NITDA)	FMST Agency/Parastatal	4
8.	National Board for Technology Incubation (NBTI)	FMST Agency/Parastatal	1
9.	Raw Materials Research and Development Council (RMRDC)	FMST Agency/Parastatal	3
10.	National Biotechnology Development Agency (NABDA)	FMST Agency/Parastatal	1
11.	National Office for Technology Acquisition and Promotion (NOTAP)	FMST Agency/Parastatal	4
12.	Centre for Bio-Enterprise Development	Niger Delta Science, Technology & Bio-Industrial Park (NDSTB)	1
13.	Manufacturers Association of Nigeria (MAN)	Industry, Manufacturing	2
14.	Nigerian Breweries Plc.	Industry, Food & Beverages	1
15.	Zenith Bank Plc.	Industry, Banking	1
16.	Development Information Network	Civil Society Organisation, Policy Advocacy	1
17.	Obafemi Awolowo University (OAU), Ile-Ife	Federal Ministry of Education, Tertiary	2
18.	Librarians' Registration Council of Nigeria	Federal Ministry of Education & Media, Nigerian Union of Journalist	2
19.	Guardian Newspapers	Media, Nigerian Union of Journalist	1
20.	Vanguard Newspapers	Media, Nigerian Union of Journalist	1
21.	UNESCO, Nigeria	International Development Partner	1
22.	UNDP, Nigeria	International Development Partner	1
23.	World Bank, Nigeria	International Development Partner	1
	Total		41

Annex 9: Interview Questions - Qualitative Data Collection

Interview questions

Introduction: This research is looking into the roles, development and evolution of capabilities in **ONLY POLICY FORMULATION** in DCs government institutions. It uses the FMST as the illustrative case study. **Capabilities** for the purpose of this research are defined in terms of *processes, routines and skills* needed for policymaking. Processes and routines relate to those at the institutional level and skills address those at an individual policymaker level.

GENERAL PROFILE

1. Please briefly state your name, job title (or position) and your major duties.
2. How long have you been in this position?
3. Can please describe your educational background?

Process questions: Examples of policy formulation processes are: agenda setting, setting of clear policy objectives, selecting a policy course, proposing policy options, deciding on policy instruments (e.g. use tax credits or education/training to achieve policy objectives), constructing policy alternatives, evidence gathering and analyses, stakeholder(s) identification, deciding on stakeholders' roles and so on.

IDENTIFICATION AND ROLE OF PROCESS CAPABILITIES

4. What are the policy formulation processes at the FMST?
5. Which of these processes you have identified must be present at the FMST in order to formulate STI policies?
6. What roles do processes play in formulating STI policies at the FMST?

INCUMBENCY, ORIGINS, AND DEVELOPMENT OF PROCESSES

7. How have policy formulation processes developed at the FMST?
8. Have there been obstacles/problems with the development of these processes? If yes, what are they? If none, why?
9. What are the measures taken to continue the development of these processes?
10. Have there been difficulties with the implementation of these measures to continue developing these processes? If yes, what are the difficulties? If no, why not?
11. If there have been difficulties with the development of processes, how have they been overcome?

EVOLUTION OF PROCESSES

12. How have these processes evolved (over the years) at FMST? *[If necessary ask "which of these processes has evolved?"]*
13. In your opinion why has these processes evolved at FMST?

CORE CAPABILITIES

14. What process(es), in your opinion, must be present at the FMST in order for the institution for successfully formulate STI policies?
15. Why are they important?

ADDITIONAL PROCESSES

16. Are there additional STI policy formulation processes that the FMST may be seeking to acquire? If yes, why? If not, why?
17. How does the FMST plan to develop these?

Routines questions: routines are the repetitive and recognisable activities that result in a policy process such as agenda setting. For example, in order to set a policy agenda, various repetitive tasks such as research and evidence gathering useful in defining and understanding the problems better; consultations with interest groups or coordination of various stakeholders might be necessary. These recognisable activities, e.g. coordination, when collectively carried out by a group of individuals in a repetitive manner are known as a routine.

IDENTIFICATION AND ROLE OF ROUTINE CAPABILITIES

1. What are the policy formulation routines at the FMST?
2. Which of these routines you have identified must be present at the FMST in order to formulate STI policies? Why must they be present?
3. What roles do routines play in formulating STI policies at the FMST?

INCUMBENCY, ORIGINS, AND DEVELOPMENT OF ROUTINES

4. How has policy formulation routines developed at the FMST? [If necessary ask “what are the origins of these routines?”]
5. Have there been obstacles/problems with the development of these routines? If yes, what are they? If none, why?]
6. What have been the measures taken to deal with these problems?
7. What are the measures taken to continue the development of these routines?
8. Have there been difficulties with the implementation of these measures to continue developing these routines? If yes, what are the difficulties? If no, why not?
9. If there have been difficulties with the development of routines, how have they been overcome?

EVOLUTION OF ROUTINES

10. How have these routines evolved (over the years) at FMST? [If necessary ask “which of these routines has evolved?”]
11. In your opinion why has these routines evolved at FMST?

Continue with same format for routines – selectively

Continue with same format for skills – even more selectively

ADDITIONAL SKILLS

1. Are there additional STI policy formulation skills that the FMST may be seeking to acquire? If yes, why? If not, why?
2. How does the FMST plan to develop these?

CONCLUDING QUESTIONS

1. Please describe the policy formulation environment at the FMST?
2. What are the policy formulation stages at the FMST?
3. Is there any other essential information on policy formulation processes, routines or skills at the FMST that I have not covered so far and you would like to add?

Thank you for your time and useful contributions.

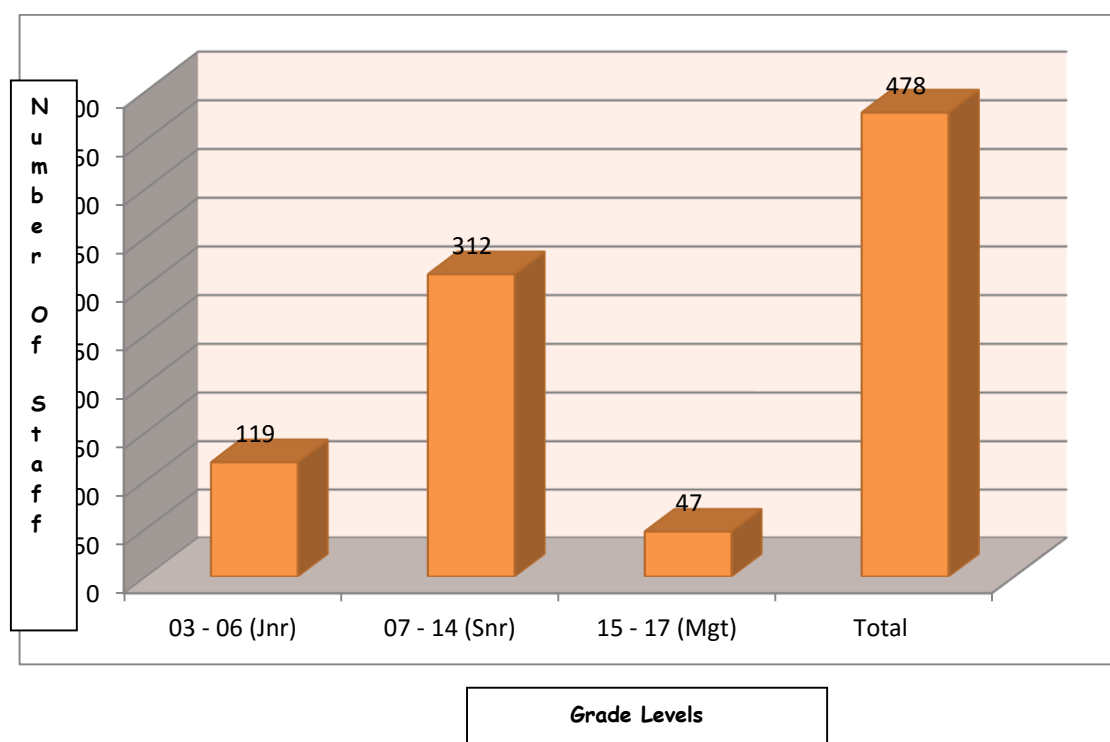
Annex 10: Staff Classification at FMST

According to Departments, Units and Offices

S/N	Departments/Units & Offices	Number of Staff
1	PRPA	59
2	HRM	113
3	CTER	48
4	F&A	83
5	TAA	40
6	HMST	35
7	PROC.	10
8	LEGAL	6
9	ICT	36
10	PS	5
11	TOTAL	478

According to Grade Levels

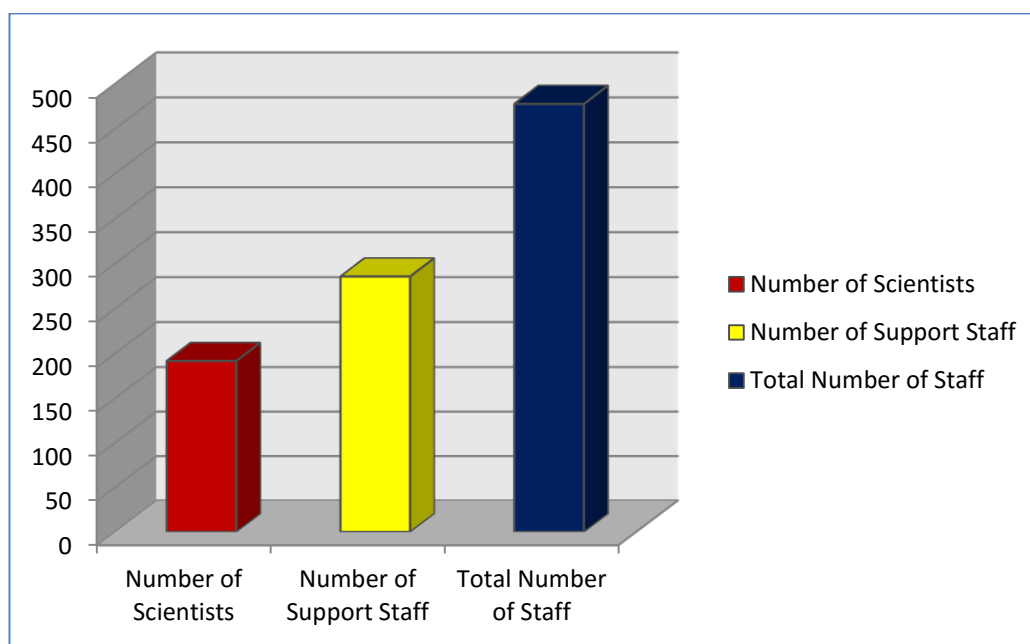
S/N	Grade Levels (years)	Number of Staff
1	03-06	119
2	07-14	312
3	15-17	47
4	Total	478



Source: FMST (2012b)

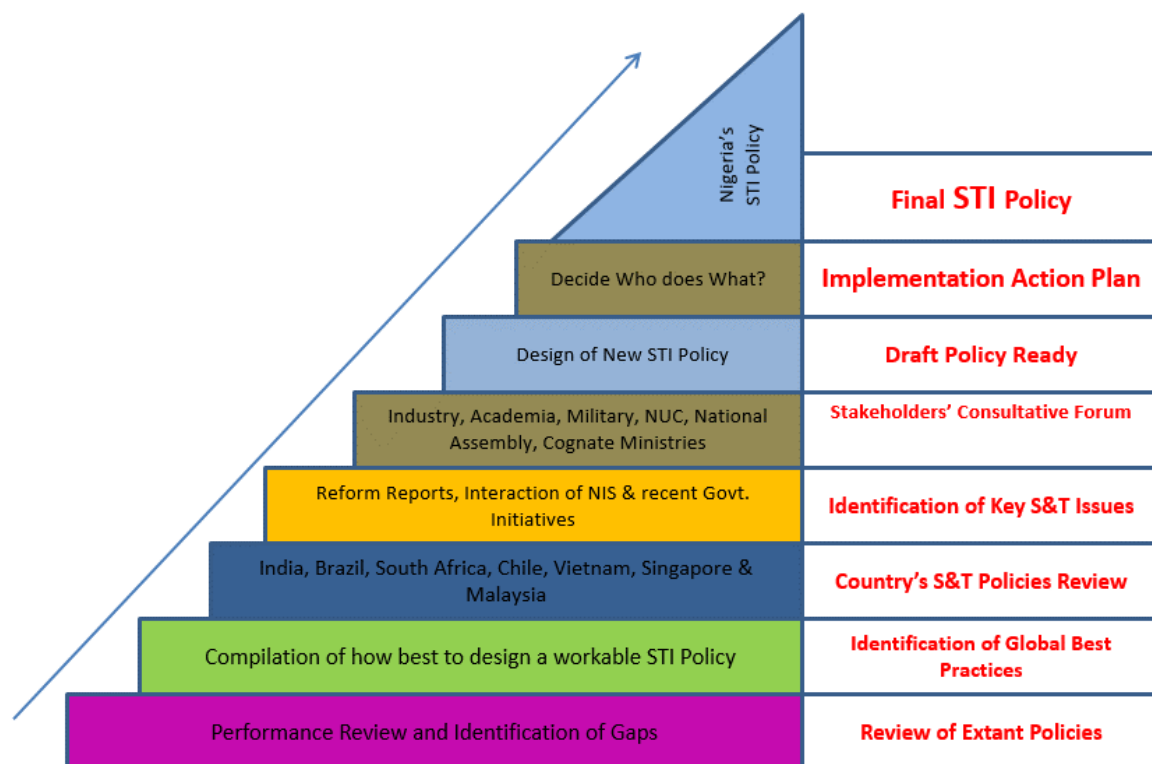
According to Number of Scientists and Support Staff

S/N	Number of Scientists	Number of Support Staff	Total Number of Staff
1	192	286	478



Source: FMST (2012b)

Annex 11: Key STI Policy Formulation Stages and Processes at FMST



Source: Siyanbola (2011a)

Annex 12: Participants and Organisations in FMST 2012 STI Policy Formulation

Notes: The FMST expressed appreciation to the individuals below for their valuable contributions, support and inputs in the formulation of the Science Technology and Innovation Policy.

1. Honourable Minister of Science and Technology, Prof. Ita Okon Bassey Ewa
2. Permanent Secretary, Dr. (Mrs.) 'Dere Awosika, MFR, mni
3. All Directors of the Federal Ministry of Science and Technology (FMST)
 - a. Engr. W. K. Jimoh – Director, Information and Communications Technology (ICT)
 - b. Mr. O. Ogenyi - Director, Planning, Research and Policy Analysis (PRPA)
 - c. Mr. Y.S. Mohammed – Director, Technology Acquisition and Assessment (TAA)
 - d. Mr. A. H. Yusuf – Director, Human Resource (HRM)
 - e. Mr. Mohammed A. Hassan – Director, Finance and Accounts (F&A)
 - f. Dr. S.O. Fadoju – Ag Director, Chemical Technology and Energy Research (CTER)
 - g. Dr. M.T. Gwaza – Ag Director, Physical and Life Sciences (PLS)
4. All Directors- General of FMST Agencies
 - a. NASENI – Prof. O. O. Adewoye
 - b. NACETEM – Dr. Willie O. Siyanbola
 - c. FIIRO – Dr. (Mrs.) G. Elemo
 - d. NITDA – Prof. C.O. Angaye
 - e. NBTI – Prof. G.L. Abdullahi
 - f. RMRDC – Prof. A.P. Onwualu
 - g. NABDA – Prof. B.O. Solomon
 - h. NITR – Prof. M. Mamman
 - i. PRODA – Prof. G.N. Onuoha
 - j. NARICT – Dr. E.M. Okonkwo
 - k. NAEC – Dr. F.E. Osaisai
 - l. CHELTECH – Dr. M. Adamu
 - m. NIBRI – Prof. D.S. Matawal
 - n. NASRDA – Dr. S.O. Mohammed
 - o. NOTAP – Dr. U.B. Bindir
 - p. NNMDA – Mr. T.F. Okujagu
 - q. NIGCOMSAT – Engr. T. Ahmed Rufai
 - r. ECN – Prof. A.S. Sambo
 - s. SHETSCO – Prof. Sunday A. Thomas
 - t. NISLT – Dr. I. F. Ijagbone
5. The Chair of various Experts' Sub-committees
 - a. Education – Prof. Tunde Adeniran
 - b. Environment – Prof. A.M.A. Imavbore
 - c. Health – Prof. E.M. Essien
 - d. Commerce and Industry – Dr. Ike Abugu
 - e. Information Communications Technology – Prof. (Mrs.) Nike Osofisan
 - f. Technology Incubation, Intellectual Property, Technology Transfer and – Engr. Tukur Ahmed
 - g. Transport – Prof. Micheal Filani

- h. Mines and Steel – Prof. Siyan Malomo
 - i. Land Housing and Urban Development - Prof. J.I. Ighalo
 - j. Institution and Legislative Framework – Prof. Ibidapo Obe, Co-Chair-
Prof. Oyebanji Oyelaran
 - k. Space –Prof. E.E. Balogun
 - l. STI Governance and Funding – Prof. OdeOjowu
 - m. Energy – Prof. C.C. Okoro
 - n. Agric and Water Resources – Prof. Ambrose Voh
 - o. Collaboration in STI – Prof. Osita Ogbu
 - p. Defence – Prof. Femi Odekunle
 - q. Material and Material Engineering – Prof. Boniface Oloche
 - r. Biotechnology –Prof. Emanuel Hala Kwon-Ndung
 - s. Women and STI – Prof. Dennis Ityavyar
 - t. Youths and Sport – Prof. L. O. Eboh
6. All management and Staff of the Federal Ministry of Science and Technology (FMST), National Centre for Technology Management (NACETEM) and all other Agencies/Parastatals of FMST.

Source: FMST (2011, pp.29-30)