

**Science, Technology &
Innovation Policy and Strategy**

2016 - 2025





SCIENCE, TECHNOLOGY AND INNOVATION POLICY AND STRATEGY 2016 - 2025



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Foreword



The *2030 United Nation Agenda for Sustainable Development*, adopted by world leaders from 193 member countries in September 2015 at an historic UN summit held at New York city USA. It urges nations to develop and adopt policies and strategies to ensure that the *169 targets* of the *17 Sustainable Development Goals (SDGs)* are attained in the next fourteen years. Agenda 2030 also recognizes the key role *Science, Technology and Innovation (STI)* plays in attaining these goals.

The Government leadership of Seychelles not only recognizes the importance of STI in attaining the SDGs but also the larger role that *knowledge* plays in socio-economic development. Consequently, the High-Level Steering Committee for Knowledge-Based Economy (KBE) mandated National Institute for Science Technology and Innovation to evolve a national *Policy and Strategy for Science, Technology and Innovation 2016-2025*, to provide the framework for Seychelles' transition towards a more Knowledge-Based Economy.

The policy and strategy document, the first by NISTI since its enactment and establishment in 2014, is based on the Key Result Areas of national development strategies. It provides guidelines for other implicit national policies and strategies related to building and strengthening the foundation of *Governance* and the four pillars of a KBE, postulated by the World Bank Institute – namely, *Economic Incentive and Policy Regime; An Educated, Knowledgeable and Skilled Work Force; an efficient National Innovation System; and a Modern and Adequate Information Infrastructure.*

The Government is committed to provide full support for the implementation, monitoring and evaluation of these policy initiatives and would like to put in place the institutional arrangements to catalyse this transformation. Science, technology and innovation should not be viewed as just *buzz words* or *technical jargon*, but as means for making people's lives better. This policy is hence aimed at offering the kind of quality of life, opportunities and socio-economic environment that enhances people's lives and encourages businesses to invest. Every implementation measure of this policy and strategy document must therefore remain focussed towards attaining this aim.

Vincent Meriton,
Vice President, Republic of Seychelles
Chairman, High Level Steering Committee
For Knowledge-Based Economy

Preview



The *Seychelles Policy and Strategy for Science, Technology and Innovation 2016-2025* is not just a statement of desirable intent, but of focussed objectives and clear strategies for Seychelles to transit to a knowledge-based economy.

The policy and strategy incorporates initiatives for building an *STI Eco-System* through prioritised policy measures and institutional arrangements like the establishment of a *People's Group, National Research Foundation, Research Data Centre, STI Knowledge Hub, Business, Technology and Innovation Incubator* and an *Integrated STI Governance System*, which will help in cross-sectoral, vertical and horizontal integration of STI.

The policy and strategy will be implemented through two five year plans with clear policy objectives converted into well planned and integrated programmes, included in the annual PPBB plan of NISTI, MDAs and related stakeholders to ensure that Seychelles' transition to a KBE is smooth and timely.

I am sanguine that this being an evidence-based policy and strategy, will receive the wholehearted support of all stakeholders for the integration of STI into the socio-economic development of Seychelles.

I congratulate Mr Xavier Estico, CEO, National Institute for Science, Technology and Innovation for his dedication and selfless commitment in bringing this policy and strategy to fruition.

I would also like to place on record my gratitude for the encouragement and guidance received from President Danny Faure and Vice President Vincent Meriton throughout this important exercise.

**Dr. Conrad Shamlaye,
Chairman Board of National Institute for Science, Technology and Innovation,
Republic of Seychelles**

Acknowledgements



The policy and strategy has been based on extensive literature review of past and present government strategies and policies, studies on *STEM Education*, *World Bank KAM Indicators for KBE*, *Audit of Government Laboratories and Research Facilities in Seychelles* and an elaborate process of stakeholder interactions and consultations through one-on-one meetings and workshops.

The *Policy Initiatives and Instruments* have been based on *policy responses to stakeholder inputs* received during these consultations on selected thematic areas, based on the KRAs of our national development strategies of *Seychelles Strategic Land Use and Development Plan 2040*; *Seychelles Sustainable Development Strategy 2012-2020*, *National Development Strategy 2015-2019*, the *SADC Regional Integrated Strategic Development Plan 2020* and the *UN Sustainable Development Goals 2030*.

I would like to thank all those who assisted in the studies and audits, made policy documents available and provided valuable inputs during consultations for their kind cooperation and encouragement throughout the process of this policy formulation.

I would also like to express my sincere thanks to the Ministers, Principal Secretaries and CEOs of the Government of Seychelles for their personal and delegated representation, the International STI Centre (ISTIC), Malaysia; Professor Omar Abdul Rahman - Consultant to ISTIC; Dr Lee Yee Cheong - Chairman, ISTIC Governing Board, UNESCO; Professor John Mugabe - University of Pretoria, South Africa and Professor Michael Blakeney - University of Western Australia, for their support and guidance throughout the exercise. I would like to extend my gratitude to NISTI Chairman Dr Conrad Shamlaye, NISTI Board members and Mr Michael Benstrong, former Minister for Investment, Entrepreneurship Development and Business Innovation for their constant guidance and encouragement. Last but not least, I would like to extend my gratitude to our consultant Mr. Deepak Das for his contribution in conceiving and executing this complex project.

I thank you all again, especially those whom I have been unable to list here and look forward to your continued support in helping us implement this policy and strategy to fulfil our national strategic intent of transitioning to a knowledge economy.

Xavier Estico,
Chief Executive Officer,
National Institute for Science,
Technology and Innovation,
Republic of Seychelles

Contents

ACRONYMS	7
EXECUTIVE SUMMARY	9
1.0 FRAMEWORK FOR THE NATIONAL SCIENCE, TECHNOLOGY AND INNOVATION POLICY and STRATEGY	
1.1 Background	
1.1.1 Socio-Economic Background	13
1.1.2 STI Management in Seychelles.....	14
1.1.3 Existing STI Policy Environment.....	14
1.2 Conceptual Framework	
1.2.1 Concept of a Knowledge Based Economy (KBE).....	15
1.2.2 Role of STI in Sustainable Socio-Economic Growth.....	15
1.2.3 Importance of GERD and Institutional Arrangements for Funding.	16
1.2.4 National Innovation System.	16
1.3 Gaps and Challenges.....	16
1.4 Vision, Mission and Strategic Objectives.....	19
1.5 Specific Policy Objectives.....	19
2.0 NATIONAL PLANNING AND STI.....	20
2.1 National Development Priorities.....	20
2.2 Identifying the STI Priorities and Enablers in the National Development Strategy (NDS 2015-19).	20
2.3 Integrating STI into National Development Strategy.	21
2.4 Establishing a National Research Foundation	22
3.0 BUILDING AND STRENGTHENING THE PILLARS OF A KNOWLEDGE-BASED ECONOMY	
3.1 Providing Economic Incentive and a Favourable Institutional Regime	22
3.2 Creating a Knowledge Society: Educated and Skilled in STI, Informed and Connected.....	23
3.2.1 Science, Technology, Engineering, Mathematics, Innovation and Entrepreneurship Education.....	23
3.2.2 Reversing Brain Drain.....	24
3.2.3 Prospecting and Utilising Scientific Education, Research Funding and Training Opportunities.....	24
3.2.4 Building Awareness, High Trust and Participation in STI.....	24
3.3 Evolving a National Innovation System	
3.3.1 Building STI Capacity	24
3.3.2 Promoting Innovation and Entrepreneurship	26
3.3.3 Technology Management	27
3.4 Information Infrastructure	
3.4.1 Increasing Awareness and Ensuring Independent Management of ICT in a Knowledge Economy.	28
3.4.2 Building a Modern National IT Eco-System.....	28
3.4.3 Integrated ICT- National Development Strategy.....	29
4.0 USING STI FOR THE PEOPLE	
4.1 Establishing a People’s Group.....	29
4.2 Focus Research on People Centric Issues.....	29
4.3 Promoting Social Innovation to Negate the Ill Effects of Technology.....	30
4.4 Improving Health Care.....	30

4.5 Personal Financial Betterment.....	30
5.0 STI IN SOCIO-ECONOMIC DEVELOPMENT OF SECTORS	
5.1 General Measures for Embedding STI for Economic Development.....	31
5.2 STI in Tourism.....	31
5.3 STI in Agriculture and Food Security.....	32
5.4 STI in Blue Economy.....	32
5.5 STI in Energy, Environment and Construction: Building a Smart Seychelles - Victoria Master Plan.....	33
6.0 SMART INTERNATIONAL PARTNERSHIPS	
6.1 Bilateral.....	34
6.2 Regional.....	34
6.3 International Collaborations – STI in Achieving SDGs.....	34
7.0 STRATEGY FOR RESEARCH, TECHNOLOGY AND INNOVATION MANAGEMENT	
7.1 Overall Strategy.....	35
7.2 Institutional Arrangements, Plans and Processes for Policy Implementation.....	37
7.2.1 Strategy for STEM I&E Education.....	38
7.2.2 National Research Foundation (NRF).....	38
7.2.3 National Research Data Centre (NRDC).....	38
7.2.4 Business, Technology and Innovation Incubator.....	39
7.2.5 Integrated STI Governance System.....	39
7.3 Implementation Timelines.....	40
7.4 Detailed Implementation Plan.....	40
7.5 Prioritisation and Funding Strategies.....	40
8.0 MONITORING, EVALUATION AND IMPACT ASSESSMENT	
8.1 Monitoring and Evaluation.....	41
8.2 Follow-up and Review Processes.....	42
CONCLUSION.....	43
Appendix A KNOWLEDGE BASED ECONOMY FRAMEWORK: WORLD BANK KAM.....	44
Appendix B QUANTITATIVE AND QUALITATIVE EVIDENCE.....	46
Annexure 1 to Appendix B SWOT SUMMARY OF THE EXISTING STI ECO-SYSTEM OF SEYCHELLES.....	48
Annexure 2 to Appendix B BASIC KAM SCORE CARD OF SEYCHELLES: DECEMBER 2014.....	50
Annexure 3 to Appendix B AN ANALYSIS OF STEM SUBJECT PERFORMANCE AND CAREER CHOICES.....	52
Appendix C STI GAPS IDENTIFIED AND POLICY RESPONSES.....	53
Appendix D KEY FINDINGS AND RECOMMENDATIONS.....	56
Appendix E INTEGRATED STI GOVERNANCE SYSTEM FOR SEYCHELLES.....	60
Appendix F RELEVANT TERMS AND DEFINITIONS.....	62

ACRONYMS

AfDB	African Development Bank
ANHRD	Agency for National Human Resource Development
AU	African Union
ASTII	African Science, Technology and Innovation Indicators
ASTI/IFPRI	Agricultural Science and Technology Indicators/International Food Policy Research Institute
BERM	Blue Economy Road Map
DICT	Department of Information and Communication Technology (Government of Seychelles)
EE	Energy Efficiency
ERP	Enterprise Resource Planning
GERD	Gross Domestic Expenditure on Research and Development
GOVERD	Government Expenditure on Research and Development
ICT	Information and Communication Technology
IPR	Intellectual Property Rights
ISTIC	International STI Centre
IT	Information Technology
ITES	Information Technology Enabled Services
IoT	Internet of Things
IUU	Illegal Unreported and Unregulated (Fishing)
KBE	Knowledge Based Economy
KEI	Knowledge Economy Index
KI	Knowledge Index
KMs	Kilometres
KRAs	Key Result Areas
MLGHA	Ministry of Local Government and Home Affairs
MEECC	Ministry of Environment, Energy and Climate Change
MIEDBI	Ministry of Industry, Entrepreneurial Development and Business Innovation
MFTBE	Ministry of Finance, Trade and the Blue Economy
MFTEP	Ministry of Finance, Trade and Economic Planning (Erstwhile MFTBE)
MoEHRD	Ministry of Education and Human Resource Development
MoH	Ministry of Health
MEICS	Ministry of Employment, Immigration and Civil Status
MLUH	Ministry of Habitat, Infrastructure and Land Transport

MoU	Memorandum of Understanding
NBS	National Bureau of Statistics
NDS	National Development Strategy
NEPAD	New Partnership for Africa's Development
NFNSP	National Food and Nutrition Security Policy
NISTI	National Institute for Science, Technology and Innovation
NIS	National Innovation System
OA	Open Access
OECD	Organisation for Economic Cooperation and Development
PPBB	Programme Performance-Based Budgeting
R&D	Research and Development
RDC	Research Data Centre
RE	Renewable Energy
RISDP	Regional Integrated Strategic Development Plan
SADC	Southern African Development Community
SAA	Seychelles Agriculture Agencies
SANBio	Southern Africa Network for Biosciences
SBFA	Small Business Financing Agency
SBS	Seychelles Bureau of Standards
SCMRT	Seychelles Centre for Marine Research and Technology
SDGs	Sustainable Development Goals (of the United Nations)
SEC	Seychelles Energy Commission
SEnPA	Small Enterprise Planning Agency
SIB	Seychelles Investment Board
SIT	Seychelles Institute of Technology
STEM I&E	Science, Technology, Engineering Mathematics Innovation & Entrepreneurship
SSDS	Seychelles Sustainable Development Strategy
SSLUDP	Seychelles Strategic Land Use and Development Plan
STB	Seychelles Tourism Board
STI	Science, Technology and Innovation
STISA	Science, Technology and Innovation Strategy for Africa (2024)
TGMI	The Guy Morel Institute
UniSey	University of Seychelles
UNESCO	United Nation Educational Scientific and Cultural Organisation
UNDP	United Nation Development Program

EXECUTIVE SUMMARY

The Republic of Seychelles comprises of 115 pristine islands, spanning an archipelago in the Indian Ocean, approximately 1,500 km east from the African coast, northeast of Madagascar. The Republic has its unique set of socio-economic challenges of limited – population (95,000), industrial capacity (scarce real estate for industry or farming), scientific and technical human resources (limited researchers, technical institutes and only one University) and markets (lack of economy of scales). Albeit these challenges of the past few years, Seychelles has done well by taking major steps in its macro – economic restructuring (including tightening monetary policy and relying on exchange rate flexibility) which has not only helped it ride its financial crisis since 2008, but by late 2015, helped it attain the coveted World Bank ranking of a *high income* nation. Its economy, although growing at a rate of 3.7 - 4.5 % (IMF:2015 -16) primarily, relies on tourism and fisheries and remains vulnerable to global developments and domestic risks. Domestic risks are linked to state owned enterprises and issues impacting fisheries and tourism (e.g. algae bloom killing fish affecting the artisanal fishing industry and to a certain extent the semi-industrial fishing). Even with an average per capita income of almost USD 15,000, 39% of the population remains below the poverty line of SCR 3,945 (around USD 300 per adult per month, highlighting the high disparity in income distribution (46 %) as per the 2013 National Survey. Seychelles, therefore, warrants more inclusive growth through energising and facilitating entrepreneurship and the growth of the private sector.

Of late, Seychelles has taken the strategic initiative of focussing on economic diversification through the development of a *Blue Economy* or an economy based on optimal and sustainable exploitation of its vast exclusive economic zone (EEZ) of 1.4 million square kms. This has also changed the perspective of Seychelles from being viewed as a *Small Island Developing Nation* (SIDS) to a '*Large Blue Resource Nation*'. This will in turn necessitate huge investments in related research, technology and innovation activities in the field of *Biosciences* and the *Blue Economy*.

However, not enough is happening in research and innovation, despite progress in income and education standards. Although there are a large number of national / sectoral policies, which implicitly promote STI e.g Fisheries, Agriculture, Health, ICT, SME, Industrialisation, Tourism, etc., but there is no explicit national policy framework which ingrains STI into the national development strategy. Consequently, there exists a felt need in the Government and amongst the people to address these lacunae through identification of shortcomings and relevant policy and strategy interventions. In mid-2015, the *High-Level Steering Committee for Knowledge-Based Economy (KBE)* under the chairmanship of the Vice President mandated NISTI to formulate a National Policy and Strategy for Science, Technology and Innovation Management in Seychelles for transitioning Seychelles into a knowledge-based and innovation driven economy in the next ten years – 2016 to 2025. This policy and strategy is an outcome of that mandate, aimed at addressing gaps, which

have been identified through qualitative and quantitative data evaluation and evidence collated from literature review of existing government policies and stakeholder consultations for a duration of about eight months. The thematic areas for the consultations were compiled after an analysis of the influence of STI on the common KRAs of the national, regional and international development strategies.

The policy is structured to address and strengthen the four key pillars of a Knowledge-Based Economy i.e. **Economic Incentive and Policy Regime** (Institutional and Regulatory); **Creating a Knowledge Society** (Educated, Informed and Skilled In STI); **Evolving a National Innovation System**; and; **Building a Modern Information Infrastructure**.

The **policy objectives** selected to address the gaps identified in research, technology and innovation management in Seychelles, include **Leadership** (political commitment, policy direction and policy integration), **STI in Socio-Economic Transformation** (using STI to improve the quality of life of the people); **Human Capital Development** (promote STEM I&E and build holistic human capital); evolving the **National Innovation System** (strengthening and effecting integrated functioning of the components of the national innovation system); **Capacity Building** (based on the *National Research Plan* and *Strategic STI Initiative Plan*); **STI Data Management** (in collaboration with existing data repositories and all stakeholders); **Information Infrastructure**, (building a modern and adequate *IT Eco-System*); **Governance** (governance of STI and optimising the use of STI in governance); and; **Efficient Implementation, Monitoring and Evaluation**.

The **implementation strategy** includes both *policy measures* and *institutional arrangements* for promoting *STEM I&E Education*; establishing a *National Research Foundation* (NRF) to provide criteria for prioritisation and funding for research and publications; a *National Research Data Centre* to act as a data repository for all research outcomes as well as a data bank for the *STI Knowledge Hub*; a *Business, Technology and Innovation Incubation System* to provide assistance to SMEs and individual entrepreneurs; and; an *Integrated STI Governance System* for establishing linkages between key stakeholders of STI at the strategic, operational and functional levels.

Implementation would entail detailed plans to be prepared and included in the national and sectoral PPBB development plans, spread across two five-year plan periods. Each of these plans would have a *logframe matrix*, with clear STI priorities, resources, responsibilities and timelines at both, the national and sectoral levels.

The implementation of this policy and strategy will be through an inter-ministerial implementation body or mechanism that will bring all sectoral agencies together to ensure synergy and efficient utilization of national resources.

Monitoring and evaluation will be carried out using internationally accepted indicators of R&D, innovation and human development. In addition, locally relevant indicators of sustainable development outcomes of STI will be designed and used in the monitoring and evaluation of policy and strategy implementation.

This is a people’s STI policy and strategy, as it focuses on research, capacity building, resource utilisation and inclusive socio-economic development. The implementation of the policy and strategy as well as its review mechanism, hence, focuses on the socio-economic impact of STI policy interventions on the quality of life of the people of Seychelles.

KEY FINDINGS AND RECOMMENDATIONS¹

KEY FINDINGS / GAPS IDENTIFIED	RECOMMENDED POLICY MEASURES / INSTITUTIONAL ARRANGEMENT
The national development planning process is fragmented (different ministries are handling and driving short and long term national development strategies without integration and with no STI foresight and advisory mechanism).	Establish a <i>National Planning Commission</i> to identify the common thread between the SSLUDP, SSDS, NDS, BERM and other national initiatives to evolve integrated short (5 year), medium (10 year) and long (25 year) term national development strategies. Integrate STI planning and policy measures through an ‘ <i>STI Foresight & Advisory Body</i> ’ under the aegis of NISTI and a <i>National Research Foundation (NRF)</i> .
Sectoral and Institutional Rivalry and lack of Integrated Governance of STI	Establish an <i>Integrated STI Governance System</i> by strengthening and setting up linkages between the strategic, operational and functional levels of governance of STI and planning and execution of STI projects and programmes.
Limited Planned Funding of STI / No Estimation or Plans for Gross Domestic Expenditure on Research and Development (GERD).	Hold regular national surveys for <i>R&D, Innovation and Knowledge Economy Indices</i> to evaluate the status and impact of STI initiatives on socio-economic development and the quality of lives of the people. Increase GERD to 1% by 2020 and 2% by 2025 on identified areas of priority.
Inadequate STI Capacity - laboratories, incubators, science parks, engineering and technology institutes of higher learning, etc.	Evolve a ten year <i>National STI Capacity / Research Infrastructure Development Plan</i> (by NISTI and the NRF after an infrastructure need analysis), with clear sectoral responsibilities for monitoring, upkeep and sharing of assets developed.

¹ Details of Key Findings and Recommendations are at Appendix D

<p>Inadequate STI Capability - scientific human resource and over reliance on foreign scientific human capital.</p>	<p>Scientific human capital will be built and financed through a three-pronged strategy of STEM I&E Education, collaborative international research project plans and attracting the best STI talent (including the Seychelles diaspora).</p>
<p>Absence of a National STI Data Repository / Knowledge Hub.</p>	<p>Establish a <i>National Research Data Centre (NRDC)</i> and link its database to an <i>STI Knowledge Hub</i> under NISTI.</p>
<p>Inadequate involvement and investment of the private sector in STI and scarce public private partnerships.</p>	<p>Encourage public-private sector partnership and funding in technology prospecting, acquisition and research and development through co-development funding, tax rebates, waivers, assured orders and long term partnerships with strategic industries.</p>
<p>Insufficient innovation and entrepreneurship and a weak National Innovation System (NIS).</p>	<p>Set up a <i>Business, Technology and Innovation Incubator</i> and establish linkages between the components of the NIS in the form of joint research and technology development projects, exchange and mobility of manpower skilled in STI, technology licensing agreements, and sharing of information and resources.</p>
<p>The benefits of STI are not reaching the people.</p>	<p>Establish a <i>People's STI Group</i>, and use <i>Technological and Social Innovation</i> to negate the negative effects of technology on social and cultural wellbeing of the people.</p>
<p>Need to further modernise IT Eco-System for IT Enabled Services in e-Government, e-governance, service delivery and e-commerce in public and private sectors.</p>	<p>Integrate network and internet requirements planning with the NDS for e-Government and e-governance. Give primacy to IT Infrastructure Funding for building cloud based ERP system(s) to reduce the need for hardware, software, network administration and system management by all.</p>
<p>Fragmented international partnerships and cooperation agreements and arrangements in STI.</p>	<p>Strengthen the role of NISTI to render advice to the Government and ensure representation in regional / international meetings, follow up and audit of STI commitments made and met. Establish a dynamic online portal linked to international institutions and organisations.</p>
<p>Inadequate monitoring and absence of an evaluation mechanism.</p>	<p>Evolve a <i>National Index for STI</i> encompassing the Frascati, Oslo and World Bank KEI indicators to suit the KRAs of the Government and the aspirations of the people of Seychelles. Integrate STI feedback mechanism with PPBB.</p>

INTRODUCTION

Recognising the importance of STI and the need for creating a *knowledge-based economy* to fuel sustainable development, the *Higher-Level Steering Committee for KBE* of the Government of Seychelles, in mid-2015, mandated NISTI to formulate the National Policy and Strategy for Science, Technology and Innovation for the next ten years – 2016 to 2025. This policy and strategy is an outcome of that mandate, aimed at addressing gaps, which have been identified through qualitative and quantitative collation and analysis of evidence.

This policy and strategy document is laid out in the following eight sections:-

- 1.0 Framework for the National Science, Technology and Innovation Policy and Strategy
- 2.0 National Planning, Governance and STI
- 3.0 Building and Strengthening the Pillars of a Knowledge-Based Economy
- 4.0 STI for the People
- 5.0 STI in Socio-Economic Development of Sectors
- 6.0 Smart International Partnerships
- 7.0 Strategy for Research, Technology and Innovation Management
- 8.0 Monitoring, Evaluation and Review

1.0 FRAMEWORK FOR THE NATIONAL SCIENCE, TECHNOLOGY AND INNOVATION POLICY AND STRATEGY

1.1 Background.

1.1.1 Socio-Economic Background. The Republic of Seychelles comprises 115 pristine islands spanning an archipelago in the Indian Ocean, approximately 1,500 km east from the African coast, northeast of Madagascar. The current population - estimated at 93,000, the smallest of any African State is mostly concentrated in its largest island Mahé, only 26 kms long and 8 kms wide. Seychelles therefore, has its unique set of socio-economic challenges of limited – population, industrial capacity, scientific and technical human resources and markets (lack of economy of scales). Albeit these challenges, in the past few years, Seychelles has done well by taking major

steps in its macro – economic restructuring (including tightening monetary policy and exchange rate flexibility). This has not only helped it ride its financial crisis since 2008, but by late 2015, helped it attain the World Bank ranking of a *high income* nation. Its economy, growing at a rate of over 4 % (IMF predicted growth rate for 2017 is 4.5 %), primarily relies on fisheries and tourism, but remains vulnerable to global developments and domestic risks. Domestic risks are linked to state-owned enterprises and issues impacting fisheries and tourism (e.g. recent algae bloom). Even with an average per capita income of almost USD 15,000, the high disparity in income distribution (46% in a 2013 National Survey) warrants more inclusive growth through entrepreneurial development of the private sector. Private enterprise apart from fisheries and tourism is mostly related to imports and trade with scant innovative entrepreneurship by SMEs or individuals. Of late, Seychelles has taken the strategic initiative of focussing on economic diversification through the development of a *Blue Economy* or an economy based on optimal and sustainable exploitation of its vast exclusive economic zone (EEZ) of 1.4 million square kms. This has also changed the perspective of Seychelles from being viewed as a *Small Island Developing State* (SIDS) to a '*Large Blue Resource Nation*'. However, this will in turn necessitate huge investments in related research, technology and innovation activities in the field of *Biosciences* and the *Blue Economy*.

1.1.2 STI Management in Seychelles. In Seychelles, prior to 2008 there was a *Science and Technology Council* represented by a mix of the public and private sectors, which unfortunately, could not really succeed in embedding S&T into socio-economic development, due to lack of institutional support. Between 2008 and 2010, UNESCO helped the Government carry out a baseline study through stakeholder consultations and drafted the basic framework for management of Science, Technology and Innovation (STI), which culminated into Seychelles' first STI Policy in 2011. However, this too could not be implemented effectively due to institutional gaps in national capacity and capability. In 2012, another UNESCO funded audit of STI was carried out, which identified these institutional gaps. Consequently, and in recognition of the critical role science, technology and innovation play in sustainable development, the Government of Seychelles through an Act passed by the National Assembly in April 2014, established the National Institute for Science, Technology and Innovation (NISTI) as an autonomous body under the patronage of the President. The overall objective of this enactment was to establish a fully functional agency that acts as the umbrella body for the development, dissemination and promotion of science, technology and innovation (STI) in Seychelles.

1.1.3 Existing STI Policy Environment. The existing explicit policy for STI in Seychelles is ingrained in the *NISTI Act of 2014* which lays down generic guidelines for STI capacity and capability building as well as the central coordinating role of NISTI. The *2011 STI Policy* warranted the creation of a *STI Council*, and several other measures which were never implemented due to lack of policy coherence, institutional support and perhaps the national will to implement it. Consequently, the responsibility and role of NISTI as a national coordinator for STI is not being achieved due to lack of

authority, weak linkages and frequent changes in its governance. NISTI as per its Act of 2014 was to be under the President's Office but has been functioning under the Ministry of IEDBI until November 2016. It has since been placed under the Vice President's Office. There are a number of implicit policies like the Seychelles Strategic Land Use and Development Plan (SSLUDP 2040), Seychelles Sustainable Development Strategy (SSDS 2012-20), National Development Strategy (NDS 2015-19) and the emerging Blue Economy Road Map (short and mid-term) at the national level; and several sectoral policies like Department of Information and Communication Technology (DICT), Industrial, SME, Agriculture, Tourism, Fisheries, Environment, Energy, Investment, etc. which implicitly promote STI. The setting up of the *High-Level Steering Committee for KBE* under the chairmanship of the Vice President and the creation of a *Technical Committee* is now providing political support to STI in many ways. Also, the recent decision of placing NISTI under the Vice President's Office will help to enhance its autonomy and role as a national coordinator.

1.2 Conceptual Framework.

The framework of this policy and strategy is based on the following concepts: -

1.2.1 Concept of a Knowledge-Based Economy (KBE). The World Bank Institute terms economies which invest in knowledge for socio-economic growth as *knowledge economies* and measures them using a *Knowledge Economy Index (KEI)*, which ascertains whether the environment is conducive for knowledge to be used effectively for economic development. The Government of Seychelles in 2014 set up a *High-Level Steering Committee* under the chairmanship of the Vice President for strengthening the four pillars of KBE - *economic incentive and institutional regime, education and human resources, the innovation system and a modern and adequate information infrastructure*. The Committee aims at transitioning Seychelles from its current World Bank status of an 'Efficiency-Driven Economy' to a *Knowledge-Based Economy (KBE)*. Seychelles' transition into a KBE is not envisaged in the classical sense of high-end technological growth of more the developed and richer nations but in selected fields of STI relating to *environment management, biosciences and the Blue Economy*. The detailed description of the concept of a KBE is at **Appendix A**.

1.2.2 Role of STI in Sustainable Socio-Economic Growth. The fact that STI is critical to attaining sustainable development today is widely accepted and has been manifested in many international policy documents. In 2005 the United Nations Millennium Task Force of Science and Technology released a report, *Innovation: Applying Knowledge in Development*, which vividly shows the link between STI and application of knowledge in socio-economic development. In the same year, African countries adopted a Consolidated Plan of Action (CPA) on Science and Technology that was developed under the aegis of the African Union and its New Partnership for Africa's Development (NEPAD) and many of Africa's Regional Economic Communities (RECs) have designed plans or strategies for STI. In 2014, Africa revised its CPA to reflect new socio-economic developments and priorities and adopted the *Science, Technology and Innovation Strategy for*

Africa (STISA) 2024. It is very clear that Africa and the international community recognize the importance of STI in sustainable development. Also in 2014, The enactment of NISTI followed by the issuance of this policy and strategy formulation mandate by the HLSC (KBE) in 2015 highlights the seriousness of the Government of Seychelles in promoting *Research and Development* to build *Knowledge* for sustainable socio-economic development. *Transforming Our World: The 2030 Agenda for Sustainable Development* adopted on 26th September 2015 by the UN urges nations to evolve ambitious Science, Technology and Innovation (STI) policies and strategies to ensure that the 169 targets of the 17 Sustainable Development Goals (SDGs) are attained in the next fourteen years.

1.2.3 Importance of GERD and Institutional Arrangements for Funding. There is a direct correlation between the level of government investment in Science, Technology and Innovation in terms of GERD (Gross Domestic Expenditure on R&D) and development – provided it is focussed. Seychelles is committed to attain a GERD of at least 1% of its GDP by 2020. However, with its recent strategic focus of economic diversification through the development of a *Blue Economy* or an economy based on optimal and sustainable exploitation of its vast exclusive economic zone (EEZ) of 1.4 million square kms, it will need considerable investments in related research, technology and innovation activities. This necessitates two things – firstly, the need to grow GERD and mainstream STI into national development plans; and; secondly ensure that adequate institutional arrangements are established for STI planning, prioritisation, funding and monitoring.

1.2.4 National Innovation System. Innovation and entrepreneurship are crucial to promoting growth, keeping firms competitive, reducing income disparity as well as attaining the UN SDGs. Innovation is a critical pursuit not only for the private sector but also for improved delivery of public and social services. It is therefore imperative that the different components of the *national system of innovation* in Seychelles, like Government, Academia, Industry, Financial Institutions, Support Institutions, and People, function in an integrated manner to promote innovation and entrepreneurship. An effective *National Innovation System* warrants linkages in the form of joint research and technology development projects, exchange and mobility of manpower skilled in STI, technology licensing agreements, and sharing of information, resources and technology infrastructure between public and private sector institutions.

1.3 Gaps and Challenges.

1.3.1 Absence of a National Planning Body. There is no national planning body for evolving an integrated national development strategy and achieving cross – sectoral policy integration. Presently, the national development strategy planning process is fragmented - the 25 year SSLUDP 2040 is being driven by the Ministry of Habitat, Infrastructure and Land Transport; the 10 (9) Year SSDS 2012-20 is driven by the Ministry of Environment, Energy and Climate Change; the 5 Year NDS

2015-19 is driven by the Ministry of Finance and the Department of Foreign Affairs; and; the emerging Blue Economy Road Map (short and mid-term) has been placed under the Ministry of Finance, Trade and the Blue Economy. This along with frequent changes in portfolios of ministries has led to a lack of coherence in the selection and pursuit of national development priorities and related policies and strategies.

1.3.2 Absence of an STI Advisory Body and Coordination Mechanism at the National Level. Government monitoring of research and innovation performance and establishing criteria and mechanisms for allocating priorities and resources that give strong incentives to excellence in areas of focus has not been institutionalised. Earlier STI policy objectives (2011) of establishing *STI Council* and the overarching *coordinating role of NISTI* as per the NISTI Act of 2014 have not been achieved due to inadequate institutional support, empowerment and linkages. NISTI, as per its Act of 2014 was to be under the President's Office but has been functioning under the Ministry of IEDBI until November 2016. It has since been placed under the Vice President's Office. These frequent changes in governance structure of STI have resulted in the absence of a clear '*national agenda for STI*' from being an integral part of the national development strategy.

1.3.3 Sectoral, Institutional Rivalry and Lack of Integrated Governance of STI. There exists sectoral and institutional rivalry for position and funding amongst MDAs and Institutions related to STI. Institutions have limited incentives to strive for excellence or to cooperate with other stakeholders or private sector actors. Committees and Boards have not been effective in bringing about integration of STI into the national development fabric due to either the lack of, or conflict of interests of the members in promoting STI. This is largely due to the fact that NISTI was established recently after most MDAs and the absence of an integrated STI governance system.

1.3.4 Funding STI and GERD. Currently Seychelles is not able to estimate its Gross Domestic Expenditure on Research & Development (GERD). Most of the research, technology and innovation activities in Seychelles have been through stand alone projects funded by international institutions or organisations with limited reference to inclusivity, performance criteria or correlation to national development goals. When criteria are used they do not always cover key features such as cooperation with industry or dissemination of results. This has happened due to international as well as national funding for research not being accounted for under GERD or by a national agency for the purpose.

1.3.5 Inadequate STI Capacity. There exist inadequate laboratories, incubators, science parks, engineering and technology institutes of higher learning. The 2015 Audit of Public Laboratories and Research Institutions of Seychelles revealed that there is a need to build advanced technology national laboratories for key areas of R&D identified. It also identified a need for having standing instructions for its upkeep, coordinated and shared utilisation.

1.3.6 Inadequate STI Capability. There is a lack of scientific human resource and over reliance on foreign scientific human capital. Poor performance of youth in Sciences and Mathematics and lack of awareness, interest and preference in pursuing STEM related careers is disconcerting.

1.3.7 Absence of a National STI Data Repository / Knowledge Hub. Over the years, a lot of research has been carried out and is still being done in Seychelles, whose outcomes and metadata are either scattered across multiple agencies or simply not available due to improper research data plans and management. This has resulted in inadequate openness and sharing of *Knowledge* as a developmental resource.

1.3.8 Private Sector in STI. There is inadequate involvement and investment of the private sector in STI and scarce public private partnerships in the development of innovative technologies or systems. There also exist insufficient partnerships between the academia and the private sector.

1.3.9 Limited Innovation and Entrepreneurship and a Weak National Innovation System (NIS). The support system to promote entrepreneurship and innovation is weak. The *linkages* between the *components of National Innovation System (NIS)* like NISTI, UniSey, public and private R&D institutes, policy-making bodies, private enterprises, research-oriented NGOs, financial institutions and *technology support agencies* like Seychelles Bureau of Standards, Department of ICT, and the National Bureau of Statistics are not structured. The IPR regime is dispersed across three agencies.

1.3.10 STI and the Community. The benefits of STI are not reaching the people, as STI initiatives are not always focussed towards their needs. People's issues like cardio-vascular ailments, obesity, cancer, substance abuse, breakdown of the family structure, invasive species impacting health and the environment, traffic congestion, personal financial betterment, etc. do not always get the right priority and funding. There is also a lack of focus on *Social Innovation* to address societal problems like high risk social behavior, teenage pregnancies, life-style related health issues, addiction to 'social media', declining family values, honesty, decency, tolerance, faith and trust.

1.3.11 Lack of a modern IT Eco-System for IT Enabled Services in E-Government, E-Governance, Service Delivery and E-Commerce in Public and Private Sectors. Inadequate connectivity, cloud-based services, lack of updated or absence of web portals is impacting the management of STI and knowledge economics. Outreach strategies of e-commerce and e-governance have not significantly reduced the need for cash handling and queues for bill payments.

1.3.12 Fragmented and Weak International Partnerships and Cooperation Agreements in STI. International partnerships in STI are fragmented and not fully functional.

Seychelles has lost out on many regional and international STI promotions and funding opportunities due to its weak linkages with international partners and lack of coordinated functioning within.

1.3.13 Inadequate Monitoring and Absence of an Evaluation Mechanism. This is perhaps the weakest link of STI governance, which is compounded by the absence or lack of data for all the indices of R&D, Innovation, Knowledge Index and Knowledge Economy Index (World Bank KAM Indicators). Limited audit of STI capacity and capability has been carried out and sectoral initiatives are often opportunistic rather than being based on a national need analysis. The Government administrative and PPBB feedback mechanism of MDAs does not include STI indicators.

1.4 Vision, Mission and Strategic Objectives.

Vision

‘A knowledge-driven, innovative, prosperous and pristine Seychelles’.

Mission

Embed science, technology, research and innovation into the socio-economic transformation of Seychelles to spur knowledge-driven and value-added sustainable growth for improving the quality life of its people.

Strategic Objective

Transform Seychelles into a knowledge-based and innovation-driven economy that will attain its *national* as well as the *United Nations’ Sustainable Development Goals* by 2030.

1.5 Specific Policy Objectives.

Specific objectives of this policy and strategy are to:

- (a) Build broad-based political leadership for promoting the integration of STI into development plans, programmes and practices;
- (b) Increase the country’s gross domestic expenditure in R&D and innovation to 1% of GDP by 2020 and 2% by 2025;
- (c) Build endogenous human skills or capacity in STEM and entrepreneurship in the country;
- (d) Promote the creation of local technology-based enterprises that generate employment for the youth in the country;

- (e) Build strong linkages between public and private sectors in research, technology development and innovation;
- (e) Build a world-class infrastructure for research and innovation in the country;
- (f) Ensure that STI are efficiently procured and applied in policy-making on various sustainable development issues;
- (g) Govern STI so that it contributes to social inclusion, environmental sustainability and economic growth as well as international competitiveness;
- (h) Establish a modern and efficient information infrastructure to support knowledge sharing and enabling future IoT functions in a Smart Seychelles;
- (i) Ensure all research data is managed in a manner to ensure its availability and dissemination;
- (j) Enhance or improve the country's participation in international STI cooperation;

2.0 NATIONAL PLANNING AND STI

2.1 National Development Priorities.

STI is cross-cutting and pervasive and all ministries, departments and agencies of the government, the private sector and civil society need to give it an impetus to boost socio-economic growth. However, sectors, which require special STI focus and investment, based on the priorities identified in the national development strategies, are tabulated below: -

AREAS OF FOCUS FOR STI		
BLUE ECONOMY	SOCIAL	PRIVATE SECTOR
EDUCATION	TOURISM	FISHERIES
ENVIRONMENT	ENERGY	AGRICULTURE AND FOOD SECURITY
HEALTH	ICT	GOVERNANCE

2.2 Identifying the STI Priorities and Enablers in the National Development Strategy (NDS 2015-2019).

The *national agenda or priorities for STI* based on the four KRAs of the NDS are:

2.2.1 KRA 1: Governance.

- Build an effective *STI Governance System* through institutional structures and linkages for ensuring political commitment, policy direction, developmental planning, implementation coordination, monitoring and evaluation and review.
- Ensure efficient E- Government and E-Governance using ICT and IT Enabled Services (ITES) through a national IT - Eco System.

2.2.2 KRA 2: Economic Development. Find new sources of growth and competitiveness in the *Blue Economy*:

- Embed STI in the priority economic sectors of Fisheries, Tourism, Health, ICT, Agriculture, Biotechnology, Transportation and Marine Science
- Support business innovation and SMEs
- Emphasise on demand-side innovation policies

2.2.3 KRA 3: Social Development.

- Build scientific human capital for a knowledge economy – Improving skills and education in science, technology, engineering and mathematics, innovation and entrepreneurship.
- Create, sustain and rebuild social cohesion and a high trust society.
- Build a healthy, active and inclusive society - eradicate social ills of substance abuse, high-risk social behaviour and eroding family values and mainstream the community into governance.

2.2.4 KRA 4: Environment and Energy

- Place environmental issues, climate change and clean energy high on the national agenda.
- Make Seychelles a world leader in conservation and environment management.

2.3 Integrating STI into National Development Strategy.

In order to integrate STI into national development the following policy measures will be undertaken:

- A. Establish a *National Planning Commission* for integrated long, mid and short term socio-economic national development planning, focussed on national interests.
- B. Build an *STI Foresight and Advisory Mechanism* capability in NISTI.
- C. Establish a *National Research Foundation* to develop criteria for research prioritisation and plans, and provide grants to researchers. The purpose of the NRF will be to plan GERD and orient research for the betterment of the quality of lives of the people of Seychelles.

- D. Provide adequate incentive and remove barriers to innovation through tax incentives and rebate to private companies that invest in or provide funding to R&D in the country.
- E. Evolve a National IPR Policy supported by an IPR Act, which will look at all aspects of intellectual property.
- F. NISTI will prepare a 10 year *STI Strategic Initiative Plan (SSIP)* comprising two five-year plans integrated with the NDS with clear milestones to ensure monitored growth of STI.

2.4 Establishing a National Research Foundation.

The *National Research Foundation* will lay down the prioritisation and funding criteria with respect to the evolution and implementation of the *National Research Plan*. E.g. to keep Seychelles pristine, the government will identify and promote use of only environment friendly technologies and establish standards for the same. The NRF will evolve the *National Research Plan* for five year periods and a *25 Year Long Term Research Plan* to secure funds for selected prolonged research projects. In line with the research plans, NRF will evolve a prioritised *10-Year Research Infrastructure Development Plan*. The NRF will monitor and plan GERD and also ensure that ethical use of STI is promoted early in school and in all research done in Seychelles.

3.0 BUILDING AND STRENGTHENING THE PILLARS OF A KNOWLEDGE-BASED ECONOMY

3.1 Providing Economic Incentives and a Conducive Institutional Regime to Promote the Growth of a Knowledge-Based Economy².

The following measures will be adopted by relevant Ministries, Departments and Agencies (MDAs) to strengthen the KBE pillar of '*Economic Incentive and Institutional Regime*' in Seychelles.

- A. Carry out periodic *impact assessment* (through statistical analysis of practical indicators) of Seychelles' '*Economic Incentive and Institutional Regime*' over the past five years; and; focus on continuously improving the key determinants, which impact growth of a *knowledge economy* through further development of institutional regimes and economic incentives.

² The details of the Knowledge Assessment Methodology (KAM) and the relationship of *Economic Incentive and an Institutional Regime* to a *Knowledge Based Economy* are given at **Appendix A**.

- B. Examine the long-term implications on STI of regional and international economic and trade agreements (e.g. IEPA, COMESA, WTO, etc.).
- C. Evolve an integrated system of economic policy implementation, retaining cross – sectoral relevance to national commitments and priorities.

3.2 Creating a Knowledge Society: Educated and Skilled in STI, Informed and Connected.

3.2.1 Science, Technology, Engineering, Mathematics, Innovation and Entrepreneurship (STEM I&E) Education. In order to build an inquiring mind in society, science acculturation and generate interest in STEM related careers, the following measures will be implemented:

- A. **A STEM I&E Committee (COSTEMIE)** with cross-sectoral representation from civil societies, NGOs, STI related MDAs, NISTI, UniSey, Private Sector (involved in R&D and Innovation) will be established in the Office of the Vice President.
- B. **COSTEMIE Plan.** The Committee will review the entire curriculum of STEM I&E Education and introduce inquiry-based and applied science learning from early schooling until tertiary education. It will also evolve a holistic, prioritised *COSTEMIE Plan* for building physical infrastructure, information infrastructure, human capital and implementation mechanism over a ten-year period, to be reviewed every two years. Innovation and Entrepreneurship Education will form an integral part of this plan.
- C. **Sponsorship and Involvement.** Sponsorship should be sought from private and unorganised sectors through CSR and tax incentives in education, training and awards for applied industry specific STEM I&E competitions, e.g. a Solar Boat/Bicycle Race; Using IoT (Internet of Things) for Security; Doing Business through the Internet, etc.
- D. **Science Centre.** A modern *Science Centre* should be built under the aegis of NISTI and the Ministry of Education at a suitable location on Mahe. The proximity of all learning institutions and optimisation of resources will encourage the establishment of a single yet high quality ‘Science Centre’ on Mahe. The science centre should be an activity-based model akin to the *Singapore Science Centre*, albeit on a smaller and more relevant scale. It should be a place where students and teachers love to come for a fun day with science.
- E. **International Roving Science Fairs.** *Roving Science Fairs*, which tour the world. (e.g. the *Australian Science Circus, Africa, 2015*) should be invited to Seychelles. In addition, visits of selected bright students in science should be organised to countries having advanced science centres e.g. Singapore, Malaysia, South Africa, etc.

3.2.2 Reversing Brain Drain. The following policy initiatives will be taken by ANHRD, NISTI, UniSey, Department of Foreign Affairs, Employment, Human Resource Development, Education, IEDBI and Finance to build on the existing human capital in STI: -

- A. **Mapping** of Seychelles diaspora across the globe in STI activities by category.
- B. **Encourage investment and participation** of the Seychelles scientific diaspora through committee memberships, projects, institutional collaborations and employment incentive schemes like higher pay, prioritised land allotment, tax concessions, etc.
- C. **Attract the best international talent in STI** to pristine Seychelles, for collaborative research projects.

3.2.3 Prospecting and Utilising Scientific Education, Research Funding and Training Opportunities World Wide. There are many government to government arrangements as well as regional/international research and scientific education and research opportunities for Seychellois, which remain under exploited. NISTI through its network of international partnerships will be the central coordination agency for prospecting, identifying, categorising and facilitating the utilisation of scientific education, research funding and training opportunities globally. The National STI Web Portal (NISTI Website) will have search engines configured to provide the latest information as well as formats and timelines for applications for such opportunities.

3.2.4 Building Awareness, High Trust and Participation in STI through Constituencies, Collaborations and Teamwork. The compartmentalised functioning of all the components of the NIS – Government, academia, industry, financial institutions, R&D institutions, private sector, NGOs and individuals can be improved by *institutionalising functional transparency* and building a *high trust society*. Constituencies like committees, institutions, science centre, open STI forums and competitions will all enthuse people to trust each other, collaborate and share. Technologies for seamless monitoring, traceability, checks and balances will assist in dissuading errant individuals and removing trust deficit. Annual STI Open Forum comprising researchers, businesses, politicians, individuals and policy-makers will be held to share achievements, ideas and future plans. This will be coordinated by NISTI.

3.3 Evolving a National Innovation System.

3.3.1 Building STI Capacity.

3.3.1.1 Improving Infrastructure for Research, Technology and Innovation Management. In order to improve infrastructure for R&D and Innovation the following steps will be taken: -

A. Carry out an analysis of public and private sector research and development infrastructure needs and identify gaps/shortcomings in terms of capacity, capability and relevance.

B. Evolve a *National Research Infrastructure Plan* based on the *National Research Plan* through the aegis of NISTI and the *National Research Foundation*, which will take a holistic look at critical deficiencies in R&D capacity and capability, both public and private.

C. Establish a common Outbound (R&D) cum Inbound (Prospecting) *Technology Transfer Centre* with linkages to all R&D establishments and an IPR eco-system.

D. The *National Research and Development Infrastructure Plan* will extend over a ten-year period broken down into two five-year plan periods, further divided into annual *Programme Performance-Based Budgeting* (PPBB) plans.

E. Orient and train key technical personnel for running the establishments through international quality training standards collaboratively set by NISTI and the Seychelles Bureau of Standards (SBS).

3.3.1.2 Establishing a Research Data Centre and STI Knowledge Hub. NISTI will collaborate with regional and international stakeholder's to develop the following: -

A. **Research Data Centre (RDC).** A Research Data Centre will be established at NISTI, which will act as a national research data repository of all past, on-going and future research work in Seychelles. All research data at the Seychelles Bureau of Standards and other research institutions and organisations will be transferred to the RDC to be run under the aegis of NISTI. It will also curate data into current digital format for easier storage, duplication and dissemination.

B. **STI Knowledge Hub.** NISTI through its *National STI Portal* will build a STI Knowledge Hub with suitable linkages and query tools for easy access to its knowledge repository. The Knowledge Hub will have a suitable *Information Processing System* to facilitate sharing.

C. **Open Access (OA) Policy.** All MDAs and Institutions in Seychelles will adopt an OA policy for publishing of all public funded *peer reviewed research papers* and *seminars and workshop reports* in accordance with international norm of *Gold OA* (in case the Article Processing Charges are being publicly funded) and *Green OA* (after a maximum embargo period of 12 months). Definitions, terms and specific conditions for the OA Policy must be included in the National IPR Policy and reviewed periodically to make information increasingly open.

3.3.1.3 Building a Regional Centre of Excellence for Research in Biosciences and the Blue Economy. In line with its national focus of sustainably, exploiting its vast exclusive economic zone of 1.4 million square kms, Seychelles will establish a research centre of excellence for developing niche technologies in the field of *Biosciences* and *Blue Economy Technologies* like Blue Biotechnology, Ocean Energy and Marine Science. This role will be adopted by the *Blue Economy Research Institute (BERI)* in collaboration with *SFA* and other related institutions.

3.3.1.4 Strengthening Technology Support Institutions. Based on the needs analysis of the national R&D Infrastructure Plan, STI support institutions like SIT, SIB, UniSey, etc. will review their curriculum of training and adopt new curriculums to suit the sectoral and industry training needs, e.g. training personnel in new fields of marine sciences, energy efficiency, renewable energy, ITES, smart buildings, bio-sciences, etc. The responsibility for streamlining the training to suit sectoral needs and setting standards and regulations will be that of the parent MDA in collaboration with the Ministry of Education and Human Resource Development and the department of Employment.

3.3.1.5 Ensuring GERD/GDP Ratio (R&D Intensity) Builds up to 1% by 2020 and 2% by 2025. NISTI in collaboration with the Ministries of Industry, Trade and Finance will ensure that Seychelles' GERD builds up to the subject targets committed regionally to the SADC (RISDP) and internationally to the United Nations SIDS /SDG Conferences. The endeavour will be to ensure that all priority areas of R&D and Innovation activities are funded adequately in collaboration with the national development strategy and not just meet or cross the annual percentage targets. The measure of its current state of expenditure on R&D and Innovation will be done through STI Indicators (R&D and Innovation) Surveys as per the OECD Frascati and Oslo Manuals suitably adapted for Seychelles, once every two to three years. The selection of indicators should ensure that both national as well as the UN sustainable development goal-achievements are measured.

3.3.2 Promoting Innovation and Entrepreneurship.

3.3.2.1 Establishing Industry – Academia linkages in RDC (Research, Development and Commercialisation). NISTI in collaboration with tertiary academic institutions, UniSey, the industrial sector (Public and Private) and SCCI will identify projects for research partnership between the industry-academia, which are of socio-economic value and promote its part funding by the Private Sector and the Government.

3.3.2.2 Establishing a Support System for Entrepreneurial Start-Ups and MSMEs. NISTI with the Ministry of IEDBI in collaboration with SCCI, SEnPA, and SBFA will establish a Business, Technology and Innovation (BTI) Incubator for start-ups and MSMEs. This, along

with the *National Innovation System* and an *IP Eco-System* will help boost start-ups and entrepreneurship in Seychelles.

3.3.2.3 Establishing an Eco-system for Intellectual Property. Presently the IPR regime in Seychelles is being handled by three agencies - the Department of Culture, the Department of Trade and the Registration Office. It is recommended that the regime be institutionalised under any one Ministry or Department and a consolidated *National IPR Act* be legislated. Promoting the 'Made in Seychelles' brand and institutional arrangements for entrepreneurship and innovation would require an unambiguous and robust *National IPR Policy*. The IPR regime in Seychelles will adopt a holistic approach towards promotion of IPR awareness; generation and commercialisation of IPRs; and; resolution of IP legal, administrative, institutional and enforcement related matters. It will have adequate safeguards in the form of judicial review and appellate provisions. An *Intellectual Property Appellate Board* will be set up to hear appeals arising from disputes on Patents, Trade Marks, Copyrights and Geographical Indications. Conscious efforts will be made to develop a robust e-service delivery system, including real-time public dissemination of dynamic IP knowledge through innovative e-enabled tools. The *National IPR Policy* must include a detailed OA Policy.

3.3.2.4 Promoting Open Data, Open Innovation, Crowd Sourcing and Funding. The *STI Knowledge Hub* established by NISTI through its portal will provide open access to data to all; promote open innovation schemes of the public and private sector as well as facilitate crowd sourcing and funding. Its *Information Processing System* must facilitate these functions.

3.3.2.5 National Schemes for Promoting Innovation. The following national initiatives will be taken by NISTI through the Office of the Vice President : -

A. **Hold innovation forums and programmes** on issues of priority, identified and funded by both the public and private sector.

B. Run an annual '**National Innovation Week**' with awards to individuals and companies for suggesting innovative ideas for resolving critical problems affecting the people. This could coincide with the national slogan or national day celebrations.

3.3.3 Technology Management.

3.3.3.1 Need Analysis and Prioritisation Mechanism. The *NISTI* under the aegis of the *National Research Foundation* (NRF) along with the *STI Advisory Body* will carry out a

technology audit across all sectors, once every three years. The audit will ascertain the technology needs of Seychelles, in terms of *technology for acquisition* in the ensuing five-year period, which will be included in or are a part of the *Sectoral Acquisition Plan or Projects*; and; *technologies requiring R&D* in the ensuing ten-year period, which will be included in the *National Research Plan*. The criteria for prioritisation will be worked out by NISTI in collaboration with the concerned sector, the STI Advisory Body and the NRF, duly approved by its Board Members. All technologies acquired by any sector and are of some common use to others, will be shared by the MDA acquiring the technology. Criteria for project approvals in Seychelles will have a clause for sharing of research data through inclusion in the IPR portion of project proposals.

3.3.3.2 Technology Transfer Centre. The growth of research and innovation activities would warrant the establishment of a technology transfer centre in Seychelles, under the aegis of the Ministry of Employment, Entrepreneurial Development and Business Innovation. The Centre can assist in technology prospecting, transfer, absorption for all *inbound* technologies; and; help in the process of research, development and commercialisation (RDC) by facilitating patent applications through the IPR regime for all *outbound* technologies. As a technology transfer policy, maintainability and training of human resource will be integral to all contracts with technology providers.

3.3.3.3 Funding Critical Technologies. The Government of Seychelles will identify and if need be, establish a *Technology Acquisition Fund*, which will fund critical technologies required by Seychelles in the next five to ten years, which will be made open to all for promoting entrepreneurial growth. This will give a boost to the inception and growth of new technologies. The acquisition of such technologies through major sectoral projects will also be absorbed and shared with the private sector.

3.4 Information Infrastructure.

3.4.1 Increasing Awareness and Ensuring Independent Management of ICT in a Knowledge Economy. The national *STEM I&E Education Initiative* will include ICT and ITES Education in its curriculum. In addition, DICT will ensure the development of an ICT workforce integral to all sectors of the Government and Community to ensure independent upkeep of websites and management of networks systems by all. Initial and refresher training for this will, in the beginning, be dovetailed into ICT acquisition contracts and sectoral training curriculums, coordinated by DICT.

3.4.2 Building a Modern National IT Eco-System. DICT may consider building a cloud-based ERP system(s) IT architecture to reduce the need for hardware, software, network

administration and system management by all. Network and internet requirements planning will be integrated with the national development strategy for e-Government and e-governance and include the need for 'Smart Victoria and Seychelles' initiatives being planned in the SSLUDP 2040. The ERP architecture will be modular in design to ensure that it facilitates adaptation and upgrade. Large and complex network solutions should be avoided, which may make future modernisation or migrations uneconomical. The IT Eco-System should be simple yet modern in its architecture to ensure speedy implementation and upgrades in e-Government and e-governance platforms. The IT Eco-System will extend to *Common Service Centres* in each District or Community Centre to enable extension of e-services delivery to all. Funding for building a modern information infrastructure and IT workforce will be given primacy.

3.4.3 Integrated ICT- National Development Strategy. The Department of ICT will ensure that its policy and strategy are in synchrony with the national development strategy. Network requirements and technologies acquired or being developed will be compatible and amenable to each other. Also, the network and system upgrades should be timed for modernisation in similar time frames.

4.0 USING STI FOR THE PEOPLE

4.1 Establishing a People's Group.

In order to ensure inclusiveness in STI policy making and implementation, it is imperative to involve the people through the establishment of a *People's STI Group*, preferably under the aegis of the *Departments of local Government, Youth, Culture and Sports*. The People's Group will be involved in the formulation of the *National Research Plan* and all other requisite stages of STI Policy planning and implementation. The composition of the *People's STI Group* will include members from the Department of Social and Family Affairs, Local Government and Sports; Health; Education; District Administration, Community Centres, Educational Institutions, NGOs and selected eminent individuals in society. The concept could extend to all sectors for inclusive national planning.

4.2 Focus Research on People Centric Issues.

Through meetings with the People's Group and opinion polls or Delphi Surveys, the choice of the people for Government investment in research in areas like Education, Health, Security, Environment, Personal Financial Planning and Service Delivery will be obtained annually. Once the priorities of the people have been obtained the Government will run public-private sector funded schemes for promoting research and innovation to address priority issues like cardio-vascular

ailments, obesity, cancer, substance abuse, breakdown of the family structure, invasive species impacting health and/or the environment, traffic congestion, etc.

4.3 Promoting Social Innovation to Negate the Ill Effects of Technology.

NISTI along with the People's STI Group will coordinate and promote the use of *Technological and Social Innovation* to negate the ill effects of technology on social and cultural life and wellbeing of the people. The People's Group will ensure that there is no *digital divide* amongst the community by running familiarisation programmes while utilising e-services, including e-learning from *Common Service Centres* established for the purpose. The Group will also ensure that obsessive use of electronic devices leading to ill health amongst people is curtailed through innovative means.

4.4 Improving Health Care.

An important part of *STI and the Community* is provision of advanced health care. STI tools like Decision Analytic Models (DAMs) could be adopted as established means of evidence synthesis to differentiate between health interventions at the national level. People focussed health care projects will be launched after e-surveys. STI will be used to help improve diagnostics, prognosis and treatment using technologies like remote testing/specialist consultancies, IPR free affordable drugs for all, non-invasive surgeries, etc. Build regional and international networks to keep abreast with advanced health related technologies, processes, resources, etc. Improvements in National Health Service will be periodically audited on the basis of evidence collated from both the service provider and receiver (patients).

4.5 Personal Financial Betterment.

Banker's Association and Ministry of Finance must run *Personal Financial Betterment Courses* and introduce long term personal financing schemes through the Ministry of habitat, Infrastructure and land transport and other stakeholders. Endeavour will be made to reduce the cost of housing construction for all through induction of better technology sponsored by Banks and Financial Institutions as CSR initiatives. Financial and banking services will be improved to promote e-finance and e-commerce to encourage start-ups and reduce the need for cash handling and queues in banks for cash transactions. Online billing and payments will be made compulsory for all major public service providers.

5.0 STI IN SOCIO-ECONOMIC DEVELOPMENT OF SECTORS

5.1 General Measures for Embedding STI for Economic Development.

The following policy will apply to all economic sectors: -

- A. Each economic sector will plan at least one high technology and/or a unique innovation Project every five years to boost or transform the performance of the sector.
- B. Sectoral strategies related to STI must be shared with NISTI for priority funding by the NRF from national and international sources.
- C. Geographical Indication (GI) Product Marketing will be included in all trade agreements signed by Seychelles.
- D. All successful policy interventions will be followed by changes in functional acts of MDAs, where necessary, to bring about legality and role clarity in the national agenda for STI.
- E. The Government will facilitate private sector investment in R&D and promote establishment of R&D facilities in PPP mode with provisions for benefits sharing. NISTI in collaboration with all research establishments, UniSey, and SCCI under the aegis of the Ministry of Finance and Trade will encourage public-private sector partnerships and funding in technology prospecting, acquisition and research and development. This will be promoted through incentive schemes like *Government Funding and Tax Rebates / Waivers for Research, Long Term Partnerships with Strategic Industries, Assured Orders*, etc.
- F. The NRF will encourage the Private Sector to partner with research and financial institutions (public and private) and other stakeholders to adopt a consortium approach to product development in selected technological areas e.g. mariculture, blue biotechnology, renewable energy, agro-products, 'big science', etc.

Key Sector Specific STI Interventions. In addition to the general measures mentioned above, the following sector specific STI policy interventions are suggested as guidelines for inclusion in sectoral policies and plans: -

5.2 STI in Tourism.

- A. Virtual and theme-based tourism will recreate historical events, virtualize remote geographical locations and preserve sensitive habitats. Concepts like *agro-tourism* and *work*

holidays (especially in technical fields) will be explored to offset comparability costs with similar destinations.

B. NISTI could partner STA and STB in evolving a serial innovation strategy in tourism to maintain the *exclusive destination* brand of Seychelles.

C. Technologies like one point biometric passenger identity recording for passage all through the country destinations; Wi-Fi hot spots; public transport timings on phone applications, dial-a-service, etc. needs to be increased to allow passengers to access online information services (especially financial services).

D. The challenge of maintaining the concept of paradise – a perfectly sustainable environment – needs to be met through unobtrusive and aesthetic use of technology, e.g. roofing of parking lots having photovoltaic panels; heat exchange panels for heating water and cooling buildings, etc. have to be instituted. A gradual shift to green buildings and unobtrusive technologies will be promoted in the tourism industry.

5.3 STI in Agriculture and Food Security.

A. Heavy dependence on imports (90%) for less than 90 days of food stocks in Seychelles, needs to be improved by enhancing local produce to achieve clear targets through injection of new technologies, research on herbicides, and innovative marketing practices.

B. Introduction of *new cash crops or products* and enhancing their value through marketing of '*Made in Seychelles*' brand of new products through the GI route will be explored.

C. Seychelles will enter into technology partnerships for sharing of expertise, resources and a common market with regional and international organisations and associations.

5.4 STI in Blue Economy.

A. Identify, prospect, acquire and develop technologies through an integrated '*Technology Evaluation and Approval Empowered Committee*' approach for technologies related to marine science, fisheries and the *Blue Economy* needs.

B. Identify areas of potential through research and focus research capacity and capability building in them.

C. Long term priority research projects will be included in the *National Research Plan* for ring-fencing funds linked to the annual PPBB by the *National Research Foundation*.

D. SFA and other research institutes will institutionalise sharing of information like GIS location of fish stock and zoning of fishing areas with local artisan fishermen through mobile applications developed or procured for the purpose by the Fishermen's Association and Fishing Boat Owner's Association under the aegis of the Ministry of Fisheries and Agriculture.

5.5 STI in Energy, Environment and Construction: Building a Smart Seychelles - SSLUDP 2040/Victoria Master Plan.

A. Innovative eco-friendly construction with unobtrusive renewable energy (RE) technologies and energy efficiency (EE) norms will be incorporated into **building codes** and **town planning**. The following RE and EE Strategies are recommended: -

- A renewable energy and energy efficiency promotional campaign and advocacy plan will be developed, agreed and implemented.
- The regulatory and business environments for RE based grid-connected electricity generation be improved, wind and solar resource databases further developed.
- Government agencies and private investors capabilities be developed to design, engineer, construct and operate decentralized electric power and energy systems based on RE.
- Energy efficiency standards and labels be developed and implemented for all categories of buildings and for household appliances and equipment having major impact on electricity consumption and peak load.
- The Ministry of Environment, Energy and climate change (MECC) and Land Use and Housing must draw an *Environment Technology Action Plan (ETAP)* for inclusion in the implementation of the *Seychelles 2040 Plan*.

B. **Smart financing schemes** will support modern infrastructure development and knowledge sharing. E.g. *Microsoft Indian Ocean Scheme* of inducting world-class de-novo smart technologies (for Internet of Things (IoT) for a *Smart Victoria*) will be shared and extended to all sectors.

C. Modern and improved **public transportation and traffic decongestion measures** like electronic road pricing, self-contained zones, work from home days, traffic-free zones, improved walking paths, etc. will reduce the need to travel to Victoria by transport.

D. Solar powered and rechargeable E-cars and E-Bicycles, doubling as micro grid storage devices, will be planned in a phased manner to promote a *Carbon Neutral Seychelles*.

6.0 SMART INTERNATIONAL PARTNERSHIPS

6.1 Bilateral.

NISTI under the aegis of the HLSC for KBE and in collaboration with the department of Foreign Affairs will strengthen bilateral relationships with technologically progressive friendly countries through institutional arrangements like technology sharing, workshops, STEM I&E Education, technical training and joint STI mega projects like *Smart City Systems*; 100% Renewable Energy; Solid Waste Management; Biosciences; Big Science Projects, etc.

6.2 Regional.

NISTI must ensure representation in regional meetings, follow up and carry out an annual audit of commitments made and met regionally. It will render advice to the Government on future regional STI commitments of Seychelles before agreements are inked. As far as possible, STISA 2024 and the SADC/RISDP 2020 STI, NEPAD, SANBio and SARIMA targets will be included in the national STI programmes and PPBB. NISTI must also ensure that all regional promotional or sponsored opportunities are availed through an efficient online system of information dissemination and monitoring.

6.3 International Collaborations – STI in Achieving Sustainable Development Goals.

NISTI will establish linkages (including online linkages) to the '*Technology Facilitation Mechanism*' (Interagency Task Team on Science, Technology and Innovation for the SDGs, a collaborative Multi-stakeholder Forum on Science, Technology and Innovation for the SDGs and an online platform) being established by the United Nations to support the attainment of the Sustainable Development Goals (SDGs) - in particular SDGs 9, 14 and 17.

The sections or provisions on STI under SDG 17 on means of implementation will be followed - like the importance of international cooperation on and means of ensuring access to STI (SDG 17.6); transfer of environmentally sound technologies (SDG 17.7); and; operationalization of a technology bank and capacity building mechanism (17.8). Use of STI platforms will also be made for *Science Diplomacy* in areas like security arrangements against Illegal, Unreported and Unregulated (IUU) Fishing, conventions against chemical / biological weapons, drugs or dangerous goods trafficking, etc.

7.0 STRATEGY FOR RESEARCH, TECHNOLOGY AND INNOVATION MANAGEMENT

7.1 Overall Strategy.

In order to focus attention on important thrust areas of policy intervention, which not only span across the *KBE Pillars*, but also across *key sectoral areas*, the implementation strategy will endeavour to evolve a common *STI Eco-System*. The strategic thrust areas of the *STI Eco-System* will encompass the following: -

(a) **Strengthening Research Potential and Research Capacity.** In order to build multi-disciplinary research potential in Seychelles it will be necessary to evolve a strong base for STEM I&E, by implementing a strong Seychelles specific STEM I&E Model. The endeavour will be to build internal scientific human capital through initial collaborative research with international researchers, capitalise on the Seychelles diaspora world wide and strengthen STI institutions. The beautiful and pristine environs of Seychelles provide a unique opportunity for attracting international talent, which should be employed to build world class interdisciplinary research programmes and teams by financing human capital.

(b) **Streamline Research Planning, Funding and Monitoring.** In order to focus energy and optimise funds on key result areas it is suggested that the *National Research Foundation* be established at the earliest to evolve a *National Research Plan* (including a *Research Infrastructure Plan*).

(c) **Improving Research Data Management.** Establishing the *Research Data Centre* will also be a priority to ensure that research outcomes and metadata is curated, documented, archived and available for access to all researchers and STI stakeholders.

(d) **Creating a Knowledge Society.** NISTI will facilitate in a *cross-sectoral technology audit* and establish a *STI Knowledge Hub* (an online portal rendering information and environment friendly technological advice). It will ensure that all STI stakeholders gain awareness about inexpensive world class technologies relevant to them and Seychelles, through the *NISTI Portal* and periodic *STI Workshops* held for the purpose.

(e) **GERD and Financing of STI.** Post a national R&D and innovation audit it will be clearer 'Where are we now?' and in terms of the *National Research Plan* evolved by the *National Research Foundation (NRF)* what institutional arrangements and policy measures need to be given priority ('What do we need to do, where, and by when?'). The endeavour will be to attract both international and national funding and gradually build GERD to GDP ratio to 1 % by 2020 and 2 % by 2025 in the selected thrust areas.

(f) Promoting Innovation and Entrepreneurship. NISTI will endeavour to provide an ideal climate for boosting the *national innovation system*, by establishing linkages between its various components through programmes and institutional arrangements. *Academia – private industry interface, establishing a BTI Incubator, financing entrepreneurship, instituting a simple and efficient IPR Regime and providing access to regional and international markets* are some areas which will be given priority to help remove the barriers to innovation and entrepreneurship in Seychelles. Every public undertaking and private sector enterprise as well as institutions will have an innovation section to promote serial innovation.

Figure 1: Below depicts the key policy measures and related institutional arrangements for integrated governance of the STI Eco-System.

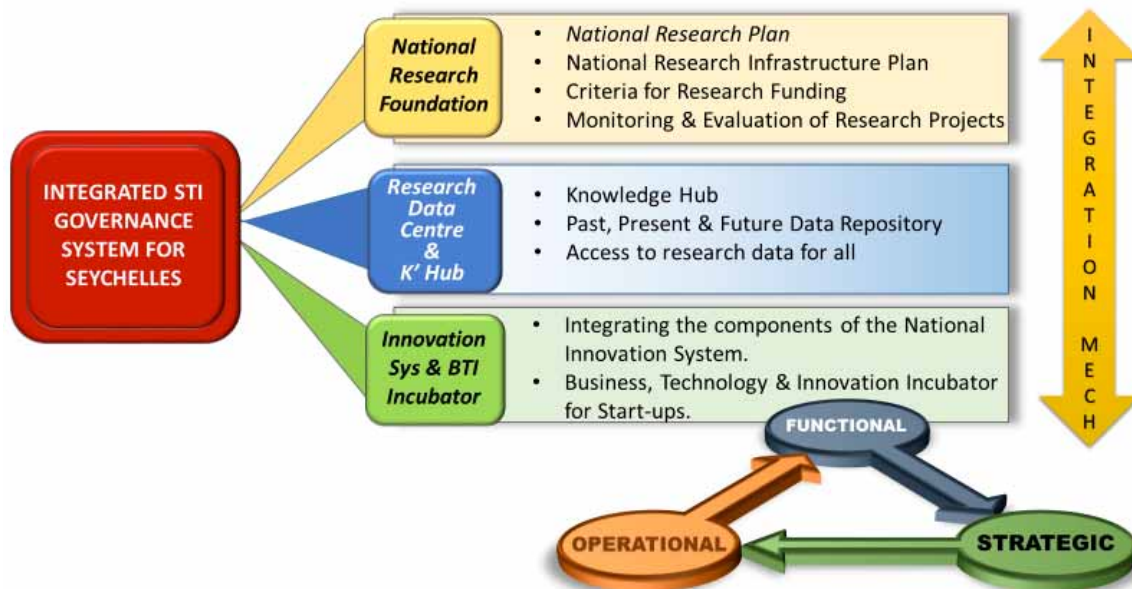


Figure 1: Overall Strategy for Building an STI Eco-System

7.2 Institutional Arrangements, Plans and Processes for Policy Implementation.

NISTI through the aegis of the Office of the Vice President will ensure the implementation of the Policy and Strategy through the following arrangements, plans and processes: -

Institutional Arrangement	Purpose	Role and Responsibilities of NISTI
<i>Committee for STEM I&E</i>	Set up a clear strategy for developing a STEM I&E Education Model and a <i>COSTEMIE Plan</i> .	Propose the Committee for nomination by the HLSC for KBE. Provide secretarial support for implementation management and monitoring of the <i>COSTEMIE Plan</i> by the Office of the VP.
<i>National Research Foundation (NRF)</i>	Provide criteria for prioritisation, funding and publications of research in line with national development strategies. Plan and orient GERD towards attaining national objectives and improving the quality of lives of the people	<p>A. Carry out a feasibility study for the modalities of establishing the NRF under the Office of the VP.</p> <p>B. Project through the <i>Technical Committee</i> of the HLSC for KBE the <i>Technology Audit Plan</i> including resource requirement for its execution once every three years.</p> <p>C. Plan the GERD for the <i>National Research Plan</i> and the <i>Research Infrastructure Plan</i> evolved by the NRF.</p> <p>D. Ensure that projects in the five year <i>Strategic STI Initiative Plan</i> are included in the five year NDS and Annual PPBB of respective MDAs.</p>
<i>National Research Data Centre</i>	Provide a data repository for all research outcomes and a knowledge hub for open access by all.	Float a project proposal for the establishment of the <i>Research Data Centre</i> for the collation, storage, retrieval and sharing of all research data (carried out in or for Seychelles) and its sharing through the Knowledge Hub.
<i>Business, Technology and Innovation Incubator</i>	Provide assistance to MSMEs and individual entrepreneurs as a part of a larger STI eco -system.	Project the proposal for setting up of a <i>BTI Incubator</i> (through the Office of the VP) along with the Ministry of Finance & Trade, the Ministry of Employment, Entrepreneurial Development and Business Innovation, SCCI and the Private Sector.
<i>Integrated STI Governance System</i>	Establish linkages between key stakeholders of STI at the strategic, operational and functional levels	Identify/appoint/promulgate - an <i>STI Advisory Group</i> , <i>STI Liaison Officers</i> in selected MDAs, <i>People's Group</i> (through the Ministry of Local Government, Youth, Sports and Culture) and collaborative International Programmes for promoting STI. Establish linkages through selected projects and programmes.

7.2.1 Strategy for STEM I&E Education. Figure 2 below indicates the outline strategy for adopting a STEM I&E Education System in Seychelles: -

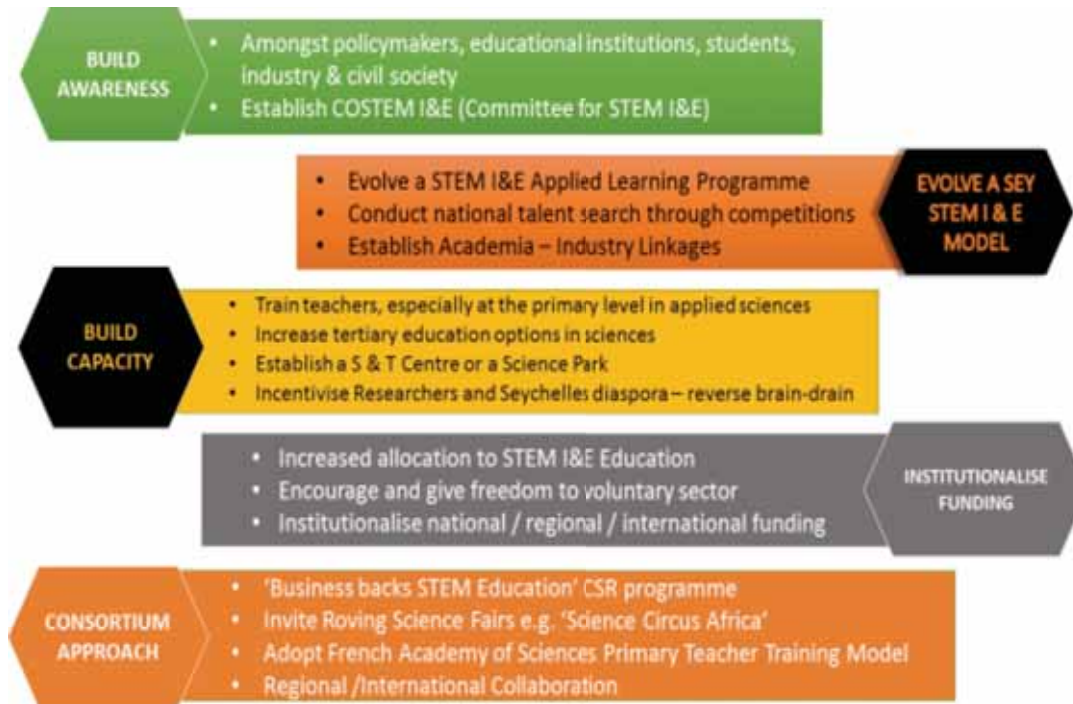


Figure 2: Strategy for STEM I&E

7.2.2 National Research Foundation (NRF). The NRF will be a multi-disciplinary body drawn through consensus from all socio-economic sectors influenced by STI. A feasibility study may be undertaken to form the composition, role, charter and resources required to institutionalise the NRF. The Study should also frame a draft Act for the NRF to be approved by the National Assembly.

7.2.3 National Research Data Centre (NRDC). The outline structure and linkages of the NRDC is depicted at Figure 3 below: -

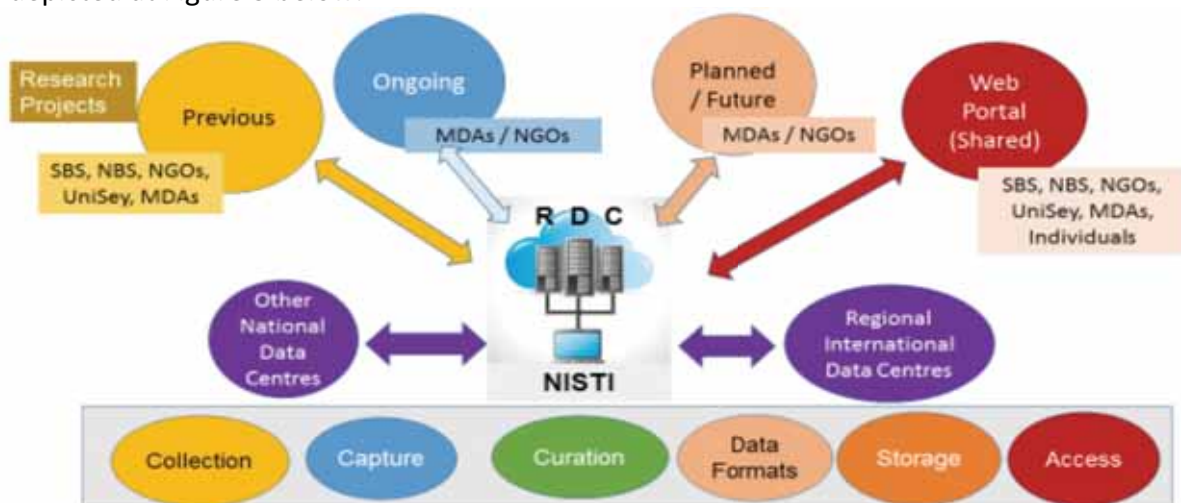


Figure 3: NRDC & Knowledge Hub

7.2.4 Business, Technology and Innovation Incubator. The BTI Incubator will be established under the aegis of the Ministry of EEDBI as per the outline structure depicted in Figure 4 below: -

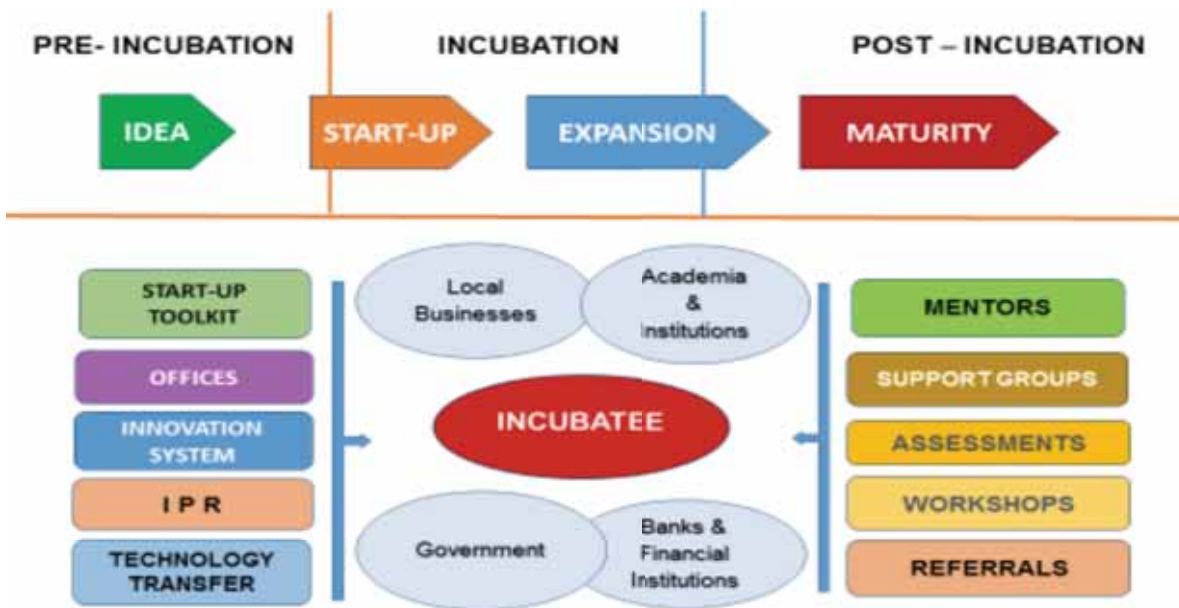


Figure 4: BTI Incubator

7.2.5 Integrated STI Governance System. In order to effect governance and speedy implementation of the STI initiatives and strategic plans, it is imperative that there is coherence, cooperation and collaboration amongst all stakeholders of STI. This would require horizontal and vertical linkages to be established between different levels through mechanisms depicted at Figure 5 below (Details are at Appendix D): -

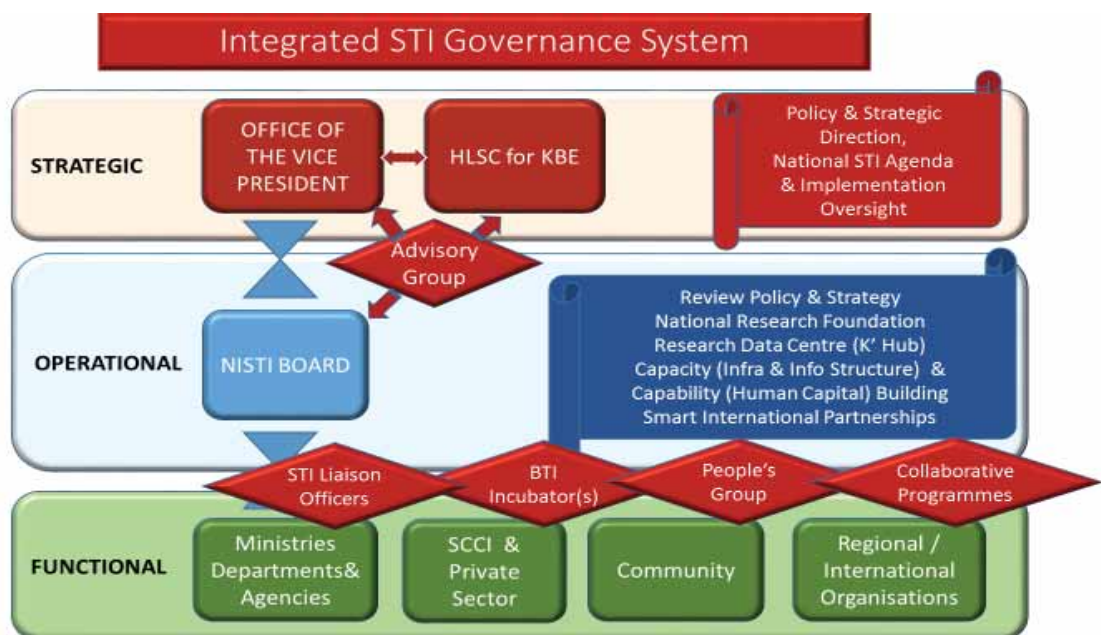


Figure 5: Integrated STI Governance System

7.3 Implementation Timelines.

The policy interventions under thematic areas, which are aligned with the national development KRAs, will be implemented in a non-linear manner, spread across two five-year plans, with advent in the first and building up in the second plan period. The outline implementation plan is depicted in Figure 6 below:-



Figure 6: Outline Implementation Plan

7.4 Detailed Implementation Plan.

Each of the policy measures and institutional arrangements mentioned above will require a detailed Log Frame Matrix to be evolved by NISTI in consultation and coordination with all stakeholders with clear indication of objectives, responsibilities, resources and timelines for implementation, as well as indicators for measuring outcomes of these strategic initiatives. Implementation will be carried out in an integrated manner through an inter-ministerial implementation body set up for the purpose, which will ensure that sectoral priorities and plans are respected and kept in perspective, while achieving the national STI agenda.

7.5 Prioritisation and Funding Strategies.

GERD/GDP ratio or 'R&D intensity' will be balanced for R&D and Innovation activities as well as the *Technology Acquisition Fund* for critical technologies. The national endeavour will be to not just increase GERD to 1 or 2 % of the GDP but to fund every prioritised STI initiative linked to socio-economic transformation of Seychelles, through a wide base of public and private sources.

Regional and international funding for STI will be actively sought and a more elaborate process will be evolved to include capacity and capability building expenditures in all project proposals. Also, only those regional and international project proposals will be selected or promoted, which are in alignment with national KRAs.

Funding strategies for the *National Research Plan* may include a combination of national, regional and international sources. e.g. Establishing a *Regional Fisheries Accredited Certification Centre* for sanitary and phyto-sanitary rules for trade and a *BTI Incubator* from the iEPA/EPA funds of the European Commission (EC); *Environment and Climate Change Research Laboratory* funded through UN Environment Programme (UNEP-7 Programme); *Blue Economy Research Institute*, funded through the Commonwealth Secretariat; and the *Science Centre* through the SADC and national STI budget. The integrated STI Governance System will have a software system for timely budgetary projections and evaluation like the Planning Implementation & Evaluation (PIE) System of South Korea.

8.0 MONITORING, EVALUATION AND IMPACT ASSESSMENT

8.1 Monitoring and Evaluation.

The process of monitoring and evaluation will be open to promote accountability to the people, support effective inter-sectoral cooperation, foster exchanges of best practices and mutual learning. A robust, voluntary, effective, participatory, transparent and integrated monitoring and review mechanism is detailed below:-

A. A national set of indicators for measuring status of STI will be developed amalgamating the R&D (Frascati), Innovation (Oslo) and Knowledge Economy (World Bank KAM) Indicators in the context of Seychelles. *Measuring social or human impact of the STI initiatives* identified will require unique indicators like *ease of accessibility, resource savings* (time and money), *quality of product and service, enhancement of quality of life* (environment, awareness, choice of jobs, purchasing power, access to speedy justice for all, spiritual wellbeing, etc.), which would need to be developed as a dynamic aspirational model to meet the Seychellois homogenous culture and lifestyle aspirations.

B. Each sector will earmark an *STI Focal Person or Team*, who will contribute to the implementation by helping track progress of sector specific initiatives. They will seek support of other sectors and NISTI to overcome shared challenges and identify new and emerging technologies for achieving sectoral KRAs.

C. A national physical survey of R&D and Innovation will be carried out once every 2– 3years, based on the indicators evolved to meet national and international data requirements.

D. In order to assess the current status of STI annually, an online annual feedback and review mechanism must be built into the national sectoral performance reports and PPBB Report.

E. An audit of STI capacity and capability built into key sectors will be assessed through joint periodic sectoral STI gap analysis. This could be quantified into a model depicting the index for total national capacity for STI for easier annual assessment.

8.2 Follow-up and Review Processes.

The review process of this policy and strategy will be aligned with the periodicity of review process of national development strategies. Preferably the review periodicity will not exceed three years and will be guided by the following principles: -

A. Review will be voluntary, based on evidence and sector-led, taking into account different sectoral realities, capacities and levels of development, respecting sectoral policy space and priorities.

B. New policy initiatives will build on existing platforms and processes, where these exist, avoid duplication and respond to sectoral circumstances, capacities, needs and priorities.

C. Endeavour will be made to induct emerging technologies or innovative methodologies while minimising the reporting burden through in-built online administrative feedback instruments.

D. It will ensure that longer-term orientation and continuity is maintained and sectors are assisted by NISTI in making informed STI choices.

E. The review process and mechanism will be people centred and always aimed at improving the quality of life of the people.

F. The monitoring and evaluation mechanism and structures will be robust and continuously improved through strengthening of national data systems and evaluation programmes including regional and international support programmes.

CONCLUSION

This policy and strategy is structured to build and strengthen the foundation of *Governance* (Governance of STI and STI in Governance) and the four pillars of a *Knowledge-Based Economy* promulgated by the World Bank Institute - namely, *Economic Incentive and Policy Regime* (Institutional and Regulatory); *Creating a Knowledgeable and Skilled Work Force*; *Evolving a National Innovation System*; and; a *Modern and Adequate Information Infrastructure*. It also focusses on other areas of STI, specific to sectoral development in Seychelles, like *STI in Development of the Community*, *Role of the Private Sector in STI*, *STI in Tourism*, *STI in Marine Science and Fisheries (Blue Economy)*, *STI in Agriculture and Food Security*, *STI in Infrastructure – Smart Victoria / Seychelles 2040 Plan* and *Building Smart Partnerships*.

The overall implementation strategy focusses on giving primacy to those policy measures and institutional arrangements having maximum cross-sectoral impact on socio-economic development and improving the quality of lives of the people. Key policy initiatives and institutional arrangements are aimed at building an *STI Eco-System* and promoting *effective governance, research and innovation in Seychelles* through arrangements like - a *National Research Foundation*, a *Research Data Centre*, *STI Knowledge Hub*, a *Business Technology and Innovation Incubator* and an *Integrated STI Governance System*.

This policy and strategy does not endeavour to take Seychelles into the league of highly industrialised, larger and richer nations in terms of overall technological capability, but intends to transition Seychelles into a KBE in selected fields of STI related to *environment management, biosciences and the Blue Economy*. However, the need for urgency in action is imperative in achieving this transition in our times, so that the planners and implementers can reap the benefit of what they have sown. The motto of Seychelles to make this transition happen will be “*Think Big, Start Small, and Act Now!*”

**KNOWLEDGE-BASED ECONOMY FRAMEWORK:
WORLD BANK KNOWLEDGE ASSESSMENT METHODOLOGY**

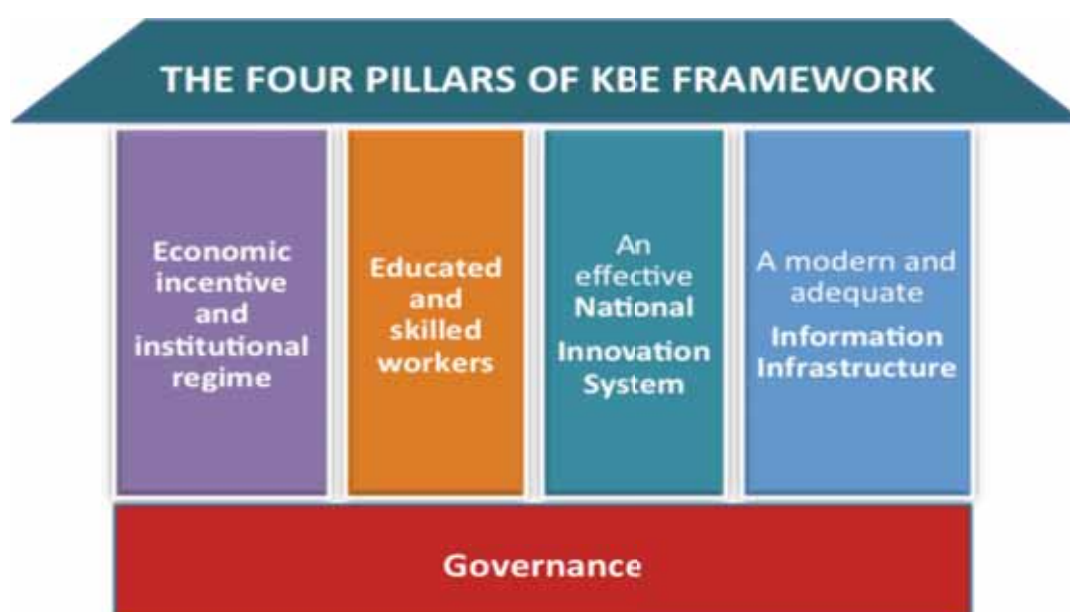


Figure 7: The Four Pillars of the KBE Framework

The Concept of a Knowledge-Based Economy. Progressive nations and successful firms the world over are increasingly investing more time and money on acquiring *knowledge* as a key stimulant for socio-economic growth through research, development and innovation activities. The World Bank Institute terms such economies as *knowledge economies* and measures them through a *Knowledge Assessment Methodology (KAM)* using a *Knowledge Economy Index (KEI)*, which ascertains whether the environment is conducive for knowledge to be used effectively for economic development. The index is calculated based on the average of the normalized performance scores of a country on all four pillars of a knowledge economy - *economic incentive and institutional regime, education and human resources, the innovation system and an information infrastructure or Information and Communications Technology (ICT)*.

Figure 7 above depicts the four pillars of the Knowledge-Based Economy. In making the KEI indices, World Bank considered 3 key variables for *economic incentives and institutional regimes* - tariff and nontariff barriers, regulatory quality and rule of law. These three key variables are found to be the most significant variables for the pillar of '*economic incentive*' for all countries in the world. However, different *economic incentives* like Openness, Trade Freedom, Business Freedom,

Investment Friendly Environment, and *institutional regimes* like Voice and Accountability, Political Stability, Government Effectiveness, Regulatory Quality (restrictive/non-restrictive), Rule of Law and Control of Corruption are the key factors contributing towards a knowledge economy in most nations in transition to a KBE, like Japan, South Korea, Taiwan, Singapore, Hong Kong, Malaysia, Indonesia, Philippines, Thailand and China

Figure 8 below, shows how an initial boost to *economic incentive and policy regime* attracts foreign and domestic investment, which in turn builds capacity for the KBE. Once the first-order development works steadily, the second-order developments take place where all the three interact with each other mutually or independently to improve all the three components to create a complete knowledge-based economy.

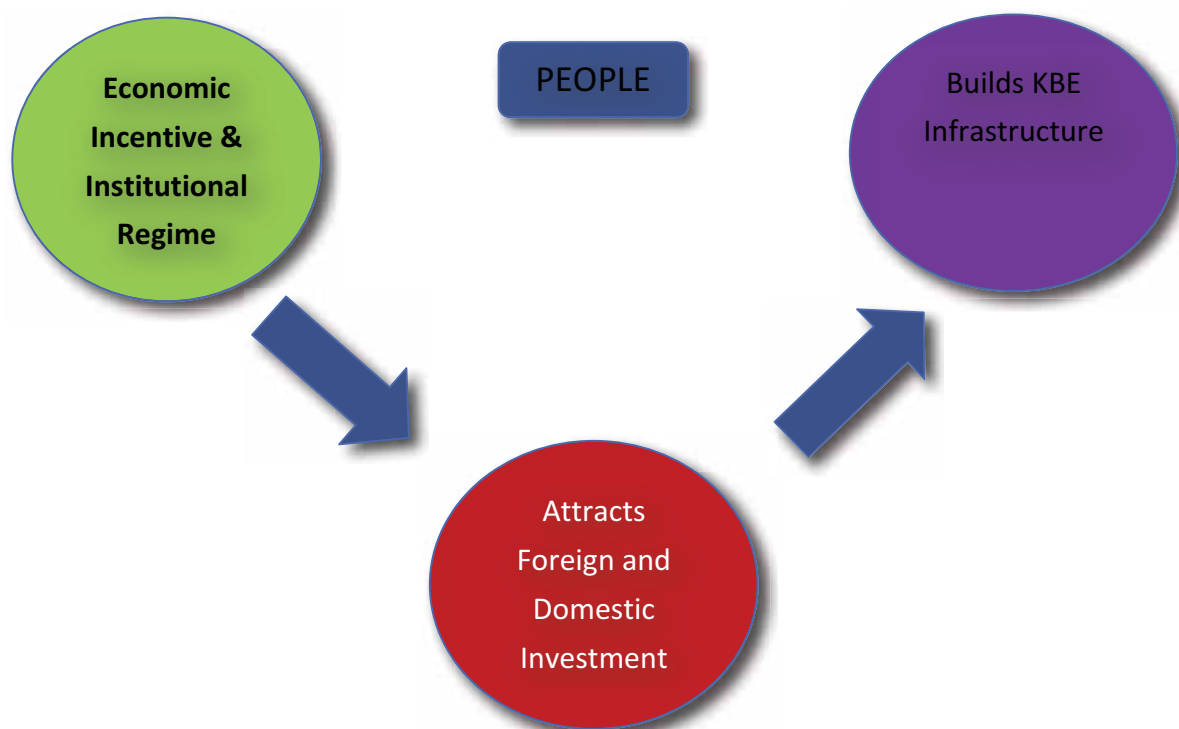


Figure 8: Influence of Economic Incentive and Institutional Regime in Building a KBE

‘Prohibitive tariffs, import restrictions, quantitative restrictions, services market access barriers, use of “adjustment” tariffs and taxes to increase import costs, burdensome and non-transparent standards and regulations, weak enforcement of intellectual property rights, and subsidies add to the cost of trade’ (Heritage Foundation Online, 2009).

QUANTITATIVE AND QUALITATIVE EVIDENCE

Quantitative Evidence

1. The quantitative evidence for basing policy responses have been gathered from the following data: -
 - (a) **Seychelles World Bank KBE / KAM Report - December 2014** for data on the current status of indicators of the *Basic Score Card* based on the four pillars of the knowledge based economy (Details are at the **Annexure 1** to this Appendix).
 - (b) **Audit of Government Laboratory and Research Facilities – August 2015**
 - (c) Planning data used in the **National Development Strategy 2015-19** (Final Draft to Cabinet).
 - (d) **Annual Statistical Report of the Ministry of Education 2015** – related to performance of students in STEM subjects and pursuit of higher studies and careers in science.
 - (e) **ANHRD Data of 2009 – 15** related to Higher Education and STEM Careers. (Detailed analysis is at **Annexure 2** to this Appendix).
 - (f) Central Bank of Seychelles statistical data for economic indicators.
 - (g) Planning data from the under-mentioned national strategies and plans have also been taken into account: -
 - i. SSLUDP 2040 and Victoria Master Plan
 - ii. SSDS 2012-20
 - iii. NDS 2015-19 (Cabinet Draft Version)
 - iv. Interim Blue Economy Road Map (EC / SSDL Study Report)
 - v. Role of STI in Achieving UN SDG – Africa Science Forum Report -December 2015
 - (h) **Data collated from questionnaires, interviews and workshops conducted between January and June 2016 with stakeholders mentioned at Para 3 below.**

Qualitative Evidence

2. (a) Thematic Areas of focus and KRAs of national strategies and policies and the UN 'Agenda 2030 SDGs'.
- (b) One-on-One Stakeholder consultations held between January to June 2016
- (c) Seychelles – Malaysia (NISTI-ISTIC) Joint International Workshop on 'Building an Integrated STI Governance System for Seychelles' on 11-12 March 2016.
- (d) Validation Workshop on Theme-Based Policy Options and Policy Responses on 7th June 2016

Consultations Held

3. The following consultations were held: -
 - (a) Cabinet Members and Leader of Government Business in the National Assembly.
 - (b) Ministries of Environment, Energy and Climate Change; Education; Health; Social Affairs, Community Development and Sports; Investment, Entrepreneurship Development and Business Innovation; Finance, Trade and the Blue Economy; Foreign Affairs and Transport; Agriculture and Fisheries; and Land Use and Housing.
 - (c) UniSey, STA, SIT and TGMI.
 - (d) SCCI, DICT, SFA, SLA, SIB, SEnPA, SBFA, SAA, Air Seychelles, Bank of Baroda and Central Bank of Seychelles.
 - (e) Dr Lee Yee Cheong, UNESCO, Prof John Mugabe, University of Pretoria, Prof Luke Mumba, NEPAD/ASTII, Prof Michael Blakeney, University of Western Australia, Elizabeth Bakibinga, Commonwealth Secretariat, UK and Roland Alcindor, UNDP.
 - (f) Seychelles Interfaith Association and individuals.

SWOT SUMMARY OF THE EXISTING STI ECO-SYSTEM OF SEYCHELLES

STRENGTH AND OPPORTUNITIES

- Peaceful and stable political environment, free electorate, healthy macro-economic conditions, high income nation ranking (World Bank in late 2015) and positive economic growth trajectory (3.7 % in 2015 to 4.5% in 2017).
- Good overall governance (fourth in Africa in Ibrahim Index of Africa's Governance in 2015) and corporate governance with sufficient delegation and independence to para-statal organisations in key sectors like STI (NISTI), Fisheries (SFA), Investment (SIB), Energy (SEC), Tourism (STB), SMEs (SEnPA), etc.
- Homogenous society, pristine environment with relatively high standards of cleanliness and social awareness.
- Strong political will to support STI, through the HLSC for KBE under the chairmanship of the Vice President, the setting up of NISTI in 2014 and its recent relocation under the Vice President's Office.
- Dynamic and sustainable national socio-economic development strategic plans – SSLUDP 2040, SSDS 2012-20, NDS 2015-19 and commitments to RISDP 2020 and the UN SDGs 2030 in its strategic plans.
- International and regional STI linkages being established by NISTI e.g MOU with ISTIC (UNESCO) of Malaysia (March 2016), SADC – STI (RISDP); NEPD-ASTII ; etc.
- Increased FDI inflows especially offshore companies due to favourable investment climate.
- Fairly good ICT infrastructure and efficient institutional set up of the Department of ICT under the Vice President's Office.
- Nascent yet vibrant and forward looking University (UniSey) and technical and vocational training institutes like Guy Morel Institute, STA, SIT, etc
- Existence of explicit STI Act (2014) and implicit sectoral STI policies.
- Relatively high levels of Education and Health.
- Strong NGO regime committed to environmental research.

WEAKNESSES AND CHALLENGES

- Relatively high disparity in income distribution (0.46 Gini Coefficient in December 2013 Household Survey).
- Dependence on a narrow range of economic activities like fisheries and tourism which have relatively high vulnerability to climate change as well as global economic fluctuations.
- Absence of a national agenda for STI and limited integration of STI in national development strategies. STI is driven by sectoral initiatives with inadequate coordination and knowledge sharing.
- Weak institutional linkages /coordination particularly between components of the national innovation system – government, academia, industry, financial and research institutions, SMEs, etc.
- Low levels of industrialisation, weak manufacturing base, limited markets and high import dependence (e.g. 90 % of food is imported).
- Lack of measurable indicators and data for evaluation and review of STI status. No record of Gross (Domestic) Expenditure on Research and Development - GERD to GDP ratio (First ever STI survey was completed in July 2017)
- Dispersed research data repositories with limited access to researchers and public.
- Inadequate STI Capacity and Capability due to resource paucity in infrastructure and inadequacies in technical manpower (Poor performance and interest in STEM and STEM related careers).
- Rivalry, lack of trust and transparency in the functioning of the components of the NIS, as also within the MDAs of the Government.
- Limited resources and technology to monitor or safeguard against IUU Fishing and other illegal activities like piracy, transit of dangerous goods or dumping of harmful waste, etc .

Annexure 2 to Appendix B

BASIC KAM SCORE CARD OF SEYCHELLES: DECEMBER 2014

Variable	Value	Notes	Normalized Score
Annual GDP Growth Rate	5.12	Averaged the annual growth rate from 2005- 2009 using data from WDI; compared this with annual average growth rates of 145 countries. 49 countries performed better than the Seychelles. Computed normalized score	6.62
Tariff & Non – Tariff Barriers	56.2	Took the 2014 rate given to us by the Seychelles. The Heritage Foundation suggested a 33.4 rate. Compared this with rates for 144 countries; 141 performed better than Seychelles. Computed the normalized score.	0.21
Regulatory Quality	-0.29	Used the 2013 rate from the World Governance Indicators. Compared this with rates for 147 countries; 95 performed better than the Seychelles. Computed the normalized score.	3.54
Rule of Law	0.04	Used the 2013 rate from the World Governance Indicators. Compared this with rates for 147 countries; 62 performed better than the Seychelles. Computed the normalized score.	5.78
Economic Incentive Regime Pillar (1)			3.18
S&E Journal Articles /Mil. People, 2007	43	Took the 2009 rate given to us the Seychelles. Compared this with rates for 146 countries; 60 performed better than Seychelles. Computed the normalized score.	5.89
Royalty Payments and receipts (US \$/pop.)	35.346	Took the 2012 rate given to us by the Seychelles. Compared this with rates for 126 countries; 42 performed better than Seychelles. Computed the normalized score.	6.67
Patent Granted by USPTO/Mil People Avg. 2003-2007	50	Took the 2005-2013 number given to us by the Seychelles. Compared this with rates for 147 countries; 22 performed better than Seychelles. Computed the normalized score.	8.5
Innovation Pillar (2)			7.02
Average Years of Schooling, 2010	7.83	Took the 2013 rate given to us by the Seychelles. Compared this with rates for 128 countries; 81 performed better than Seychelles. Computed the normalized score.	3.67
Gross Secondary Enrollment rate, 2009	99.9	Took the 2013 rate given to us by the Seychelles. Compared this with rates for 146 countries; 25 performed better than Seychelles. Computed the normalized score	8.29
Gross Tertiary Enrollment rate, 2009	3.35	Took the 2013 rate given to us by the Seychelles. Compared this with rates for 142 countries; 135 performed better than Seychelles. Computed the normalized score	0.49
Education Pillar (3)			4.15
Total Telephone per 1000 People, 2009	1753	Took the 2013 rate given to us by the Seychelles. Compared this with rates for 146 countries; 20 performed better than Seychelles. Computed the normalized score	8.63
Computers per 1000 People, 2008	378	Took the 2014 rate given to us by the Seychelles. Compared this with rates for 147 countries; 35 performed better than Seychelles. Computed the normalized score	7.62
Internet Users per 1000 People, 2009	470	Took the 2014 rate given to us by the Seychelles. Compared this with rates for 146 countries; 45 performed better than Seychelles. Computed the normalized score	6.92
ICT Pillar (4)			7.72
KEI	Knowledge Economy Index (1+2+3+4)		5.52
KI	Knowledge Index (2+3+4)		6.3

A KEI of 5.52 places Seychelles at 62 out of 147 countries

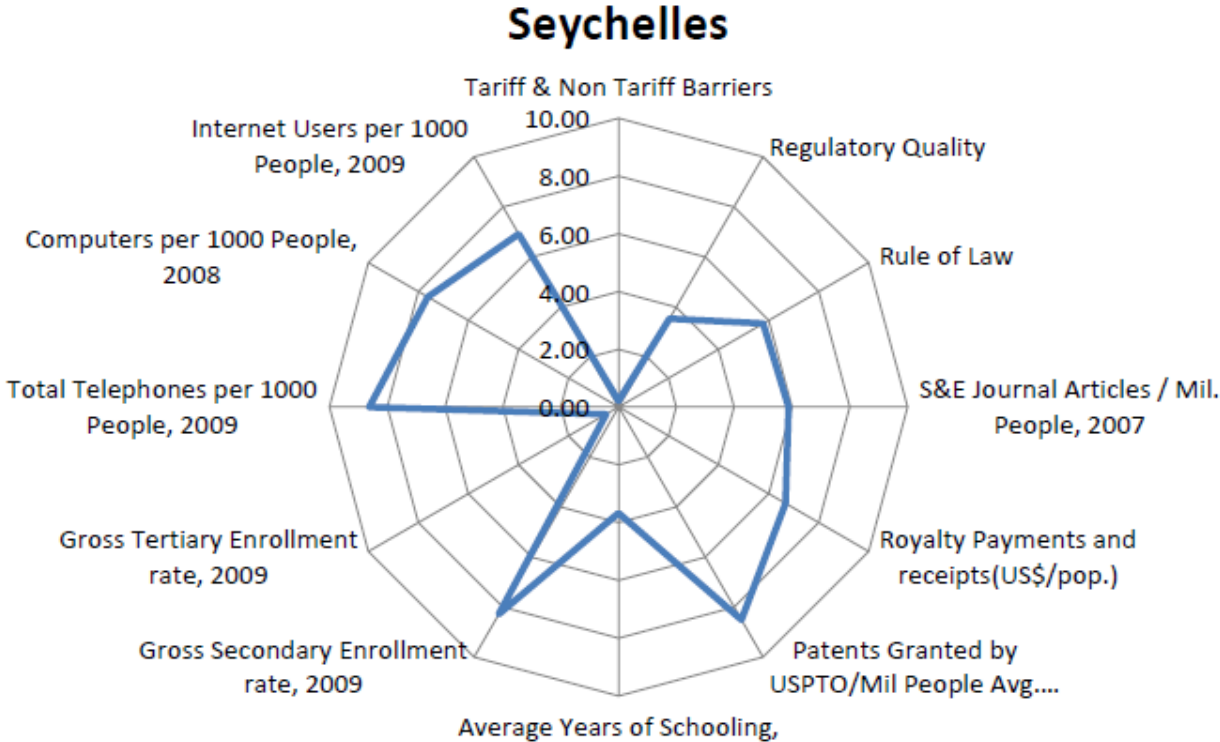


Figure 9: Basic Score Card of Seychelles Compared to all Other Countries

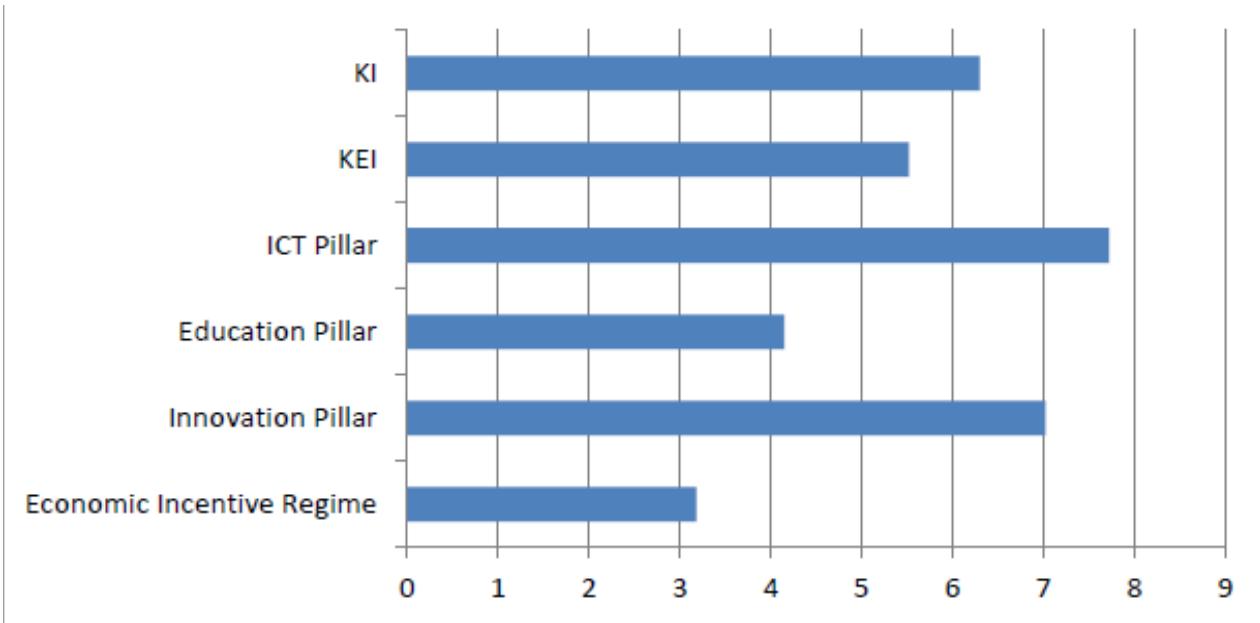


Figure 10: COMPARATIVE SCORES OF THE K4 PILLARS

AN ANALYSIS OF STEM SUBJECT PERFORMANCE AND CAREER CHOICES IN SEYCHELLES

The data collated from various international and national sources between 2007 and 2015, highlight the status of STEM Education and the interest amongst the youth in Seychelles to pursue higher education in STEM subjects. The inference does not read too well in terms of converting Seychelles into a *Science and Technological Innovation State*. School math scores were at the lower end of the SACMEQ Mean Scale in 2007; Between 2011-13 only 4 % students scored Grade C or above in combined sciences in IGCSE Exams; only 12 % students pursue University Graduate (UG) Degree in pure sciences compared to 88 % who pursue pure arts; only 7.6 % of all UGs opt for applied sciences, the rest opt for applied fields in arts/humanities and only 11 % opt for technical vocational training. To compound this problem the only university in Seychelles - UniSey offers only courses in Computer and Information System and Environmental Sciences. The Seychelles Qualifications Authority (SQA) Data from 2013 to 2015 reflects the increase in holders in Bachelors in Applied Sciences and Vocational Diplomas and Certificates but decline in qualified doctors and engineers. This alarming trend of poor performance in Sciences and Math by the youth of Seychelles and lack of awareness, interest and preference in pursuing careers in STEM Education fields for better jobs or innovative businesses needs to be addressed urgently through policy intervention and action.

STI GAPS IDENTIFIED AND POLICY RESPONSES

SERIAL NO.	GAPS / SHORTCOMINGS IDENTIFIED	KEY POLICY RESPONSES
1	<p>Lack of Streamlined National Planning</p> <ul style="list-style-type: none"> Absence of a national planning body for evolving a consolidated long, mid and short term national development strategy. Lack of an STI Advisory Mechanism at the national level 	<p>A. Establish a <i>National Planning Commission</i> independent of sectoral influences.</p> <p>B. Build an STI foresight and advisory mechanism at the strategic and operational levels</p> <p>C. Integrate STI in national development through STI Strategic Initiatives.</p>
2	<p>Inadequate Political Commitment, Leadership and Coordination of STI</p> <ul style="list-style-type: none"> Inadequate empowerment and acceptance of NISTI as the national coordinator of all STI issues Absence of an STI coordination mechanism Lack of inter-sectoral knowledge sharing and coordination 	<p>A. Ensure political commitment and support for STI through the institutions of HLSC for KBE, STI Advisory Body and the NISTI Board providing policy direction, policy integration, implementation oversight and coordination.</p> <p>B. Strengthen the vertical and horizontal linkages by evolving an integrated system of governance of STI at all levels</p> <p>C. Institutionalize knowledge sharing through mandatory sharing of research outcomes irrespective of source of funding, through a favourable IPR regime</p>
3	<p>Inefficient STI Data Management</p> <ul style="list-style-type: none"> Absence of a national repository for research data and outcomes Absence of a Knowledge Centre Lack of knowledge sharing platforms 	<p>A. Ensure efficient research data management and knowledge access and sharing by institutionalization of a research data management system and knowledge hub.</p> <p>B. Ensure ICT Integration across all sectors and the community for improved data access to the Knowledge Hub.</p>
4	<p>Inadequate STI Capability (Human Capital)</p> <ul style="list-style-type: none"> Inadequate scientific human resource and over reliance on foreign experts. 	<p>A. Build holistic human capital for STI</p> <p>B. Promote STEM* I&E (*Science (research), Technology, Engineering, Mathematics, Innovation and Entrepreneurship) Education.</p>

	<ul style="list-style-type: none"> • Poor performance of youth in Sciences and Math and lack of awareness, interest and preference in pursuing STEM related careers • Lack of institutions of higher learning in science, technology and innovation. • Inadequate coordination of technical training curriculum and industry needs. • Lack of involvement of the community in problem solving. 	<p>C. Make STEM I&E Careers attractive and interesting through better pay and career growth opportunities in R&D and Innovation.</p> <p>D. Build a culture of science and scientific thinking amongst the people through 'Idea Challenge' awards for problem solving.</p> <p>E. Incentivise the Seychelles scientific and entrepreneurial diaspora to return, invest or promote STI projects for Seychelles</p>
5	Inadequate STI Capacity (National Laboratories, Incubators, Science Parks, Institutes of higher learning, etc.)	Build research, technology and innovation infrastructure based on national priorities and industry needs.
6	Lack of a modern IT Eco-System	Build a modern and reliable information infrastructure
7	Inadequate involvement of the Private Sector in STI <ul style="list-style-type: none"> • Weak academia-industry interface • Inadequate incentive for private sector involvement in R&D and Innovation 	Build public – private sector partnership in STI through a multi-pronged incentivisation scheme like tax relief/holiday, public funded R&D, assured orders, incubation support to start –ups, better academia-industry interface mechanism, etc.
8	Inadequate monitoring and evaluation mechanism	<p>A. Identify and promulgate STI Indicators for monitoring and evaluation of national capacity in STI.</p> <p>B. Institutionalise regular surveys on R&D, Innovation and Knowledge Economy Indices to steer monitoring, evaluation and review.</p>
9	Weak and dispersed components of a national innovation system	Identify strategic initiatives for the promotion and growth of the key components of the <i>national innovation system</i> and their integration.
10	Fragmented and weak international partnerships	A. Establish strong and structured linkages with international STI partners through project partnerships in knowledge sharing,

		<p>training, funding, research and development, trade and common market access agreements.</p> <p>B. Use STI platforms for <i>Science Diplomacy</i> in areas like security arrangements against Illegal, Unreported and Unregulated (IUU) Fishing, conventions against chemical / biological weapons, drugs or dangerous goods trafficking, etc.</p>
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KEY FINDINGS / GAPS AND RECOMMENDATIONS

KEY FINDINGS / GAPS IDENTIFIED	RECOMMENDED POLICY MEASURES / INSTITUTIONAL ARRANGEMENT
<p>The national development planning process is fragmented. The 25 year SSLUDP 2040 is being driven by the Ministry of Land Use and Housing; the 10 (9) Year SSDS 2012-20 is driven by the Ministry of Environment, Energy and Climate Change; the 5 Year NDS 2015-19 is driven by the Ministry of Finance and the Ministry of Foreign Affairs; and; the emerging Blue Economy Road Map (short and mid-term) by the Ministry of Finance, Trade and the Blue Economy. This along with frequent changes in portfolios of ministries has led to a lack of coherence in the selection and pursuit of national development priorities and related policies/strategies.</p>	<p>There is a need to establish a <i>National Planning Commission</i> comprising knowledgeable and experienced people from the Government, Academia and Civil Society, who are apolitical, devoid of sectoral influences and hold national interests at the fore. The <i>National Planning Commission</i> will identify the common thread between the SSLUDP, SSDS, NDS, BERM and other national initiatives to evolve an integrated short (5 year), medium (10 year) and long (25 year) term national development strategy. It will also look at international and regional commitments to the RISDP of the SADC and the UN 2030 Sustainable Development Goals.</p>
<p>An STI foresight and advisory body and coordination mechanism at the national level is absent. NISTI as per its Act of 2014 was to be under the President's Office but has been functioning under the Ministry of IEDBI until November 2016. It has now been placed under the Vice President's Office. These frequent changes in governance structure of STI has resulted in the absence of a clear '<i>national agenda for STI</i>' from being an integral part of the national development strategy. Government monitoring of research and innovation performance and establishing criteria and mechanisms for allocating priorities and resources that give strong incentives to excellence has not been institutionalised. Earlier STI policy objectives of 2011 of establishing an <i>STI Council</i> and the overarching <i>coordinating role of NISTI</i> as per the NISTI Act of 2014 have not been achieved due to inadequate institutional support, empowerment and linkages.</p>	<p>STI Planning and policy measures will be integrated with the planning of the <i>National Development Strategy</i> through an '<i>STI Foresight and Advisory Body</i>' under the aegis of NISTI and through the establishment of a <i>National Research Foundation (NRF)</i>. The NRF will evolve a <i>National Research Plan</i> which will include the Short (five year) and Long Term (6 -25 year) <i>Research Plans</i> as well as a <i>Research Infrastructure Development Plan</i>. A ten-year <i>Strategic STI Initiative Plan</i> will be evolved by NISTI based on the strategic initiatives for STI recommended in this Policy and Strategy in consultation with the <i>STI Advisory Body</i> and the <i>NRF</i>.</p>

<p>Sectoral and Institutional Rivalry and Lack of Integrated Governance of STI. There exists sectoral and institutional rivalry for position and funding amongst MDAs and Institutions related to STI. Institutions have limited incentives to strive for excellence or to cooperate with other stakeholders or private sector actors. Committees and Boards have not been effective in bringing about integration of STI into the national development fabric due to either the lack of, or conflict of interests of the members in promoting STI. This is largely due to the absence of an integrated STI governance system.</p>	<p>NISTI has recently been placed under the Vice-President's Office to encourage inter-ministerial cooperation and bring about role clarity and responsibility amongst all stakeholders of STI. This will be given further impetus through the establishment of an <i>Integrated STI Governance System</i>. This would involve setting up linkages between the strategic, operational and functional levels of governance of STI and a responsive mechanism for coordinated planning and execution of STI projects and programmes.</p>
<p>Funding STI / GERD. Currently Seychelles is not able to estimate its Gross Domestic Expenditure on Research and Development (GERD). Most of the research, technology and innovation activities in Seychelles have been through stand alone projects funded by international institutions or organisations with limited reference to inclusivity, performance criteria or correlation to national development goals. When criteria are used they do not always cover key features such as cooperation with industry or dissemination of results. This has happened due to international as well as national funding for research not being accounted for under GERD or by a national agency for the purpose.</p>	<p>A regular (every 2-3 year) national survey will be held for <i>R&D, Innovation and Knowledge Economy Indices</i> to evaluate the status and impact of STI initiatives on socio-economic development and the quality of lives of the people. GERD will be increased to 1% by 2020 and 2% by 2025 on identified areas of priority. GERD Programmes will be linked to the PPBB to ensure accountability and timeliness. NISTI will evolve or procure a software (on the lines of the South Korean Planning Investment and Evaluation (PIE) Model) for timely planning, prioritised investment and effective evaluation of STI programmes.</p>
<p>Inadequate STI Capacity. There exist inadequate laboratories, incubators, science parks, engineering and technology institutes of higher learning, etc. The 2015 <i>Audit of Public Laboratories and Research Institutions of Seychelles</i> revealed that there is a need to build advanced technology national laboratories for key areas of R&D identified. It also identified a need for having standing instructions for its upkeep and coordinated and shared utilisation.</p>	<p>A ten-year <i>National STI Capacity and Research Infrastructure Development Plan</i> will be evolved by NISTI and the NRF after an infrastructure need analysis, with clear sectoral responsibilities for monitoring, upkeep and sharing of assets developed. The plan will be an outcome of the <i>National Research Plan</i> and may include infra and info-structures like a <i>Science Centre, BTI Incubator, Test Laboratories, Technical Institutions, etc.</i> but must include the Private Sector and NGOs.</p>
<p>Inadequate STI Capability. There is a lack of scientific human resource and over reliance on foreign scientific human capital. Poor performance of youth in Sciences and Math</p>	<p>Scientific human capital will be built and financed through a three-pronged strategy of STEM I&E Education, collaborative international research project plans and attracting the best STI talent</p>

<p>and lack of awareness, interest and preference in pursuing STEM related careers is disconcerting.</p>	<p>(including attracting the Seychelles diaspora) in them.</p>
<p>Absence of a National STI Data Repository / Knowledge Hub. Over the years, a lot of research has happened and is happening in Seychelles whose outcomes and metadata are either scattered across multiple agencies or simply not available due to improper research data plans and management. This has resulted in inadequate openness and sharing of <i>Knowledge</i> as a developmental resource.</p>	<p>Establish a <i>National Research Data Centre (NRDC)</i> and link its database to an <i>STI Knowledge Hub</i> under NISTI. All research outcomes and data will be curated, digitized, stored and made available in the NRDC for access through the <i>STI Knowledge Hub</i>. All future public funded research projects will have an IPR clause for outcome and meta-data sharing with the NRDC.</p>
<p>Private Sector in STI. There is inadequate involvement and investment of the private sector in STI and scarce public private partnerships in the development of innovative technologies or systems. There exist insufficient partnerships between the academia and the private sector</p>	<p>NISTI in collaboration with all research establishments, UniSey, and SCCI will encourage public-private sector partnership and funding in technology prospecting, acquisition and research and development. The Government may promote this through co-development funding, tax rebates, waivers, assured orders, long term partnerships with strategic industries, etc.</p>
<p>Insufficient innovation and entrepreneurship and a weak National Innovation System (NIS). The support system to promote entrepreneurship and innovation is weak. The <i>linkages</i> between the <i>components of National Innovation System (NIS)</i> like NISTI, UniSey, public and private R&D institutes, policy-making bodies, private enterprises, research oriented NGOs, financial institutions and <i>technology support agencies</i> like Seychelles Bureau of Standards, Department of ICT, and the National Bureau of Statistics are not structured.</p>	<p>Set up a <i>Business, Technology and Innovation Incubator</i> under the aegis of the <i>Ministry of Employment Entrepreneurship Development and Business Innovation (MEEDBI)</i>. Establish linkages between the components of the NIS in the form of joint research and technology development projects between public and private sector institutions, exchange and mobility of manpower skilled in STI, technology licensing agreements, and sharing of information and resources. The <i>NRF</i> and NISTI under the leadership of the Vice President (Chairman HLSC for KBE) will play the role of a coordinator by identifying and incorporating such plans and programmes in the <i>STI Strategic Initiative Plan</i> and the <i>National Research Plan</i>.</p>
<p>STI and the Community. The benefits of STI are not reaching the people as STI initiatives are not always focussed towards their needs. People’s issues like cardio-vascular ailments, obesity, cancer, substance abuse, breakdown of the family structure, invasive species impacting health and the environment, traffic congestion, personal financial betterment, etc. do not always get the right priority and funding.</p>	<p>Establish a <i>People’s STI Group</i>, which will be involved in the formulation of the <i>National Research Plan</i> and all other requisite stages of STI Policy planning and implementation. NRF along with the <i>People’s STI Group</i> could prioritise government spending on people specific research, as also coordinate and promote the use of <i>Technological and Social Innovation</i> to negate the ill effects of technology on social and cultural wellbeing of the people.</p>

Need to Further Modernise IT Eco-System for IT Enabled Services in e-Government, e-governance, service delivery and e-commerce in public and private sectors. Inadequate connectivity, cloud-based services, lack of updated or absence of interactive web portals (e.g. NISTI does not have a web portal for information dissemination) is impacting the management of STI and knowledge economics. Outreach strategies of e-commerce / e-governance have not significantly reduced the need for cash handling and queues for bill payments.

DICT may consider building a cloud-based ERP system(s) IT architecture to reduce the need for hardware, software, network administration and system management by all. Network and internet requirements planning will be integrated with the national development strategy for e-Government and e-governance and include the need for 'Smart Victoria/Seychelles' initiatives being planned in the SSLUDP 2040. Funding for building a modern information infostructure and IT workforce will be given primacy. *E-innovation needs to be given more importance in the national innovation plan of Seychelles.*

Fragmented international partnerships and cooperation agreements and arrangements in STI. Seychelles has lost out on many regional and international STI promotion and funding opportunities due to its weak linkages with international partners and lack of coordinated functioning within. Project partnerships in knowledge sharing, training, funding, R&D, using STI platforms for *Science Diplomacy* for security arrangements against IUU Fishing, CBRN weapons, dangerous goods, etc. is weak.

NISTI will render advice to the Government and ensure representation in regional / international meetings, follow up and audit STI commitments made and met. NISTI must establish a dynamic online portal and link it with relevant international institutions / organisations including the UN *'Technology Facilitation Mechanism'* for attaining SDGs. It must also ensure that all international promotional or sponsored opportunities are availed through strong linkages with STI partners and an efficient online info-dissemination system.

Inadequate monitoring and absence of an evaluation mechanism. This is perhaps the weakest link of STI governance, which is compounded by the absence or lack of data for all the indices of R&D, Innovation, Knowledge Index and Knowledge Economy Index (World Bank KAM Indicators). Limited audit of STI capacity and capability has been carried out and sectoral initiatives are often opportunistic rather than being based on a national need analysis. The Government administrative / PPBB feedback mechanism of MDAs does not include STI indicators.

NISTI will evolve a *national index for STI* encompassing the Frascati, Oslo and World Bank KEI indicators to suit the KRAs of the Government and the aspirations of the people of Seychelles. Evaluation of the *social or human impact of the STI initiatives* will be carried out by identifying and instituting unique indicators like *accessibility, resource savings, enhancement of quality of life* (pristine environment, awareness, choice of jobs, purchasing power, access to speedy justice, spiritual wellbeing, etc.). The reporting burden will be minimised through use of inbuilt online administrative feedback instruments. An audit of STI capacity and capability built into key sectors will be assessed through joint periodic sectoral STI gap analysis based on the national STI indicators.

INTEGRATED STI GOVERNANCE SYSTEM FOR SEYCHELLES

Organisation Structure

I Strategic Level

(a) **High Level Steering Committee for KBE:** This *Committee* would provide strategic direction for building all the pillars (including NIS) of the KBE. The Steering Committee will have under it a number of sub-committees for each of the four pillars to ensure the concurrent building of these pillars in line with the World Bank KAM indicators.

(b) **Office of the Vice President.** The Vice President's Office together with the HLSC for KBE will be the driving force for inter-ministry and cross sectoral integration of STI at the strategic level. It will hold regular workshops and meetings on the **STI path** (policy and strategy) Seychelles is best suited to adopt and pursue in light of its socio-economic impact.

II. **Operational Level.** At the operational level NISTI and NISTI Board will be the coordinating body for all STI related issues and in addition to its mandated charter, will do the following: -

(a) Carry out Policy and Strategy Formulation and Review based on the strategic direction and guidelines laid down by the HLSC for KBE and the NISTI Board.

(b) Establish a *coordinated implementation mechanism* through *NISTI Board Members* with respect to *all STI related national development agenda*. Where project monitoring and coordinating units exist, it will *establish linkages for coordinated monitoring and evaluation*.

(c) Through the *National Research Foundation* manage and provide research grant approvals through a two-stage process (NISTI Board and the HLSC for KBE).

III. Functional Level

(a) **Ministries, Parastatals and Agencies.** All ministries and public sector agencies *STI Representatives* or Project Monitoring Units will ensure that NISTI is kept abreast with STI related issues, to ensure that sectoral and national development plans receive funding and assistance as per national priorities.

(b) **Business Entities and Associations.** Create technology and innovation incubators and a technology aware eco-system through the collaboration of NISTI with Business Entities and Associations.

(c) **Governance of STI in the Private Sector.** In order to create a business culture of continuous technology enhancement the Seychelles Chamber of Commerce and Industry (SCCI) in collaboration with NISTI may issue guidelines for good governance of STI in the Private Sector.

Norms and Rules of Governance

The norms and rules of governance related to building an Integrated STI Governance Mechanism will encompass the following: -

- (a) Identify the role of STI in the national development strategy in the key sectors chosen for socio-economic transformation in collaboration with Seychelles' strategic development plans (SSLUDP/SSDS/NDS).³
- (b) Evolve a holistic *Policy for STI* allowing prioritization in capacity (infrastructure like laboratories, research institutes, science centre, science academy, knowledge hub) and capability building (*human capital through STEM I&E*⁴ at all levels) for long - term competitiveness.
- (c) R&D priority, funding, research publication and record keeping by the *National Research Foundation* and the *National Research Data Centre*. NISTI will take over these roles from the Seychelles Bureau of Standards (SBS) and establish linkages with all research institutions, projects and the National Statistical Bureau (NSB).
- (d) Ensure that a *Smart STI Information Infrastructure* is planned holistically at the national level, which will include a *National Innovation System* with an inbuilt *Intellectual Property Rights (IPR/GI)*⁵ *Eco-System* and *Internet Protocol (IP) Eco-System*.
- (e) Promote and popularize 'STI Culture' in schools through STEM I&E Education and communities through District Administrations to help solve social problems and reduce the adverse impact of technology on lifestyle and culture.
- (f) Partake in R&D activities, which are of national importance and key to socio-economic transformation and people related welfare issues.
- (g) *Build Smart Partnerships with regional and international organisations* and promote their linkages with relevant ministries and sectors.
- (h) *Implementation, coordination and evaluation* through careful selection of indicators and drivers and putting in place an independent annual review and oversight mechanism.

³ Seychelles Sustainable Land Use & Development Plan 2040; Seychelles Sustainable Development Strategy 2012-20; National Development Strategy 2015-19.

⁴ STEM and I&E – Science, Technology, Engineering, Mathematics and Innovation & Entrepreneurship.

⁵ Intellectual Property Rights/Geographical Indication to protect and add value to innovative MSME products.

RELEVANT TERMS AND DEFINITIONS

1. **Science and Scientific Method.** Science (from Latin: scientia, meaning "knowledge") is a systematic enterprise of gathering knowledge about the world and organizing and condensing that knowledge into testable laws and theories. As knowledge has increased, some methods have proved more reliable than others, and today the scientific method is the standard for science. It includes the use of careful observation, experimentation, measurement, mathematics, and replication — to be considered a science, a body of knowledge must stand up to repeated testing by independent observers.
2. **Technology.** Technology is the usage and knowledge of material, tools, techniques, and crafts, or is systems or methods of organization, or is a material product of these things (e.g. Nano processor). The word technology comes from the Greek technología, 'craft' and -logía, the study of something, or the branch of knowledge of a discipline. The term can either be applied generally or to specific areas: examples include "construction technology", "medical technology", or "state-of-the-art technology".
3. **Innovation.** Innovation is defined simply as a "new idea, product or process". A technological product innovation is the implementation/commercialisation of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or a combination of these. The Oslo Manual defines four types of innovation: product innovation, process innovation, marketing innovation and organisational innovation.
4. **Social Innovation** Social innovation seeks new answers to social problems by:
 - (a) Identifying and delivering new services that improve the quality of life of individuals and communities.
 - (b) Identifying and implementing new labour market integration processes, new competencies, new jobs, and new forms of participation, as diverse elements that each contribute to improving the position of individuals in the workforce.
5. **Research.** The use of the scientific method to make new discoveries is called research, and the people who carry out this research are called scientists. Scientists could be from any

field of Science e.g. Social Scientist. Applied science is the practical application of scientific knowledge.

(a) **Research and Development (R&D).** **R&D (experimental)** comprise creative and systematic work undertaken in order to increase the stock of knowledge –including knowledge of humankind, culture and society – and to devise new applications of available knowledge.

(b) **Researchers and R&D Personnel**

- **Researchers:** Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned. R&D may be the primary function of some persons or it may be a secondary function. It may also be a significant part time activity.
- **R&D Personnel:** All persons employed directly for R&D will be counted, as well as those providing direct services such as R&D managers, administrators, and clerical staff.

(c) **Measurement of Personnel Employed in R&D.** Involves measuring their number in head counts (HC): the total number of persons who are mainly or partially employed in R&D is counted; measuring their R&D activities in full-time equivalence (FTE): the number of persons engaged in R&D is expressed in full - time equivalents on R&D activities in person - years.

(d) **Public and Private Sector Researchers.** Public sector researchers refer to researchers in the government and higher education sectors. Private sector researchers refer to researchers in the business enterprise and private non-profit sectors.

(e) **Small and Medium-Size Enterprises (SMEs).** Small and medium-size enterprises are enterprises with a sales turnover not exceeding Seychelles Rupees (SR) 25 Million and/or full time employees not exceeding 50.

6. **Licence and Patent Revenues from Abroad.** The export part of international transactions in royalties and license fees.

7. **Patents.** The Patent Cooperation Treaty (PCT) is an international treaty, administered by the World Intellectual Property Organization (WIPO), signed by 133 Paris Convention countries. The PCT makes it possible to seek patent protection for an invention simultaneously in each of a large number of countries by filing a single “international” patent application instead of filing several separate national or regional applications.
8. **Technology Transfer.** Technology transfer refers to the transfer of knowledge (*know how*) from a technology provider (developed nation / R&D Centre) to a recipient (developing nation or industry). It may be outgoing - *technology development* (R&D) for commercialisation or exports, or incoming - *technology acquisition* or imports for development/modernisation. The *Technology Transfer Office* or *Technology Management Office* manages intellectual property (patents, inventions, software, other copyrightable works) developed at the R&D Centre/Research Institution.
9. **Technology Prospecting and Technology Foresight.** The identification of the critical technologies in support of current and anticipated future needs of industry must be done through *technology prospecting* and *technology foresight*. In this context, *prospecting* is searching, identifying and acquiring existing technology that meets the requirement. *Foresight* refers to search for emergent technologies. While prospecting is "down to earth", there is a tendency for foresight to be an academic exercise, unless it is done for immediate industry needs in the context of reviving, sustaining or enhancing an enterprise or an industry sector.
10. **Knowledge-Based Economies.** Economies, which are directly based on the production, distribution and use of knowledge and information. This is reflected in the trend in developed and developing economies towards growth in high-technology investments, high-technology industries, more highly skilled labour and associated productivity gains.
11. **Science Technology and Innovation (STI).** The shift of emphasis from only Science to Applied Science and Technology to Science, Technology and Innovation in supporting socio-economic growth has shifted the focus of nations from mere academic pursuit to research for focussed development and innovation for disruptive technologies / processes.
12. **Science in Policy Making.** The role of science in policy making implies that scientific method is followed while gathering, analysing and basing policy on evidence. This ensures that policy planning and promulgation is pragmatic, focussed on problem solving and is not driven by whims or nepotism.

13. **Policy** is a principle or rule that guides decisions in order to achieve a rational outcome. Policy may also be a declaration of intent with a logical justification. To be relevant an STI Policy cannot be a stand-alone policy, but must be one in support of the national development policy.
14. **Public policy** is the principled guide to action taken by the state with regard to a class of issues, in a manner consistent with law and institutional customs. The foundation of public policy is composed of national constitutional laws and regulations. Public policy is considered strong when it solves problems efficiently and effectively, serves justice, supports governmental institutions and policies, and encourages active citizenship.
15. **Strategy** generally involves setting goals, determining actions to achieve the goals, and mobilizing resources to execute the actions. In the context of policy implementation, a strategy describes how the (*policy objectives*) will be achieved by the means (resources - human, material and time) through *coherent actions*.
16. **Programme Performance Based Budgeting (PPBB)**. The PPBB comprises budgeting for and reporting on public expenditure by programmes, while taking into account the performance of the programmes against performance indicators. It enhances allocation of resources to government priority policy areas and plans, improves focus on achievement of results for the benefit of the people and also improves predictability of funds flow to ministries, departments and agencies.

Sources :- *Oslo Manual 2005 3rd Edition*; *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities*, OECD publishing, Paris; *Essentials of an STI Policy*, by Prof Omar Abdul Rahman ISTIC, Malaysia; and; *Policy and Strategy Documents of the Government of Seychelles*.