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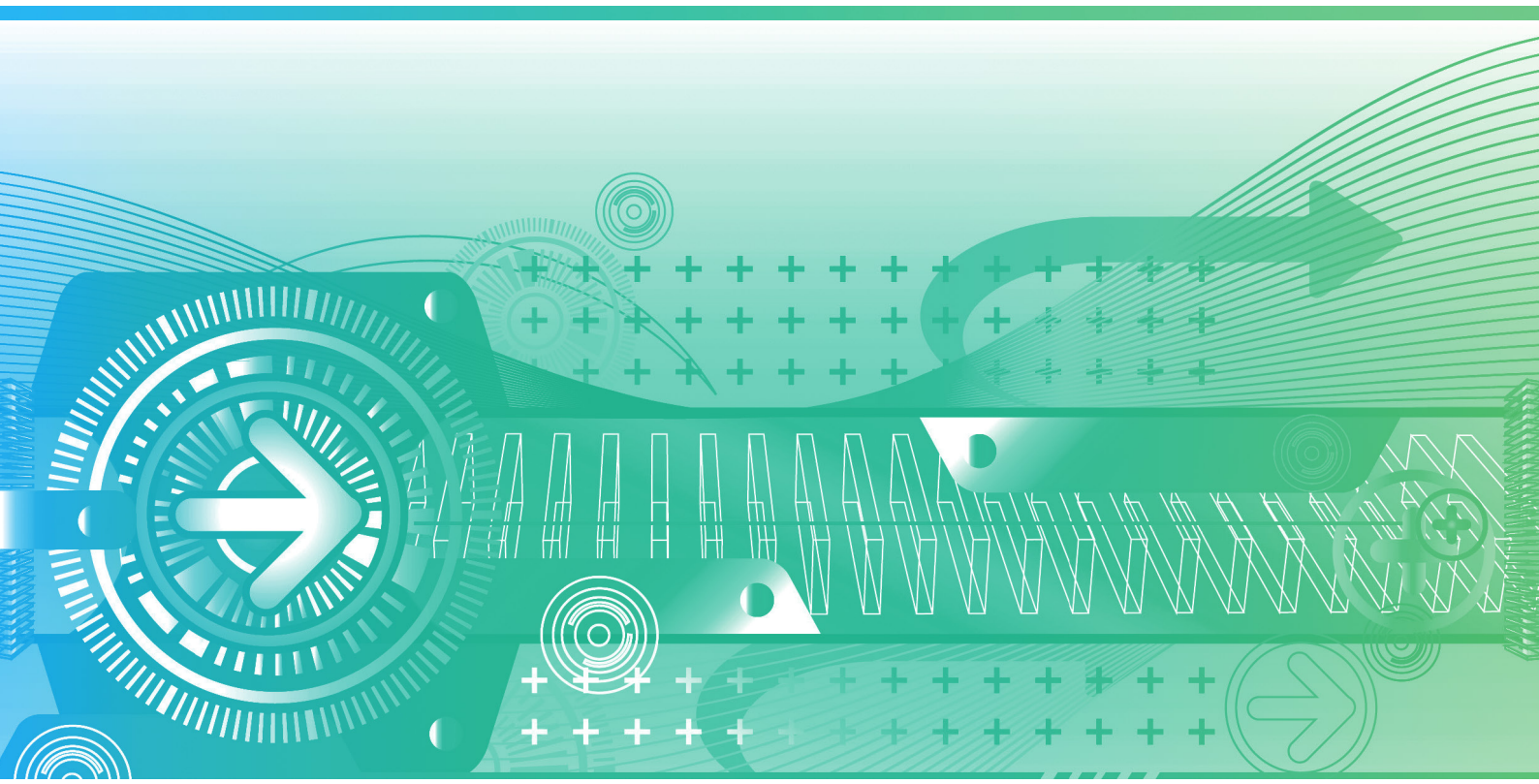

Cabo Verde National System of Innovation

Measurement, Analysis & Policy Recommendations

MINISTÉRIO DAS FINANÇAS

GOVERNO DE CABO VERDE
A TRABALHAR PARA TODOS.

PROEMPRESA
INSTITUTO DE APOIO E PROMOÇÃO EMPRESARIAL

Disclaimer:

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Contents

1.0 Acronyms

ADEI	Agência para o Desenvolvimento Empresarial e Inovação
ARB	Arbitrageurs
BCV	Banco de Cabo Verde
BTS	Bartlett's Test of Sphericity
CVNSI	Cabo Verde National System of Innovation
CEO	Chief Executive Officer
CODESTRIA	The Council for the Development of Social Science Research in Africa
CIP	Competitive Industrial Performance
DASI	Data Acquisition Survey Instrument
DASI-V3	Data Acquisition Survey Instrument Version 3
DGES	Directorate General for Higher Education
FIs	Financial Institutions
FDI	Foreign Direct Investment
FOSS	Free Open Source Software
GNSI	Ghana National System of Innovation
GOV	Government
GoCV	Government of Cabo Verde
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GNI	Gross National Income
HE	Higher Education
IFS	International Foundation for Science
ISID	Inclusive and Sustainable Industrial Development
IND	Industry
ICT	Information and Communications Technology
PROEMPRESSA	Instituto de Apoio e Promoção Emprersarial
IPR	Intellectual Property Rights
ILO	International Labor Organization

IPU	Innovation Promotion Unit
ISIC	International Standard Industrial Classification
ITU	International Telecommunications Union
IGQPI	Instituto de Gestão da Qualidade e da Propriedade intellectual
KMO	Kaiser-Meyer-Olkin
KBIs	Knowledge-Based Institutions
LDC	Least Developed Countries
LLL	Lifelong Learning
LMI	Lower Middle Income
MHESI	Ministry of Higher Education, Science and Innovation
MESCI	Ministry of Education, Science & Innovation
NSI	National System of Innovation
NPD	Non-Positive Definite
NOSI	Network for Open Science Initiatives
OECD	Organization for Economic Co-operation and Development
R&D	Research and Development
RIs	Research Institutes
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovation
SIGOV	Sistema de Integrado de Execução Orçamental e Financeira
SIDS	Small Island Developing States
SSA	Sub-Saharan African
TVE	Total Variance Explained
TH	Triple Helix
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organizatio
UNIDO	United Nations Industrial Development Organization
UMI	Upper-Middle-Income

2.0 Preface

by LI Yong

Director General
United Nations Industrial Development Organization

The key to sustainable economic growth in Cabo Verde lies in the effective exploitation of innovation, knowledge production and technology transfer mechanisms, first and foremost in relation to industrial development. The application of this coherent and effective policy approach represents the ability of an economy to enhance its competitiveness and economic growth, particularly in the wider context of the global knowledge-based economy. With increasing importance being placed on knowledge as a key economic driver, more effective management of knowledge resources is required and the systematic organization of tacit knowledge and codified knowledge is particularly crucial.

A National System of Innovation (NSI) represents the strength and quality of the systematically organized interactions and linkages between government, knowledge-based institutions (KBIs), industry and arbitrageurs (venture capital, angel investors, financial institutions). The measurement, visualization and understanding of the dynamics of a NSI are crucial to the formulation of evidence-based policy for the effective use of resources.

UNIDO acknowledges the importance of evidence in optimally deploying policy instruments and targeting available resources (economic incentives and institutions) so that the Government of Cabo Verde (GoCV) can achieve competitive advantage. This is attained through the development of a well-functioning NSI, working as a driver for long-term socio-economic development. Within this framework, the extent to which inclusive and sustainable industrial development is envisaged in the policy orientation of the GoCV is a key dimension. Inclusive and sustainable industrial development is the foundation for development that will marry advancing income levels with equity.

The mandate of UNIDO – as one of the specialized agencies of the United Nations system – to provide its member states with capacity-building and policy advisory services is manifest in this report.
The Cabo Verde National System of Innovation – Measurement, Analysis and Recommendations maps and measures, as well as analyses the challenges, potential and opportunities arising from the NSI within Cabo Verde's socio-economic context. The report is a source of policy insight for supporting the GoCV to elaborate a coherent, evidence-based industrial policy that articulates the role of science, technology and innovation throughout the economy.

The chapters in this report are the result of UNIDO's services in capacity-building, policy analysis and empirical research on the Cabo Verde National System of Innovation (CVNSI). It aims to enhance the understanding of the role of the core actors, their interactions and perspectives, thus providing a strong basis for strategic planning, policies and management of policy actions to effectively achieve national targets and goals.

3.0 Foreword

by Mr. Pedro Lopes
Secretary of State for Innovation & Technical Training of Cabo Verde

The objective to propel Cabo Verde to a globally competitive and prosperous position has been addressed prominently by the Government of Cabo Verde (GoCV). Within Cabo Verde's policy circles the importance of embracing science, technology and innovation for economic development has become more prominent than ever before.

The GoCV's aim is to move away from a factor endowment bound model of economic development to one that is knowledge-based, and innovation driven. However, the challenges that need to be addressed include: a fragmented science, technology and innovation (STI) landscape with poor linkages between the research base and industry; inadequate funding with over-reliance on external resources, and an overall lack of advocacy for STI at high political and policy levels. The resultant effect is a low global competitiveness ranking.

A means to overcome these barriers – an area in which progress is being made – is through clear and targeted policy, enabling the effective allocation of resources. Our policy objectives are to increase productivity through enhancing competitiveness, employment and equitable social and economic development. In order to drive this transformation, the development of an effective and efficient NSI is vital to achieving this.

With technical assistance from UNIDO, this report provides an analytical view of the relevant actors within the NSI, their inter-relational dynamics, and their individual dispositions with respect to barriers to innovation and innovativeness, and policy instruments.

The analysis is based on data gathered as a part of the CVNSI Survey conducted by UNIDO in 2018. The value of this report lies primarily in its representation of the mapped and measured CVNSI, in terms of the strengths and weaknesses of organizational actor linkages. However, it also provides a comprehensive set of policy recommendations and the UNIDO methodology serves as a high-resolution longitudinal instrument to monitor, assess and evaluate policy implementation with respect to the CVNSI. Moreover, it facilitates the hard choices regarding policy decisions and trade-offs related to the role of STI in development policy and permits a view of the direction STI policy would need

to take in order to support the objectives of Cabo Verde's development strategy, the Ninth Legislation.

In the context of Cabo Verde's recent economic growth performance, the survey results are encouraging due to the positive contributions of the actors themselves and the findings and issues that emerge for policy consideration. Indeed, the main findings of the analysis indicate the following with respect to the CVNSI:

- There is the need to optimise and strengthen linkages between crucial actors of the system of innovation;
- There needs to be a more applied orientation to the types of relationships between system actors;
- There is an imbalance in the directionality of actor relationships;
- The most significant latent factor barrier to innovation for the system is 'unsophisticated market knowledge";
- In policy terms the views of what is successful and what is not varies from actor to actor and is often convergent from the government's own view.

At its current stage of development, the local industry needs support that can be effectively delivered through a comprehensive strategy which requires all key actors' interventions, including: science and research efforts promoted by knowledge-based institutions (i.e. universities and research centres), state incentives and infrastructure improvements provided by the government, as well as financial intermediation by arbitrageurs, and industry's efforts to enhance its innovation profile.

As the CVNSI Survey results suggest, the GoCV has several possible strategies for encouraging adaptive and innovative performance to strengthen the linkages among the key actors in the NSI. This aim resonates with the intentions stated by the government, especially in its STI, industry, and education policies.

It is hoped that the findings, implications and recommendations will not only be sources for informed discussion and design of STI policy, but also the foundation for designing business plans and management actions for fostering innovation in Cabo Verde.

4.0 Acknowledgements

The CVNSI Survey and report would not have been possible without the close collaboration of key personnel from the GoCV, Ministry of Finance, namely: Mr. Pedro Lopes, Secretary of State for Innovation and Technical Training of Cabo Verde. Dr. Bernardo Calzadilla-Sarmiento, Director of the Department of Trade Investment and Innovation (TII), The United Nations Industrial Development Organization (UNIDO), and other ministries of the GoCV, namely the Ministry of Education. Profound expressions of appreciation and special gratitude are extended to Mr. Pedro Barros, the President of the Instituto de Apoio e Promoção Emprersarial (PROEMPRESSA), for making generous resources available for the execution of the survey and actively participating in the project, and to UNIDO for providing funding resources and supporting the project team.

Special thanks are extended to: Mr. José Luís Neves, Secretary General of the Chamber of Commerce; Mr. José Manuel Alves Mendes, Director of the Department of Economic and Business Statistics (INE); Mr. Jailson Semedo, Senior Technician at the Ministry of Industry, Commerce and Energy; and Mr. Marco Aguiar, former president of PROEMPRESA for providing access to their respective business directories.

The CVNSI Survey and the data analysis and results presented in this report have been performed, analysed and authored by Dr. Ritin Koria, Associate Expert for Innovation (UNIDO), and supported by Ms. Francesca Guadagno, Consultant, and Mr. Lars Radscheidt, Research Associate. Ms. Benilde Carvalhal, Ms. Dunia Lopes and Mr. Bruno Livramento from PROEMPRESA, provided excellent and invaluable support in the field, in Cabo Verde, for operationalising the survey and data acquisition and the necessary capacity building. Mr. Waldemar Monteiro for his support to reviewing national policy, as well as Ms. Lauren Cooke is thanked for editorial work.

Appreciation is also extended to Dr. Raymond Tavares - Industrial Development Officer (UNIDO) for overseeing the overall project, and Mr. Rui Levy, UNIDO National Coordinator in Cabo Verde, whose efficient administrative and logistical support made the project execution all the more effective. PROEMPRESA and UNIDO are also especially grateful to all the respondents: government policy-makers, chief executives of business enterprises, leaders in knowledge-based institutions, and directors of financial institutions, venture capital and knowledge brokering firms for participating in the survey.

5.0 Executive Summary

This report, The Cabo Verde National System of Innovation – Measurement, Analysis and Policy Recommendations, surveys and depicts for the benefit of the Government of Cabo Verde (GoCV) policy-makers, the essential and systemic features of the landscape of innovation and innovativeness in Cabo Verde. This is a positive first step towards a coherent policy delivery mechanism as well as a long-term policy monitoring and management capability for Cabo Verde.

Although there are many serious significant challenges identified from the analysis, it should be understood that together the policy analysis, policy implications arising from the analyses, and the policy recommendation to address these implications provide an unprecedented menu of evidence-based policy choices to address the challenges. The approach outlined in this report is a comprehensive and holistic in nature with respect to mapping and measuring the Cabo Verde System of Innovation. The value addition provided is in terms of enabling an accurate visualisation of the connectivity between the core actors of the CVNSI; the significant barriers to innovation and innovativeness; as well as the relative success of extant policies in overcoming the barriers. After all it is not a matter of the number of assets a country has with respect to innovation and innovativeness, but rather how well and coherently they are connected.
In presenting the results for the benefit of policy-makers, and the essential and systemic characteristics of the landscape of innovation and innovativeness, this report represents a landmark in evidence-based policy-making in Cabo Verde. It is the result of project execution under the aegis of the Ministry of Finance, in concert with Instituto de Apoio e Promoção Emprersarial (PROEMPRESA). All results and reporting have undergone a rigorous review by representatives of PROEMPRESA; The University of Cabo Verde; University Jean Piaget; the Chamber of Commerce; the Ministry of Industry, Trade and Energy (MICE); and PROCAPITAL. The analysis, implications and recommendations need to be viewed in light of the economic performance of Cabo Verde, firstly as a Small Island Developing State (SIDS) and secondly as a graduate from the Least Developed Countries (LCD) group. The analysis of GoCV policy documents; the mapping and measurement of the CVNSI in terms of analysing linkages between (and within) actors; barriers to innovation; and the success of policy instruments (in relation to barriers to innovation and factors of policy success) disclose the significant key policy analysis findings, the major implications from the analysis, and the recommendations that stem from them.

Firstly, there is the need to strengthen linkages between crucial actors of the CVNSI, particularly for the use and application of research, skills orientation and development. Secondly, the analysis highlights that relationships between actors in the CVNSI are imbalanced, which stymies the flow of knowledge and information crucial to the innovation process. This links to the third finding that the most significant latent factor barrier to innovation for the system is unsophisticated market knowledge, without which there is limited drive to innovate.

Regarding policy success, policies are analysed in terms of supply-side measures (services and financial) and demand-side measures. Government actors view supply-side financial measures as not effective/neutral when considering the innovation process. This is noteworthy particularly as the input of R&D to innovation is well documented as well as government respondents themselves considering the cost of innovation as a high constraint. Knowledge-based institutions view research grants, government-backed venture capital and tax breaks as the most successful policy instruments, yet access to finance is seen as a high constraint. The perspective held by industry is that overall all policies are deemed to be successful in promoting innovation. However, supply-side financial measures are least successful as a whole. This supports the industry view that lack of finance is the highest constraint to innovation and indicates that more needs to be done in this policy area.

The arbitrageur view point with respect to supply-side financial measures is that research grants are successful, and the other measures are rated as neutral or moderately successful. Of the demand-side measures, government procurement is seen to be the most successful. This is noteworthy as, in terms of barriers to innovation, lack of finance is considered as a constraint by the majority of respondents.

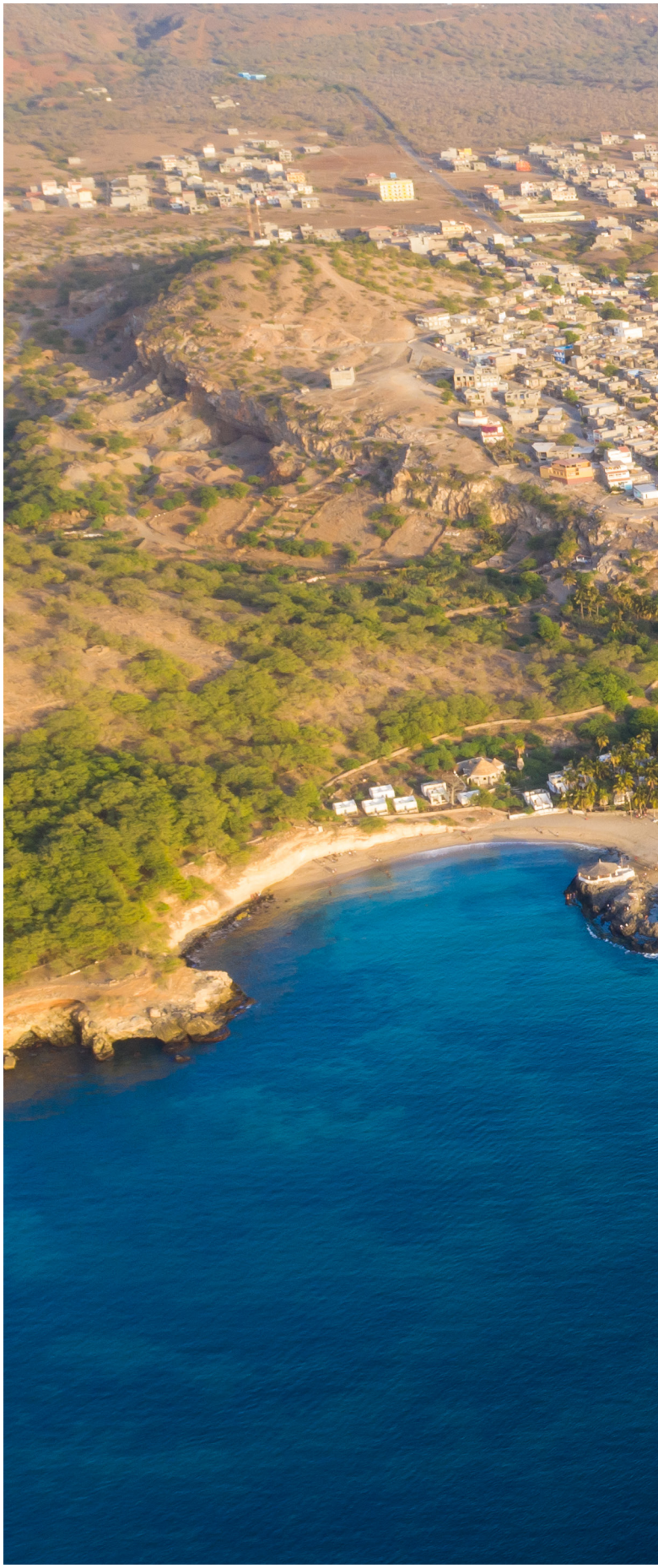
In general, what is clear across all actors is that ICT, in terms of rate of access and skills, is a success, however from the perspective of knowledge-based institutions this could be improved upon. One rationale for this may be due to what the academic community in other countries have experienced, and in this respect, what has been done was successful, but more could be done.

It is evident that each actor has a specific view on what is effective or ineffective policy, and this needs to be taken into account when selecting an effective policy mix. Policy selection should not be an arbitrary process, it should be based on evidence and reflect the needs of the actors in the system, as well as being in line with Cabo Verde's overall strategic orientation.

The major implications of the analysis outlined in the report are that there are very few externalities, if any, that emanate from the public goods of funding and supporting, and research institutions are exacerbated by the absent nexus of the knowledge-base and industry. What is present has the great potential to be bolstered. The lack of positive externalities magnifies the dysfunction of the absent relationships relevant to innovation in the national economy. The remoteness of actors causes them to be relatively independent of the policy-making process, especially in terms of wielding influence in configuring and calibrating policy to exploit knowledge as well as intermediating the flows of technical know-how. It is clear that the system actors are not removed from or 'shy' of ICT and this poses interesting possibilities for the types of technology-led innovation that can be developed. What is required is a widely accepted conducive environment in which organizational rigidities are removed.

In sum, the CVNSI report recognises the value of comprehensive survey instrumentation and the critical importance of mapping and measurement to guide the discussion for evidence-based policy craft and management. The reapplication of the methodology of mapping and measuring the CVNSI in two to three years' time to ascertain the effects of policy choices, implementation and resource application, and hence innovation and innovativeness in the Cabo Verdean economy, is strongly advised.

In putting forward the CVNSI analysis, implications and recommendations, the sovereignty of the GoCV is fully respected. The observations and implications and recommendations that emerge as a result of the analysis need to be considered holistically and in their entirety. The final selection of recommendations and the resources to be applied in implementing policy on innovation and innovativeness remains a matter of sovereign choice by, and priorities of, the GoCV.



6.0 Introduction

The CVNSI Survey is contextualised by the Government Programme for the Ninth Legislation, which was launched on the 24th of May 2016. It emphasises the role of innovation and knowledge, science, technology and innovation (STI), and sets goals for: macroeconomic stability; international competitiveness and business environments; employment and decent work; education, health, equality, and social inclusion; and exports and regional integration.

With this in mind, the primary purpose of this report is to: inform policy-makers with evidence on the national debate on innovation; better enable the GoCV to consider strategic, operational and tactical policy choices, and facilitate better deployment of the available resources in a prioritised and sequential manner, either by concentrating on reinforcing strengths and/or overcoming weaknesses. Consequently, the report is necessarily analytically intense, drawing attention to the areas of strengths, weaknesses and fragility, as well as points of vulnerability and liability in the CVNSI. This attention is expressed without value judgment, in full respect of the sovereignty of the GoCV.

Given the complexity and emergent characteristics of the CVNSI, the report achieves this purpose by:

i. providing a statistically significant set of tools, resources and metrics with which policy management can be mapped and measured through evidence-based data and analysis;
ii. explaining the institutional and structural challenges faced in the CVNSI policy management;
iii. setting out key ideas, insights and examples from research and evidence from the survey;
iv. and, delineating key principles for the GoCV policy-makers and the supporting policy community in Cabo Verde. These are summarised as analysis, policy implications and policy recommendations.

With regards to the management of the CVNSI, policy-makers confront four major issues:

i. the need to better comprehend the increasing pressures of decision-making;
ii. the dynamic tension between evidence, heuristics, practice and theoretical considerations;
iii. the paucity of data availability; and,
iv. the need for evidence-based pragmatic approaches that provide insights for decision-making.

For policy management, the report therefore portrays the patterns and dynamics that characterise the CVNSI, the relations of the actors (and their collective behaviour) and the interconnectedness of the elements of the CVNSI. In digesting the report, policy-makers need to take into account the following key ideas:

i. the CVNSI is characterised by a complex system of elements that are differentially interdependent, interconnected by multiple feedback mechanisms, and that system-wide behaviour emerges from accumulated interactions among the parts;
ii. in complex systems (Allen., 2000), processes of change are highly sensitive to conditions and can shift dramatically with non-linear tipping points (points of policy leverage);
iii. as a complex, ultimately human, system, the CVNSI is operated by `adaptive agents' that act to maximise their interests and managerial utility, who network, react to and influence other actors in the system, respectively. Enhancing the adaptive response capacities and capabilities of these networks through policy levers is essential to strengthening resilience, innovativeness and innovation.

The report is based on empirical, data-driven statistically significant analysis in order to provide rigorous evidence-based insights. The following seven principles guide the policy analysis, implications and recommendations:

i. one cannot manage what is not measured and what gets measured gets done;
ii. understanding the systemic nature of the CVNSI;
iii. involving those actors that matter the most in decisions that are crucial to the effectiveness and efficiency of the CVNSI;
iv. avoiding 'one size-fits-all strategies' and embracing multiple policy instruments;
v. establishing real-time longitudinal analysis and learning as key to operational effectiveness;
vi. openness to the adaptation of efforts to local conditions;
vii. and, framing the policy management of the CVNSI as

a dynamic network involving a multilateral system of actors. With these principles, a more innovative, relevant and appropriate approach to the policy management of the CVNSI is possible.

6.1 Cabo Verde National System of Innovation (CVNSI) Survey Project Provenance

The CVNSI Survey Project emerged from the GoCV recognising the importance of STI for sustainable economic growth and future international competitiveness. Of particular interest to this report, the Government Programme for the Ninth Legislation emphasises the importance of linkages between higher education institutions, firms, and government to foster innovation and create the conditions for higher competitiveness in international markets. At the same time, linkages between national actors and foreign centres of excellence are identified as important mechanisms for the absorption of foreign knowledge, skills, capabilities, and new technologies (IX Legislature Prorgam; p. 86).

To further stress the role of STI as a source of sustained economic growth, the government also launched a programme to make Cabo Verde a platform for digital innovation. Through this programme, the government aims at transforming the archipelago into a centre for the advancement of digital and nano-technologies, thus becoming a focal point for Africa in terms of innovation and knowledge production. In order to achieve this, and in continuity with the history of the country, the government recognises the central role of human capital formation and Information Communication Technologies (ICTs) (PEDS - Strategic Plan for Sustainable Development 2017/2021: p. 157). As regards the latter, the Government Programme for the Ninth Legislation reiterates the objective of making Cabo Verde a cyber-island, where broadband internet is treated as a "necessity good" and becomes accessible to the entire population (p. 37).

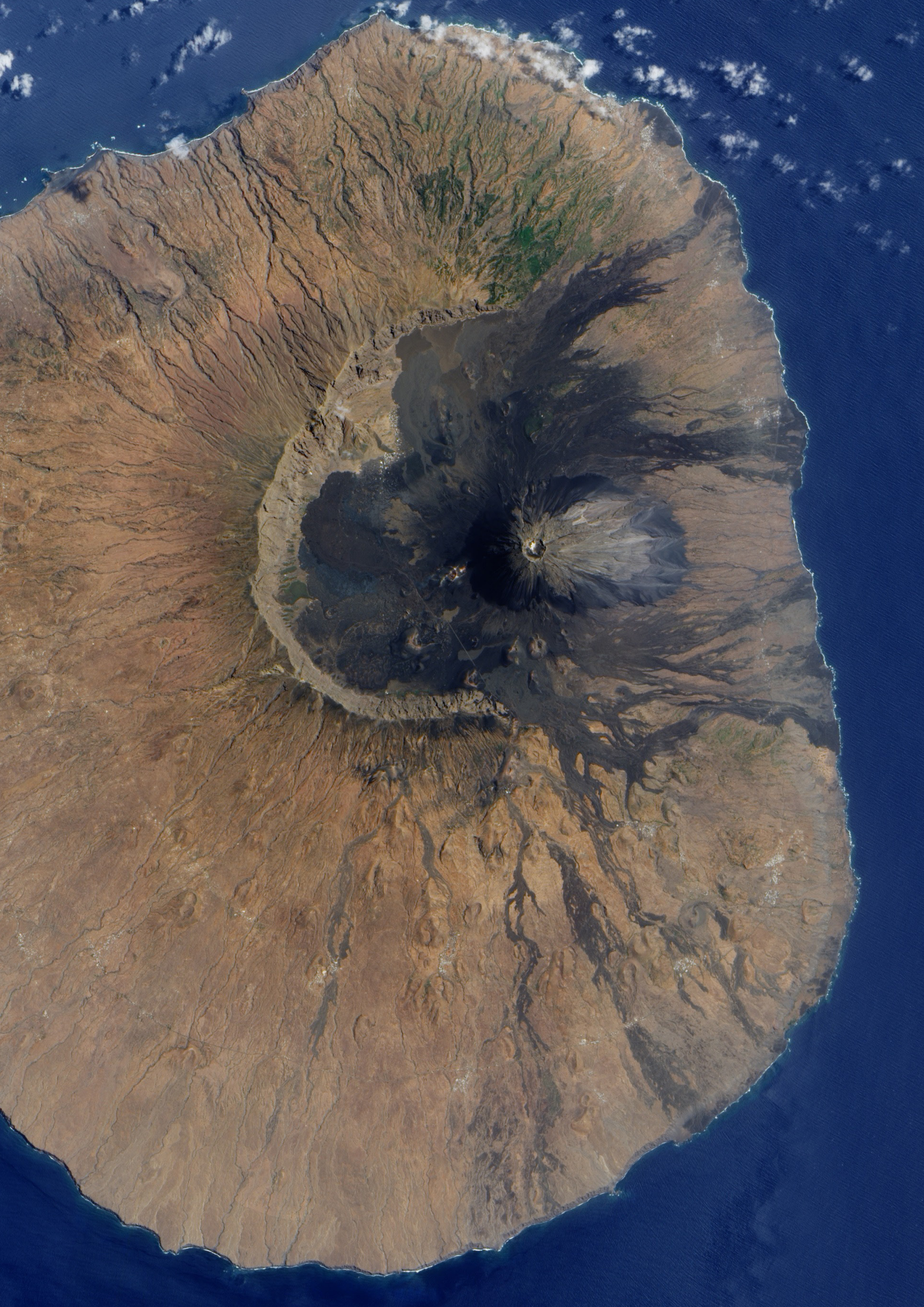
The importance of the project and the resulting report was signalled by Dr. Pedro Lopes, Secretary of State for Innovation, in May 2018.

6.2 The Structure of this Report

This report is structured to allow for a holistic understanding of our unique approach and the nature of policy recommendations given here. Chapter 7 focuses on the theoretical underpinnings of the approach used for the mapping and measuring of the CVNSI. It offers a literature review on the NSI and the Triple Helix, emphasizing the genesis and evolution of the NSI approach and the role and impact of university-industry-government relations for an economy's innovation capacities. In addition to these established models of analysis, we present UNIDO's approach – the Triple Helix Type IV which stresses the role of arbitrageurs and a well-established ICT infrastructure for a well-functioning NSI.

Chapter 8 presents the methodological approach that was used in undertaking the CVNSI. Chapter 9 follows by introducing Cabo Verde's economic context, which sets the scene for an in-depth analysis of the NSI by placing its economy in a global context. It also highlights the most important economic linkages, as well as local challenges. This is followed by Chapter 10, which articulates national policy priorities regarding science, technology and innovation (STI). It reviews innovation policy with respect to industry and information and communication technology (ICT) as well as education.

Chapter 11, 'Analysis and Results of the CVNSI', is the core of this report and provides an empirical analysis of Cabo Verde's NSI. It depicts the inter- and intra-actor linkages of Cabo Verde's innovation system and offers an evaluation of the country's innovativeness, barriers to innovation and the perceived success of instruments. This culminates in a set of unique evidence-based policy recommendations for the GoCV in order to foster inclusive and sustainable industrial growth, innovation, and entrepreneurship.



7.0 Theoretical Underpinnings

Innovation is increasingly viewed as the salient ingredient in the sustainable growth of the modern economy. An economy must continuously absorb new knowledge and develop new skills and capabilities if it does not wish to find itself on the down side of the cross-country income distribution. Historically, countries that fostered innovation, by developing interconnected innovation systems, have proven to be more capable of generating new knowledge and translating it into business opportunities and thus wealth creation (Freeman, 1987; Nelson and Rosenberg, 1993; Lundvall, 1992, 2016a; Chaminade et al., 2018). More importantly, from a development perspective, studies have shown that well-functioning innovation systems are essential in order to catch up (Kim, 1992, 1997; Kim and Nelson, 2000; Fagerberg and Srholec, 2008; Malerba and Nelson, 2013; Fagerberg et al., 2017). This chapter presents the theoretical underpinnings for the approach used in mapping and measuring the CVNSI. It introduces the concept of the NSI, as well as reviews the elements that constitute its early conceptualisation, through a review of the evolution of seminal literature. Based on this, the chapter outlines the traditional Triple Helix model of university-industry-government interactions as well as its extension.

7.1 The Genesis and Evolution of the NSI Approach

The concept of the NSI originates from the works of Freeman and was first manifested in 1987. During the last three decades the concept has gradually evolved and recognises the importance of interaction, intra- and interlinkages within the innovation system, even more. The most prominent definitions and perspectives include:

"[...] the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies." (Freeman, 1987, p.1)
"[...] the elements and relationships which interact in the production, diffusion and use of new, and economically useful knowledge [...] and are either located within or rooted inside the borders of a nation state." (Lundvall, 1992, p.2)[30]

"[...]a set of institutions whose interactions determine the innovative performance [...] of national firms." (Nelson and Rosenberg., 1993, p.4)
"[...] that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such, it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies." (Metcalfe, 1995, p.38)
"[...] firms do not normally innovate in isolation, but in collaboration and interdependence with other organizations. These organizations may be other firms (suppliers, customers, competitors, etc.) or non-firm entities such as universities, schools, and government ministries. The behaviour of organizations is also shaped by institutions—such as laws, rules, norms, and routines—that constitute incentives and obstacles for innovation. These organizations and institutions are components of systems for the creation and commercialization of knowledge. Innovations emerge in such ''systems of innovation.'' (Edquist, 2005, p.182)
"[...] the envelope of conforming policies as well as private and public organizations, their distributed institutional relations, and their coherent social and capital formations, which determine the vector of technological, change, learning and application in the national economy." (Bartels et al., 2012, p.6)

From these definitions, it is evident that certain recurring elements constitute a NSI: actors (intended as firms and other organizations), modes of interaction (knowledge transfer, learning, collaboration and linkages), skills, institutions, innovation and technological change. The idea behind the concept of innovation systems is that firms cannot (and do not) innovate in isolation; they are part of a larger system. This system, the NSI, is composed of actors – firms, universities, research centres, the government and its agencies, the financial sector – and institutions, also referred to as the "rules of the games", i.e. all common habits, routines, laws, regulations, and norms that regulate the interactions

[1] For a thorough review of the NSI literature, see Lundvall (2007), Acs et al., (2017), and Chaminade et al. (2018).

between individuals, groups, and organizations (Edquist, 2005). Firms interact with each other and with the other NSI actors in different ways. In this regard, interactive learning, i.e. the process in which NSI actors exchange knowledge and cooperate to create, absorb, and use new knowledge, is a vital element of the NSI. Indeed, it is precisely because of these interactions that the system as a whole is more than the sum of its parts (Lundvall, 2007, 2016a).

With this in mind, the rate of technological innovation and the overall competitive advantage generated by the NSI are ultimately determined by factors such as: the intensity of inter- and intra-actor relationships; effective policy management of frictions that arise because of agency problems and managerial utility in, and among actors, as well as the effective use of resources. These factors determine the coherence of the data, information, and knowledge available, as well as the value of their exchanges within the NSI.

The conceptual and empirical articulations are framed in terms of understanding networks and interactions as complex adaptive systems, with respect to properties of non-linear systems, knowledge generation and flows (Leydesdorff and van den Basselaar, 1994; Bartels and Voss, 2005; Bartels and Lederer, 2009; Bartels et al., 2012; Koria et al., 2014). Broadly speaking, complex adaptive systems are those that exhibit emergent behaviour due to interactions between their component elements. They are characterised by interconnectedness, feedback loops, non-linear change and tipping points, and emergent properties at the macro-level which need to be understood holistically. These factors reveal the complex nature of innovation processes, thereby reducing the appeal of mono-causal explanations of poorly functioning NSI.

The innovation system literature emphasizes the role of public policies, and in particular STI policies, in providing the resources and incentives to foster innovation (skills, finance, intellectual property rights, etc.) and in promoting interactions among firms and the other NSI actors (Lundvall and Borras, 2005; Fagerberg, 2017; Edler and Fagerberg, 2017). By carrying out ex-post analyses of innovation processes, the NSI approach is also able to shed light on the obstacles to innovation. In this way, these studies can produce policy implications that can guide policy-makers in designing "systemic innovation policies", i.e. policy mixes that can tackle the weakness of the system in a holistic way (Metcalfe, 2005; Edquist, 2011; Flanagan et al., 2011; Weber and Rohracher, 2012; Borras and Edquist, 2013; Cunningham et al., 2016).

While the basic elements of NSI outlined above have been recognised in developed as well as emerging and developing economies, case studies show that there are differences in terms of the functioning of a NSI, and especially in the strength and depth of the linkages among its actors (Kim and Nelson, 2000; Lundvall et al., 2009; Bartels et al., 2012, Malerba and Nelson, 2013; Muchie and Baskaran, 2017). Studies on developing countries have also highlighted the role of domestic capabilities, building international knowledge transfers, natural resources, and policies to create or strengthen the NSI. (Lundvall et al., 2009; Malerba and Mani, 2009; Gu and Lundvall, 2016; Andersen et al., 2015). Taking into account the characteristics of developing economies, the term "inclusive innovation systems" was coined to refer to the innovation systems that are capable of generating new knowledge and innovations, and at the same time also producing "inclusive innovation", i.e. innovation for and by the poor (Altenburg, 2009; Andersen and, Johnson 2015; Dutrenit and Sutz, 2016).[31]

7.2 The Triple Helix Model of University-Industry-Government-Relations

Traditionally the literature on the Triple Helix model has focused on the relationships between universities and knowledge-based institutions (KBI), firms, governments, and hybrid organizations at the intersection of these three helices (Etzkowitz and Leydesdorff, 1995; Leydesdorf, 2001). According to this literature, the scope and intensity of the interactions between the three actors are reflected in varying institutional arrangements, referred to as Triple Helix Type I, II, and III (TH-Type I, II and III) (Etzkowitz and Leydesdorff, 2000; Etzkowitz, 2003b, 2008; Ranga and Etzkowitz, 2013).

In the TH- Type, the three helices are strongly defined, with relatively weak interactions. Institutionally, "the nation state encompasses academia and industry and directs the relations between them" (Etzkowitz and Leydesdorff, 2000: p. 111). New knowledge is produced only within universities and research centres. Hence, TH-Type I is largely viewed as a failed development model with not enough room for 'bottom up' initiatives, where "innovation was discouraged rather than encouraged" (Etzkowitz and Leydesdorff, 2000, pg.112). In order to achieve statist reform "the first step […] is the loosening of top down control and the creation of civil society where one is lacking" (Etzkowitz, 2003a, pg.304). Otherwise, there is minimal direct connection to the needs of society,

[31] Over the last two and a half decades, the systemic nature of innovations has been studied at varying nested levels – national, regional, sectoral, technological, and urban (Carlsson and Stankiewitz, 1991; Cooke, 1996; Breschi and Malerba, 1997; van Winden, 2014; Wieczorek et al., 2015; Asheim et al., 2016; Lee and Malerba, 2017). Alternative differentiations of studies, within the broader realm of IS, examine both high-tech, as well as low-tech industries (Larsen et al., 2012; Gu et al., 2013; OECD, 2013; Farinelli, 2016; Iizuka and Gebreeyesus, 2017). Other perspectives of analysis focus on sustainability and respective prerequisite innovation systems (Altenburg and Pegels, 2012; Purkus et al., 2018). More recent literature examines the NSI concept in a globalized world, i.e. Global Systems of Innovation and Transnational Systems of Innovation. Studies have, however, shown that only economies with a functioning and interconnected NSI have the capacity and capability to absorb foreign knowledge and to reap the benefits from international trade (Pietrobelli and Rabellotti, 2011; Lundvall, 2016b; Binz and Truffer, 2017; Lee et al., 2017; Fagerberg et al., 2017).

which in turn discourages the introduction and diffusion of innovations in the economy. (Martin and Etzkowitz, 2000).

Triple Helix Type II is characterised by decreasing direct control of the state on the functions of Type I with a shift of focus on fixing market failures. The mechanisms of communication between the actors are strongly influenced by and deeply grounded in market mechanisms and innovations (Nelson and Winter, 1982; Bartels, et al., 2012). The point of control is at the interfaces (Leydesdorff, 1997) and consequently new codes of communication are developed (Leydesdorff and Etzkowitz, 1998b). Research is also carried out outside universities and research centres. As research becomes increasingly multidisciplinary and applied, societal needs have a direct influence on it (Etzkowitz and Leydesdorff, 2000; Martin and Etzkowitz, 2000; Ranga and Etzkowitz, 2013). TH-Type II can be considered a 'laissez- faire' model of interaction, "in which people are expected to act competitively rather than cooperatively in their relations with each other" (Etzkowitz, 2003, pg.305).

To summarise and compare TH-Types I and II, "statist societies emphasise the coordinating role of government while laissez-faire societies focus on the productive force of industry as the prime mover of economic and social development" (Etzkowitz, 2008, pg.13). However, In TH-Type III, the three actors assume each other's roles- in the institutional spheres as well as the performance of their traditional functions. With the emergence of TH-Type III, a complex network of organizational ties has developed, both formal and informal, among the overlapping spheres of operations.

The transformation of universities is of particular relevance. After having incorporated research as an additional mission beyond teaching, universities recognise their role in the pursuit of economic and social development (Etzkowitz and Leydesdorff, 2000; Webster, 2000; Ranga and Etzkowitz, 2013; Etzkowitz, 2008, 2017). Hence, universities take on entrepreneurial tasks such as marketing knowledge, increased technology transfers and the creation of spin-offs and start ups, as a result of both internal and external influences (Etzkowitz, 2017; Etzkowitz and Leydesdorff, 2000; Etzkowitz etal., 2000). These entrepreneurial activities are assumed with regional and national objectives in mind, as well as financial improvements to the university and the faculty (Etzkowitz, et al., 2000). In doing so, universities cease to be ivory towers, disconnected and isolated from society, but interact closely with the industry and government (Etzkowitz and Leydesdorff, 2000; Etzkowitz etal, 2000).

In addition to the above, "firms develop an academic dimension, sharing knowledge among each other and training employees at ever higher skill levels" (Leydesdorff and Etzkowitz, 1998, pg.98), as well as increased collaboration with knowledge-based institutions (KBIs). Increased university-industry collaboration is visualised through: i) an increased patenting output, particularly as they are a "repository of information about how the socially organised production of scientific knowledge is interfaced with the economy" (Leydesdorff, 2004); ii) the increase in university revenues from licensing (Perkmann and Walsh, 2007); iii) a greater proportion of industry funds making up university income (Hall, 2004); and iiii) the diffusion of technology transfer offices, industry collaboration support offices and science parks (Siegel et al., 2003, in Perkmann and Walsh, 2007, pg. 4). Governments therefore create incentives through "informed trade-offs between investments in industrial policies, S&T policies, and/or delicate and balanced interventions at the structural level" (Leydesdorff, 2005). Phrased differently, there is a shift in the traditional role of policy from the facilitation of basic science to its 'bridging function'.

In a nutshell, the Triple Helix Type III assumes that the three spheres - universities, industry, and government- overlap, and their boundaries become more permeable. A complex network of organizational ties develops: individuals and ideas move around the three helices, and synergies are maximized (Etzkowitz, 2002). Actors evolve and assume each other's roles, with new hybrid organizations emerging at the interfaces, e.g. incubators, science parks, technology transfer offices, venture capital firms, angel networks, and seed capital funds (Etzkowitz, 2000; Etzkowitz and Leydesdorff, 2000; Etzkowitz, 2002; Ranga and Etzkowitz, 2013). In the context of its use, the Triple Helix model has also been applied to the context of developing economies. Case studies document how innovation and learning processes differ in developing economies, what factors constrain the adoption of more integrated Triple Helix models, and how actors and mechanisms cope with these factors (Sarpong et al., 2017). In this regard, it has been noted that while the components of the Triple Helix do not change, the intensity and quality of their interactions are often weaker than in developed economies (Dzisah and Etzkowitz, 2008). Generally, in order to address such challenges effectively, through tailored and targeted policy interventions, there is the clear need for system level measurement.

7.3 Our Framework of Analysis: The Triple Helix Type IV

Our framework for analysis of the CVNSI is grounded in the literature, but it extends the traditional model in two main ways and is referred to as Triple Helix Type IV. The TH-Type IV has the additional features of arbitrageurs and the presence of diffused ICT.

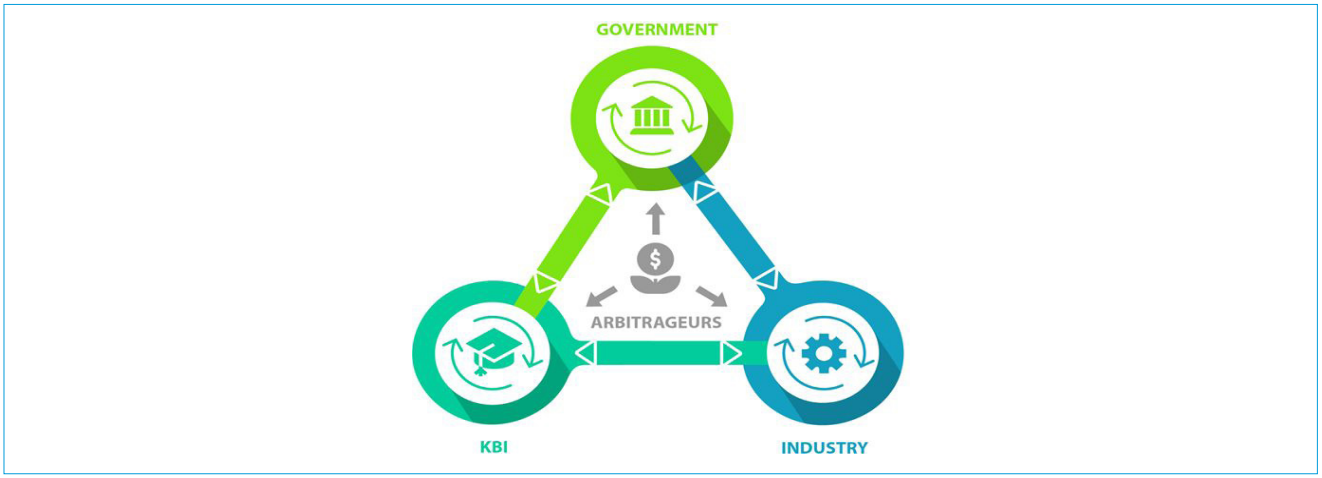
Arbitrageurs can be defined as venture capitalists, angel and knowledge brokers. This set of actors is of "crucial importance as the innovation process requires internal and external knowledge which has led to the emergence of new business models and new types of companies. As such, knowledge

brokers and venture capitalists [32] [33]fill this gap through the provision of links, knowledge sources and even technical knowledge so that firms can improve their performance in terms of survival rate as well as accelerate and increase the effectiveness of their innovation processes (Zook, 2003; Hargadon, 1998; Baygan and Freudenberg, 2000). Their resource allocation role is based on the assessment of advantages in information asymmetries (Williamson, 1969, 1971, 1973)" (Bartels, et al., 2012, pg.7). However, information asymmetry and uncertainty can lead to transaction problems. "Countries seeking to encourage the emergence and growth of entrepreneurial firms need to devise ways that reduce transaction problems" (Li and Zahara, 2012, pg.95). It can be said that a combination of both formal institutions and (informal) cultural values can provide the proper incentives to reduce transaction problems. Compared to the Triple Helix Type III, our augmented version of the model also gives prominence to ICTs. Through the spread of digital information and ICT, a new technological wave and a new corresponding mode of development has emerged (Perez, 1983; Freeman and Louça, 2001; Mowery, 2009). Today, ICTs are at the centre of what many believe to be the Fourth Industrial Revolution, and part of Industry 4.0 (World Bank, 2016).

Innovation activities shape and use ICTs with lagged but often large effects on productivity and innovation in both developed and developing economies (Commander et al., 2011; Bloom et al., 2012; Forman and van Zeebroeck, 2012; Hall et al., 2013; Cirera et al., 2016; Paunov and Rollo, 2016; Hjort and Poulsen, 2017)[34]. The channels through which ICTs affect firms' productivity and innovation are multiple, and often difficult to disentangle. For example, ICTs can facilitate access to information and knowledge, fostering learning and knowledge flows, or ease communication among firms and NSI actors, thereby promoting collaborative projects. In order to make the most of these new technologies, countries have put in place a number of policies. However, often their design does not take full account of the local environment in which actors operate, suggesting a potentially large role for evidence-based policy-making in this area (Koria et al., 2014).

Our inclusion of ICT in NSI is not based solely on the concept of access, but on the work of Hilbert, et al. (2010) who view the digital divide as being attributable to issues of storage, the ability to compute and transmit digital information; to

***Figure 1.** An illustration of Triple Helix Type IV.*



Source: Author's elaboration.

[32] There is a varying topology for venture capital: University venture capital – seeks a "balance between transferring technological innovations produced within the university to existing firms, on the one hand, and spinning them out on the other" (Etzkowitz, 2008, pg.130); Corporate venture capital – "seeks to capitalize knowledge that is not directly relevant to a firms core competency" (Etzkowitz, 2008, pg.131); Foundation venture capital – "Is at a very early stage and relatively little is known about its operation"(Etzkowitz, 2008, pg.132); Community development venture capital – supports firm formation in low-growth and slow-growth industries in poor communities and urban areas; and, angel investors and syndicates fill the gap in 'early stage investment' that is left open by venture capital transition to later stage investments.

[33] "Each type of venture capital corrects another's deficiency. Thus, public venture capital focuses on the creation of new industries and jobs, seeking long-term economic growth. Public venture capital can maintain a focus on early-stage investments, especially in societies where government is restrained from acting too closely to the market. … University venture capital can take a long-term perspective and is able to operate at the early seed stage. Foundation venture capital, with resources guaranteed by an independent legal structure, not subject to other organizational priorities, is the purest public venture capital instrument, able to act on the early stage and in the downturn" (Etzkowitz, 2008, pg.136).

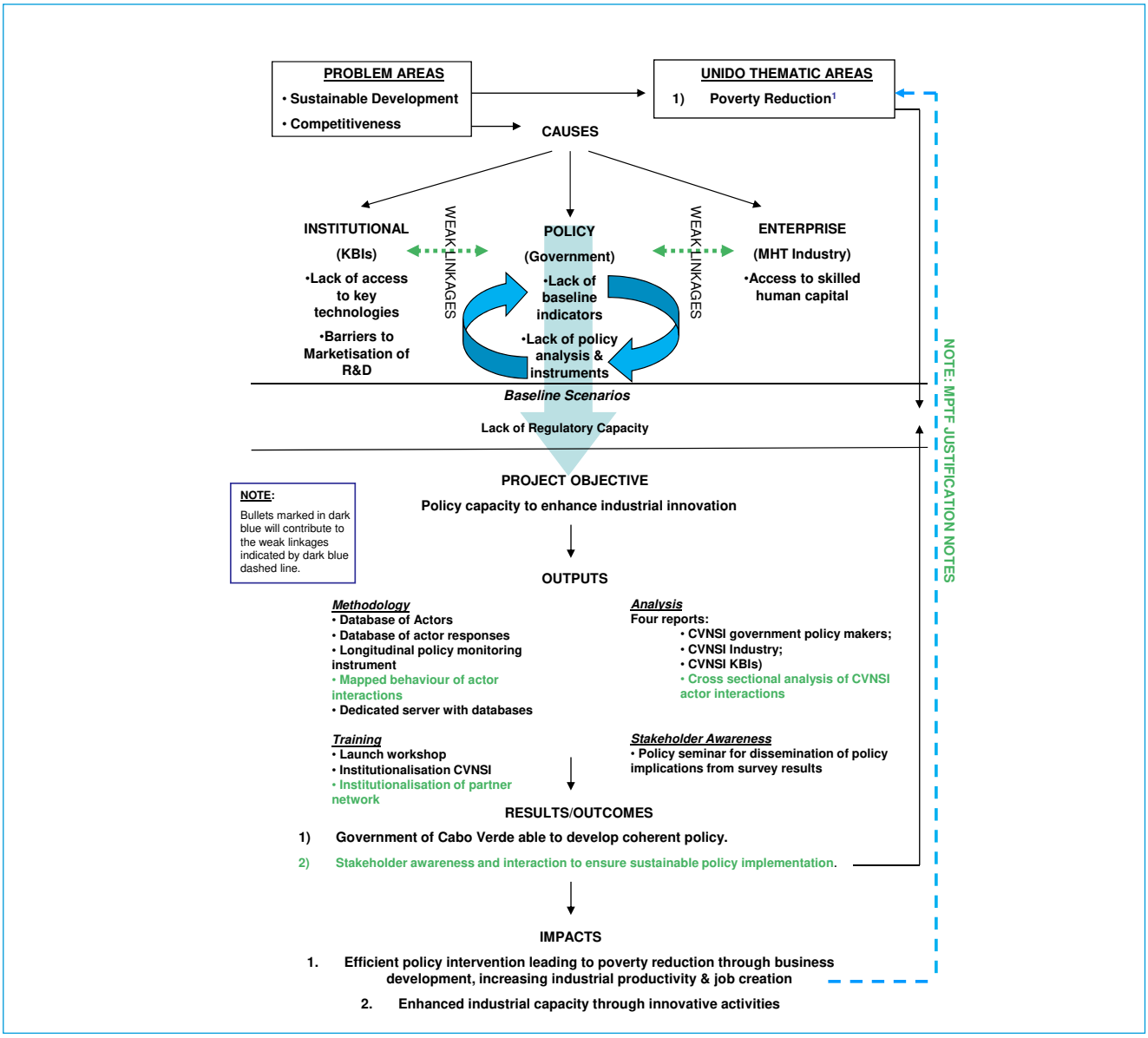
[34] For an extensive review of this literature, see Biagi (2013) and Kretschmer (2012).

contextualise not just the quantity of hardware but also the corresponding performance in relation to all four NSI actors, as depicted in the Triple Helix Type IV. Figure 1 illustrates this framework as the Triple Helix Type IV. It is the basis for measuring the NSI, and hence provides the framework for policy analysis, policy implications and policy recommendations in the context of the articulation of national priorities.

8.0 Methodology UNIDO's Approach to Assessing the CVNSI

The CVNSI Survey has been executed in the light of the fact that a holistic view of the NSI is indispensable to the efficacious execution of policy on innovation and innovativeness in the economy. The following figure – Methodological Framework for CVNSI Survey – illustrates the logic of the UNIDO methodology with respect to the CVNSI Survey.

Figure 2. ***Methodological framework for the CVNSI Survey.***



8.1 Data Collection

Essentially two basic forms of data collection exist- those with and those without an interviewer, or, phrased differently: interviews and self-administered questionnaires (de Leeuw, 2009 in Dillman Ed). The first category, interview surveys, can either be administered in person or over the telephone. There is a great deal of variation in the use of these methods across countries, due to technical reasons (lack of infrastructure) or cultural norms (Dillman, 1978; Dillman, 1998). Self-administered questionnaires take on many forms and can be used in group or individual settings. A well-known example of a self-administered questionnaire is the mail survey, and its computerized equivalent, the Internet survey, which is rapidly gaining popularity (Raziano, et al., 2001; de Leeuw, Hox., 2003). Often a combination approach is used, particularly when there is the need to ask sensitive questions. All the taxonomical approaches mentioned are respondent orientated, and it is clear that the method choice is complex and based on a delicate balance between the quality of the data acquired, time and costs.

Alternative approaches to data collection exist, namely: mail surveys, face-to-face interviews and telephone interviews. In line with the reasoning of Koria, et al. (2012), that i) "… maximizing the use of the budget, internet surveys can cover a much larger sample size than the conventional mail survey (Berrens, et al., 2003); ii) the time dimension associated with conducting web-based surveys is much lower in comparison to other forms (Cobanoglu, Warde and Moreo, 2001); iii) the quality of retrieved data is higher in terms of non-response and the ability to include conditionality in a discreet manner (Olsen, 2009); iv) a higher reliability of data is achieved due to the reduced need for data entry (Ballantyne, 2004; and Muffo, et al., 2003)." (Koria, et al., 2012., pg.8); as well as a reflection on the TH-Type IV model[30], the internet-based approach was chosen[31].

8.2 Sample Selection

As per the theoretical underpinnings outlined in Chapter 7, the CVNSI Survey focused on four core actor groups, namely: government (GOV), knowledge-based institutions (KBI); industry (IND and arbitrageurs (ARB).

The GOV is represented by high-level officials, generally directors, in the relevant public institutions directly or indirectly responsible for innovation. These include the Ministries of Trade and Industry, Science and Technology, Economy, Finance, Education and Environment. The requisite information was obtained through relevant government databases and desk research.

The knowledge community (KBIs) is represented by universities and innovation-related faculties/departments (economics, science, engineering, technology and business) in higher education (HE), as well as heads of think-tanks and public and private research institutes (RIs). These will be identified from the DST's directory of R&D institutions and the department heads will be selected. The focus will be on departments where relevant R&D activities are more likely to occur and that cover areas such as economics, science, technology, engineering and mathematics (STEM) and ICT. All relevant KBIs will be covered and therefore no sampling is required.

Table 1. ***CVNSI universe of respondents, convenient sample and responses.***

CVNSI universe of respondents, convenient sample and responses				
Actor	**Universe**	**Convenient**	**Response**	**Response rate**
Government	21	20	6	30%
Knowledge-based institution	99	98	30	30.60%
Industry	2648	1889	249	13.20%
Arbitrageur	17	14	4	28.50%
	2785	2021	289	13.50%

Note: the convenient sample represents respondents whose contact details were verified through the verification protocol developed by Bartels and Koria (2012).

[30] As the TH-Type IIII model introduces the inclusion of diffused ICT into the traditional TH model, it was considered that the use of an electronic web-based medium for conducting the Cabo Verde National System of Innovation (CVNSI) survey would add weight to the methodology.

[31] UNIDO uses an innovative remote DASI which has been operationalised and tested "in-house" and in African countries (The Manu River Union countries, Morocco and Egypt).

The industrial community is represented by the chief executive officers (CEOs) of firms from the manufacturing and service sector in accordance with the UNIDO ISIC Revision 4 Classification. Due to the size of Cabo Verde a take all approach will be undertaken. Respondent data will be collected from existing and updated business directories[32] and needs to include both domestic- and foreign-owned firms. The estimated universe and convenient sample from each of the databases is indicated in Table 1.

As for arbitrageurs which are composed of banks, venture capitalists as well as angel investors, the respondent information was obtained through desk research.

8.3 The Data Acquisition Survey Instrument (DASI)

The Data Acquisition Survey Instrument (DASI) for the CVNSI Survey was created using an iterative multi-step process, and currently stands at its third iteration. The provenance of the earlier iterations of the tool can be found in both the Ghana and Kenya National System of Innovation Survey Reports (Bartels and Koria, 2012, 2015). The current iteration, DASI-V3, saw the introduction of new actor-specific questions to support NSI level findings and to provide better insights at the actor level. This enhancement of the DASI allows for greater accuracy and impact of the policy recommendations in the short-, medium, and long-term.

8.4 Survey Operationalisation

The launch of the survey was accomplished by using a combination of both the free open source software (FOSS) tool LimeSurvey© as well as face-to-face interviews.

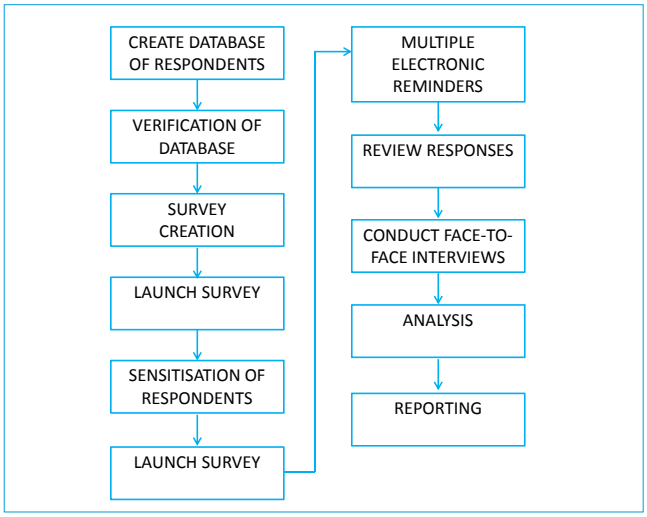
The LimeSurvey© tool is an advanced online survey system. The outputs from the verification protocol were uploaded into the LimeSurvey© system and individual tokens were assigned to each target respondent. This restricted survey access solely to the targeted qualified individual respondent, therefore greatly enhancing the fidelity, reliability and validity of the results obtained.

As previously mentioned, the CVNSI Survey was launched remotely once the initial critical mass of target respondent contacts had been gathered. The survey was remotely and non-intrusively managed via the LimeSurvey© interface. Electronic reminders were sent out to the target respondents who had only partially completed or not responded at all. This process was facilitated by the structure of the LimeSurvey© back-end, as the system logs the exact date and time at which the survey was accessed and to what degree it was completed. For those who had not accessed the survey for a long period, a follow up was made via telephone to assess whether the target respondent faced any technical difficulties.

Once responses were completed, they were automatically uploaded into the survey response database. After a period of 3 months the survey responses were analysed with the planned statistical analysis in mind. In the first run of the survey there were not enough responses for meaningful multivariate analysis. Therefore, appointments were made, and face-to-face interviews were conducted where the enumerator inputted the information directly into the back-end of the electronic survey tool.

In both cases (direct email contact and face–to-face), as the survey is the database, error from the transcription of results is eliminated thus resulting in high-fidelity responses (Koria et al., 2012). Figure 3 shows the steps associated with the data collection process.

Figure 3. Operational methodology.



8.5 Secondary data collection

In addition to the primary data collection undertaken it is crucial to gain a view of what is being presented in the form of secondary sources at the national level, particularly those from government. The secondary sources that were analysed comprised qualitative material consisting of policy documents, government budget statements, national development and action plans, as well as national strategies. The purpose of analysing these documents was to gain an understanding of the policy direction that the Government of Cabo Verde is taking. Phrased differently, is there convergence or divergence between what is presented within policy documentation from the actual results obtained? The results of the analysis are presented in Chapter 10 of this report.

[32] Business databases were provided from: The Chamber of Commerce, Department of Economic and Business Statistics, the Ministry of Commerce and PROEMPRESSA.

9.0 Cabo Verde's Economic Context

9.1 Setting the Scene: Cabo Verde's Economic and STI Setup

Since its independence in 1975, Cabo Verde has sustained rapid rates of economic growth, which allowed it to graduate from the group of least developed countries (LDC) in 2008. Being a small archipelago in the middle of the Atlantic Ocean, Cabo Verde has naturally developed into an open economy. Scarce in natural resources and with a small manufacturing industry, its economy relies on few commodities and services.

Tourism is growing rapidly, attracting foreign investment and generating new sources of income growth. Considerable investments in expanding education and the use of ICTs have been central to Cabo Verde's development strategy. Today, these investments might offer some of the necessary inputs for the diversification of the country's economy and its development into a knowledge-based cyber-island.

This chapter provides a macroeconomic perspective and presents a coherent analysis of the major economic and structural trends of Cabo Verde's economy. Moreover, the analysis includes a brief overview of the status of its business environment and competitiveness, ICT infrastructure, as well as the current situation in terms of human capital and STI efforts. As Chapter 10 of this report discusses, these are top priorities in the government's economic agenda.

9.2 Economic Growth and Structural Transformation Patterns

As previously mentioned, Cabo Verde has enjoyed rapid and sustained economic growth since its independence in 1975 (Figure 4), particularly in the 1990s and the early 2000s. In the 1990s, major economic reforms transformed the centrally planned economy into a market economy, by privatizing state-owned enterprises, liberalizing imports, and promoting investment. In the early 2000s, further reforms to modernise the economy and the public sector, paired with a booming tourism industry, created a new momentum for structural change and rapid economic growth (AfDB, 2012).

Until the late 2000s, economic growth in Cabo Verde has been above the average of the lower-middle-income (LMI) group to which it belongs, as well as the average for sub-Saharan African (SSA) economies (Figure 4). In the late 2000s, however, the country suffered the consequences of the global financial crisis, especially in the form of declining foreign investment and remittances, which over time had substituted for foreign aid[30]. Economic growth subsequently fell from 13.8% in 2007 and 5.5% in 2008, to -2.3% in 2009 (Figure 4). Today, the economy is slowly resuming to positive economic growth, with rates of 3.8% in 2016 and 3.5% in 2017 (World Bank, 2018)[31]. Thanks to these sustained economic growth rates, in 2016 Cabo Verde enjoyed an income per capita of around 3,500 US dollars (in constant 2010 prices), above the averages for LMI and SSA economies (2,119 US dollars and 1,638 US dollars respectively).

Recent projections by the World Bank (2018) estimate future growth rates at 3.6% in 2018 and 3.8% in 2019 and 2020. If these projections are confirmed and sustained in the future, Cabo Verde will reach an income per capita of 4,016 US dollars by 2028[32]. Such an income per capita would allow Cabo Verde to be reclassified as an upper-middle-income (UMI) economy, based on current thresholds defined by the World Bank[33].

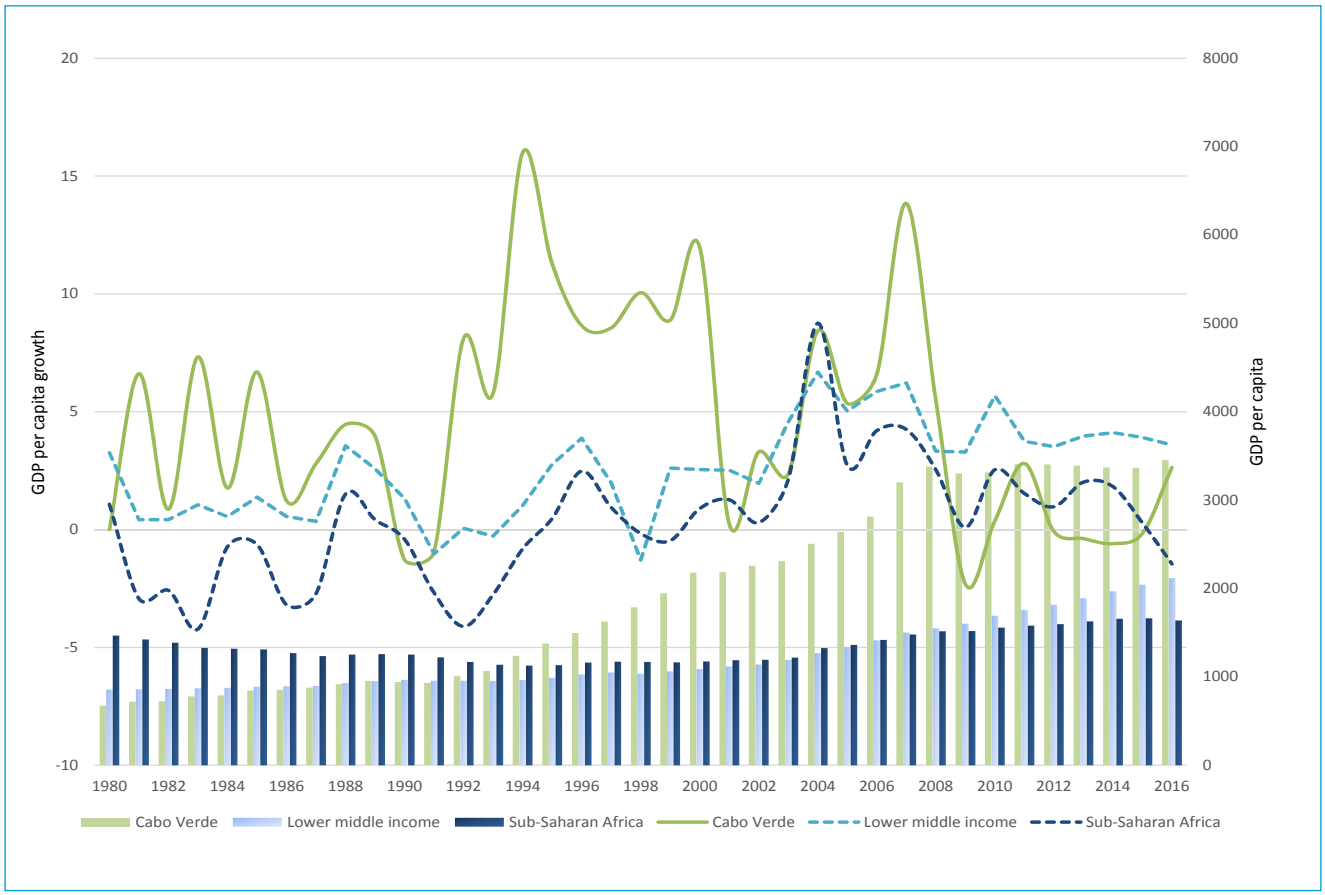
[30] Cabo Verde's economy was hit by the international crisis through various channels. Since the outburst of the crisis, Cabo Verde's ratio of non-performing loans rose significantly. Moreover, a contraction in consumer and private credit is believed to have the potential to endanger future economic growth (IMF, 2016b).

[31] Data for 2017 are the World Bank's estimates. According to other international organizations, GDP growth in 2017 might have been higher, reaching 3.7% (AfDB, OECD, and UNDP, 2017) or even 4% (IMF, 2018).

[32] Here income per capita refers to the GNI per capita in current US dollars (Atlas methodology) (World Bank's World Development Indicators, last accessed: 12th January 2018).

[33] Authors' estimates based on population estimates from the World Bank's Population Estimates and Projections Database (Last accessed: 17th January 2018); GNI per capita (current US dollars, Atlas methodology) from the World Bank's World Development Indicators (Last accessed: 12th January 2018); and growth rate projections from the World Bank (2018). To compute projections of GNI per capita levels, we assume that the projected growth rate for 2020 (3.8%) will be sustained until 2028. While the World Bank periodically redefines its thresholds, for the sake of simplicity, here we assume that thresholds to classify countries into income groups will not change until 2028.

Figure 4. GDP per capita and GDP per capita growth: Cabo Verde, LMI and SSA economies, 1980-2016.



Source: World Bank's World Development Indicators (Last accessed: 2nd January 2018).
Notes: GDP per capita in constant 2010 US$.

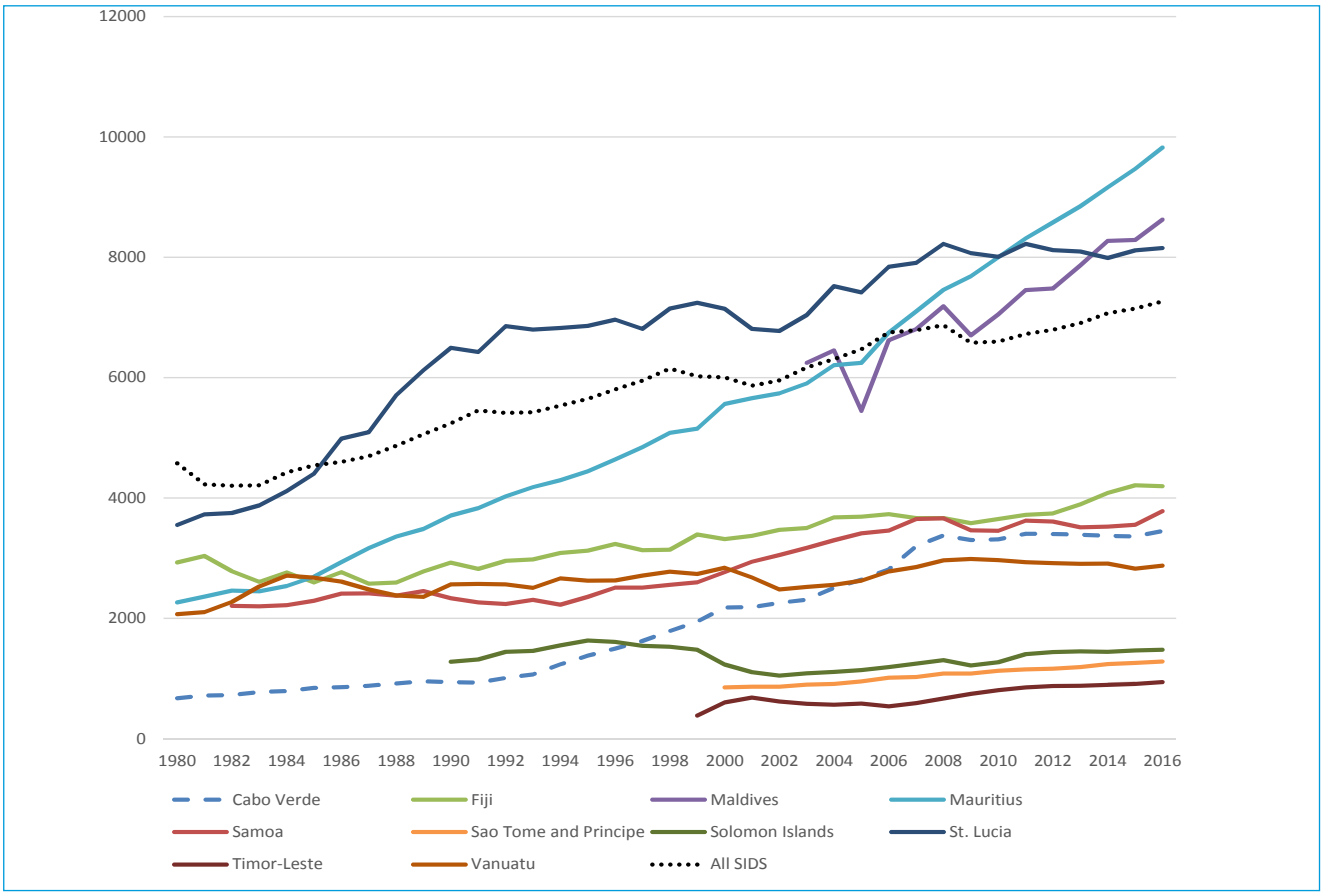
In order to benchmark this economic performance, Cabo Verde can be compared to other Small Island Developing States (SIDS). We select a sub-set of SIDS that can be considered comparators or role models for Cabo Verde. Two main criteria are used to define this sub-set: income per capita and population. From the UNCTAD list of SIDS, we retain middle-income economies and drop countries with a population above 2.5 million and below 150 thousand inhabitants. The resulting peer group is composed of: Cabo Verde, Fiji, the Maldives, Mauritius, Samoa, Sao Tome and Principe, Solomon Islands, St. Lucia, Timor-Leste, and Vanuatu (see Annex 1 for an overview of these economies).

Figure 5 depicts GDP per capita from 1980 to 2016 for Cabo Verde, the selected SIDS, and the average of all SIDS included in the UNCTAD list. Cabo Verde is positioned between upper-middle income economies (St. Lucia, Mauritius, and the Maldives) and lower income economies, such as the Solomon Islands, Sao Tome and Principe, and Timor-Leste. Today, its income level is comparable to that of Fiji, Samoa, and Vanuatu.However, compared to the other economies, Cabo Verde's economic trajectory seems more successful. With an income per capita of 674 US dollars in 1980, Cabo Verde was among the poorest economies throughout most of the 1990s. By 1997 Cabo Verde's economy outperformed the Solomon Islands, and in 2005 Vanuatu. With incomes growing fivefold from 1980 to 2016, Cabo Verde was the fastest growing island among all SIDS. Despite this, and due to its low starting point, today Cabo Verde is not among the richest economies in the group and is far from the average of all SIDS[34].

Economic growth and socio-economic development are accompanied by processes of structural transformation by which productive resources move from lower to higher productivity economic activities. Through this process, incomes rise, new job opportunities are generated, and

[34] (UNCTAD 2010). The UN has not produced an official list for SIDS. Different UN organizations have compiled their own lists. These include between 50 and 30 countries, composing a rather heterogeneous group, with some very small countries (e.g. Tuvalu) and some with above 2.5 million inhabitants (e.g. Jamaica). Income levels also vary considerably: some countries are low-income, or least developed countries (e.g. Comoros and Timor-Leste), while others already achieved the high-income status (e.g. Seychelles, the Bahamas, and Barbados). This report uses the list compiled by UNCTAD, available here: http://unctad.org/en/pages/aldc/Small%20Island%20Developing%20States/UNCTAD%C2%B4s-unofficial-list-of-SIDS.aspx

Figure 5. GDP per capita, Cabo Verde, selected SIDS and all SIDS average, 1980- 2016.



Source: World Bank's World Development Indicators (Last accessed: 19th January 2018).
Notes: GDP per capita is expressed in constant 2010 US dollars. "All SIDS" refers to all SIDS in the UNCTAD list.

productivity growth and innovation become engines of economic growth (UNIDO, 2013, 2016).

Over the last decades, Cabo Verde has enjoyed some structural change away from agriculture into services (Figure 6)[35]. The transformation from an agrarian to a service-based economy began in the early 1990s, when agriculture accounted for 22% of total value added. Around the same time, "other activities", which included business and financial services and government services such as public administration, health, and education, started to expand. Since independence, these activities have gained 13 percentage points in total value added.

These services have become the most important contributor to Cabo Verde's GDP, accounting for 35% of value added in 2016. (Figure 6).

Since the early 2000s, wholesale, retail trade, restaurants, and hotels have also increased their share in value added, returning to their mid-1970s share. These services are the second largest industry in the economy, accounting for 19% of Cabo Verde's GDP in 2016. Furthermore, transport, storage, and communication have almost doubled their share in value added, from 8% to 15%; while manufacturing, which accounted for merely 8% of GDP in 1976, grew until the late 1980s and reached a (low) peak of 11.6% in 1987. In the mid-1990s, however, the economy started to prematurely deindustrialise and in 2016 manufacturing only accounted for 6.7% of Cabo Verde's GDP[36].

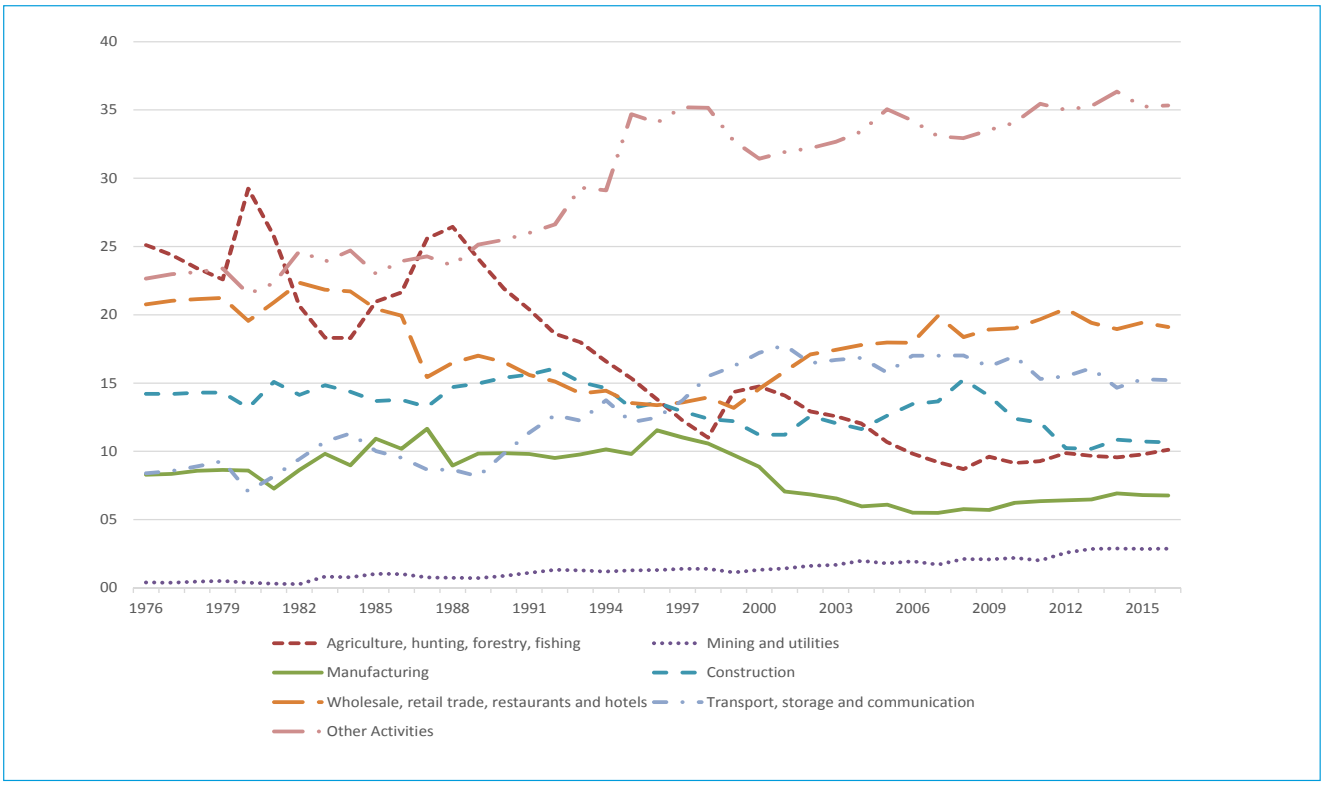
UNIDO's competitive industrial performance (CIP) index confirms the weak performance of Cabo Verde's manufacturing industry (Table 2).[37] With its poor export performance and

[35] The limited arable land and poor soil fertility has made the country dependent on food imports. In recent decades, the government has implemented a number of policies to revert this trend, ensure food security, and spur agriculture labour productivity growth (AfDB, 2012).

[36] Within manufacturing, processing of fish and other food-related industries stand out, albeit small.

37 Produced by UNIDO since 2002, the CIP is an effective tool to benchmark industrial performances across countries. The CIP compares over 140 economies across a number of indicators capturing countries' industrial, technological and export structure.

Figure 6. ***Sectoral shares in value added, 1976-2016.***



Source: UN National Account Main Aggregates Database (Last accessed: 9th January 2018).
Notes: Shares are calculated from absolute values in US dollars (constant 2010 prices).

small manufacturing industry, Cabo Verde ranked 135th in the CIP index in 2017. Compared to the SIDS selected here, Cabo Verde performed better than St. Lucia (138th) and the Maldives (142nd), but worse than Fiji (113th) and Mauritius (87th). Indeed, St. Lucia and the Maldives have the largest service sectors in the group, accounting for over 80% of total value added. By contrast, Mauritius and Fiji have the largest manufacturing industries implying that Cabo Verde's production structure is very similar to those of the other SIDS selected here. Due to the structural change dynamics described above, it

Table 2. ***CIP ranks and shares of agriculture, manufacturing, and services in value added in Cabo Verde and selected SIDS (2016).***

CIP ranks and shares of agriculture, manufacturing, and services in value added in Cabo Verde and selected SIDS (2016).				
	CIP rank		**Shares in value added (2016)**	
		Agriculture	**Manufacturing**	**Services**
Cabo Verde	135	10.1	6.8	69.7
Fiji	113	9.7	12.5	72.1
The Maldives	142	4.7	2.4	83.2
Mauritius	87	3.7	14.1	75.5
Samoa	n.a.	9.6	9.3	66.6
Sao Tome and Principe	n.a.	10.6	8.2	70.3
Solomon Islands	n.a.	26.1	6.8	62.3
St. Lucia	138	3.0	3.1	83.6
Timor-Leste	n.a.	5.4	0.3	26.4
Vanuatu	n.a.	23.9	3.6	66.1

Source: Authors' elaboration based on data from UNIDO and UN Main Aggregates Database.

is unsurprising that opportunities for learning and labour productivity growth have been rather limited in Cabo Verde. As Figure 7 shows, while some labour productivity growth occurred, its nature was sporadic and unsustainable. Indeed, services, and in particular traditional services, proved to be less capable of absorbing and generating new knowledge and technologies than many manufacturing activities. Such a structural change pattern might also explain Cabo Verde's high unemployment rates. While services are good at absorbing labour, an undiversified economy with a small manufacturing industry might find it hard to generate enough employment even for a small workforce. Unemployment in Cabo Verde was estimated at 10.7% in 2011[38]; compared to the average for SSA (7.7%) and LMI economies (5.1%), this rate seems rather high.

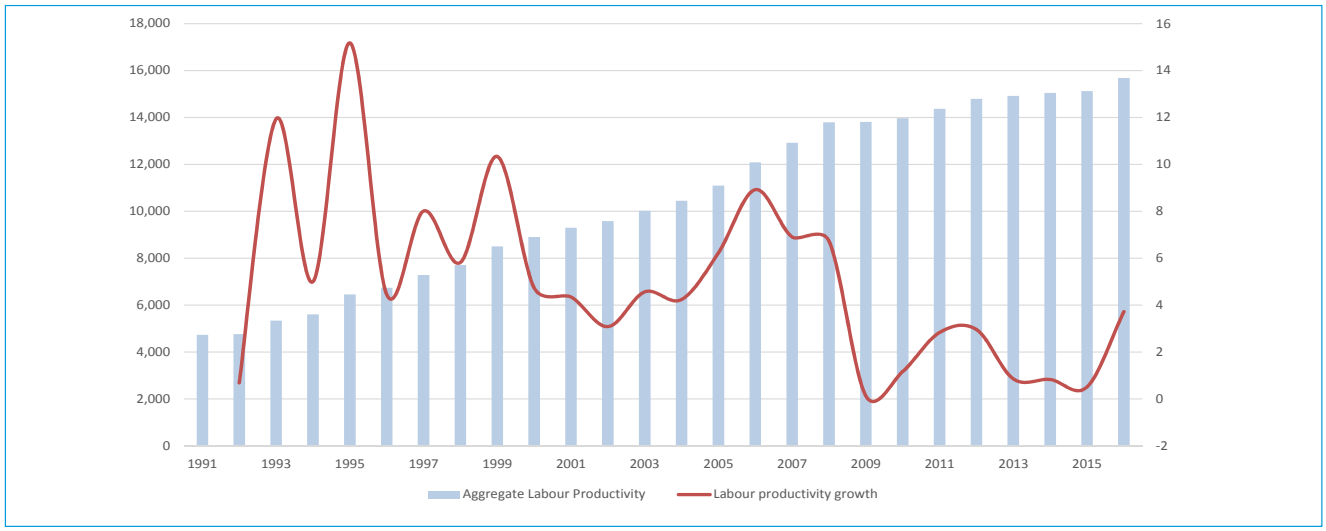
Strong investments, also by the public sector, have played a key role in spurring economic growth in Cabo Verde (AfDB, 2012). Figure 8 shows investment cycles, proxied by the share of gross fixed capital formation (GFCF) in GDP from 2007 to 2014. Three findings emerge: Firstly, Cabo Verde's investment shares are well above the averages for the selected SIDS, lower middle income (LMI) and SSA economies. Secondly, following international business cycles, Cabo Verde's investment declined slightly in 2009, and more dramatically in 2012-2013; in recent years, investment seems to be resuming. Thirdly, in all the years bar 2013, the private sector contributed more than the public sector to GFCF (68% versus 32%). However, public investments seem to intervene counter cyclically, rising in periods of low investment rates in order to counteract business cycles.

9.3 Cabo Verde's Openness: Foreign Investment and Trade Patterns

With political reforms in the 1990s, Cabo Verde's economy opened up and gradually became over-reliant on external markets, which is a common trend in comparably sized economies. Its business cycles seem deeply interlinked with European cycles, through monetary policies, inflows of tourists, remittances, and foreign direct investment (FDI) (IMF, 2016a).[39] Indeed, over the last decades, Cabo Verde has attracted considerable FDI, especially in tourism (AfDB, 2012). As Figure 9 highlights, FDI accounts for large shares of Cabo Verde's GDP, 7% on average with a peak of 13% in 2007. These shares are much higher than in LMI and SSA economies, respectively 1.9% and 2.6% on average. Although FDI shares are still below remittances in GDP (13% in 2016), these figures strongly signal an over-dependence of the economy on foreign investments. This deep reliance on FDI is a common phenomenon among SIDS, and between 1998-2016 FDI inflows in the selected SIDS averaged 6% of their GDP (Figure 9).

Data on trade openness, measured as the sum of imports and exports of goods and services as a share of GDP (Figure 10), confirm the over-reliance of Cabo Verde and SIDS on foreign markets. In the last two decades Cabo Verde's trade accounted for 97% of its GDP, on average 30 and 40 percentage points above the averages for SSA and LMI economies respectively. Other SIDS are characterised by very similar trends, with trade accounting on average for 110% of their GDP.

Figure 7. ***Aggregate labour productivity and labour productivity growth, 1991-2016.***

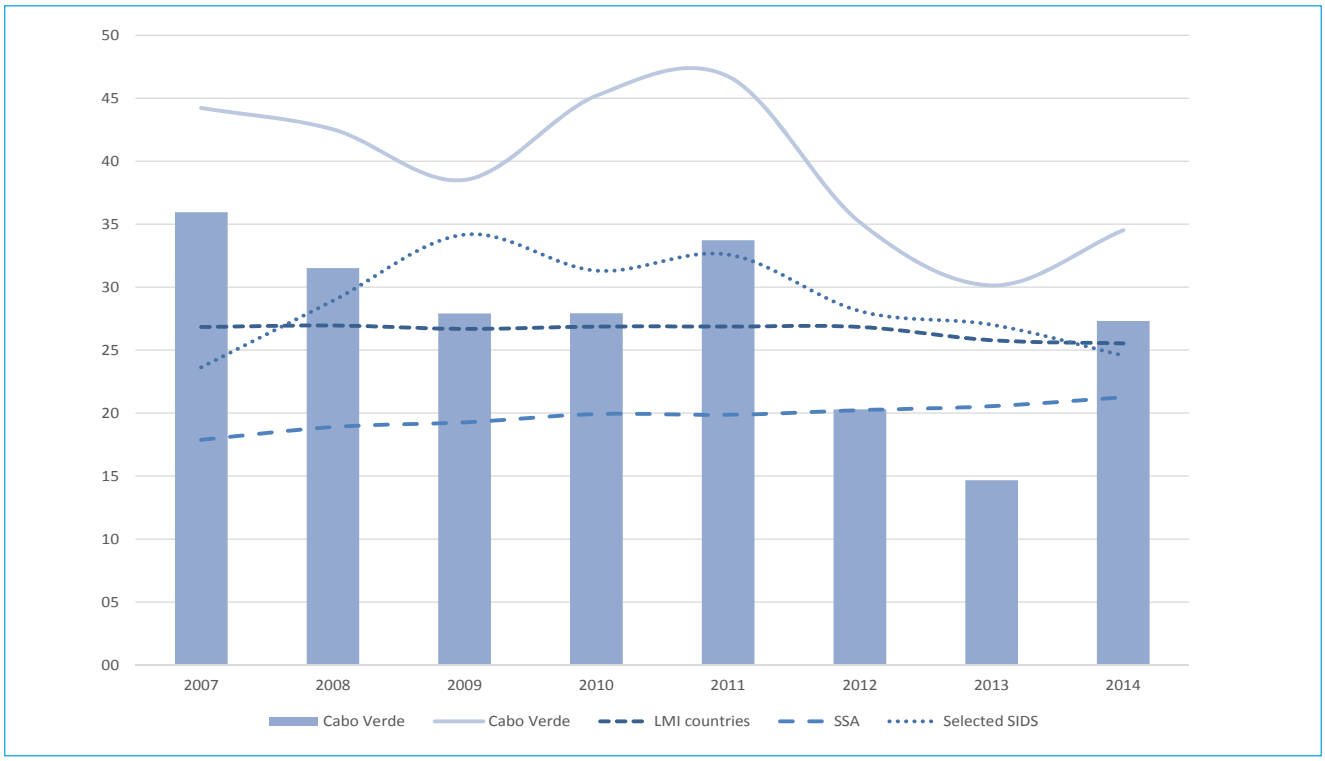


Source: UN Main Aggregates Database and ILO Stats (Last accessed: 10th January 2018).
Notes: Value added figures are in constant 2010 US dollars.

[38] Data from ILO stats. Data refers to national estimates.

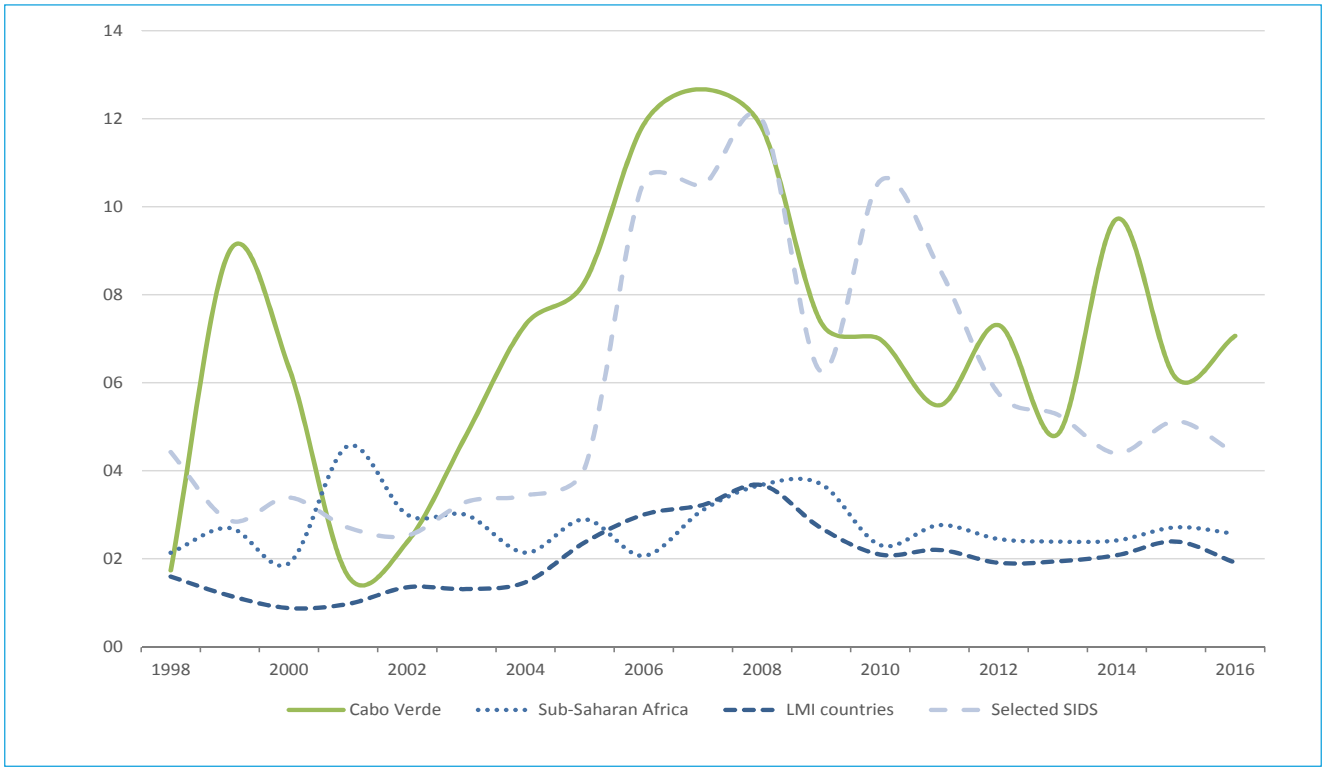
[39] Since 1999, Cabo Verde's currency is pegged to the Euro.

Figure 8. Gross fixed capital formation and private sector as a share of GDP, Cabo Verde, SSA and LMI economies, and selected SIDS, 2007- 2014.



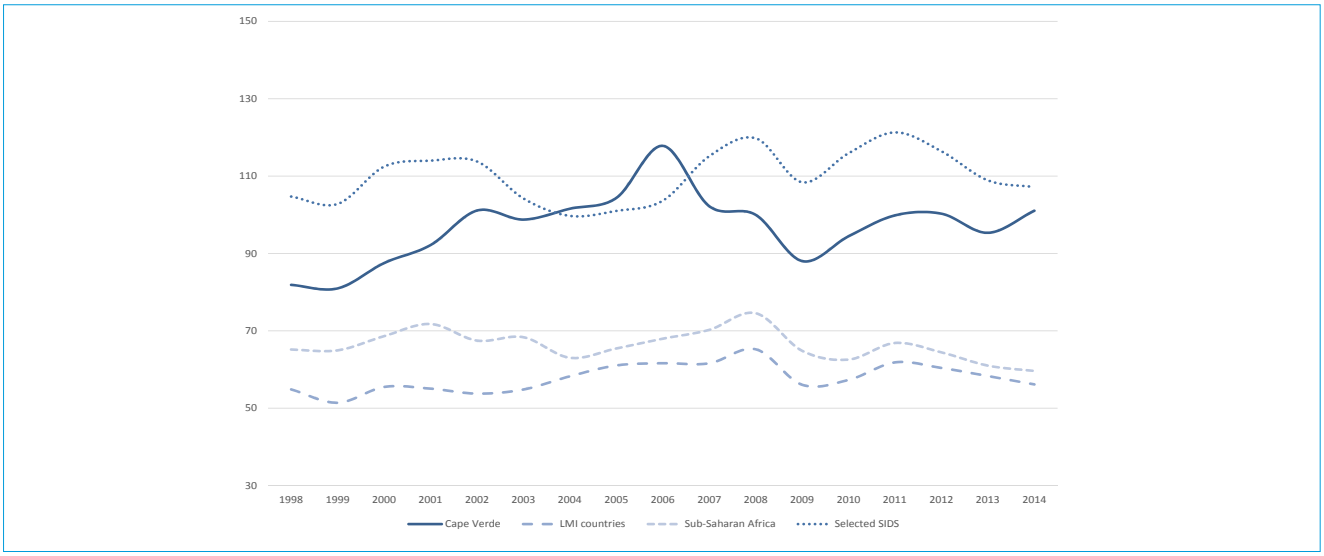
Source: World Bank's World Development Indicators (Last accessed: 19th January 2018).
Notes: Here "Selected SIDS" includes Fiji, Mauritius, St. Lucia, Timor-Leste, and Vanuatu. Data on the share of private GFCF is only available for a few SIDS, so they are not shown here.

Figure 9. FDI inflows as a share of GDP, Cabo Verde, SSA and LMI economies, and selected SIDS, 1998-2016.



Source: World Bank's World Development Indicators (Last accessed: 2nd January 2018).

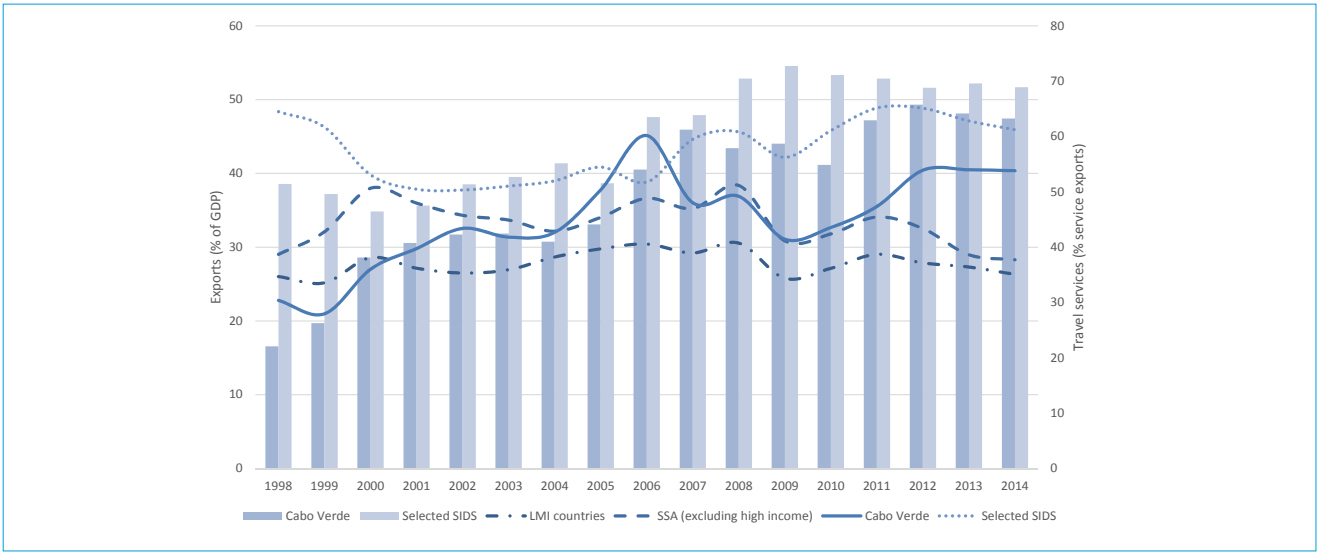
Figure 10. ***Trade as a share of GDP, Cabo Verde, SSA and LMI economies, and selected SIDS, 1998-2014.***



Source: World Bank's World Development Indicators (Last accessed: 2nd January 2018).

Looking more closely at the trade patterns of Cabo Verde, we see that its share of exports in GDP increased from 23% to 40% from 1998 to 2014, albeit with a small drop in the aftermath of the global financial crisis (Figure 11). Today Cabo Verde outperforms both LMI and SSA economies, even though the absolute export values are evidently much smaller. High export rates are common among SIDS, also due to the small size of their national economies. In most of the years displayed here, the selected SIDS show a stronger export performance than Cabo Verde. However, their growth path has been much less impressive, also due to the larger size of their travel industries by the late 1990s. Indeed, in Cabo Verde and the SIDS selected here, exports are mainly composed of services, especially travel services (Figure 11); the share of travel services in Cabo Verde almost tripled from 1998 to 2014. As discussed in Chapter 10, the government has made tourism a key pillar of its economic programme and a number of policies and initiatives have been designed to spur its growth. Its development is expected to generate new investment opportunities, employment, and economic growth. While this specialization seems natural, given Cabo Verde's geography, the data presented in this chapter depict a rather strong specialization. This might endanger future prospects for socio-economic development by making the economy dependent on one single economic activity with limited opportunities for productivity enhancements and innovation.

Figure 11. ***Exports of goods and services as a share of GDP and travel services as a share of service exports, Cabo Verde, SSA and LMI economies, and selected SIDS, 1998-2014.***



Source: World Bank's World Development Indicators (Last accessed: 2nd January 2018).
Notes: The data point for manufactured exports for Cabo Verde in 2008 is not available and is obtained as the average between 2007 and 2009.

As further evidence, an inspection of Cabo Verde's export basket shows low levels of diversification and sophistication of exported commodities (Figure 12). Over 80% of the total exports of goods is comprised of prepared or preserved fish and frozen fish, with another 16% of exports being textiles and footwear. Despite the growth depicted in Figure 12, the absolute values remain small. The major trading partners are Spain, to which Cabo Verde exported 56% of its exported goods, Portugal (12%), and Italy (7%). Albeit with differences, other SIDS also present rather undiversified export baskets, composed of a few simple commodities (see Annex 1).

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9.4 The Status of the Cabo Verde's Business Environment, ICTs, and Human Capital

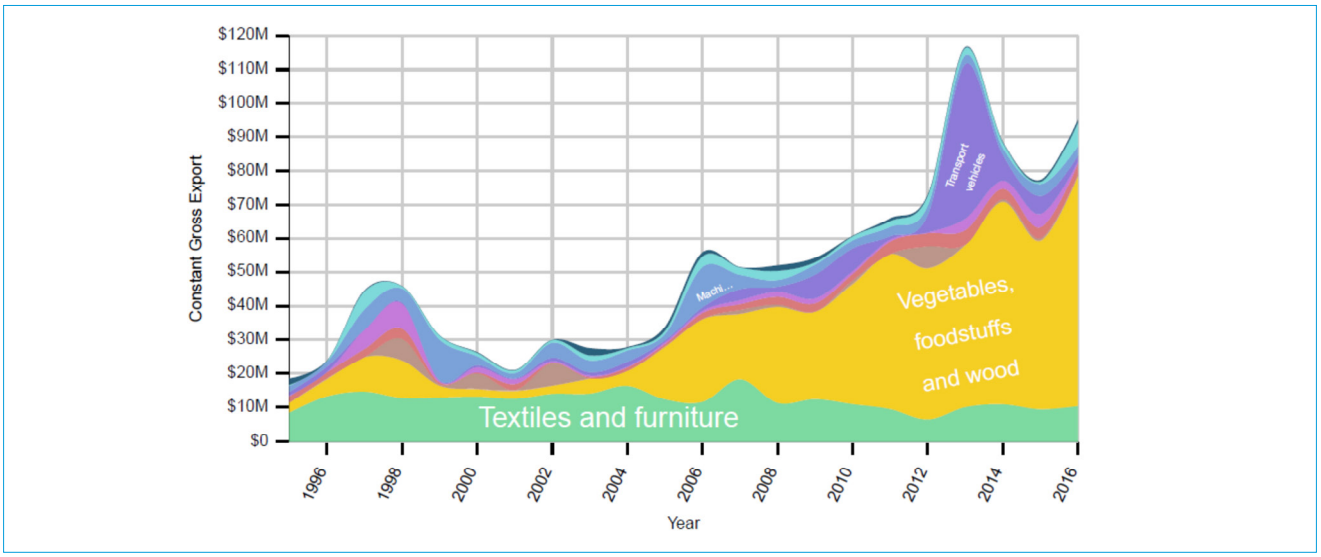
Creating the preconditions to transform Cabo Verde into a knowledge-based cyber-island is among the priorities of the government (see Chapter 10 of this report). In order to do so, the government aims at improving the business environment in which firms operate, facilitating access to ICTs and strengthening human capital. Given the relevance of these policy objectives in the case of Cabo Verde, this section reviews available statistics on these topics.

9.4.1 Competitiveness and Business Environment

Cabo Verde ranks 127th in the World Bank's Ease of Doing Business[42]. Within the World Bank's framework, the country performs well in aspects such as enforcing contracts, dealing with construction permits, registering properties, and paying taxes. Its weakest points relate to resolving insolvency, protecting minority investors, and getting electricity. While 90% of the population has access to electricity, procedures to obtain an electricity connection seem cumbersome in terms of the documents required, time, and costs. Compared to the SIDS selected in this study, only the Maldives (136th), Sao Tome and Principe (169th), and Timor-Leste (178th) rank below Cabo Verde, indicating that there is room to improve its position in this index.

Indeed, the data collected by the World Bank's Enterprise Surveys confirm this. When the sample of firms surveyed is restricted to manufacturing firms, the largest obstacles to operations are: electricity (for 29% of the respondents), practices of competitors in the informal sector (17%), and access to finance (15%).[43] Incidences of electricity shortages are very high, with 83% of the surveyed firms reporting power outages.[44] This is further confirmed by the ranking in the Global Competitiveness Index 2017/18 by the World

Figure 12. Exports of goods by category, 1995-2016.



Source: Atlas of Complexity (Last accessed: 2nd January 2017).[20]

[40] Data from the Atlas of Complexity (Last accessed: 12th January 2018).

[41] Figure available at: http://atlas.cid.harvard.edu/explore/?country=51&partner=undefined&product=undefined&productClass=HS&startYear=undefined&target=Product&year=2016 [Accessed July 2018]

[42] The World Bank's Ease of Doing Business covered 190 economies in 2018.

[43] Overall, 49% of the manufacturing firms surveyed declared to have invested in new fixed assets (machinery, vehicles, equipment, land, or buildings).

[44] As far as access to finance is concerned, only 34% of the firms surveyed have a credit line from a financial institution.

Economic Forum (2017), where Cabo Verde ranks 110th.[45] Since 2010/11, when it was first featured in the report, Cabo Verde has gained 7 positions. Its best performance is in institutions and health and primary education, ranking 65th in both. Major improvements have also been registered in higher education and training, as well as business sophistication and innovation, where it has gained respectively 23, 13, and 19 positions since 2010/11.

In line with the results of the World Bank's Ease of Doing Business and Enterprise Surveys, the most persistent obstacle to competitiveness identified by the Global Competitiveness Index is access to financing. Tax burdens and government bureaucracy are also perceived as obstacles to higher competitiveness. Finally, the inadequacy of an educated workforce, which was perceived as the second most problematic factor for competitiveness in 2010/11, seems to have become a less severe constraint.

9.4.2 ICTs Access

ICTs are a key element in Cabo Verde's industrial strategy. As seen in Chapter 10, the government aims at turning the country into a cyber-island that is specialised in ICT-based services. According to the ITU (2017), Cabo Verde has made considerable efforts to improve its ICT access (see Table 3) and across virtually all indicators it performs considerably better than the average African economy.

In several dimensions – mobile-cellular subscriptions, active mobile-broadband subscriptions, 3G coverage, and fixed- and mobile-broadband prices – Cabo Verde outperforms the world average. It was estimated that 62% of Cabo Verde's households have access to the internet and 48% of the individuals surveyed by ITU use the Internet.

Compared to other SIDS, Cabo Verde's performance is much closer to UMI SIDS, such as Fiji and the Maldives, than LMI SIDS (the Solomon Islands and Vanuatu) (ITU, 2017).

When compared to the richest of the SIDS selected, Mauritius, Cabo Verde can improve in many areas (see Table 3), although estimates of the use of internet among individuals and within households (measured as the percentage of households with internet access and the percentage of individuals using the internet) are rather close.

***Table 3.** Key ICT indicators for Cabo Verde and Mauritius, 2016.*

Key ICT indicators for Cabo Verde and Mauritius, 2016.				
Key indicators	**Cabo Verde**	**Mauritius**	**Africa**	**World**
Fixed telephone sub. per 100 inhab.	12.6	31.0	1.0	13.6
Mobile-cellular sub. per 100 inhab.	117.4	144.2	74.6	101.5
Fixed broadband sub. per 100 inhab.	3.0	16.9	0.4	12.4
Active mobile-broadband sub. per 100 sub.	70.0	51.7	22.9	52.2
3G coverage (% of population)	87.6	95.4	59.3	85.0
LTE/WiMAX coverage (% of population)	0.0	36.7	25.7	66.5
Mobile-cellular prices (% of GNI pc)	8.7	0.6	14.2	5.2
Fixed broadband prices (% of GNI pc)	3.6	0.3	39.4	13.9
Mobile-broadband prices 500 MB (% of GNI pc)	1.3	0.7	9.3	3.7
Mobile-broadband prices 1 GB (% of GNI pc)	5.8	1.0	17.7	6.8
Percentage of households with computer	37.4	61.2	9.6	46.6
Percentage of households with Internet access	62.0	63.8	16.3	51.5
Percentage of individuals using the Internet	48.2	53.2	19.9	45.9
Int. Internet bandwidth per Internet user (kbits/s)	23.4	63.5	51.0	74.5

Source: ITU (2017): 37 and 118.
Notes: Numbers in italics are ITU estimates.

[45] In 2017, 137 economies were ranked by the Global Competitiveness Index.

9.4.3 Human Capital

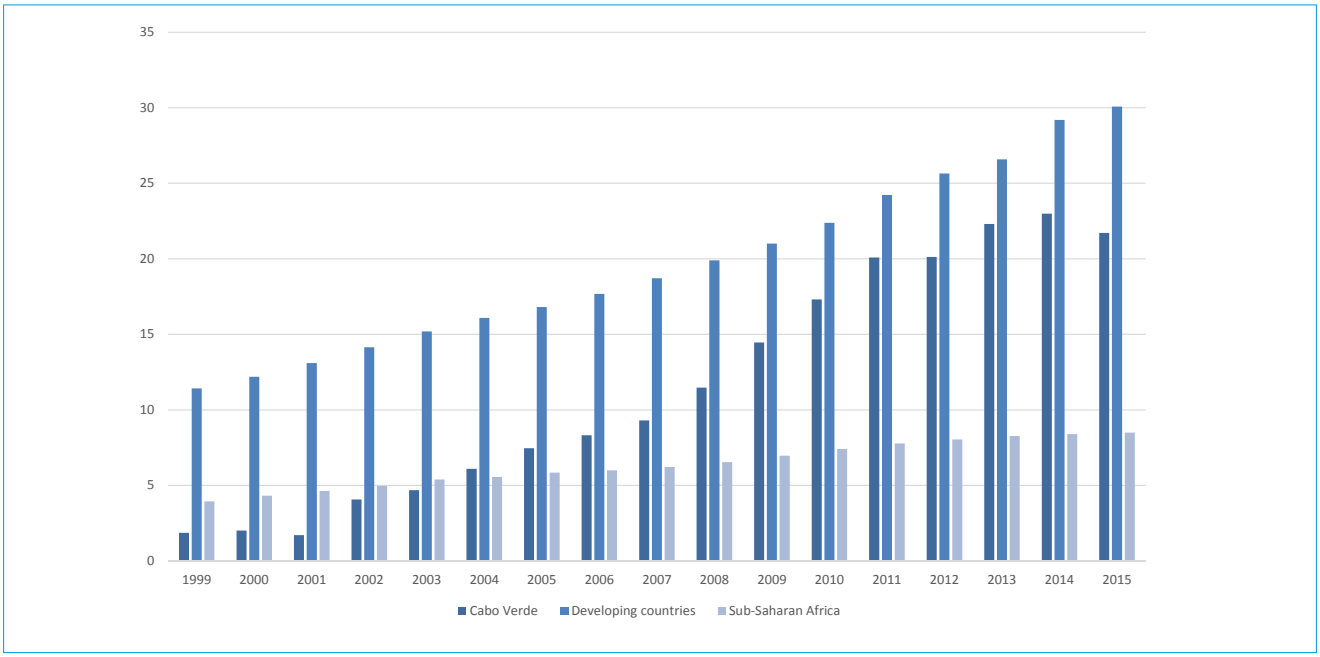
Since independence, education has been a cornerstone of Cabo Verde's development strategy. In 2013, the government spent 5% of the country's GDP on education, with 80% of expenditures for primary and secondary education. These expenditures are higher than the averages for both sub-Saharan and LMI economies (respectively 4.5% and 3.4%).[46] Compared to the group of SIDs selected here, only the Solomon Islands spend more than Cabo Verde on education, with expenditures reaching 10% of the country's GDP in 2010. UNESCO data also show that 87% of the adult population and 98% of the youth are literate.

According to the World Competitiveness Report 2017/18 (World Economic Forum, 2017), Cabo Verde performs well in terms of education, especially in primary education. For example, primary education enrolment and the quality of the education system, are ranked 49th and 54th globally. However, Cabo Verde is facing challenges in secondary education completion. While a large share of students enrol, economic pressures – also due to increasing tuition fees – force a significant share of students to terminate their studies before completion (Longenecker and Barnum, 2017). Further areas for improvement concern tertiary education and training, where Cabo Verde ranks 86th globally, with a 96th position in tertiary enrolment. Clearly, some improvements have already been achieved since 2010/11, when it ranked 109th in tertiary education and training and 103rd in tertiary enrolment.

Indeed, gross enrolment ratios in tertiary education grew 11-fold from the late 1990s (Figure 13). While Cabo Verde performs better than SSA economies, its ratios are still lower than the average for developing economies. Nevertheless, with a gross enrolment ratio in tertiary education of 21.7% in 2015, Cabo Verde performs better than Vanuatu, the Maldives, and Fiji.[47] Mauritius, however, shows much higher enrolment ratios, starting at 10% in 1999 and reaching 39.7% in 2013.

A closer look to the data reveals that roughly 12% of tertiary students are enrolled in engineering, manufacturing, and construction programmes; around 4% in natural sciences, mathematics, and statistics and 8% in information and communication technologies (Figure 14). Taken together, these figures indicate that roughly 24% of all tertiary students in Cabo Verde have a background in science and technology, which is necessary to drive and support the government's diversification strategies (see Chapter 10).

Figure 13. Gross enrolment ratio in tertiary education, Cabo Verde, developing countries, and SSA, 1999-2015.

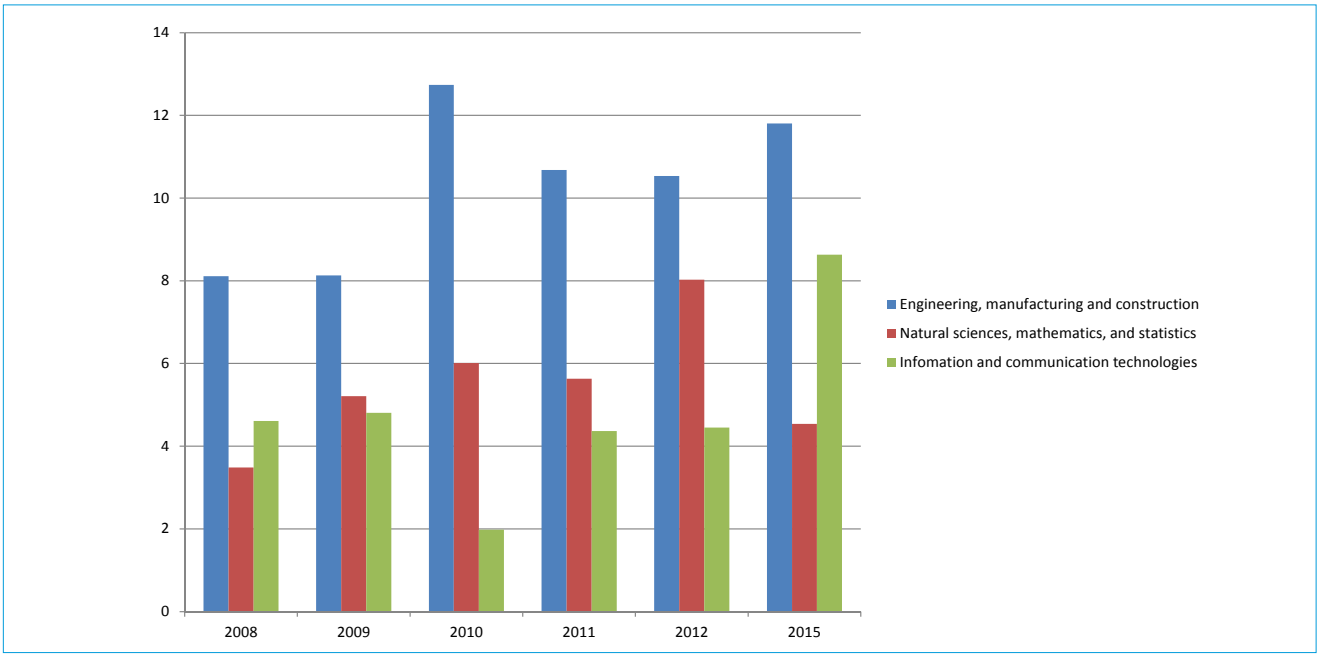


Source: UIS stats (Last accessed: 11th January 2018).

[46] Data from UIS Stats (Last accessed: 11th January 2018).

[47] According to UNESCO data (UIS Stats, last accessed: 11th January 2018), Vanuatu's tertiary enrolment ratio was 4.7% in 2004 (more recent estimates are not available). In 2005, Fiji had 16.1% of students enrolled in tertiary education. A similar tertiary enrolment ratio (16.2%) was estimated for the Maldives in 2014.

Figure 14. Science and technology graduates as a share of tertiary students, 2008-2012, and 2015.



Source: UIS Statistics (Last accessed: 11th January 2018).

9.5 STI Efforts and Outputs

Cabo Verde ranked 103rd in the Global Innovation Index, 2015 (Cornell, INSEAD, and WIPO, 2015). In the same year, Fiji and Mauritius were the only other SIDS selected that were included in the GII and were ranked 115th and 49th respectively. Mauritius, in particular, has consistently been among the top performers in the sub-Saharan African region (Cornell, INSEAD, and WIPO, 2015). Cabo Verde's areas of strengths include institutions – especially due to political stability and government effectiveness – investments and domestic credit, and its open ICT service industry. Major weaknesses not only concern R&D efforts, the quality of universities and scientific publications, but also high-tech exports and royalty and license fee receipts.

In 2011, R&D expenditures as a share of GDP was estimated at 0.07%, one of the lowest in the world.[48] Around the same year, SSA and LMI economies were spending on average 0.5% of their GDP. Mauritius, which was spending roughly 0.4% of its GDP in R&D before the global financial crisis, spent 0.2% in 2011.[49] A recent UNESCO report (UNESCO, 2015) shows that the share of R&D in GDP of which Cabo Verde is the lowest in the West African region. The number of R&D personnel (full-time equivalent) per million inhabitants is also among the lowest in the world, at 74.7 in 2011; in comparison, Mauritius had 498 researchers per million inhabitants in 2012.[50]

With 49.6 scientific publications per million inhabitants, Cabo Verde's scientific output is satisfactory, albeit small in absolute terms; comparatively in West Africa, the Gambia (a low-income economy) performs better (UNESCO, 2015). Scientists from Cabo Verde publish mostly in geosciences and biological sciences and the main foreign co-authors are from Portugal and Spain, hinting to the role that diaspora might play in science (UNESCO, 2015). Compared to the other SIDS selected here, Cabo Verde performs better than the Maldives (45.5) and the Solomon Islands (30); while Fiji and Vanuatu performed much better than the other SIDS, with 120 and 74 publications per million inhabitants respectively (UNESCO, 2015).

9.6 Synopsis

Since independence, Cabo Verde has enjoyed rapid economic growth, often more rapid than its peers in the LMI group, SSA group, and SIDS. In the last few decades, it has managed to transform its economy from agrarian to service-led. Its public sector has also expanded considerably and become the largest contributor to value added. While manufacturing has never become an engine of economic growth, and only a few unsophisticated goods and services – fish and tourism – dominate its export basket, services, especially travel services, are booming.

[48] Data source: UIS.Stat (Last accessed: 5th January 2018).

[49] Data source: UIS.Stat (Last accessed: 5th January 2018). Data on R&D expenditures are unavailable for the other SIDS selected here.

[50] Data source: UIS.Stat (Last accessed: 5th January 2018). Data on R&D personnel are unavailable for the other SIDS selected here.

Cabo Verde's performance in trade, exports, and FDI inflows indicate that despite dynamism, the economy is over-dependent on the external world, and therefore highly vulnerable to its shocks. For this reason, the economy has been hit by the global financial crisis of 2008-09 more than other developing economies, affecting investment rates, FDI inflows, and exports. While today economic growth is slowly resuming, new sources of sustainable growth are necessary to strengthen Cabo Verde's position in the global economy.

In terms of its international competitiveness and the status of its business environment, Cabo Verde has made considerable progress over the last few years, with major achievements in institutions, education, and bureaucratic procedures related to paying taxes and enforcing contracts. Access to ICT has also been a government priority, translating into high rates of ICT penetration among Cabo Verde's households.

The development of ICT-based services, which is among the government's top priorities, could benefit from the widespread use of ICTs, as well as the continuous and sustained investment in education. Beyond the achievements in literacy and primary education, Cabo Verde's indicators on tertiary enrolment and enrolment in science and technology programmes have improved in the last years. This indicates that an educated skilled workforce is being formed to support the transition towards a knowledge-based economy.

Finally, STI indicators show that Cabo Verde still has to catch up with its peers in several areas, most notably in R&D expenditures. However, more data are needed to fully assess the efforts and progress in STI. In this respect, this report and its related survey can shed light on the innovation and learning processes occurring within the CVNSI. Such insights are essential to guide the design of effective industrial policies and incentives for all economic actors.

10.0 Policy Review

10.1 Overview

This chapter focuses on a selection of policy documents developed by the government of Cabo Verde to enhance the role of innovation and competitiveness in the national economy. The main purpose of this review is to get a comprehensive view of the policy orientation that has been implemented by the authorities in Cabo Verde and to get an accurate view of the extent to which there is commitment to the role of STI within the economy, inter-ministerial policy coherence, as well as the policy convergence. The output will be an important input for the final objective of the present work, which is to draft a Cabo Verde National System of Innovation.

At first, the two main documents reviewed are: The government's manifesto for the IX Legislature and the Strategic Plan for Sustainable Development (PEDS) 2017/2021.

10.2 Industry

10.2.1 Present situation

There is a strong correlation between the industrialization of a country and the growth of its Gross Domestic Product (GDP). The industry has an important role as a springboard for the transformation of its economic structure and technological development. As the main vehicle for the technological development and innovation it allows an evolution of activities of low productivity towards activities of high productivity, offering great potential for innovative informal activities, resulting in a push effect in other sectors of the economy (banking, insurance, communication and transports).

The small size of the domestic market, lack of natural resources, insufficient infrastructure, and poor quality all contribute negatively to the development of the industrial sector. Regardless of these constraints, Cabo Verde has made a tremendous effort to improve transport and logistics system, road networks, energy supplies, and water and sewage services. There have been meaningful advances in the construction of infrastructure within the last years, namely: the completion of four international airports; ports on all of the islands; the expansion of the road network, and electricity, water and sewers received important investments and expansion.

Considering the country's challenges, the present government has announced within its Manifesto 11 (eleven) commitments for this decade. One of them is for Cabo Verde to be in the Top 50 for Doing Business. Regarding industry, the government's manifesto announces investments in the country's industrialization and the intention to undertake political measures, such as: zero bureaucracy; a unique tax principle for industrial licensing and operation and reinforcing the country's competitiveness regarding attracting investment. The report confirms the concerns of investors and entrepreneurs regarding financing, taxation and bureaucracy.

Cabo Verde holds the 85th position among 139 countries within the 2016 Networked-Readiness Index ranking that measures the level of a nation's readiness to take advantage of Information and Communication Technologies (ICT) in order to promote economic and social development.
According to the Competitiveness Global Report of the World Bank (2017) for industrial policy reform, the main effort should focus on accelerating education and IT training, at an individual level, in the private sector as well as the state's own structures, in order to better profit from information and communication technologies applied to the production sectors, without which it will be hard to compete in the global market.

10.2.2 Policy Review

The government's manifesto for the IX Legislature defines the goal as "to ensure sustainable development for Cabo Verde, based upon duly-structured and assessed targets in terms of impact, oriented to bringing happiness to Caboverdeans with more freedom and democracy, full employment, increase in the country's average income, in order to strengthen broader and better safety and to ensure a better quality of life for all." (Government's Manifesto 2016-2021, page 17).

The recovery of the investment in the industrialization of Cabo Verde should be maintained as an essential dimension of the economic growth model, by dint of the contribution that it might bring in terms of increased exporting ability, import reduction and wealth generation. (Government's Manifesto 2016-2021, page 80).

In its manifesto, the government attributes a determining part to tourism, being one the main pillars of the Caboverdean economy, considering it of great importance to the country's economic development.

The government is investing in centred economic specialization in the promotion of knowledge and innovation, namely by means of contracts for entrepreneurial innovation and tourism requalification as central pillars of the Caboverdean economy.

The strategy is also composed of an answer to the challenges and the opportunities of the blue and green economies: reaffirming sovereignty and increasing the value of Cabo Verde's position in the world; taking advantage of the Atlantic centrality; the transformation of Cabo Verde into a centre of commercial logistic operations, raw material transformation and specialized services rendering in the Atlantic, mediating between the national emergent economies.

The government still emphasizes the promotion of internal production, highlighting culture, agriculture, fishing and light industry, the export and development of a deliberate strategy of expansion and consolidation of the middle class, and the effective fight against informality by means of a specific action plan for commerce, services and catering in an effective partnership with the local and regional powers, as well as NGOs.

Any strategy should be supported within a knowledge-based economy, with tax competitiveness which is predictable, low risk and generates income, quality employment and prosperity for everyone. It is also this government's duty to create all the conditions so that youngsters can create extraordinary things, invest in disruptive innovation and flourish in dynamic environments formed by small and medium companies. Innovation is a risk operation and requires patience. The government, in partnership with the private sector, shall promote and encourage start-ups, technological parks, co-working environments, business accelerators and access to private and public financing (Government's Manifesto 2016 - 2021, page 199-200).

10.2.3 Policy Strategies and Incentives

The government shall adopt a new strategy of industrial support for growth and employment, and shall boost national industry, reinforcing its competitiveness and elevating the profile of the transformation industry within the national economy. (government program and motion of confidence 2016 – 2021, page 201).

The government intends to recover the investment in light industry. The recovery of the investment in the industrialization of Cabo Verde should be maintained as an essential dimension of the economic growth model, by dint of increased exporting ability, import reduction and wealth generation. The following political measures will be undertaken: to adopt the unique tax principle for industrial licensing and operation; to reinforce Cabo Verde's competitiveness in order to attract investment, namely by means of changes to the tax benefit code, the installation of a swift and credible judicial system, and the creation of a shareholding mechanism that stimulates the inflow of international venture capital; to boost the creation of an industrial value chain with effective representativeness and productive capacity, as a way to support internationalization and exports, but also as a way to develop value chains; to increase and qualify the supplier network; to invest in the creation of products with international competitiveness, differentiated products with the incorporation of brand, design and value perception allowing to increase the international sale price; to take advantage of the AGOA programmes and export easy opportunities to Canada; to promote Cabo Verde as an export platform for CEDEAO and other African destinations, and also within the context of the zero bureaucracy programme, to implement the entire Responsible Industry System, allowing the full licensing of any online industrial establishment in a very simplified way. (Government's Manifesto 2016-2021, page 80 - 81).

In order to achieve the goals of the New Economic Growth Model, the government will adopt a set of measures toward the development of the industrial sector that will impact refocusing the economy; tourism shall be the central pillar of the Caboverdean economy, refocused in a new dimension and on quality that overtakes the sectorial concept and reaches a multiple specialization of the Cabverdean economy.

It will also unite the efforts with the private sector regarding the increase in value and promotion of tourism to promote a digital era and innovation in tourism. To place transportation services at the service of tourism in order to take advantage of an ocean-based economy, the government will also: consolidate the traditional maritime activities (fishing, fishery transformation, naval industry) and value the strategic position of Cabo Verde in the Middle Atlantic; reinforce and modernize national ports and connect them to the Trans-European and African transportation network within a context of the intensification of maritime transportation; qualify human resources in order to promote development within the sector with a special incidence over the new identified opportunities; search for new excellence areas and the creation of business

opportunities (e.g. aquaculture, mariculture, tourism and nautical and leisure sports); stimulate scientific investigation and create a technological park investing in technological development and applied investigation, as well as in the creation of a set of service-providing companies and, guarantee zero bureaucracy by means of a concession of facilities for the exercise of economic activities with the creation of unique windows, unique invoice and unique agency for licencing.

It is imperative to transform agriculture into a sector that generates income, bringing prosperity and social recognition. In order to have a competitive agriculture and agroindustry in the local market and in international market niches, the government's action shall focus on the modification of the rural development perspective. It will break from the traditionalist view by establishing a transformation and modernization era with the countryside as an investment destination. Some of the measures to be undertaken are: improving rural infrastructure; relaunching the vegetable protection programme; organic farming development and relaunching professional research and training.

For the fishing sector, particularly semi-industrial, the government is assuming a new strategy in order to increase value and promote the private sector and activity within the national development framework. Some measures are: the creation of a Scientific and Technological Sea and Fishing Park, as a development centre for the sector in harmony with higher education institutions, local and regional power and the sectoral entrepreneurs; the implementation of a training system for researchers, operators, fishermen and fishmongers, and the remaining stakeholders in the sector, reproducing the resulting needs of its integrated management; the installation of a national information system regarding fishing and agriculture; the modernization and appropriateness of the industrial, semi-industrial and artisan national fleet. (Government's Manifesto 2016-2021, page 80).

10.3 Science, Technology and Innovation

10.3.1 Present situation

The capabilities in science, technology and innovation (STI) are significant determinants of progress and transition to knowledge sharing and diffusion in order to facilitate new innovations that enhance productivity increases. STI are therefore key to improving economic performance and social well-being. The ability to create, distribute and exploit knowledge has become a major source of competitive advantage, wealth creation and improvements in the quality of life.

The government recognizes that human resources are the basis of a science and technology system as the quantity and the quality of human resources, both for research within universities and research institutes, as well as for companies and industries, are a necessary condition to ensure the success of any science and technology programme. In this context, Cabo Verde has made significant investments in this sector and, as a result, the country has made significant advances in the higher education system since 2000 and is regarded as the country with the highest coverage rate in education in the African sub-Saharan. Today, Cabo Verde has 10 higher education institutes.

The country is also referred to as an example in fighting illiteracy in the world. Presently, its number is moving towards zero in some social segments. Between those 15 to 24 years old, the illiteracy rate is quite residual. It was under 2% in 2016 (UNESCO, 2016). In the meantime, the increased literacy of a people is not necessarily a sufficient condition for the development of STI, and does not in itself determine a nation's development. Scientific and technological development is much more complex and sometimes requires a high level of organization and planning. Nowadays, the scientific, technological and innovative overview of Cabo Verde, according to the Policy Letter for Science (BO. I Series, no. 27, 2016) is characterized by the 'existence of non-academic institutions that undertake research, but that produce very little in quotable terms and patent publications' (page 1003). On the other hand, 'the non-academic budgets have not allowed for an allocation of necessary resources for sustained research activity, and funding allocation for research activities is done directly and without control over the achieved results' (page 1004).

Regarding research, 'research in non-academic institutions is frequently done within the framework of international partnerships, but there is no guarantee that the model contributes towards broader national sovereignty in the production and absorption of knowledge and technologies' (page 1004). The learned context may be understood in the logic that there is a huge deficit in the country regarding research, and one can the quote legal framework (Researcher Status, Research Agenda in the IES) and a fund that promotes research in the higher education institutions of Cabo Verde (Ministry of Education - Concept GESCT, page 8).

Within the innovation sphere, the results of the Innovation Survey 2015 of Cabo Verde, carried out amongst companies, showed that out of a total of 3067 companies with organized accounting, only 120 companies dedicate themselves to innovation activities, representing 3.9% of the total of companies with organized accounting (Statistics of Entrepreneurial Innovation and Scientific Research, INE, 2016).

From individually analysing the results by different types of innovation (product, process, organizational and marketing), one concludes that 2.5% dedicate themselves to product

innovation, 2.2% to process innovation, 2.2% to organizational innovation and 2.3% to marketing innovation.

The results of the various types of innovation by activity sector show that the biggest innovations are registered in the companies in the wholesale and retail trade sector and the repair of motor vehicles and motorcycles (representing respectively 30.8% in product innovation, 33.3% in process innovation, 29.2% in organizational innovation and 32.4% in marketing innovation) and the manufacturing industry (representing respectively 19.2% in product innovation, 21.2% in process innovation, 16.9% in organizational innovation and 21.1% in marketing innovation). The municipalities of Praia, São Vicente and Sal present the biggest proportions of companies with innovation activities of any type.

10.3.2 Policy review

The significant production of wealth demands a competitive private sector that is able to innovate and attract highly qualified staff and, especially for a small and insular country, to compete in a demanding global market.

This implies investment in science, research and entrepreneurial innovation because the development of the national scientific and technological system is an essential part of the sustainability and improvement of higher education quality and, therefore, of the training and employability of the qualified Caboverdean population (Government's Manifesto 2016-2021, page 159).

The government will develop excellent human capabilities and will take advantage of the geostrategic positioning of Cabo Verde in order to promote a business environment focused around Information and Communication Technologies (ICT) and Research & Development (R&D), in order to transform Cabo Verde into a regional technological reference centre in Africa, attracting and creating work opportunities and skill centres.

The government "also intends to transform Cabo Verde into cyber islands, creating conditions for most citizens to have quality Internet access and therefore creating sustainability for a wide range of potentialities, significantly contributing to the country's economic and social development" (Government's Manifesto 2016-2021, page 200).

10.3.3 Policy Strategies and Incentives

For development in the most advanced nations, the biggest advantage has been the R&D centres, leveraged by the inherent and permanent cooperation between the state, the higher education institutions and companies, turned to the permanent innovation of supply, demand satisfaction and competitiveness in the national and international markets.

Therefore, the government has made the following commitments: developing research, development and innovation centres focused on public-private partnerships; gathering together the state, higher education institutions, scientific parks and companies; promoting the Science and Technology Agency; installing several technological and scientific parks in areas such as the sea and biodiversity, health, environment, alternative energies and water; tax incentives for the importing of equipment and stimulation for innovation and entrepreneurial research in areas of international competitiveness; the availability of financial and material resources to incentivize basic research, namely in terms of Caboverdean culture and history.

The government will undertake the following actions within the area of science, technology and innovation:

- Integration of science into the production sector, strengthening the relationship between the state/companies/higher education institutions and international excellence centres for the transfer of knowledge, skills and technologies;
- Elevation of innovation to the top of national policy as a key-element for the creation of quality employment and for the sustained growth of national productivity and international competitiveness;
- Availability of financial and material resources to incentivize basic research focused on Caboverdean culture and history, and other cross-disciplinary issues of international and applied research;
- Incentivize the dissemination of science and its transfer to technological creativity, creating awards within the science and innovation areas;
- Promotion of scientific programmes and support for the non-formal scientific education;
- Investments in the training and ability of technicians in the operation and maintenance of leading-edge technologies and the promotion of a culture of conservation of national goods and resources;
- Adoption of favourable fiscal measures;
- Creation of a Science and Technology Agency (Development and Research Centre of Cabo Verde), a public entity with competence in the promotion and development of the scientific, technological and innovation system;
- Installation of a set of scientific and technological parks in several places on the national territory, coordinated by the Science and Technology Agency (Development and Research Centre of Cabo Verde) (Government's Manifesto 2016-2021, page 159).

10.4 Education

10.4.1 Present situation

Education is one of the most important areas in the development of the NSI and a key dimension in the creation

of a knowledge-based economy. It represents the basis of a society oriented towards the future and therefore knowledge becomes the main component of economic and social growth.

The education sector in Cabo Verde has experienced massive expansion in enrolment and the number of institutions. One of Cabo Verde's biggest gains has without a doubt been the investment in education and the democratization of access to primary and secondary education, having significantly invested in technical vocational training.

Thanks to the investments made, approximately 23% of the national budget, education is now closer to the communities. A total of 140,521 permanent residents, from preschool to secondary education, are now going to schools all over the country under the guidance of 7000 teachers. The number of trained teachers has increased from 70% in 2003 to more than 95% at the present date.

In terms of infrastructure there has been a big improvement. The country features 50 secondary schools, 21 of them built in the last few years, and hundreds of elementary schools built in the last 14 years. The 3rd education reform is now ongoing and aims to modernize the sector. It should be highlighted that there has been an increase in compulsory elementary education over the last 8 years as well as the introduction of new school handbooks. The Mundu Novu Programme was created in 2009 with the goal of modernizing the teaching process using new information and communication technologies.

10.4.2 Policy review

Because education is one of the most important areas in the development of the NSI and a key dimension in the creation of a knowledge-based economy. The government's goals in terms of education and science consist of obtaining 'an excellent education level, which is fair and inclusive, reaching the top 50 in terms of the Higher Education and Training Index of the World Economic Forum.' Furthermore, 'an education system integrated into the concept of a knowledge-based economy in a school and university environment with a culture focused on research, experimentation and innovation, enabling Caboverdean youngsters to have a profound understanding of languages, science and technologies, with a cosmopolitan profile of their relationship with the world, holding values and motivating learning throughout their lives' (Government program and motion of confidence 2016 – 2021, page 9).

Because education is a key determinant for the construction of a knowledge-based economy, the government has given more and more importance to the quality of education. In this context, 'the vision is for an educational system integrated into the knowledge-based economy concept that, from bottom to top, guides young people towards proficiency in the domains of languages, integrated sciences, technologies and towards the construction of a cosmopolitan profile open to the world, able to internalise predefined values to know how to be and what to do, mutually accountable, as members of the community, to prepare for learning throughout life, research culture, experimentation and innovation.' (Strategic Plan for Cabo Verde's Education 2017 - 2021, page 95).

Because ICT plays a central role in education, the government's programme aims 'to promote research, creativity and innovation directed at raising the level of knowledge in science and technologies, as well as citizen qualification' (page 34). Furthermore, the provision of ICT facilities across the education sector will be a priority: 'The goal is to generate the mass use of technologies in schools, by reinforcing technological education and the requalification of the existing physical structures, consistent with the implementation of service integrated into the concept of the knowledge-based economy' (Government's Manifesto 2016 – 2021, page 152).

The Government's Manifesto emphasizes the important role of highly trained human capital in science and technology, entrepreneurship, math and science and the need for schooling to be closer to market is crucial for a modern and competitive curriculum: 'Concerning secondary education, this will be considered in terms of its importance within the student's exit profile and the close relationship between the level of education and the social and economic development of families. Higher education shall be transformed into a strategic axis for the country's development, which is competitive within a global context (...) aimed at quality higher education and a systemic profile of higher education/ science/research and development (page 154 - 156).
The goal is to focus on acquiring learning techniques that favour a solid base of languages, technology and science. Additionally, a strong articulation with vocational training and the necessary reformulation of the curricular structure of each of the higher education cycles, bearing in mind the reinforcement of the alignment with the Government's Manifesto, also constitute priorities.

The government intends to expand the programmes that promote education and training towards entrepreneurism, especially for the younger ones, taking into account that this is one of the main factors for the promotion of innovation and value creation within the economy, and for the promotion of self-employment: 'Effective promotion of entrepreneurship - Work for Yourself - on a perspective to establish international networks with the best entrepreneurs in the world and in the African continent, and the launching of the CVXL programme (....) that will be a programme for mentoring and start-up acceleration, based on the principles of innovation applied to the strategic areas for Cabo Verde, such as maritime-ports, airports, sea, information and communication technologies, renewable energies and finance.' (Cabo Verde Government's Manifesto, IX Legislature 2016-2021, page 30).

10.4.3 Policy Strategies and Incentives

As previously mentione, the government proposes to 'create an educational system integrated into the knowledge-based economy concept that, from bottom to top, guides young people towards proficiency in the domains of languages, integrated sciences, technologies and towards the construction of a cosmopolitan profile that is open to the world, able to internalise predefined values in order to know how to be mutually accountable, as members of the community, prepared for learning throughout life, research culture, experimentation and innovation' (Strategic Plan for Cabo Verde's Education 2017 - 2021, page 95).

Therefore, amongst other measures, it proposes the design and execution of a new curricular matrix focused on: Education in foreign languages throughout all phases and cycles; The strengthening of sciences, namely, mathematics, physics, chemistry and biology, both theoretically and practically; The effectiveness of an educational and training policy of know-how by means of centres for small crafts in all schools and idea incubators for a more practical education, as well as the reformulation of plans for the training and empowerment of students in order to increase qualification of know-how; The reinforcement of technological education and the requalification of the existing physical structures, in keeping with the implementation of an integrated educational service into the concept of a knowledge-based economy; The reformulation of the new world programme and the broadening of its effective scope to all elementary and secondary schools; The promotion of technological centres and innovative environments in all schools, as well as the extension of connectivity and access to digital libraries and regional technologic parks; computerization of all schools, aiming at the modernisation of the existing school management system.' (Cabo Verde Government's Manifesto, IX Legislature 2016-2021, page 151).

Seeking quality higher education and a systemic profile of higher education/science/research and development, the government is undertaking the following measures: To promote an integrated scientific policy, respecting the specificity of the different higher education institutions synched with the major guidelines for the country's development; To create institutional conditions for the development of a researcher's career; To create a National Research Support Fund to support research at any national higher education institution or within the research vocation, namely, in order to improve observatories and research centres; To regulate higher education in order to guarantee the quality of its institutions and courses, and to introduce, with excellent external support, an external evaluation calendar for the higher education institutions, as well as for the R&D units associated with universities; To promote the Mutual Warranty Fund as a complement to the non-refundable scholarships; To support the higher education institutions, namely, with support in acquiring equipment and teaching materials, to promote investment and the sharing of labs and common technological centres, and to stimulate tripartite partnerships for the national development, integrating the state/higher education institutions/companies.

To bolster 'education and training for entrepreneurship, promoting innovation and creating value in the economy', the government presents several actions, amongst which are: The structuring and promotion of vocational secondary education highlighting the areas related to tourism, the sea, agriculture, commerce and light industries, building and construction, telecommunications, computing and industrial electronics, according to the region's economic vocation, as well as the reinforcement of education regarding technologies and foreign languages with the introduction of computer science; The introduction of subjects and practices for the promotion of young entrepreneurship in schools, as well as support for the creation and expansion of companies by young people, highlighting the strategic areas of national development; The adoption of a significant Professional Probation Programme, guaranteeing a proper transition between school and the job market; The adoption of financing programmes by means of microcredits and the strengthening of venture capital, as an example of the creation of a guarantee fund to support the financing of entrepreneurial initiatives led by youngsters.

10.5 ICT

10.5.1 Present situation

The communications sector in Cabo Verde has made considerable advances. The landline network was expanded all over the country, reaching 71,664 clients, equal to a telephone saturation (number of landline phones per 100 inhabitants) of 13%. The broadband national network, based on optical fibre, underwater cables (1997), has reached, with the closing of the loop in 2002, 803,541 meters, and inland cable 868,232 meters, secured in loops and with capabilities (9,044,229 meters of optical fibre pairs) adaptable to the demand for network rental or retail activities. The international broadband network, also with optical fibre support, reaches the Submarine Cable Atlantis II (2000) and, for 2011, the WACS (West Africa Cable System, meaning a contribution to the country's connectivity with two international underwater cable systems and a satellite connection system (1983). The country also has a data centre, a technological infrastructure with high standards that hosts processing and data storage equipment, namely from the state and with the potential and ability to provide these kinds of services to companies, banks and other national and international entities.

Table 4. ***Regional Ranking ICT Development Index 2017.***

Regional Ranking ICI Development Index 2017		
IDI 2017 Regional Rank	**IDI 2017 World Bank**	**Economy**
1	72	Mauritius
2	90	Seychelles
3	92	South Africa
4	93	Cape Verde
5	105	Botswana
6	114	Gabon
7	116	Ghana
8	118	Namibia
9	131	Côte d'Ivoire
10	132	São Tomé and Príncipe

Source: IDI 2017.

Internet access has grown in an exceptional way in Cabo Verde; the introduction of ADSL broadband and 3G wireless has led to the rapid growth of Internet usage in Cabo Verde, and this growth is supported by the 35 digital squares of the Konekta programme (free access to broadband Internet from strategic places and municipal public squares). Increasing competition within the telecommunication sector has also contributed to a reduction in prices and an increase of caption.

A data centre and a communication network ensure the inter-connection of all 9 islands and state institutions, from sovereignty bodies, simple state services, to the services with administrative and financial autonomy - mainly institutes and local municipalities. Today, there are nearly 5000 access terminals that provide VOIP services, e-mail, and applications. It also has external connections to two major transatlantic fibre optic cables, the Atlantis II and West Africa Cable System (Cabo Verde Country Strategy Paper 2014-2018).

NOSI-Operational Nucleus for Information Society is the structure for the coordination of the promotion of the information society and electronic governance. It has as main role and attributes the promotion and implementation of policy measures capable of mobilizing the society, private sector, and public sector to build up an information society and implement measures aiming at improving the public administration organizational structure towards e-Governance (Information Society Strategy Programme, 2005).

The following are some important gains that have been obtained: The Special Regime of Land Registry is a pilot project that simplifies the land registration of real properties integrated in great tourist undertakings. Through this special regime it is possible to obtain land registration in 48 hours; Business on the day allows the establishment of enterprises on the same day, at a customer service desk of the Casa do Cidadão (Citizen's House); A special property registration system was developed and implemented that allows the great tourist facilities to register, sell and mortgage within 48 hours. Furthermore, the Tourism Simplified Licencing allows the Tourism Utility Statute to be concluded in 10 days instead of about a month (www.nosi.cv).

10.5.2 Policy Review

The integration of Cabo Verde into the world economy is one of the key strategic objectives of the government, and therefore there is a great need to develop policies geared towards the increase of productivity and competitiveness of all sectors that are most directly confronted with international competition, namely tourism, transport and telecommunications, light industry and fisheries.
The government of Cabo Verde proposed to transform it into 'cyber islands. Allowing most citizens quality Internet access therefore creates sustainability for a wide range of potentialities, significantly contributing to the country's economic and social development. Broadband shall be treated as an essential asset in everything, including within governance, communication, commerce, education and inclusion.' (Government's Manifesto 20162021, page 68).

The government intends to develop excellent human capabilities and take advantage of the geostrategic positioning of Cabo Verde in order to promote a business environment focused around Information and Communication Technologies (ICT) and Research & Development (R&D), in order to transform Cabo Verde into a regional technological centre of reference in Africa, attracting and creating work

opportunities and a skill centre, by means of the creation of scientific and technological parks. These two parks shall have the following profile: The main mission is to create a dynamic ICT market in Cabo Verde with companies that hold solutions and services that are able to compete on an international and national scale. Regional perspective to serve CEDEAO, in particular, and other regions of the African continent by means of the export of high added value services.

The Strategic Plan for Sustainable Development (PEDS) identifies a specific programme for this sector: The Cabo Verde Digital and Innovation Platform intends to transform the country into a development centre for the digital and nano-technological economy, positioning the country as a reference point in Africa and promoting a business environment focused around ICTs and R&D. (Information about the Information and Communication Technologies sector – ICTs - in Cabo Verde, 2018, page 2).

The government still intends to develop excellent human capabilities and take advantage of the geostrategic positioning of Cabo Verde in order to promote a business environment focused around Information and Communication Technologies (ICT) and Research & Development (R&D), in order to transform Cabo Verde into a regional technological centre of reference in Africa, attracting and creating work opportunities and skill centres by means of creating scientific and technological parks. These two parks shall have the following profile: The main mission is to create a dynamic ICT market in Cabo Verde with companies that hold solutions and services that are able to compete on an international and national scale.

The scientific and technologic parks will be the centre of investment in R&D for the development of a Green Economy and a Blue Economy, stimulating multidisciplinary approaches to R&D&I and innovative projects by joint ventures between companies and R&D institutions. As one of the main pillars of the future economy and one of the anchors of the country's sustainable development, by means of the ability to attract multinational and regional companies with incentive policies, the data centre of NOSI should integrate this approach (Information about the Information and Communication Technologies sector – ICTs - in Cabo Verde, 2018, page 2).

Cabo Verde's government proposes a new strategy for the ICTs' development: A digital agenda based on a new national view for broadband, investing in the digital dividend and in analog complements. Internet access will be on a mass scale through the creation of the Internet Universal Access Fund, an IXP (Internet Exchange Point) and a National Observatory for the Information Society, as well as support to the development of technology-based companies, and fiscal incentives for the ICT sector.

10.5.3 Policy Strategies and Incentives

ICT plays a determinant role on a knowledge-based economy. The production, distribution and processing of knowledge (especially scientific and technological) is increasingly performed within the domain of computational information and communication technologies.

In order to transform Cabo Verde into a regional technological centre of reference, which attracts and creates work opportunities and skill centres, the following actions shall be implemented: 'Creation of scientific and technological parks; Reinforcement of intellectual property rights, motivating the production and registration of patents; Promotion of partnerships between higher education institutions, companies and the State; Increase in the R&D System's participation within the international R&D networks, supporting Caboverdean companies with the presentation of competitive proposals for advanced technology and taking advantage of its eligibility to tender for big competitive projects and international scientific organizations to which Cabo Verde belongs; Stimulation to international visibility regarding the companies' cooperation with the R&D system by means of joint initiatives of economic and scientific diplomacy; Incentive for the reinforcement of entrepreneurial investment in R&D with commercial applicability, as well as promotion to the companies' employment of researchers; Support for companies in searching for advanced technological solutions, consulting higher education institutions and national research units; Investment in R&D for the development of a Green and a Blue Economy, stimulating multidisciplinary approaches to R&D&I and innovative joint venture projects consortiums between companies and R&D institutions.' (Government's Manifesto 2016-2021, page 66 - 67).

In order to transform Cabo Verde into 'cyber islands', aiming at quality Internet accessibility, which would significantly contribute to economic development, the following measures shall be implemented: 'Broadband shall be treated as an essential asset in everything, in governance, communication, commerce, education and inclusion. The fees charged by ANAC will be used to promote digital inclusion and the development of young people's creative ideas within the ICTs sector; We will promote ICTs as a capacity to unite the national territory and connect it to the world, and to ensure a local public and private service; We will change the national scope in terms of ICTs, characterized by a low rate of Internet usage, high cost of band width, low quality and diversity in Internet access services, high rate of digital illiteracy and a legislation deficit, mainly regarding computer security and criminality. We will introduce a special system of customs tariffs for certain types of access terminals, namely to mobile networks, in order to stimulate the mass market for Internet access. We will renegotiate the concession contract with Cabo-Verde Telecom (ending in 2020) and we will redefine

the management model for the state telecommunication infrastructure, taking into account the goals listed above. We will provide regulation for ICTs and for the telecommunication sector. The Government will create a new strategy for the development of ICTs - Digital Agenda - based on a new national view for broadband, investing in the digital dividend and in the analog complements.' (page 68 - 69).

10.6 Development

10.6.1 Present situation

Cabo Verde's successful socio-economic development during the last decade has been widely recognized. Despite its still numerous vulnerabilities, the country recorded one of the most impressive socio-economic performances in Africa and graduated from the UN Least-Developed Country status in 2008. The country is also widely recognized for its good governance in Africa and it received the second highest performance for governance in the 2012 Mo Ibrahim Index of African Governance, out of 52 countries.

Cabo Verde is a Small Island in Development State (SIDS), located in the Sahelian Eco climate area, along the Senegal coast and not very far from Europe and the Americas, with an approximate population in 2017 of 537,661 people, 267,570 of whom are women (49.8%) and 28.6% are children under 14 years of age. Practically without any natural resources and with just 10% of arable land, the characteristics of Cabo Verde's location, structure and geophysics substantially contribute to its economic and social vulnerability and determine its strategic choices and development route. Cabo Verde is recognized for its solid political governance and its impressive development trajectory that inspires trust in its development partners. The country exited the classification of Least Advanced Country (PMA) 5 at the end of 2007 due to its good performance in terms of human development and economic growth. However, as a consequence of the rating as an Average Income Country, the public aid to development and access to loans under preferential conditions decreased dramatically and the economic growth of Cabo Verde slowed down to an average of 1.3% from 2010 to 2015.

In spite of all that, Cabo Verde surprisingly achieved most of the Millennium Development Goals (MDGs) in 2015 and there are signs of economic recovery with growth of 3.2% in 2016 and equally positive prospects for 2017 and 2018. Being an SIDS archipelago formed by ten islands, with nine of them inhabited, Cabo Verde faces considerable structural challenges, such as a reduced fiscal base, a small and fragmented market and limited economic diversification. It's extremely exposed to risks related to climate and security, namely due to organized crime and drug trafficking. With an economy depending on tourism, workers' remittances and financing under preferential conditions, Cabo Verde is extremely vulnerable to worldwide economic collapses and to natural disasters.

As opposed to its strong performance in terms of development, Cabo Verde now faces the challenge of protecting its gains in terms of development, particularly within the social field, and of satisfying the needs of its large young population (46.4% are under 25 years of age and 37.1% are between 15 and 34 years of age), as it simultaneously accelerates economic growth and reduces social and environmental risks in order to continue making progress on a sustainable development route, according to the Manifesto 2030.

In terms of economic strategy, the country's ambition places the tourism sector and the service sector at the centre and as the main motor for economic growth, representing almost 22% of GDP in 2016. The vision for the country's economic transformation will depend on the investments made in the sustainable economy of the oceans, agribusiness, renewable energy, culture and creative industries, and ICTs, simultaneously reinforcing commerce, industrial development, innovation, vocational training and entrepreneurship. The economic transformation still needs to combine an agricultural sector that employs a significant number of the active population (19% of the population, of whom 34% are women and 66% are men) with the challenge to promote full-time employment, to guarantee decent work and overcome the regional asymmetries. Besides that, and in order for the country to fully benefit from the demographic transition, the policies need to promote increasingly more participation by women and youngsters as a workforce, reducing gender inequalities in employment and the high rates of unemployment amongst young people (41% between 15-24 years of age, considerably greater for women: 52.6%).

Known for its solid governance with transparent electoral processes, strong democratic institutions, free press and respect for human rights, the country continues to be compelled to reinforce citizen participation in democratic processes, particularly women (who presently represent 24% of elected MPs) and youngsters, and the efficiency and effectiveness of its public administration, including reforms to improve the rationalization and transparency of the public finance management system. Cabo Verde's government has invested in mechanisms for the more efficient and effective mobilization of internal revenue and to reinforce decentralization to reduce regional disparities. Violence related to organized crime and drug trafficking that has been present in the last years, particularly in the cities, besides the incidence of gender-based violence and sexual violence against women and girls, and the persistence of situations of sexual abuse and child exploitation, demand a constant effort from the country in order to reinforce the safety of people, the rule of law and the judicial system, as well as the fight against drugs and abuse of other substances (Cabo Verde, Cooperation of the United Nations for Development UNDAF 2018 – 2022, page 14).

10.6.2 Policy Review

The Strategic Plan for Sustainable Development (PEDS) describes the main challenges for the country's sustainable development, under which the PEDS strategic answer includes short, average and long-term measures. PEDS was created to bridge the needs and to affirm the comparative and competitive advantages of Cabo Verde, in order to take advantage of the present and future development opportunities.

The strategic plan establishes defiant targets for the period 2017/2021 in a consistent long-term approach, based on four structural goals: (1) to turn Cabo Verde into a traffic economy in the Middle Atlantic; (2) to guarantee economic and environmental sustainability; (3) to ensure social inclusion and the reduction of inequalities and social and regional asymmetries; (4) to reinforce sovereignty, valuing democracy and orienting diplomacy towards the country's development challenges.

The Government's Manifesto for the IX Legislature (2016-2021) is clear in stating its forward-looking viewpoint: 'A Cabo Verde that is developed, inclusive, democratic, open to the world, modern and safe, where full employment and full freedom prevail.'

The manifesto goes beyond this and announces an action plan to build a better country, connected with itself and with the world, to guarantee a more inclusive society and a nation that is stronger, more global and more sustainable, to guarantee the right of freedom, democracy and citizenship to all.

10.6.3 Policy Strategies and Incentives

Goal 1 PEDS – 'To transform Cabo Verde into a travel economy located in the Middle Atlantic' – National Economic Sphere

Through this goal, we envisage placing the foundation stones for the implementation of seven programmes (seven opportunities) with the capacity to generate Cabo Verde's strategy - travel platform in the Middle Atlantic.

Programme 1 – the creation of a supply logistics port for an international fleet of ships.

Programme 2 - creation of a logistics airport for the international distribution of passengers and cargo that centres around the continents and neighbouring countries of the Atlantic (Air Platform).

Programme 3 - location of companies and transformation of Cabo Verde into an International Business Centre that is attractive to the IDE and promotes the Indigenous Entrepreneurial Initiative (Commercial and Industrial Platform).

Programme 4 - creation of an international financial platform (Financial Platform).

The degree to which Cabo Verde is underdeveloped is also clearly expressed in the financial market. The financial market is dominated by six small banks with a modest capacity to intervene in the economy given their limited capital resources, whether in an isolated or consolidated manner.

The arguments presented that show the opportunity and importance of transforming Cabo Verde into an International Business Centre (BIU) are also valid regarding the creation of an international financial centre on the islands.

The financial centre is therefore an essential component of the BIU. The existence of such a centre determines a positive set of direct, indirect and induced economic effects, namely within the domains of financing companies and projects, contributing towards the balance of payments, capital circulation and the internationalization of the Caboverdean economy, the claim of the country's Atlantic centrality and the creation of qualified employment.

Programme 5 - creation of conditions that may promote and increase the participation of Caboverdeans residing abroad and also favours the ethnic component participating in the economic and social development of the country (Ethnic Investment Platform).

We intend to articulate the results of miscegenation with its origins in order to represent an important contribution for the understanding of humanity and for the promotion of peace, as well as for the economy of the islands, particularly, within the tourism and private investment domains, introducing emotion as a different initiator and humanizing element.

Programme 6 - tourism development (Tourism Platform).

Namely thanks to the consolidation and improvement of the existing and the diversification of the internal destinations and products, making tourism the phenomenon that generalizes all islands. As a tourist destination, the country has a recognized potential in other market segments, namely within the domain of adventure tourism, historical tourism, mountain, rural, urban, events, sports and health tourism. Such a goal implies and determines for a consolidation of the present destinations for sun, beach and sea, demanding a significant investment in safety, the sustainability triangle (economic, social and environmental) and in marketing. But also, regarding the planning of destination development and the harmonization of the interventions carried out by the State, municipalities and companies.

Opportunity - Cabo Verde has the capacity to welcome up to 3.000.000 tourists/year.

Programme 7 - development of the digital and nano-technological economy (Digital and Innovation Platform).

The concept for the digital and innovation platform brings much more than just the pure and necessary digitalization of the country. The country is intended to become a consumer of digital economy products, but also a researcher, investor, producer and distributor. The fact that Cabo Verde is located on a digital communication crossroad is a strong argument to be taken into account in the operational options for the platform development.

Goal 2 PEDS – 'To Guarantee Economic and Environmental Sustainability' – National Economy Sphere

It concerns the importance of tourism in Cabo Verde as this is the sector that presently drives the economy, it should be the catalyst to which all the remaining sectors should be attached in view of the value chain. Tourism in Cabo Verde presents the following challenges:

- the competitiveness challenge
- the sustainability challenge
- the concentration challenge
- the maximization challenge regarding the impact on the wealth and the well-being of Caboverdeans

In parallel with tourism development, we should identify the key-sectors that should be developed for the purposes of internal production and exports promotion. These are the sectors: fishing, agriculture, light industry and creative industries.

Goal 3 PEDS - 'To ensure social inclusion and the reduction of inequalities and social and regional asymmetries' – Social Sphere

This goal seeks to deal with the issues regarding people and their fundamental needs and rights as part of Caboverdean society. It describes the strategies to improve the living conditions of families and social inclusion for education, access to housing, worthy employment, youth, the national health system and social security, as well as for gender equality, culture and sports. The intervention axes are: Access to income and basic social services; a system of care for dependents; social-economic inclusion for disabled people; full care of families in a situation of vulnerability; integration of immigrant families, and children and young people protection against situations of personal and social risk.

Challenges within the education sector → Strategic Education Plan

Challenges within the housing sector→ National Housing Plan

Goal 4 PEDS - 'To reinforce sovereignty, valuing democracy and orienting diplomacy towards the country's development challenges' – National Sovereignty Sphere

This chapter addresses the strategies for the consolidation of democracy, peace and justice, culture, security and ndefence of the territory and external policies.

11.0 Results of the Analysis of the CVNSI and Policy Implications

11.1 Preamble

This chapter sets out to analyse the results of the Cabo Verde National System of Innovation Survey. It uses a combination of univariate and multivariate analysis which provides a strong empirical foundation. The frame of analysis can be divided into the following sections. Firstly, the characteristics of the CVNSI Survey are described in terms of the composition of the sample and its respondents. This is followed by a comprehensive analysis of the relationships between the actors of the system. This then leads to the elucidation of which barriers exist within the CVNSI, and which are most predominant for which actor group. This is also linked to the question of how successful existing policies are highlighting either the convergence or divergence between the results and what is articulated in government policy. With this in mind, this chapter aims to highlight the avenues that need attention within the CVNSI.

11.2 Characteristics of the CVNSI Survey (Sample and Respondents)

It is important to portray the characteristics of the mapping and measuring of the NSI and its survey in terms of the universal population, convenient sample and respondents. Table 5 below indicates the size of the universal population of the four actors targeted in the CVNSI Survey. One of the main challenges faced during the data collection process was the fragmented and incomplete nature of country level data. Given that the current population of Cabo Verde is approximately 0.5 million, based on the United Nations Population Fund (UNPFA, 2018)[30], in theory the consolidation of data resources should be straight forward.

The executive policy community, essentially the government (GOV), is represented by high-level officials in the relevant public institutions that are directly or indirectly responsible for innovation. These include the Ministries of Trade and Industry, Science and Technology, Economy, Finance and Education.[31] The knowledge community, made up of the knowledge-based institutions (KBIs), is represented by heads of universities and innovation-related faculties/departments (economics, science, engineering, technology and business) in higher education (HE), as well as heads of think-tanks and research institutes (RIs). Additionally, privately funded research institutes are also considered in this category.[32] The industrial community is represented by the CEOs of firms from the manufacturing and services sectors in accordance with the UNIDO ISIC Rev. 3 classification. CEOs also represent the intermediary body of arbitrageurs (comprising of financial institutions (FI), angel investors, venture capitalists and banks). This group of actors is not represented in the traditional Triple Helix model but is of crucial importance as the innovation process requires internal and external intermediation (financial, knowledge, transacting and investment), which has led to new business models and new types of companies in countries with advanced innovation-driven economies.

As such, arbitrageurs complement the traditional Triple Helix model by the provision of funds, links, knowledge sources and technical knowledge. This enables firms to improve their performance and survival rates, as well as to accelerate and increase the effectiveness of their innovation processes (Zook, 2003; Hargadon, 1998; Baygan and Freudenberg, 2000).

[30] Source: https://www.unfpa.org/data/world-population/CV [Accessed July 2018]

[31] Gabinete do Primeiro Ministro; Ministério das finanaças e Vice Primeiro Ministro; Ministério do Estado, dos Assuntos Parlamentares e Presidência do Conselho de Ministros e Ministro do Desporto; Ministério dos Negócios Estrangeiros e Comunidades e Ministro da Defesa; Ministério da Justiça e Trabalho; Ministério da Administração Interna; Ministério do Turismo e Transportes e Ministro da Economia Marítima; Ministério da Indústria, Comércio e Energia; Ministério da Agricultura e Ambiente; Ministério da Educação e Ministra da Família e Inclusão Social; Ministério da Cultura e Indústrias Criativas; Ministério da Saúde e da Segurança Social; Ministério das Infra-estruturas, Ordenamento do Território e Habitação; Ministério Adjunto do Primeiro-Ministro para Integração Regional; Secretário de Estado para as Finanças; Secretária de Estado para a Modernização Administrativa; Secretário de Estado para Inovação e Formação Profissional; Secretario de Estado para Economia Marítima; Secretário Estado Adjunto do Ministro do Estado;Secretário de Estado para Educação.

[32] Universidade de Cabo Verde; Universidade de Santiago; Instituto Superior de Ciencias Económicas e Empresariais; Universidade Jean Piaget; Universidade Lusófona; Universidade Intercontinental; Instituto Superior de Ciências Jurídicas e Sociais; Universidade Mindelo.

Table 5. ***CVNSI universe of respondents, convenient sample and responses.***

CVNSI universe of respondents, convenient sample and responses				
Actor	**Universe**	**Convenient**	**Response**	**Response rate**
Government	21	20	6	30%
Knowledge-based institution	99	98	30	30.60%
Industry	2648	1889	249	13.20%
Arbitrageur	17	14	4	28.50%
	2785	2021	289	13.50%

Note: the convenient sample represents respondents whose contact details were verified through the verification protocol developed by Bartels and Koria (2012).

The combined intermediation and resource allocation role of arbitrageurs is based on their assessment of competitive advantages in information asymmetries (Williamson 1969, 1971, 1973).

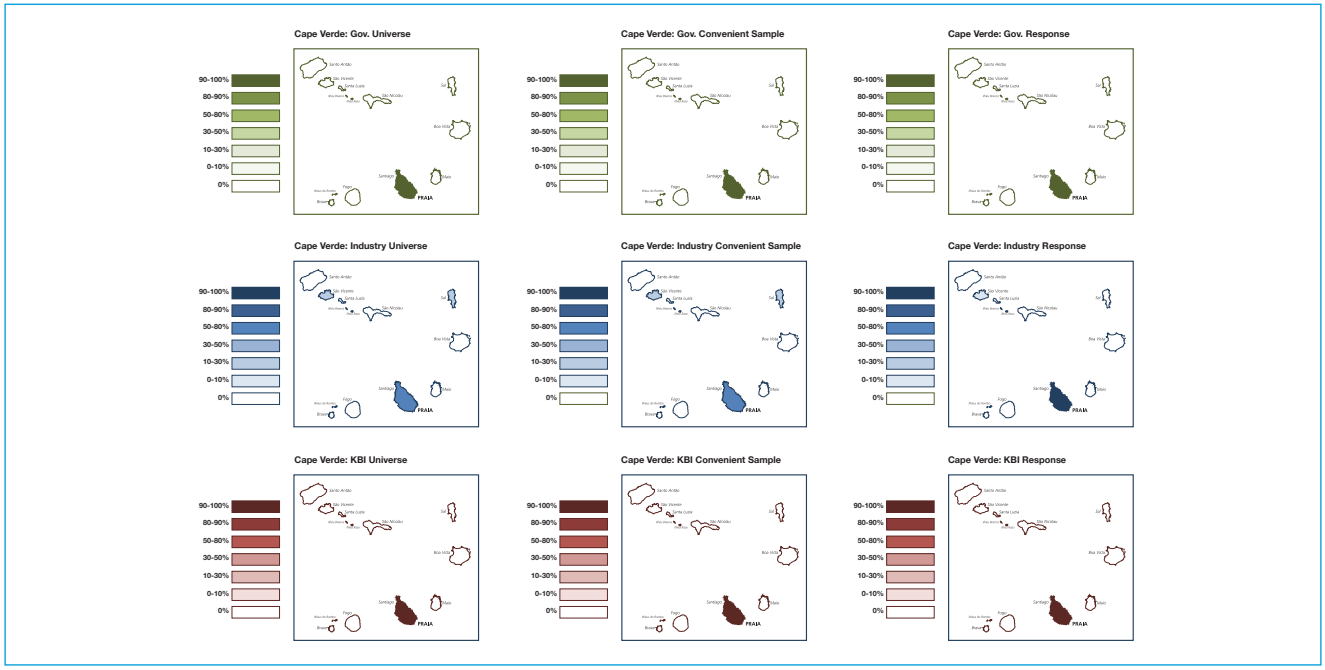
Figure 15 and Table 6, 7, 8 and 9, that follow, provide a spatial analysis of the CVNSI actor respondents in terms of location density (the universe, convenient sample, responses). The universe is in effect a 'Who is Who and Where' in innovation for Cabo Verde.[33] It is the first comprehensive database of policy-makers in GOV, KBI, IND and ARB, that deals with innovation. The universal database constitutes the first of several public goods outcomes from the CVNSI Survey. As a key dimension of the effectiveness and efficiency of a NSI is proximity, in terms of connectedness and linkages, it is crucial to appreciate the spatiality of the CVNSI actors, as it has implications for policy design.

Firstly, as is expected, the government is centralised in Santiago. Secondly, the major concentration of industry is found in Santiago, São Vicente and Sal.

This is almost mirrored by the KBIs that are concentrated in Santiago and São Vicente. Finally, it is also clear that arbitrageurs are only found in Santiago.

The spatial distribution of actors carries implications in terms of the policy recommendations. Without pre-empting any recommendations, it is clear that due to the geography of Cabo Verde as a set of islands i) communication between islands is a challenge, as is ii) collecting coordinating national data. This needs to be taken into consideration when trying to understand the challenges of innovation and hence crafting the requisite policy.

Figure 15. ***Choropleth map.***



[33] Due to the innovativeness of the methodology we have names, affiliation, and contact details of the universe of actors. This database can be used for policy monitoring and evaluation purposes with respect to mobility of human capital between, and within, the CVNSI actors (which increases the flows of knowledge within the system).

Table 6. ***Spatial distribution - government.***

Spatial distribution - government						
Government	**Universe**	**%**	**Convenient sample**	**%**	**Response**	**%**
Boa Vista						
Brava						
Fogo						
Maio						
Sal						
Santiago	21	100	20	100	6	100%
Santo Antão						
São Nicolau						
São Vicente						
Total	21		20		6	

Table 7. ***Spatial distribution - industry.***

Spatial distribution –industry.						
Government	**Universe**	**%**	**Convenient sample**	**%**	**Response**	**%**
Boa Vista	68	2.3	46	2.4	4	0.0
Brava	5	0.2	2	0.1	0	
Fogo	27	1	19	1	0	
Maio	18	0.7	16	1.8	0	
Sal	292	11	211	11.2	12	0.0
Santiago	1756	66.3	1231	65.2	211	0.8
Santo Antão	51	1.9	38	2	1	0.0
São Nicolau	29	1.1	21	1.1	2	0.8
São Vicente	402	15.2	305	16.1	21	8.6
Total	2648		1889		251	

Table 8. ***Spatial distribution – knowledge-based institutions.***

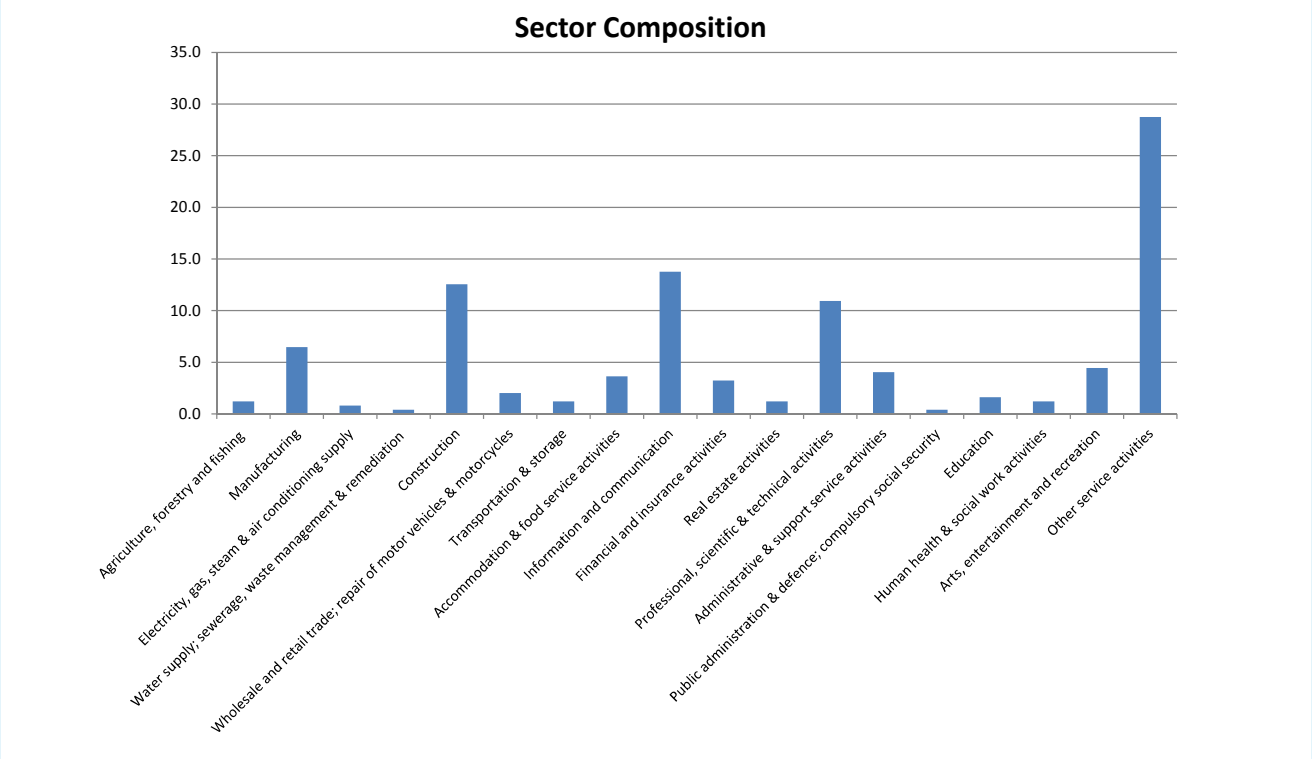
Spatial distribution – knowledge-based institutions.						
Government	**Universe**	**%**	**Convenient sample**	**%**	**Response**	**%**
Boa Vista	0		0		0	
Brava	0		0		0	
Fogo	0		0		0	
Maio	0		0		0	
Sal	3		3		0	
Santiago	84	84.8	84	85.7	26	0.9
Santo Antão	0		0		0	
São Nicolau	0		0		0	
São Vicente	12	12.1	11	11.2	4	0.1
Total	99		98		30	

Table 9. ***Spatial distribution - arbitrageurs.***

Spatial distribution - arbiitrageurs						
Government	**Universe**	**%**	**Convenient sample**	**%**	**Response**	**%**
Boa Vista						
Brava						
Fogo						
Maio						
Sal						
Santiago	17	100	14	100	4	100.0
Santo Antão						
São Nicolau						
São Vicente						
Total	17		14		4	

It is important to get some further clarity with respect to the industry actors in order to better elucidate the data in this report, particularly as the majority of innovation takes place at the firm level. The constitution of industry respondents can be seen in Figure 16, which notably indicates that the majority of the respondents come from the service, information and communication, professional scientific and technical, and construction sectors respectively. As a whole, the composition of respondent firms was mainly small and medium sized, a majority where domestically owned with 86.6% , while the proportion of foreign owned was 13.4%.

Figure 16. ***Constitution of industry respondents.***



This information will provide an anchor to orient the discussion in upcoming chapters.

11.3 Measurement and Analysis Frame

The CVNSI Survey obtained quantitative data on three dimensions of the NSI, namely: the components of the NSI; the barriers to innovation and the success of the policy. Actor perceptions of the NSI variables along these dimensions were measured by enabling respondents to express both the direction and strength of their expert opinion (Garland, 1991; Clason and Dormody, 1994) along five-point Likert scales, as well as in dichotomous, trichotomous and open questions.

There is strong empirical evidence that supports the treatment of ordinal variables as conforming to interval scales (Labovitz 1967, 1970, 1971). In order to ensure the highest validity, reproducibility and reliability of the acquired data, the CVNSI Survey instrument used test-retest questions (Easterby-Smith, et al., 2012). With respect to test-retest (intra-observer) reliability, this was achieved by repeating certain questions under different dimensions of the survey. This is the basis of test-retest reliability (Kitchenham and Pfieeger, 2002), which allows the consistency and significance of responses by the respondents, where possible, to be validated through statistical analysis. In terms of analytical tools, the two main approaches used have been descriptive statistics, namely frequency analysis, and factor analysis.

11.4 CVNSI Survey Results

A foundation to actors interacting within the system of innovation is their awareness of each other, as well as the relative importance of each other's role within the system. It is clear from the chapter on the theoretical underpinnings, that each actor within the system has a specific function. A first step in understanding these relationships is to comprehend how familiar the actors are with the term NSI. Is this term solely a buzz word or is there an effective understanding of what it means? Figure 17 provides a breakdown per actor and highlights that amongst government actors and knowledge-based institutions the majority of respondents are aware of the term.

However, in the case of industry and arbitrageurs the majority are unfamiliar. It is important to note that neither may use the term in their day-to-day vocabulary, however in reality they may be functioning in the NSI framework by default. Clarity on this will be gained as further analysis is undertaken.

A frequency analysis was conducted of all actors to gauge how important they feel the actors of the system are. What stands out is that in general the data set reflects that all actors are deemed important (very important and important scoring the majority) except for public and private research institutes, institutions supporting technical change and arbitrageurs.

In these cases, the results are generally neutral, with not so important and irrelevant as the majority (see Figure 18). The implication of this is that in general actors of the system are unaware of the roles and activities of private research institutes, ISTC and arbitrageurs.

Figure 17. ***Actor awareness of the NSI.***

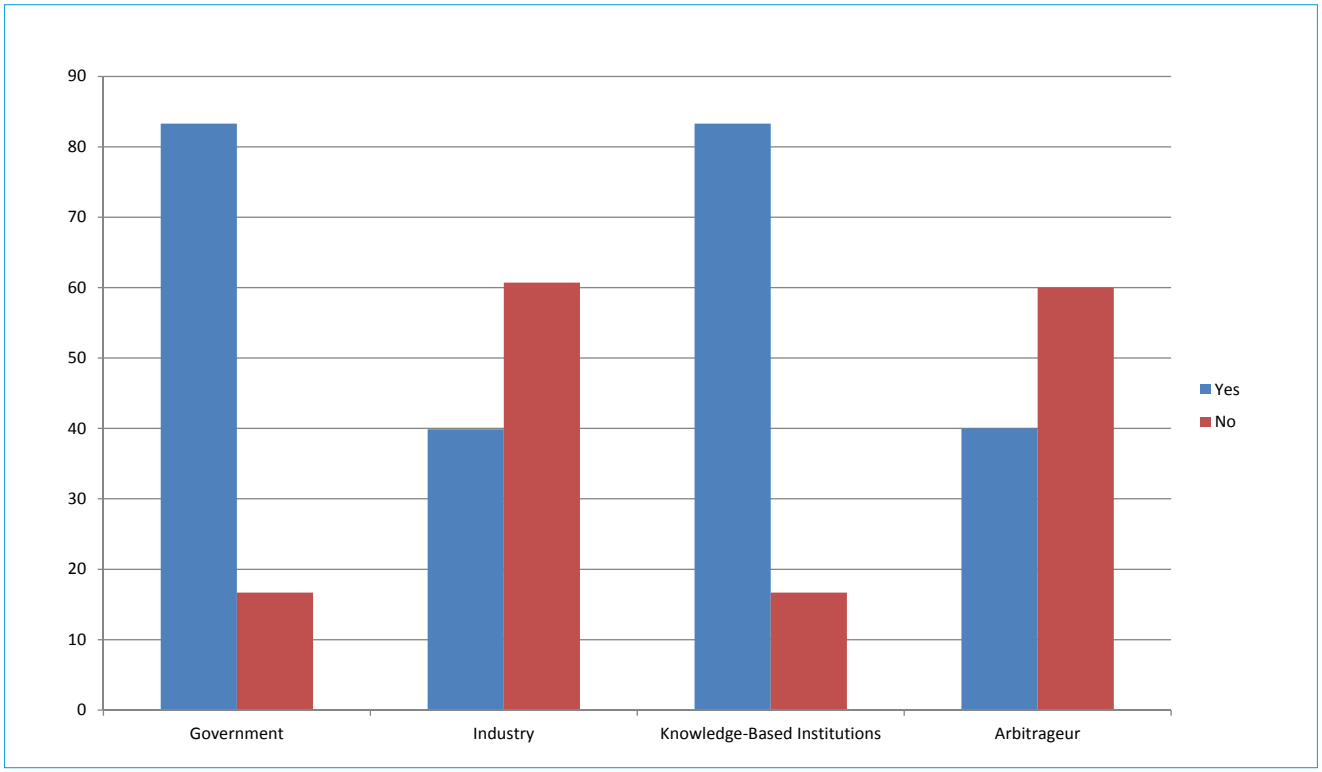
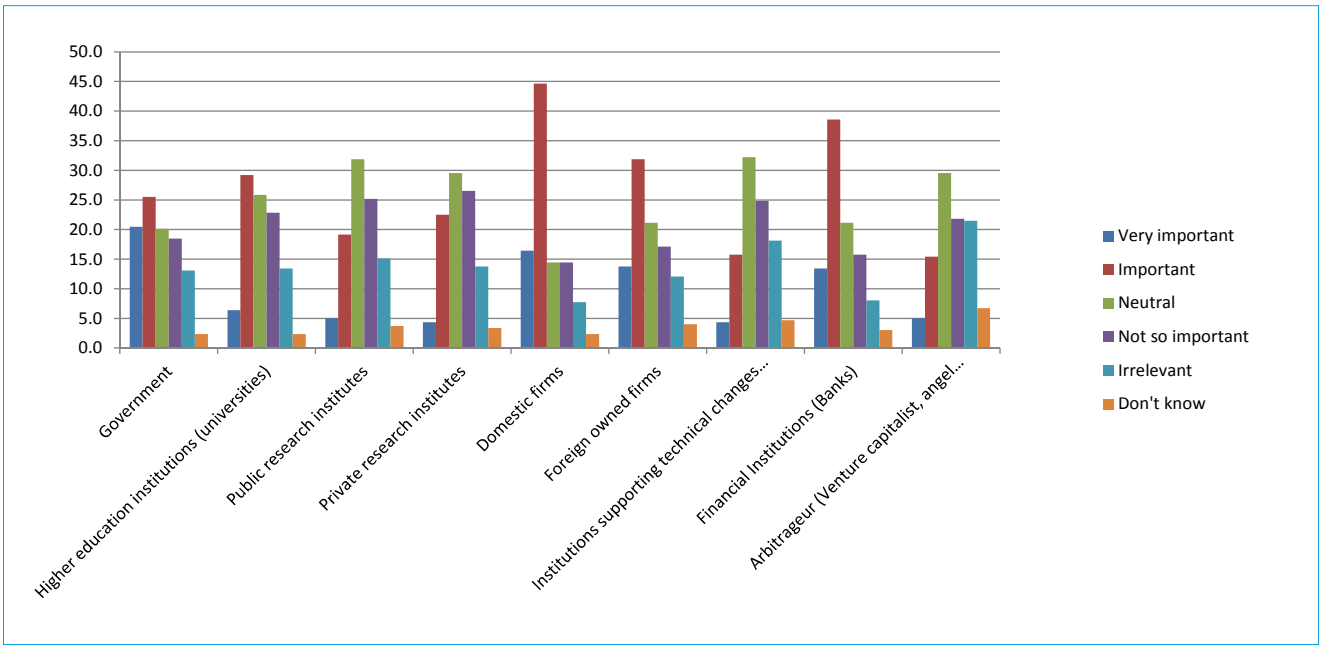


Figure 18. Actor importance.



11.5 Linkages

Before the issue of the linkages between the actors in the CVNSI is brought to the fore, it is important to reiterate the importance of linkages from the perspective of the NSI. For instance, in their critique of the linear approach to innovation, Edquist and Hommen (1999) stress the importance of interactive learning and innovation networks, for which linkages between actors are crucial (Oyelaran-Oyeyinka, 2005). Cavalcante (2011) articulates that interaction between agents through formal and informal linkages can take the form of: joint research and publications; personnel exchanges; patents and licenses; the purchase of equipment, or the transfer of particular technologies or methods for example.

In this light the analysis conducted is threefold: firstly, an understanding of the strength of actor linkages as per actor group; secondly, the type of relationships that are present; and thirdly, who initiates them.

11.5.1 Strength of Linkages

Figure 19 shows the strength of actor linkages with other actors in the system, in percentage terms. In this case, 94.7% of knowledge-based institutions indicate strong linkages with government, which is to be expected as higher education is directly funded by government and the relationship between the two is a traditional one. The next result to emerge as being prominent is knowledge-based institutions' relationships with other higher education institutions. From a system perspective this could be considered as an intra relationship, with 68.5% percent of respondents indicating a strong relationship. Although not low, it is lower than the previous result, which can be interpreted by the fact that there are 9 universities in a country with a population of approximately 0.5 million, and one would expect there to be a great deal of collaboration between the knowledge-based institutions.

However, the fragmented island nature of Cabo Verde needs to be considered, particularly its impact on informal exchange. Additionally, there could be the aspect of competition between institutions, especially when resources are limited. When it comes to the knowledge-base interacting with public research institutions, 52.6% of KBIs feel that there is a strong relationship with public research institutions, and 47.3% with private research institutions. An explanation of this could be the isolated nature of public research institutions and their association with government leading to limited sharing of data and collaboration. The impact of this is less diffusion of knowledge and information, hence a truncation in its practical application. Concerning private research institutions, their focus is more oriented.

With respect to knowledge-based institutions interacting with firms, 63.2% indicate strong relationships with domestic firms and only 42.1% with foreign firms. This will be further elaborated when the type of relationship is examined. In the case of institutions supporting technical change (for example the IGQPI - Institute of Quality Management and Intellectual Property), 52.6%% of knowledge-based institutions' respondents indicate a strong relationship. Finally, knowledge-based institutions' relationships with both financial institutions and arbitrageurs are below 47.4%

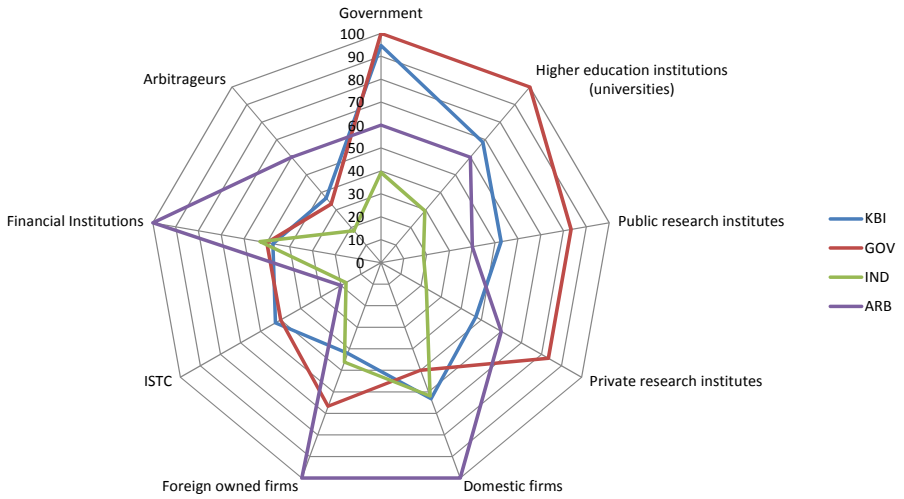
and 36.8% respectively. This low percentage is noteworthy, particularly when understanding the modality of marketisation of R&D and bringing R&D to the market.

From the perspective of the government actor group, and their relationships with themselves, 100% of respondents indicate the relationship to be strong, suggesting strong inter-actor communication. Similarly, 100% of government respondents indicate a strong relationship with higher education institutions. Once again this can be seen to be down to the aforementioned traditional relationship between the two actors. In addition, 83.3% of government respondents indicate strong relationships with public research institutes [34]and 83.4% with private. Conversely, only 50% of government actors indicate strong relationships with domestic firms, which could suggest a challenge when orienting policy incentives and disincentives nationally. Furthermore, just short of 66.7% of government respondents indicate strong relationships with foreign owned firms. This can potentially be explained by the need for controlling foreign activities in Cabo Verde, or due to support of FDI[35]. Lastly, 50% of government respondents indicate strong relationships with institutions supporting technical change and financial institutions, whereas 33.4% indicate strong relationships with arbitrageurs. This could be explained by the nascent stages of the arbitrageur landscape in Cabo Verde.

On examination of the response of industry respondents, in general it can be seen that the majority of respondents indicate a weak relationship with the other system actors, except for with domestic firms with 61.9% of respondents indicating a strong relationship. This is somewhat alarming as it seems to indicate that industry is working in isolation except for well-formed intra-relationships. A minimal number of strong relationships with the knowledge-base potentially alludes to a situation where there is a challenge in sourcing skilled individuals and research not being aligned to industry needs. Alarming still is industry's perception that they do not have strong relationships (39.3%) with government. This clearly shows that there is a divergence with the indications of government.

Finally, in the case of arbitrageur respondents (financial institutions, venture capital and angel investors), 60% indicate a strong relationship with both government and higher education institutions[36]; as well as 40% and 60% with public and private research institutions respectively. The higher percentage of strong interactions with higher education and public research institutions could signal a potential for supporting marketisation of R&D. Other notable results are the indication that 100% or arbitrageur respondents are of the opinion that they are strongly connected to both domestic and foreign firms. This is contrary to the results indicated by industry and their relationships with financial institutions and arbitrageurs, as well as with financial institutions. Similarly, 80% of respondents at institutions supporting technical change indicate a weak relationship (See Figure 20).

Figure 19. ***Actor linkages - strong.***

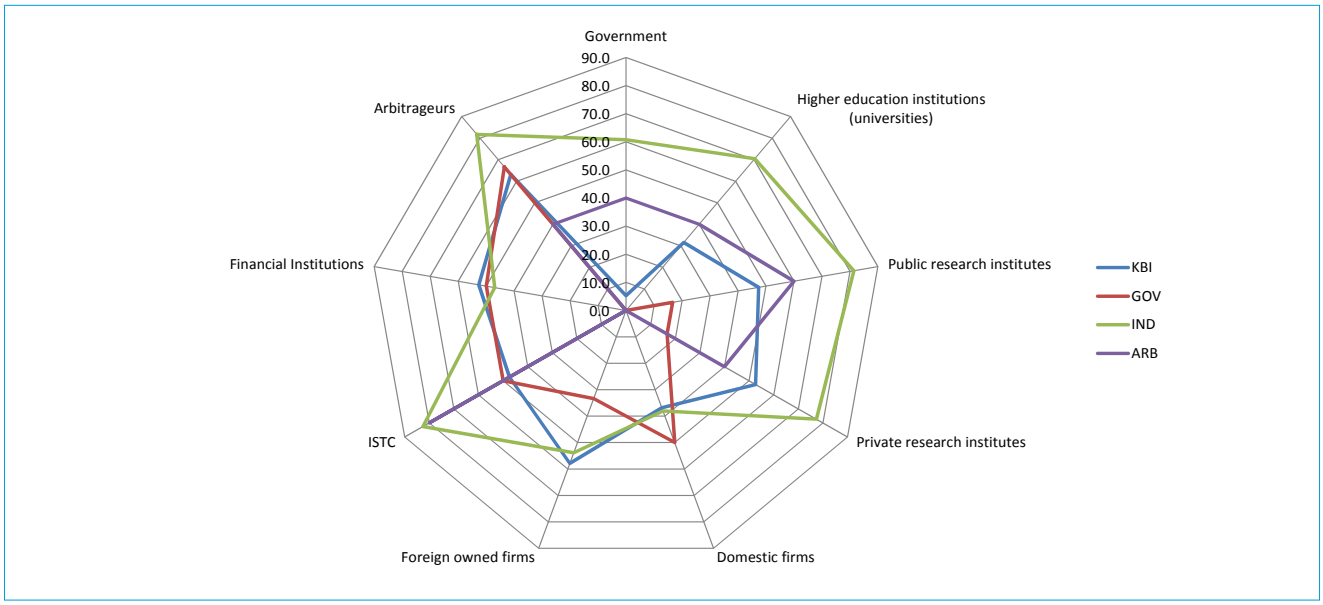


[34] In some cases, there is outreach to public and private research institutes to conduct R&D for the government. This is mainly based on personal contacts.

[35] FIC is an example of a mechanism of an investment trade fair in both St Vincent and Santiago aimed at supporting business exchange and investment. There are both domestic and international firms present.

[36] This could be reflective of the tripartite relationship between PROCAPITAL, PROEMPRESA and PROGARANT.

Figure 20. Actor linkages – weak.



11.5.2 Type of Linkage

The next point of analysis is to determine which type of engagement occurs when an actor engages with players in the system. This can be broken down in terms of inter- and intra-relationships. Firstly, actors are grouped as: i) Government, consisting of government and institutions supporting technical change; ii) Knowledge-based institutions, higher education institutions, public and private research institutes; iii) Industry, consisting of firms; and iv) Arbitrageurs consisting of arbitrageurs and financial institutions. The results that are reported are 50% and above with some exceptions.

Government interactions (see Figure 21) with other government counterparts, or in other words intra relationships, take the form of: contracts[37] (83.3%), joint research (50%), procurement contracts[38] (83.3%), and formal meetings (83.3%) which are expected as a part of formal government structure; informal meetings (66.7%) and seminars[39] (66.7%).

With respect to institutions supporting technical change, the primary mode of exchange is through seminars.

In the case of government interactions with 'knowledge-based institutions' namely higher education institutions, interactions consist of: joint research (66.7%), procurement contracts (50%), formal and informal meetings (66.7%), seminars (83.3%) and recipients of funding (50.8%). To follow, governments interactions with public research institutions consist of: contracts (50%), co-publishing (50%), licensing agreements (50%), procurement 66.7%), formal and informal meetings at 66.7% and 50% respectively, seminars (66.7%) and recipients of funding (50.7%). Finally, with respect to interaction with private research institutes their interaction is in terms of joint research (50.0%) and secondments (66.%).

With the third grouping, 'Firms', the majority of government respondents indicate interactions to be: contracts (66.7%), co-publishing (50%), procurement contracts (50%), formal and informal meetings and seminars (83.3%), (66.7%) and (66.7%) respectively.

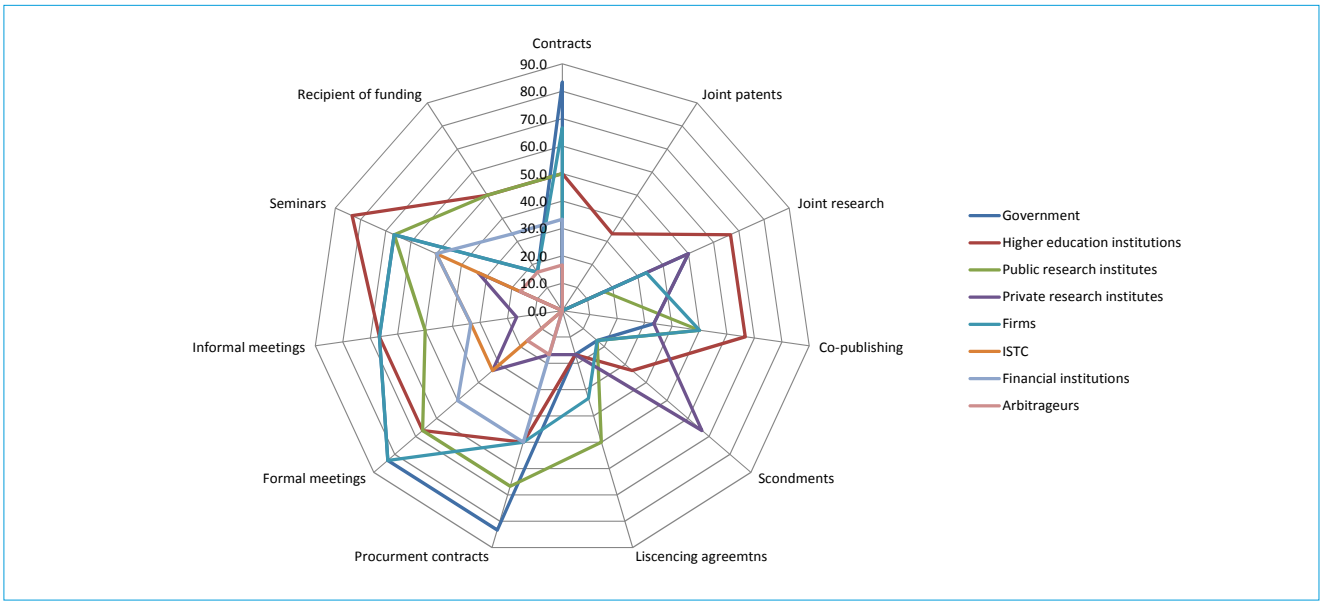
Finally, in the case of governments' interactions with arbitrageurs, in particular financial institutions, 50% of respondents indicate that interaction happens through procurement contracts, formal meetings and seminars. There are no interactions reported of government interacting with arbitrageurs through any of the mechanisms articulated.

[37] Examples include a formal agreement for PROEMPRESSA receiving funds as a part of the ecosystem protocol; and the WEBLAB programme actioned by the Ministry of Education and NOSI.

[38] This is exemplified by: procurement of educational materials by the Ministry of Education from Imprensa National and joint contracted services that appear on the government bulletin; As a part of a procurement contract public institutions' knowledge network Sistema de Integrado de Execução Orçamental e Financeira (SIGOV) was produced and is managed by Nosi.

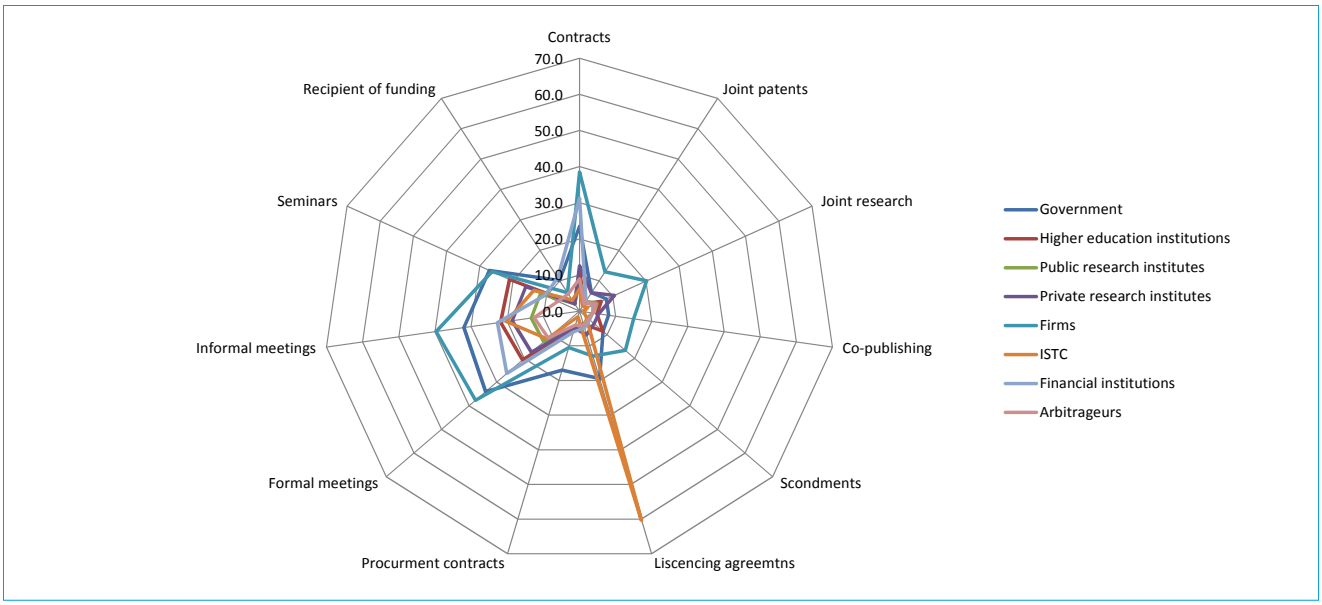
[39] Examples of these include TED'x seminars organised by NGOs but with strong support from the government. Additionally, an example is the CV NEXT - the first National Meeting of Science, Technology and Innovation, promoted by the government, and Science & Technology Week – Promoted by the Ministry of Education40 FIC is an example of this where the platform that helps promote government (NOSI) developed technology solutions which can be licensed.

Figure 21. Government interaction- type.



From the perspective of industry actors, the majority indicated that generally there are no interactions through any of the indicated channels except for licensing with institutions supporting technical change[40] (see Figure 22). Those indications that do not quite reach 50% of respondents but stand out are contracts with other firms and financial institutions (38.5% and 31.2%), formal meetings with firms and government (37.7% and 34.0%) and informal meetings with the same (39.7% and 32.0%). Joint research with other firms also takes place according to 20% of industry respondents.

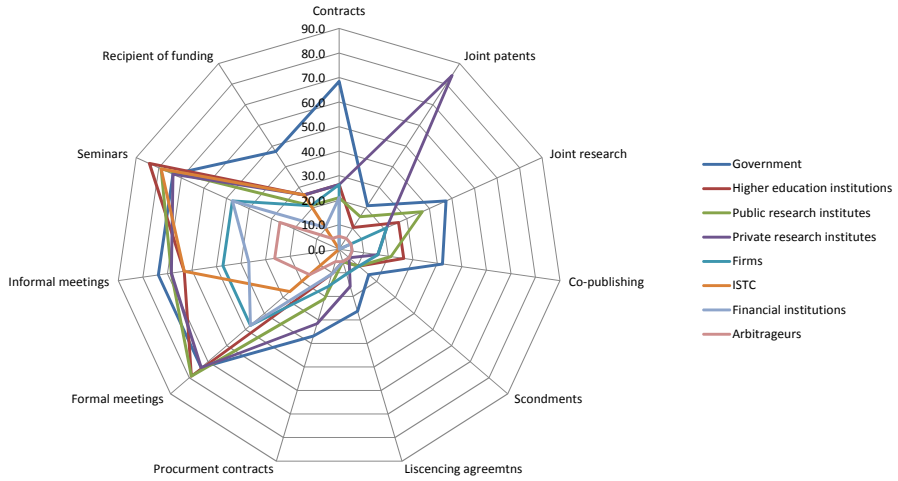
Figure 22. Industry interaction- type.



[40] FIC is an example of this where the platform that helps promote government (NOSI) developed technology solutions which can be licensed.

A description of interactions through the lens of the knowledge-base (Figure 23) shows that the majority indicate intra linkages in the form of formal (78.9 %, 78.9% and 73.7%) and informal meetings (63.2%, 68.4% and 68.4%). Knowledge-based institution interaction with the government actor group emerges to be in the form of formal meetings with government institutions (73.7%), informal meetings (73.7%) and contracts (68.4%). With institutions supporting technical change, informal exchange and seminars rank highly as indicated by 63.2% and 78.9% of respondents respectively.

Figure 23. Knowledge-based institution interaction- type.



In addition to the aforementioned there are a number of results that despite being below 50% of respondents, are never the less noteworthy. Namely, 47.4% of respondents indicate formal meetings, informal meetings and seminars as a means of communication with industry (firms). With the actor group arbitrageurs 47.4%, 36.8% and 47.4% of the knowledge-base indicate formal meetings, informal meetings and seminars as the means to communicate with financial institutions[41]. Additionally, 47.4% and 36.8% indicate joint research with government[42] and public research intuitions[43], while 36.8% and 31.6% indicate procurement contracts with the same respectively[44]. Lastly, from the perspective of arbitrageurs (financial institutions, venture capital and angel investors) (see Figure 24) the majority of actors (60%) indicate that intra-linkages consist of formal and informal meetings. Also, joint patents emerge as an intra-link, however this result seems to be anomalous and further research would be required.

In terms of inter linkages with other actors, formal and informal meetings[45] emerge with knowledge-based institutions, more specifically private research institutions.

11.5.3 Directionality of Linkages

The previous sections elucidate which actors are interacting as well as how they are interacting. In order to effectively support the system through the correct incentives or disincentives there is the need to also understand the directionality of interaction. In other words, it is important to understand who initiates dialogue.

Firstly, in the interaction between industry and the other actors of the system, industry respondents are clear that they are the ones who initiate any interaction with the other actors. In the case of government, the majority of respondents indicated that it is the partner institution that initiates any interaction. In the case of knowledge-based institutions,

[41] A programme of triangulation exists between PROCAPITAL, PROEMPRESA and PROGARANTE. Focus is on subsidized finance, technical assistance and a guarantee for small and medium enterprises but not exclusively. PROEMPRESA as a part of the network reaches out to KBIs to support spin-offs.

[42] There is the indication that a number of academics are contacted through personal connections in order to conduct research. This is not formalised and the government should see knowledge-based institutions as a resource.

[43] A number of academics are individually engaged with government institutions to provide research support. This was seen to be the case when academics from the University Jean Piaget were interviewed. However, this is normally though private contacts rather than any formalised mechanism.

[44] A number of academics are working part time and using the rest of their time working with industry or having a company of their own. With these academics there is a higher tendency to react to government calls for tender. Once again this is not formalised with the university but rather on a one-to-one basis.

[45] Currently PROCAPITAL is in the final stages of formalising its set-up. Discussions have been underway during this consultative process. At the time of writing this report, discussions are underway with the financial regulators for final clearances.

Figure 24. ***Arbitrageurs interaction- type.***

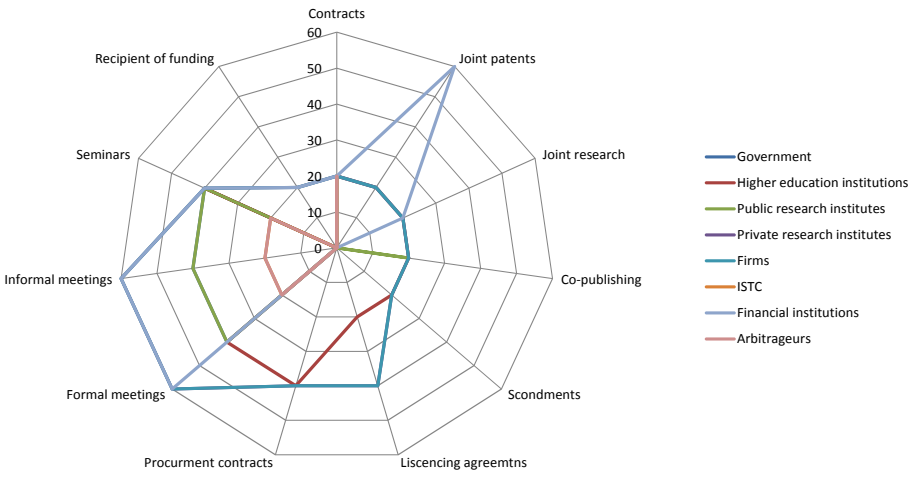


Figure 25. ***Industry perception – directionality.***

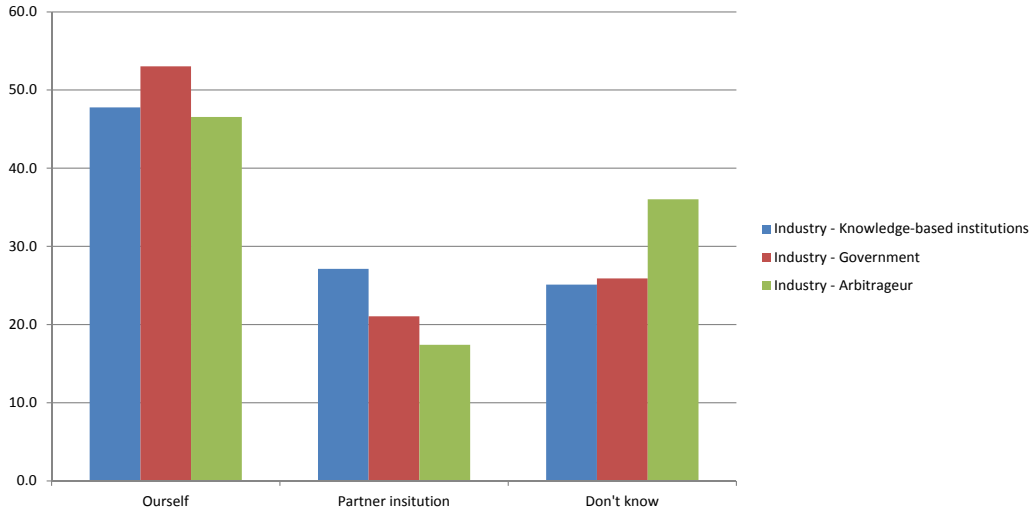
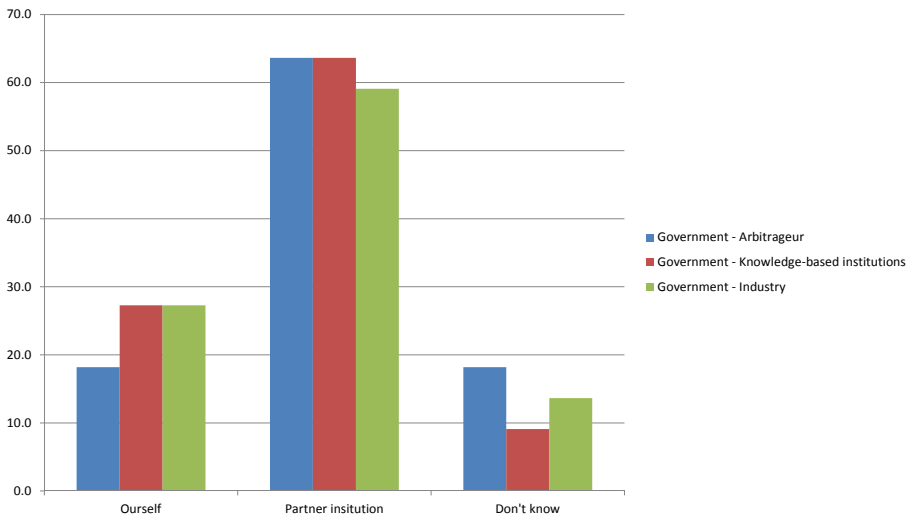


Figure 26. ***Government perception – directionality.***



the majority indicate that they initiate interaction with the government. However, in the case of their engagement with industry and arbitrageurs, the majority indicate that they are unaware of who initiates the interaction. In the case of knowledge-based institutions, the majority indicate that they initiate interaction with the government. However, in the case of their engagement with industry and arbitrageurs, the majority indicate that they are unaware of who initiates the interaction.

And finally, in the case of arbitrageurs, the majority of relationships are initiated by partner institutions, all except for that with government, where respondents indicate the relationship is initiated by themselves in equal measure. Surprisingly, there is a proportion of actors who are unsure of who initiates the relationship, particularly as there a so few actors in the CVNSI landscape. What is clear overall is that, in general, arbitrageurs maintain a relatively passive stance rather than actively exploring the potential for new

Figure 27. ***Knowledge-based institution perception – directionality.***

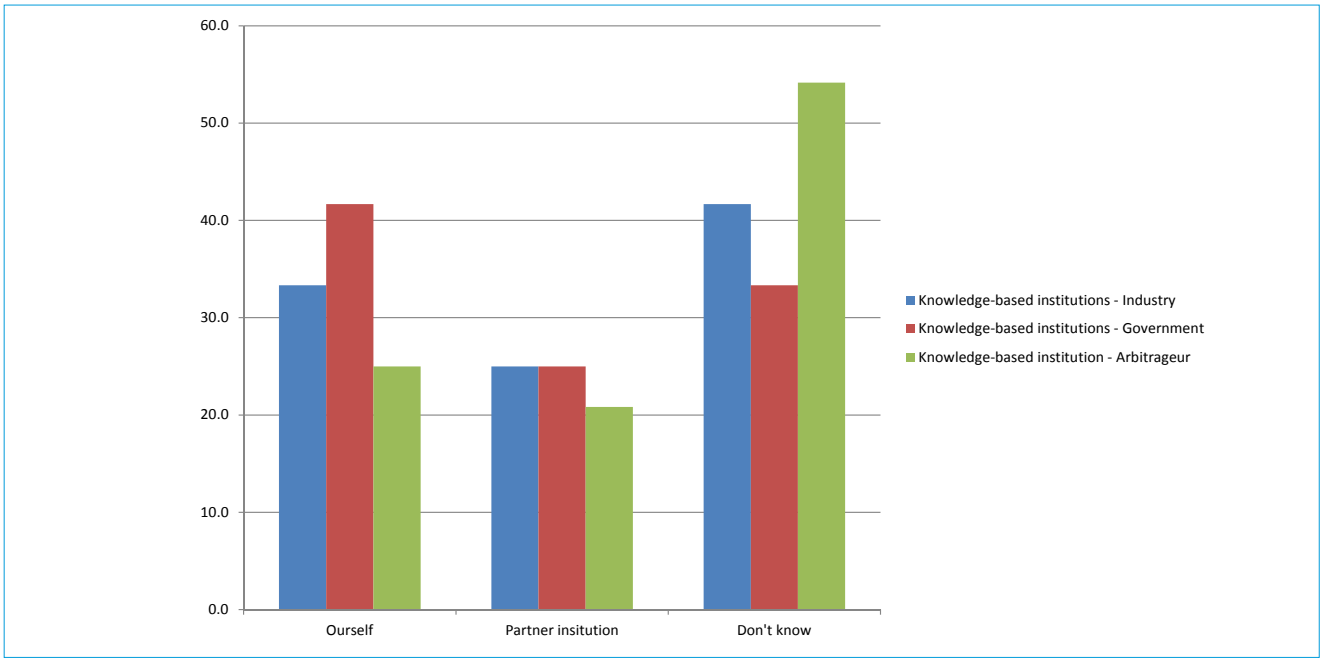
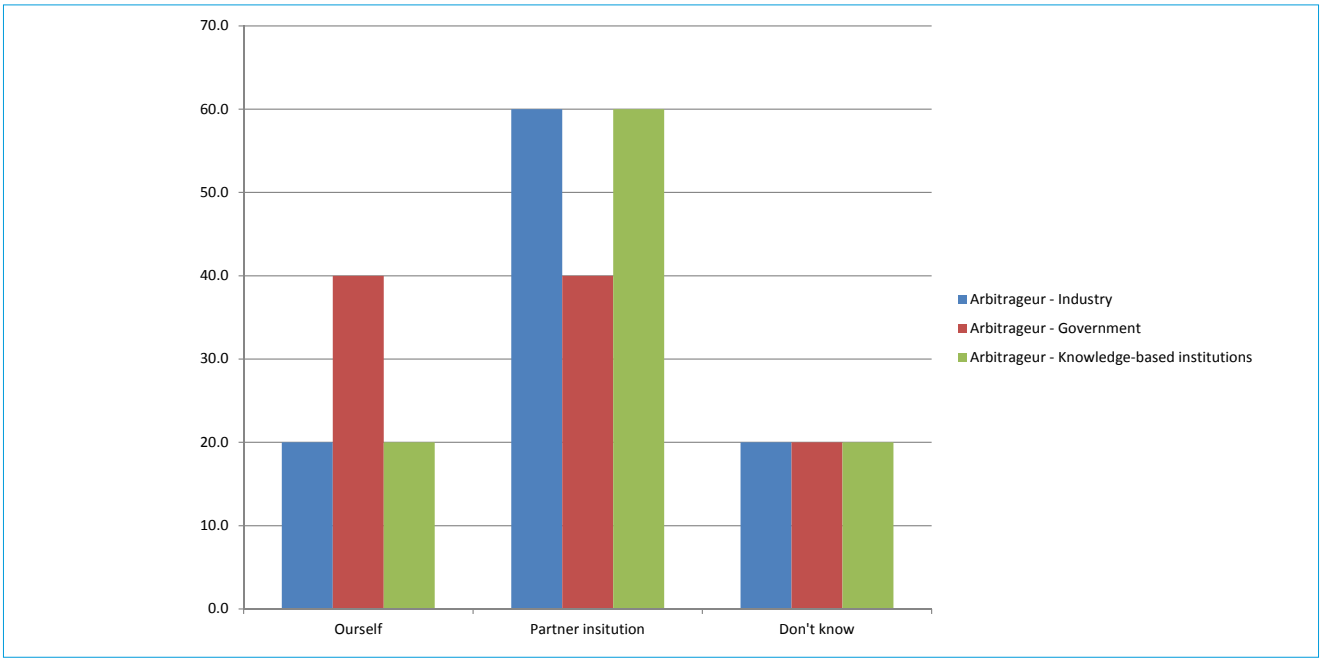


Figure 28. ***Arbitrageur perception – directionality.***



investment in innovation. The rational could well be that the venture capital industry is still at its nascent stages in Cabo Verde, and that demand for services exceeds supply. On reflecting on the results articulated thus far, it is clear that industry, and to a lesser extent knowledge-based institutions, are the drivers of interaction. In the case of knowledge-based institutions, they seem to reach out to work with other partners for knowledge exchange (Figure 23). Whereas in the case of industry, it is primarily contracts and licensing that is the rationale for exchange (Figure 22). The larger questions that arise are: How can the existing channels for exchange be bolstered? What is required to make the environment more conducive to broadening the types of communication? These aspects are important for targeted policy.

11.6 Latent Factors Barriers to Innovation

It is crucial to understand which barriers to innovation are significant. To this end, analysis is used to indicate the underlying factors that significantly influence barriers to innovation, which enables evidence-based policy design to be targeted specifically and accurately to remove the highest barriers to innovation in prioritised sequencing. Factor analysis condenses observed variables into factors in a pattern matrix (clusters of inter-correlated variables) with 'mutual interdependence' (Gaur, 1997). The factors represent the underlying structure that is responsible for the variation of variables in the data and thus the population (Kim Jae-On and Mueller 1978). The next section aims to articulate this both from the system perspective, as well as from the level of each individual actor.

11.6.1 Description of Table Structure

The column 'Factor Number' indicates the descending rank order (by importance) of the factor, which influences the sets of barriers to innovation variables. The column 'Factor Name' provides a description for the grouped variables influenced by the factor and enables meaningful policy discussion of the barriers to innovation. The factor names are assigned based on the factor loading of the variables taking the higher loading variables into consideration as well as judicious use of empirical evidence and theory in the literature of NSI. The naming of factors therefore reflects the variables that are most influenced by the underlying factor, and hence there are commonalities and differences regarding actor responses. Furthermore, the column 'Factor Loading' indicates the correlation between factors and variables, i.e. the extent to which the factor influences the variable. The column 'Cronbach's Alpha' indicates the internal consistency and reliability of the factor, and hence the cohesion of variables as a group. The dominant heuristic, or commonly accepted rule of thumb for describing internal consistency and reliability using Cronbach's Alpha, is indicated in Table 10 (George and Mallery, 2003; Kline, 1999; Cortina, 1993).

For the purpose of policy analysis, factors influencing groups of variables with Cronbach's Alpha below 0.7 are deemed inconsistent and unreliable and are rejected for policy purposes. The factors enable economy-wide policy prescriptions, as well as actor (sector) specific policy prescriptions to be carefully and accurately designed.

The column 'Total Variance Explained' (TVE) indicates the amount of variance (variation) of the groups of variables in the data sample and population, which is accounted for by the factor. It is an indication of the extent or power of the influence of the factor. The column 'Kaiser-Meyer-Olkin' (KMO) is a measure of sampling adequacy. It indicates the robustness of the sample in terms of the distinct and reliable factors extracted (Kim Jae-On and Mueller, 1978). The Bartlett's Test of Sphericity (BTS) indicates the significant confidence level regarding the coherence of factors, reproducibility and generalisability of the results (Kaiser, 1974; Dziuban and Shirkey, 1974, p.359; Kim and Mueller 1978, p.54; Rummel, 1970) (see Table 11). It should be noted that there are only representations provided for all actors as there are more variables than cases, and it also represents the system as a whole. The consequence of this is that the correlation matrix will have linear dependencies and is non-positive definite (NPD), i.e. that some of the eigenvalues of the correlation matrix are not positive numbers which leads to an inability to assess the KMO and Bartlets Test of Sphericity (IBM, 2016). For the individual actors, barriers to innovation are represented as a frequency analysis.

Table 10. ***Internal consistency of factor.***

Internal consistency of factor	
Cronbach's Alpha	**Internal Consistency/Reliability**
a _ 0.9	Excellent
0.9 > a _ 0.8	Good
0.8 > a _ 0.7	Acceptable
0.7 > a _ 0.6	Questionable
0.6 > a _ 0.5	Poor
0.5 > a	Unacceptable

Table 11. Kaiser-Meyer-Olkin (KMO).

Internal consistency of factor	
1	Perfect
> 0.9	Marvelous
> 0.8 > 0.9	Meritorious
> 0.7 > 0.8	Middling
> 0.6 > 0.7	Mediocre
> 0.5 > 0.6	Miserable
> 0.5	Unacceptable

(Source: Kim Jae-On and Mueller, 1978).

11.6.2 Frequency of Actor Barriers and System-Wide Latent Factor Barriers to Innovation

Government

From the perspective of government (see Figure 29) four major dimensions[46] emerge in terms of barriers to innovation. The first dimension can be considered to relate to organizational functions and policy functions. Within this the most striking barriers to innovation in Cabo Verde are 'Organizational rigidities', with 100% of respondents signaling it as a constraint. Along with this 'Lack of explicit policy support' indicated by 80% of respondents, followed by 'Lack of clear national strategy' and 'Hierarchical organizations', as indicated by 60% of respondents respectively. The implications of such is that there is a general inflexibility of organizations in terms of structure, which leads to the inability to adapt and respond to the changing requirements of the system. Consequently, this hinders the innovation process. This is compounded by the fact that there is a lack of strategy and policy direction. This response from government is extremely insightful as it is a reflection of their mindset and how they function, which could be considered an extremely insightful self-critique.

The second prominent dimension relates to investment and associated risks. Here we see that 80% of respondents indicated that 'Lack of finance', innovation costs being too high and 'Excessive perceived economic risk' are crucial barriers to innovation. The implication here seems that the process of taking new ideas to market is not necessarily supported by the financial sector, and perhaps a lack of information acts as a bottleneck in this process, particularly on the side of financial institutions who act in quite a conservative manner. One could speculate that this is compounded by the lack of an effective angel investor network, and that the current venture capital landscape is still at a nascent stage.[47] This is being addressed through the ecosystem protocol, see Info Box 1. As Cabo Verde is progressing along this path of developing its venture capital sector it could look towards the lessons learned from countries such as Mauritius and Singapore who also fall into the category of SIDS, however have moved further along the development path.

ECOSYSTEM PROTOCOL FRAMEWORK

The government is committed to the empowerment of the endogenous business sector and the resumption of private investment in the sectors and areas of interest for national development. It promotes, in partnership with financial institutions, a complete and diversified financing ecosystem and offers financial solutions adjusted to the needs of Cabo Verdean companies.

ECOSYSTEM PROTOCOL FINANCING FOR THE ECONOMY

Partners	
Finance Ministry	50% treasury loan guarantee
Commercial Banks	Credit. Bank financing
Chamber of Commerce, Industries and Services	Dissemination and awareness to members about the lines and modalities of funding
Northern Chamber of Commerce	
Tourism Chamber	
Pró-empresa	Technical assistance to companies

CREDIT LINES

To fill the gaps in the financing of the local business network and to provide financial support to projects that contribute to the strengthening of entrepreneurial capacity, under the Ecosystem Protocol for Financing the Economy, eight (8) financing lines have been created:

[46] These barriers are arbitrarily grouped based on systems of innovation literature.

47 PROMOTOR is currently being phased out and PROCAPITAL is in the process of being established. At the time of writing final approvals are being sought from the national regulatory authority.

Credit lines	
1	Tourism I: treasury support line
2	Tourism II: line of investment support
3	Internationalisation support line: investment support
4	Internationalisation support line: treasury support
5	nnovation support line
6	Line of business investment support
7	Trade support and other services
8	Start up support line
GENERAL FUNDING CONDITIONS *	
Credit lines	
Amount	The limit of the fiches of each line of financing cannot be exceeded.
Interest rate	The credits bear interest at the rate resulting from the risk analysis performed by each bank with a spread of less than 1% of the current rate.
Interest subsidy	The Interest rate will be subsidised up to 50% by the state (only for the Jovem Programme start up).
Warranty	Up to 50% of the amount of credit granted.
Refund	Maximum 15 years, including a maximum grace period of 3 years.
Commissions and other bank charges	Discount of 25% of the current price list.
Own funds	Minimum requirement of 20% of the total financing or up to the minimum defined in the datasheets.
*Each datasheet details the specific conditions of each financing line	

Next to emerge is the dimension of technology dynamics, with 80% and 60% of respondents indicating 'Lack of technology' and 'Lack of technically trained manpower' respectively as barriers to innovation. The indication here is that as technology is an example of embodied knowledge its absence will impact the innovation process. However, what is also noteworthy is that the technology transfer process is extremely complicated, and there are clear and concrete policy orientations to address this, namely: i) the market failure technology policy paradigm; ii) the mission technology paradigm; and iii) the cooperative technology policy paradigm. Each is addressed in turn.

Underscoring the market failure technology policy paradigm, "the free market is the most efficient allocator of goods and services and, left to its own devices, an unfettered market will lead to optimal rates of science production, technical change and economic growth. The market failure policy paradigm recognises that there may be a role for government in science and technology policy when there are clear externalities, i.e. that benefits cannot be captured in the market when transactions costs are extremely high, and when information is unavailable or distorted so that market signals are not clear. According to the market failure paradigm, the government's role in technology transfer should chiefly be limited to removing barriers to the free market through: appropriate intellectual property policies, free trade agreements, neutral impact taxation, and limited regulation of enterprise. The chief role of universities is not as a broker of technology or a commercial competitor but an educator and a provider of public domain research (Bozeman, 2000, pg. 632).

In the case of the mission technology paradigm, it is assumed that "the government should perform R&D in service of well-specified missions in which there is a national interest not easily served by private R&D" (Bozeman, 2000, pg. 632). The cooperative technology policy paradigm that expounds that the "government's role can be as a research performer, including supplying applied research and technology to industry, or as a broker, developing policies affecting industrial technology development and innovation "(Bozeman, 2000, pg. 632).To reflect on the aforementioned indications of the lack of policy orientation as a barrier to innovation, the crucial nature of the link between policy and access to technology for innovation is further underscored.

The final dimension to emerge from government is that of knowledge and information. 60% of respondents indicated 'Lack of information', 'Brain drain', 'Lack of demanding customers' and 'Lack of willingness to share knowledge' as constraints to innovation. The importance of this is that the ability to transfer both the tacit and codified knowledge, as well as information is requisite to competing in a knowledge-based economy. "The flow of technological information, knowledge and skills within the NSI is regarded as the most important thing for the purpose of technological learning and capability building" (Gachino, 2006, pg.18). With this in mind the diffusion of skills and knowledge take place through the mobility of human capital, which is negatively affected by organizational rigidities and brain drain. In the case of CV, the natural barrier being that Cabo Verde is an island nation must be recognised. In turn, brain drain is also linked to the lack of competition through the absence of a professionally

demanding group of the population (Kim, 2001). Seen from perspective of the market, information flow is crucial process particularly as driving innovation through understanding the needs of 'demanding customers' and being able to respond.

At another level, innovation is impacted by the inability to share knowledge, which has two types of implications, namely organizational and within the domain of higher education. Firstly, at the organizational level knowledge sharing is one of the main components in the knowledge management process, which relies heavily on social interaction between members of an organization to expand their own knowledge. It clearly contributes to fostering innovation within an organization and this is highlighted by the fact that rival organizations prize knowledge assets more than financial or physical assets (Aljanabi and Kumar, 2013). Secondly, within the domain of higher education; knowledge sharing is considered to be a building block of efficient performance at universities and can play a key role in enhancing their innovation performance. Conversely, a deficiency in knowledge sharing may result in reduced performance levels and poor quality of education (Aljanabi and Kumar, 2013). From this the question that arises is: What can be done to change this mindset?

Knowledge-based institutions

The next actor's view of perceived barriers to innovation is that of knowledge-based institutions (see Figure 30). Once again, the reporting results show that for over 50% three groupings emerge. Firstly, constrained human capital resources with 63.2% and 52.6% of respondents reporting 'Quality of technically trained manpower' and 'Lack of technically trained manpower' as a constraint to innovation. The implications of this are somewhat self-reflective as the 'Quality of technically trained manpower' is down to the education system[48]. In addition, the 'Lack of technically trained manpower' may result from the lack of opportunities in Cabo Verde and resulting brain drain. To link both barriers and reflecting on Figure 19 (strong linkages) we expound that the low level of interaction between knowledge-based institutions and industry could be as a result of a lack of understanding of industry needs and requirements. As a result, skilled human capital is lacking and there are reduced opportunities, as a result the net migration effect is exacerbated. The overall implication is that there is the need to reorient through recalibrating curricula that have greater interactions with industry. This could be achieved through formalising the channels of exchange between the knowledge-base and industry rather than it being based on informal contacts.

The next grouping can be described as unsophisticated markets, with 63.2% and 57.9% of respondents indicating 'Lack of innovative customers' and 'Lack of demanding customers' respectively as a constraint to innovation. Market sophistication reflects the readiness of the overall marketplace to adopt innovation. "Sophisticated markets recognise the benefits of innovations earlier and have higher expectations about innovation-related benefits (Morrison, Roberts, and Von Hippel, 2000)" in Voss, Montoya-Weiss and Voss (2006, pg.297). With this in mind, an unsophisticated market inhibits the innovation process.

The last barrier that is presented as a constraint on innovation, by 57.9% of respondents, is 'Excessive perceived economic risk'. By this we mean that the financial risk associated with innovation is too high. This can be explained by the fact that the venture capital and angel investor landscape in Cabo Verde is underdeveloped, and, as indicated in Figure 20, the level of interaction between the knowledge-base and financial institutions (banks) is low. The implication of this is that few people take the risk to take ideation to market.

Industry

In reporting the perceptions of what industry actors consider barriers to innovation it is clear (Figure 31) that the majority of respondents in all cases indicate all barriers listed to be a constraint on innovation.[49] However, there are some noteworthy indications which emerge as a higher constraint as compared to the rest (numbers above 45% being reported). Firstly, in terms of ranking (highest to least) 'Lack of finance' is considered a high constraint by 59.1% of respondents. Next, 'Lack of information' is considered by 49.4% of respondents as a constraint. This is followed by 'Excessive perceived economic risk' with 48.2%. Then, 'Hierarchical organizations' with 47.8% and 'Organizational rigidities' with 47.0%. The 'Lack of ICT capacity' and 'Restrictive public / governmental regulations' were considered as constraints by 46.6% of respondents and and finally 'Lack of clear national innovation strategy with 46.6%.

What immediately emerges from this is that government orientation and direction, albeit a constraint, is the least of industry's worries. This indicates a level of self-reliance, underscored by Figure 20 which shows a low level of engagement with government, and Figure 25 that indicates that when there is an interaction it is initiated by industry. This can be explained by the fact that they find public regulations restrictive in Cabo Verde.

Another area that emerges is finance and information as a constraint. To reiterate what was previously highlighted, organizations prize knowledge and financial assets as both contribute to innovation. When both are accessible as needed, economic risk and uncertainty is reduced. Furthermore, the

[48] Follow-up discussions with knowledge-based institutions revealed that there is a challenge in transitioning from secondary education to tertiary education. Better attention needs to be paid on the quality of skills developed. There are possibilities to provide additional support, however this requires additional resources.

[49] There is the need for a sectorial breakdown.

fragmented island nature of Cabo Verde acts as a natural barrier for communication and the flow of information and knowledge. ICT is a proven means to overcome this, acting as a conduit for enhancing the stocks and flows of data, information, and knowledge. Having said this, ICT capacity is deemed a constraint by industry respondents.

Arbitrageur

The final interpretation of actor perceptions of barriers to innovation is that of arbitrageurs (venture capital, angel investors and financial institutions) (see Figure 32). The first difference between the responses from other actors is that not all the potential barriers listed are considered a constraint. 60% of arbitrageur respondents indicate 'Quality of technically trained manpower', 'Rate of access to ICT' and 'ICT capacity' a low constraint. From this articulation, the questions that emerge are: i) What is being experienced by arbitrageurs that is not by government and knowledge-based institutions with respect to 'Quality of technically trained manpower'?; ii) With respect to 'ICT capacity' and 'Rate of access to ICT' why is their view convergent with that of government, and divergent with that of both industry and knowledge-based institutions?

When focusing on what is considered a constraint to innovation, again convergence with the view of government respondents emerges. The first arbitrary dimension could be considered to be that of organizational functions and policy functions, associated with the barriers 'Organizational rigidities'[50], 'Lack of explicit policy support', 'Lack of clear national innovation strategy', and 'Hierarchical organizations' with indications from 100%, 80% and 60% of respondents respectively.

The second grouping is that of investment and associated risks. Here we see that 80% of respondents indicated that 'Lack of finance', 'innovation costs (too high)' and 'Excessive perceived economic risk', are crucial barriers to innovation.

The third grouping is knowledge and information, with 60% of respondents indicating 'Lack of information', 'Brain drain', 'Lack of demanding customers' and 'Lack of willingness to share knowledge' as constraints to innovation. One could say that the only variation from the government view point is that of 80% of respondents indicating 'Lack of technology (technology gap)' as an additional constraint.

It is important to note that arbitrageurs are of crucial importance to the innovation process as both internal and external knowledge is required. The result of which is the emergence of new business models and new types of companies. As such, knowledge brokers and venture capitalists aim to fill this gap through the provision of links to sources of knowledge and technology, thus minimising the risk for firms, improving their performance and survival rate as well as accelerating and increase the effectiveness of their innovation processes (Zook, 2003; Hargadon, 1998; Baygan and Freudenberg, 2000). Their resource allocation role is based on the assessment of advantages in information asymmetries (Williamson, 1969, 1971, 1973). The emergent question is currently how effective is this?
On reflection of the above there seems to be an overall convergence with the views of government. This could be attributed to strong linkages and good channels of communication. This aligns with and supports the findings in Figure 19, which presents 60% of arbitrageurs indicating a strong relationship with government.[51]

All actors

The previous sections have provided an indication of the barriers perceived by the respective actors, the results being presented as frequency analysis. However, one limitation of this is that the frequency analysis lacks signification. Consequently, in addition to the actor level description analysis, and in order to concentrate the critical lens of analysis, factor analysis was applied to the entire data set as to ascertain the perceptions of the system as a whole.

From the analysis of all actors (see Table 12) four factors emerge which account for 66.8% of the total variance explained. This indicates that in this instance the original groups of variables, 'Unsophisticated market knowledge', 'Financial regulations', 'ICT protocol incapacity/incapability' and 'Poor human capital', are not very strongly correlated.

Factor 1- 'Unsophisticated market knowledge' is the most significant factor barrier to innovation and accounts for 48.5% of the total variance explained (TVE). It shows the importance of markets in driving innovation through: demanding customers, innovative customers and competition, as well as the requisite information and knowledge flows. When examining the factor loading in order to understand the relationship of each variable to Factor 1, 'Lack of demanding customers', 'Lack of competition' and 'Brain drain' are deemed to be excellent, and 'Lack of willingness to share knowledge' as good[52] (Tabachnick and Fidell 2007; Comrey and Lee 1992).

Factor 2- 'Financial regulations' has two variables negatively loading on the factor, these being 'Lack of finance' and 'Lack of explicit policy support'. The TVE, amounting to 6.7%, and the

[50] From the perspective of the venture capital sector there is the view that banks are very traditional in their outlook. There is a lack of flexibility when looking at what can be invested in and the decision-making apparatus is often slow to react. In an effort to overcome this and streamline the decision-making process the triangulation between Procapital, PROEMPRESA and Prograant has been initiated. Procapital will provide venture capital, progarant will provide the financial guarantee and PROEMPRESSA will assist in monitoring and providing technical assistance to the projects.

[51] PROCAPITAL is a government venture capital fund.

[52] Factor loading 0.32 (poor), 0.45 (fair), 0.55 (good), 0.63 (very good) or 0.71 (excellent).

Figure 29. ***Government barriers.***

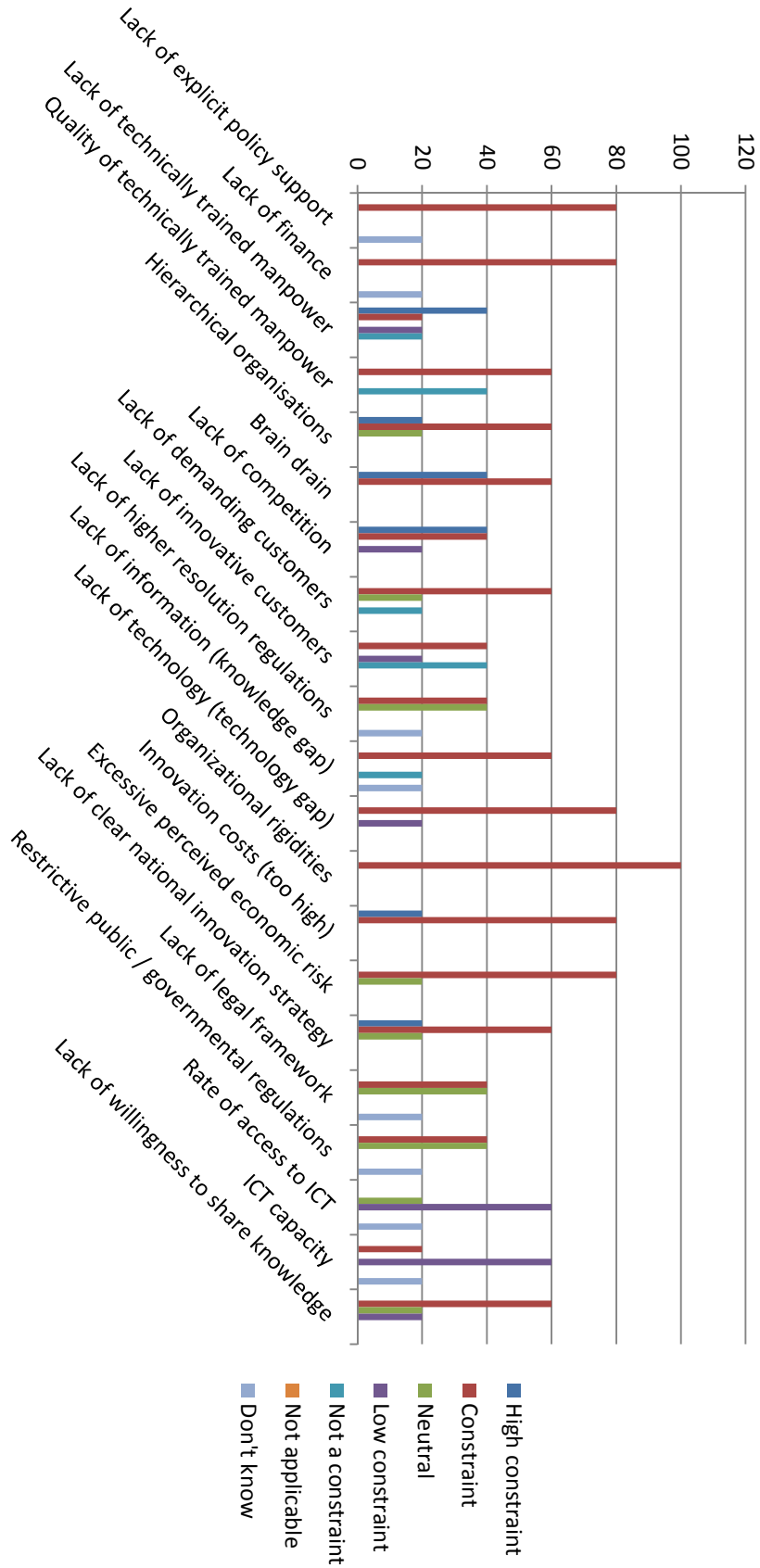


Figure 30. ***Knowledge-based institution barriers.***

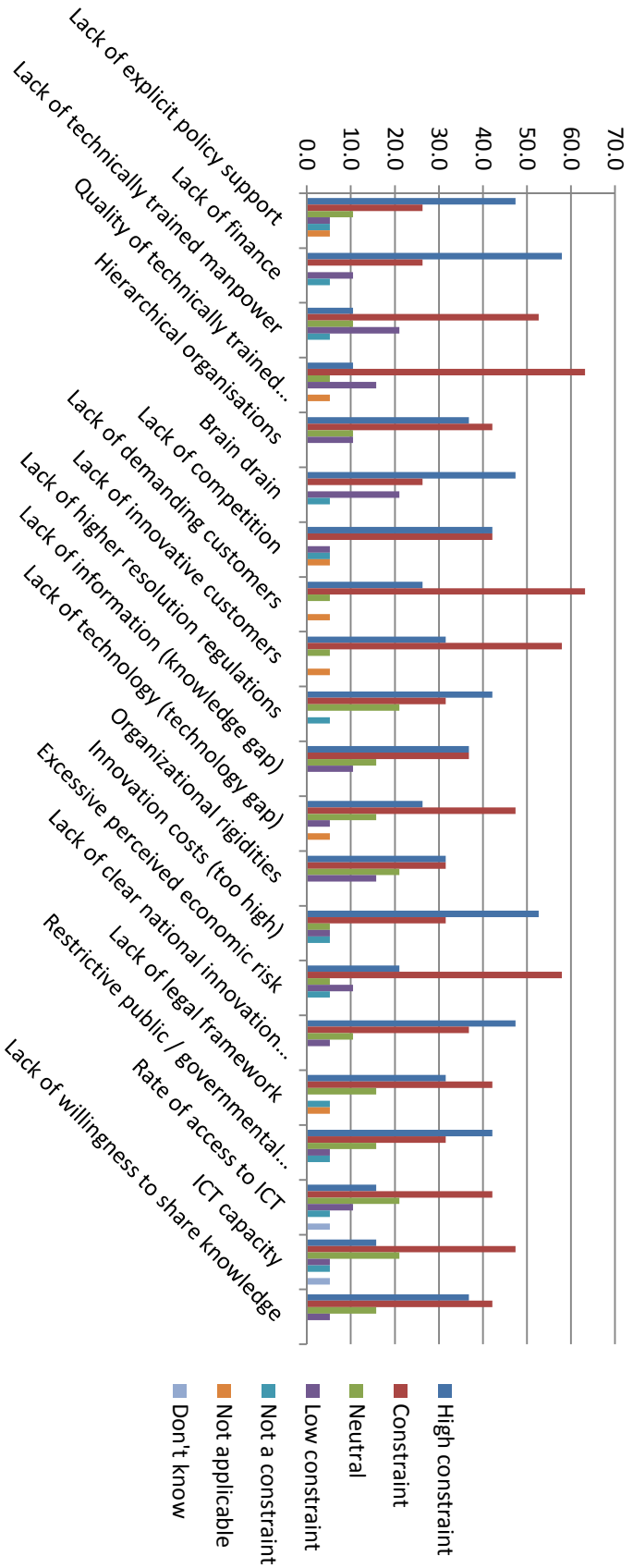


Figure 31. ***Industry barriers.***

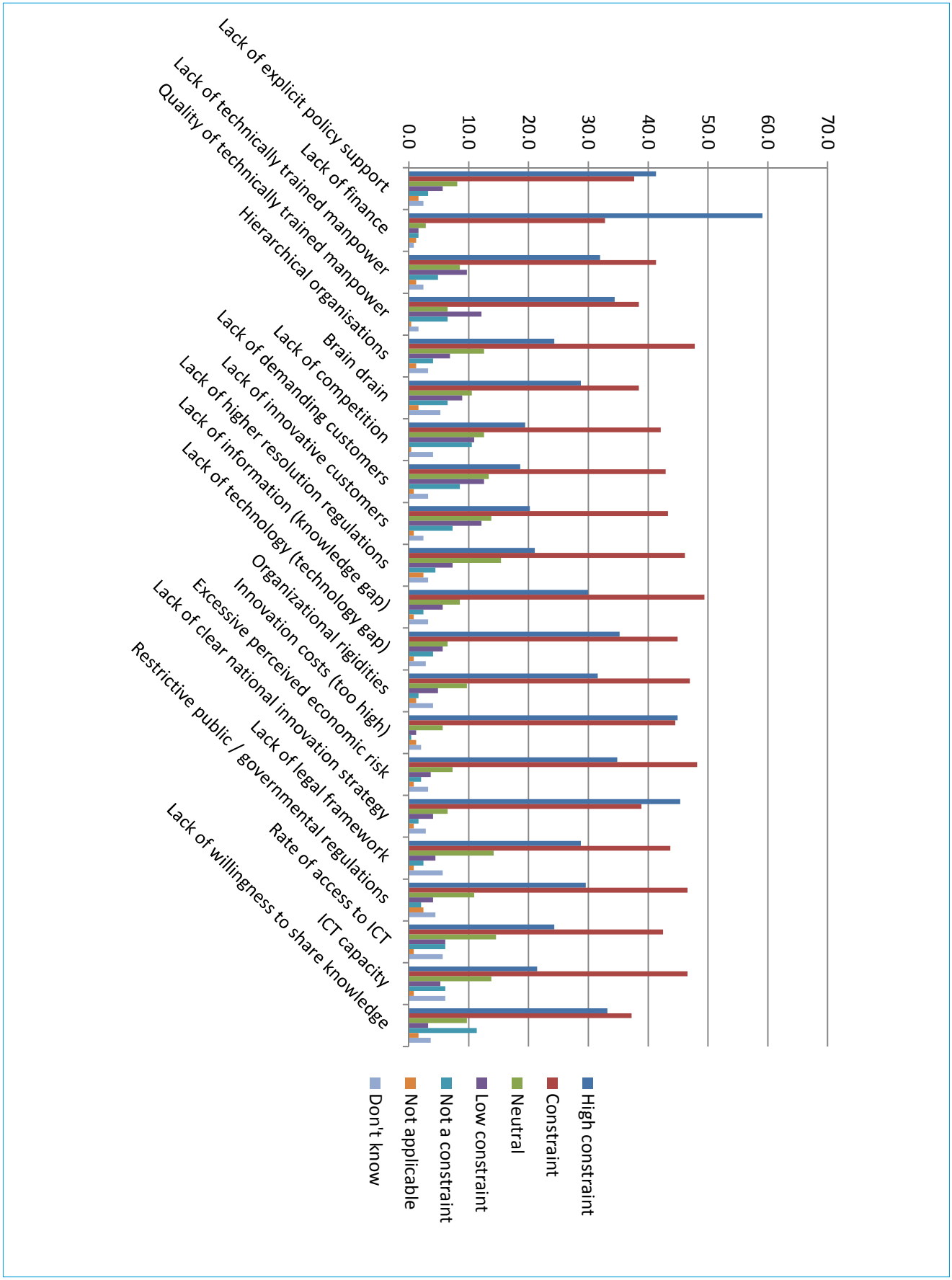
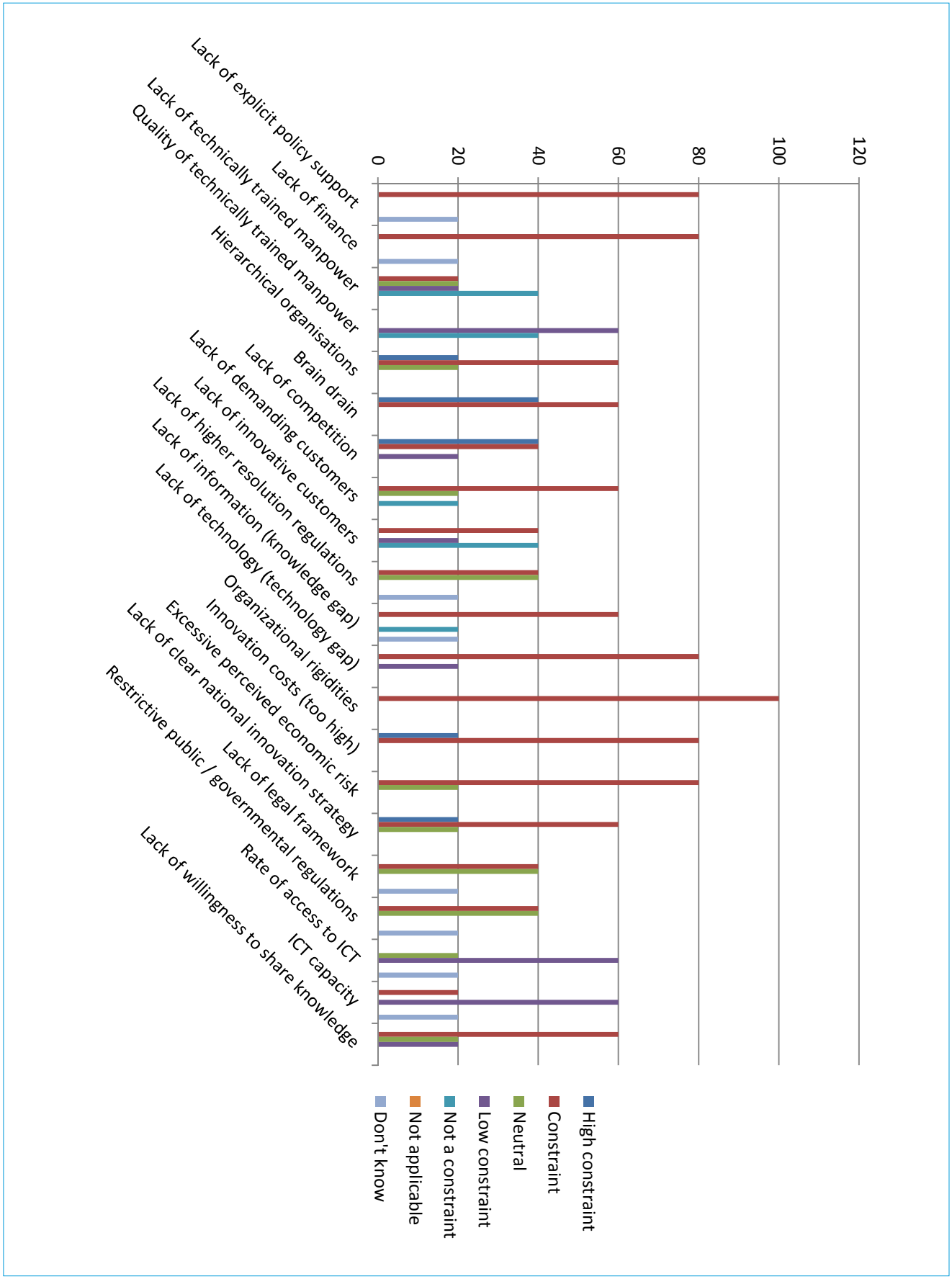


Figure 32. Arbitrageur barriers.



relationship of each variable can be categorized as excellent. Factor 3 – 'ICT protocol incapacity/incapability' only accounts for 5.9% of the TVE with 'Rate of access to ICT', 'ICT capacity', 'Lack of legal framework' and 'Restrictive public / governmental regulations' negatively loading on it. The association between the variables and the factor are excellent for the first three and very good for the last.

The final factor – 'Poor human capital' accounts for 5.6% of the TVE, with the variables 'Quality of technically trained manpower' and 'Lack of technically trained manpower' being associated as very good and good respectively.

Factors 2, 3 and 4 are significant but collectively only account for 18.3% of the TVE. Factor 1 ranks as the most important factor as it contributes close to 50% of the TVE and should be the main focus of system-oriented policies. On examining Factor 1, in comparison with previous results this could be said to support the findings of government (represented in Figure 29) where the arbitrary grouping of variables fell along similar lines. Once again this expounds the importance of information and knowledge flow from the market as a driver for innovation.

The overall implications for policy emerging from the analysis of barriers to innovation is that resources should be used on two levels. Firstly, at the individual actor level in order to address the specific needs, and secondly more overarching interventions at the level of the system. Each of these will be articulated in Chapter 12. A structured dialogue between stakeholders is required to orient which policies can be most effectively used to address barriers and challenges. Policies and their targets should not be unattainable or 'out of reach' but issues need to be addressed from a realistic perspective.

11.7 Policy success and latent factors

Having understood barriers to innovation, both at the actor and system level, it is important to ascertain how actors perceive various policies, and consequently, an understanding of whether or not they are effectively calibrated and configured. To begin with, it is important to understand what public policy instruments are, they can be defined as "a set of techniques by which governmental authorities wield their power in attempting to ensure support and effect (or prevent) social change" (Borras and Edquist, 2013., pg.1515). Unsurprisingly, the objectives of innovation policy have to do with the different national traditions and forms of state-market-society relations, not to mention the orientation of governmental ideology.

Generally speaking there are three main categories of policy instruments: i) Regulatory frameworks[53]; ii) Economic and financial instruments[54]; and iii) Soft instruments.[55] Phrased differently, these can be considered as "sticks', "carrots" and "sermons". In this vein, the respective perceived success or failure of national policies is reviewed grouping them as per the aforementioned classifications.

An alternative way to classify innovation policy is in terms of supply-side measures and demand-side measures (see Figure 33). Supply-side policies are seen to create a supply push to innovate (Voß and Simons, 2014); whereas "demand-side innovation policies are defined as all public measures to induce innovations and/or speed up diffusion of innovations through increasing the demand for innovations, defining new functional requirement for products and services or better articulating demand" (Edler and Georghiou, 2007., pg. 953). Supply-side measures can be further split into the grouping of finance (equity support, fiscal measures, support for public research, support for training and mobility, and grants for industrial R&D) and services (information and brokerage support and networking measures). Demand-side policies can be presented in four main groupings: systemic policies, regulation, public procurement, and stimulation of private demand (Edler and Georghiou, 2007).

Using this classification to order the policy instruments of Cabo Verde, the following groupings emerge: i) Supply-side finance policies include – research grants, subsidised loans,

[53] "The first type, regulatory instruments, use legal tools for the regulation of social and market interactions. The logic behind this type of instrument is the willingness from the government to define the frameworks of the interactions taking place in society and in the economy. Naturally there are many different types, but common for them all is that these regulatory instruments (laws, rules, directives, etc.) are obligatory in nature, meaning that actors are obliged to act within some clearly defined boundaries of what is allowed and what is not allowed. Obligatory measures are typically backed by threats of sanctions in cases of non-compliance. These sanctions can be very different in nature (fines and other economic sanctions, or temporary withdrawal of rights), depending on the content of the regulation and the definition of legal responsibility. Some authors believe that sanctioning is the most crucial property of regulatory instruments (focusing on the imposition and hierarchical side of regulation). Others see the normative authority of governments as the most important feature of these instruments (hence focusing on the normative-positive side of obligatory regulation). From the point of view of innovation policy, regulatory instruments are often used for the definition of market conditions for innovative products and processes" Borras and Edquist, 2013., pg.1516.

[54] "Economic and financial instruments provide specific pecuniary incentives (or disincentives) and support specific social and economic activities. Generally speaking, they can involve economic means in cash or kind, and they can be based on positive incentives (encouraging, promoting, certain activities) or on disincentives (discouraging, restraining, certain activities)" Borras and Edquist, 2013., pg.1516.

[55] "Soft instruments are characterized by being voluntary and non-coercive. With soft instruments, those who are 'governed' are not subjected to obligatory measures, sanctions or direct incentives or disincentives by the government or its public agencies. Instead, the soft instruments provide recommendations, make normative appeals or offer voluntary or contractual agreements. Examples of these instruments are campaigns, codes of conduct, recommendations, voluntary agreements and contractual relations, and public and private partnerships. These instruments are very diverse, but generally based on persuasion, on the mutual exchange of information among actors, and on less hierarchical forms of cooperation between the public and the private actors." Borras and Edquist, 2013., pg.1516.

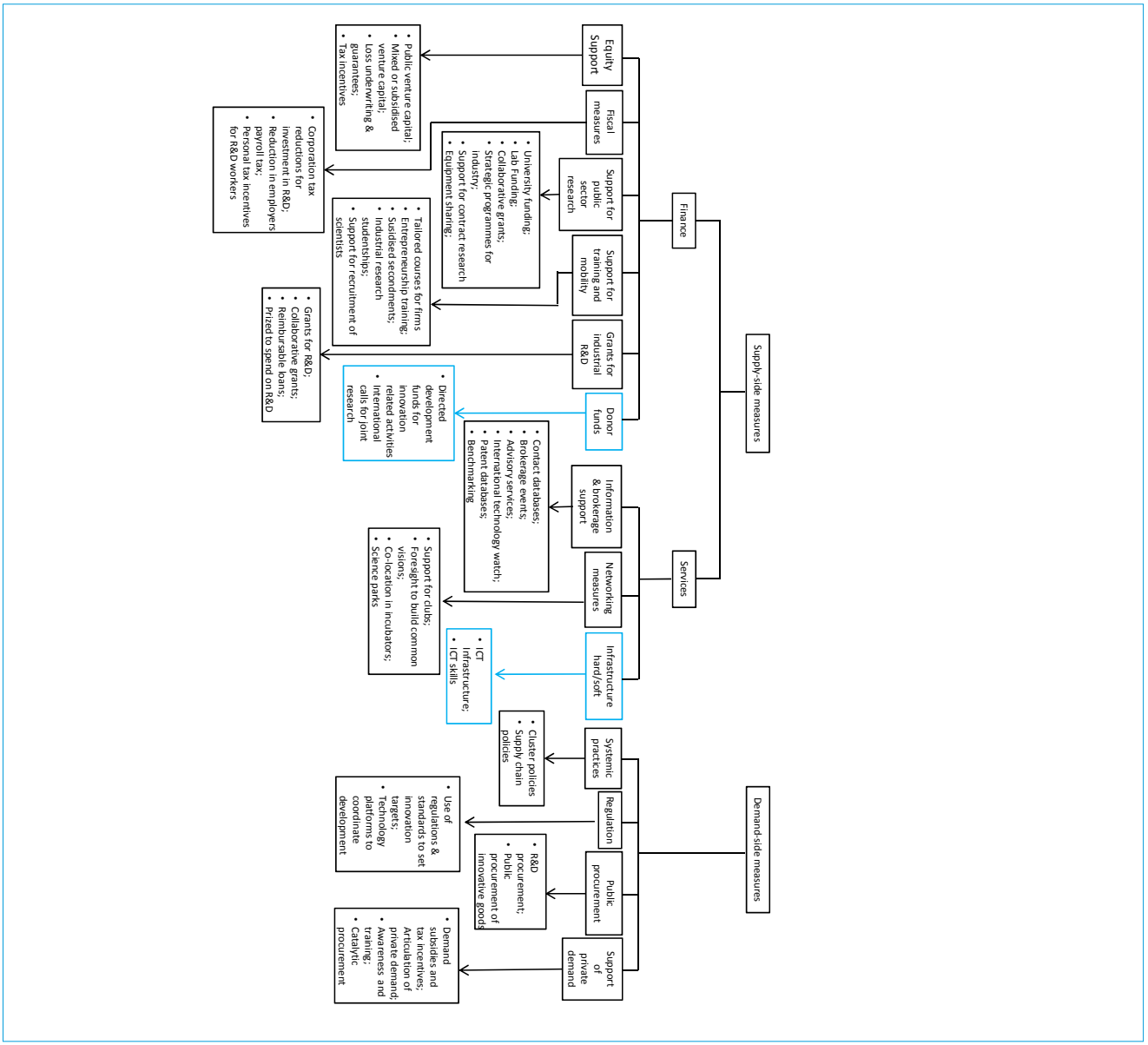
System-wide factor barriers									
Factor Number	**Factor name**	**Variables**	**Factor loading**	**Cronbach's alpha**	**Total variance explained**	**KMO**	**Bartlet's Test of Sphericity**		
							Chi Squared	Df	Sig
1	Unsophisticated market knowledge	Lack of demanding customers	0.898	0.847	48.5%	0.917	4324.565	210	0. 000
		Lack of competition	0.874						
		Lack of innovative customers	0.798						
		Brain drain	0.711						
		Lack of willingness to share knowledge	0.553						
2	Financial regulations	Lack of finance	-0.862	0.776	6.7%				
		Lack of explicit policy support	-0.861						
3	ICT protocol incapacity/ incapability	Rate of access to ICT	-0.983	0.873	5.9%				
		ICT capacity	-0.888						
		Lack of legal framework	-0.726						
		Restrictive public / governmental regulations	-0.669						
4	Poor human capital	Quality of technically trained manpower	0.635	0.879	5.6%				
		Lack of technically trained manpower	0.596						
				Cumulative total	66.8%				

Table 12. System-wide factor barriers.

government backed venture capital, donor funds, labour mobility (laws and incentives); ii) Supply-side services include – ICT access. The demand-side measures are – tax breaks, standard setting and regulation. The system as whole, as well as the views of each of the individual actors will be reviewed to understand how successful policy is through the aforementioned lens.

For government respondents the majority believe that most of supply-side financial measures (research grants, tax breaks, subsidised loans, government backed venture capital, donor funds[56], and labour mobility laws and incentives) are airing on the side of not applicable/neutral. This is surprising as lack of finance and high innovation costs were considered a constraint by the majority of government respondents (see Figure 29), as well as R&D being a major input into the innovation process. The exception to this is government procurement, where the majority of government respondents (close to 50%) view the policy as successful. Additionally, a supply-side service measure, more specifically ICT access, is seen to be highly successful by the majority of government respondents. This is supported by the indication that rate of access to ICT and ICT capacity is considered a low constraint by government respondents (see Figure 29)[57]. Finally, in the case of demand-side measures (standard setting and regulation) the majority of government respondents view them as successful or neutral (see Figure 34).

Figure 33. ***Policy taxonomy.***



[56] There are several cases where international donors have made direct bilateral investments into knowledge-based institutions.

[57] Government initiatives such as the WEB+ Progamme have been initiated to develop ICT capacity at the secondary education level.

Figure 34. Policy success – governement respondentes.

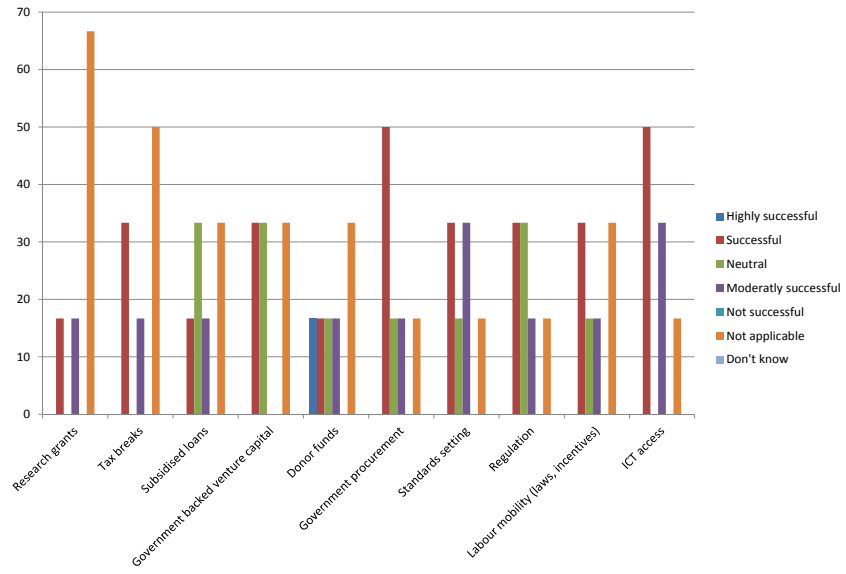
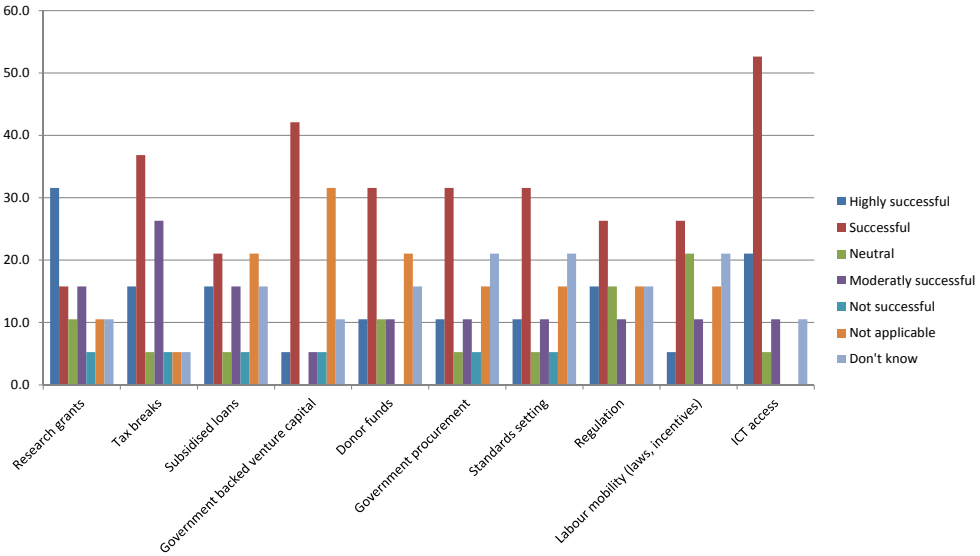


Figure 35. Policy success – knowledge-based institution respondents..



When comparing the view of knowledge-based institution respondents (see Figure 35) with that of government (See Figure 34) it is evident that in general, the majority of respondents view all policies as successful. However, in order to gain a more in-depth understanding the policies are viewed in the groupings as seen above. In terms of supply-side financial measures 'Research grants'[58], 'Government-backed venture capital'[59] and 'Tax breaks' are deemed to be the most successful[60], yet access to finance is seen as a high constraint (see Figure 30). In line with the view of government respondents, the supply-side service measure, 'ICT access' is rated to be successful by the majority of knowledge-based institution respondents. However, this is contradictory to what is reported by knowledge-based institutions in terms of barriers to innovation, as the majority of respondents report 'ICT access' and 'ICT capacity' as a constraint (see Figure 30) which may be down to the technology gap which is also deemed a constraint. One rationale for this may be due to what is experienced by the academic community in other countries, and in this respect, what is done is successful, but more could be done. Another explanation is that programmes such as WEBLABS are not extended to higher education institutions, but it is understood that they could also make an impact at that level. Finally, visualisation of demand-side measures also indicates that knowledge-based institution respondents view them as successful but overall not as much as supply-side financial and supply-side service measures.

[58] The first government call for a research grant has been initiated in 2019 with a focus on three target areas: of History of Cabo Verde, Agriculture and Marine ecosystems.

[59] Again, this is representative of the activities of setting up PROCAPITAL the government backed venture capital programme.

60 Those academics who are involved in business at the individual level have received tax breaks. This may also be linked to the REMPE initiative – see Info Box 2.

Info Box 2. - REMPE

The micro and small national companies can already count on the Law of the Special Regime of the Micro and Small Companies (REMPE), created by the Cabo Verdean government with the purpose of promoting the competitiveness, productivity, formalisation and development of micro and small companies. Approved in parliament on October 30, 2014, this law came into effect from the beginning of this month covering micro enterprises with a maximum of 5 employees and / or annual turnover of less than $5,000,000 and small companies with 6 to 10 employees and / or annual turnover in excess of $ 5,000,000 and less than $ 10,000,000.

Benefits:

- It is not mandatory to have account technician and organised accounting
- 10% of the value of the public works contract should be used to subcontract micro and small enterprises
- 25% of public procurement should target micro and small enterprises
- Commercial license exemption (to be communicated to the City Council within 30 days)
- Simplified model for tax payment purpose
- Replacement of the IUR (single income tax), VAT (value added tax), fire tax and social security contribution by unified special tax
- Unified special tax is 4% on turnover
- 30% reduction of Unified Special Tribute for 2 years for micro-enterprises
- Customs and VAT exemption on the import of goods vehicles
- Reduction by half in notary and registration fees in the purchase and sale of real estate for the installation of a company.

On the other hand, liberal professionals and importers, except street vendors, are excluded, and business owners should not be partners in more than one micro or small business and have been a partner in a micro or small Business that has been dissolved for less than 5 years. It should be noted that formal and informal companies interested in joining the scheme should go to the Offices of the Entrepreneur at the Ministry of Finance on their island for the necessary support to the accreditation process. Companies that show no adherence to the new regime will fall under the organised accounting system.

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From the perspective of industry respondents (see Figure 36) all policies are deemed to be successful, however it is clear that the most successful policy is the supply-side service measure of 'ICT access'. Following closely in terms of success is the grouping of demand-side measures, of which 'Government procurement' is acknowledged to be the most successful, whereas the supply-side financial measure, 'Labour mobility (laws, incentives)'[61] is perceived to be most successful. Conversely when viewed from the perspective of all the policy measures, supply-side financial measures are least successful as a whole. This is reflective of what is reported by industry actors in terms of barriers to innovation, who indicate lack of finance as the highest constraint to innovation (see Figure 30) suggesting more needs to be done in this policy area.

The final actor perspective on the relative success of policy instruments is that of arbitrageurs (Figure 37). Again, it is clear that the majority of respondents see the supply-side service measure of 'ICT access' as successful, which corresponds to the majority of respondents' view that the rate of access to ICT and ICT capacity are low constraints to innovation (see Figure 32). This view is consistent with that of government respondents but divergent from that of industry and knowledge-based institutions. In general, the view held by the majority of respondents with regards to supply-side financial measures is that research grants are successful, with the other measures being rated as neutral or moderately successful. Lastly, of the demand-side measures government procurement is seen to be the most successful. This is noteworthy as in terms of barriers to innovation lack of finance is considered as a constraint by the majority of respondents (see Figure 32). However, the set-up of PROCAPITAL is still at its nascent stages with final clearances from the national financial regulator Banco de Cabo Verde (BCV) being currently sought.

61 This may link to the Erasmus + programme in which academics (a proportion of which, particularly those on part time contracts are linked to industry) can be seconded for short periods to universities in Europe. However, this is more from the side of the EU rather than the Government of Cabo Verde.

Figure 36. ***Policy success – industry.***

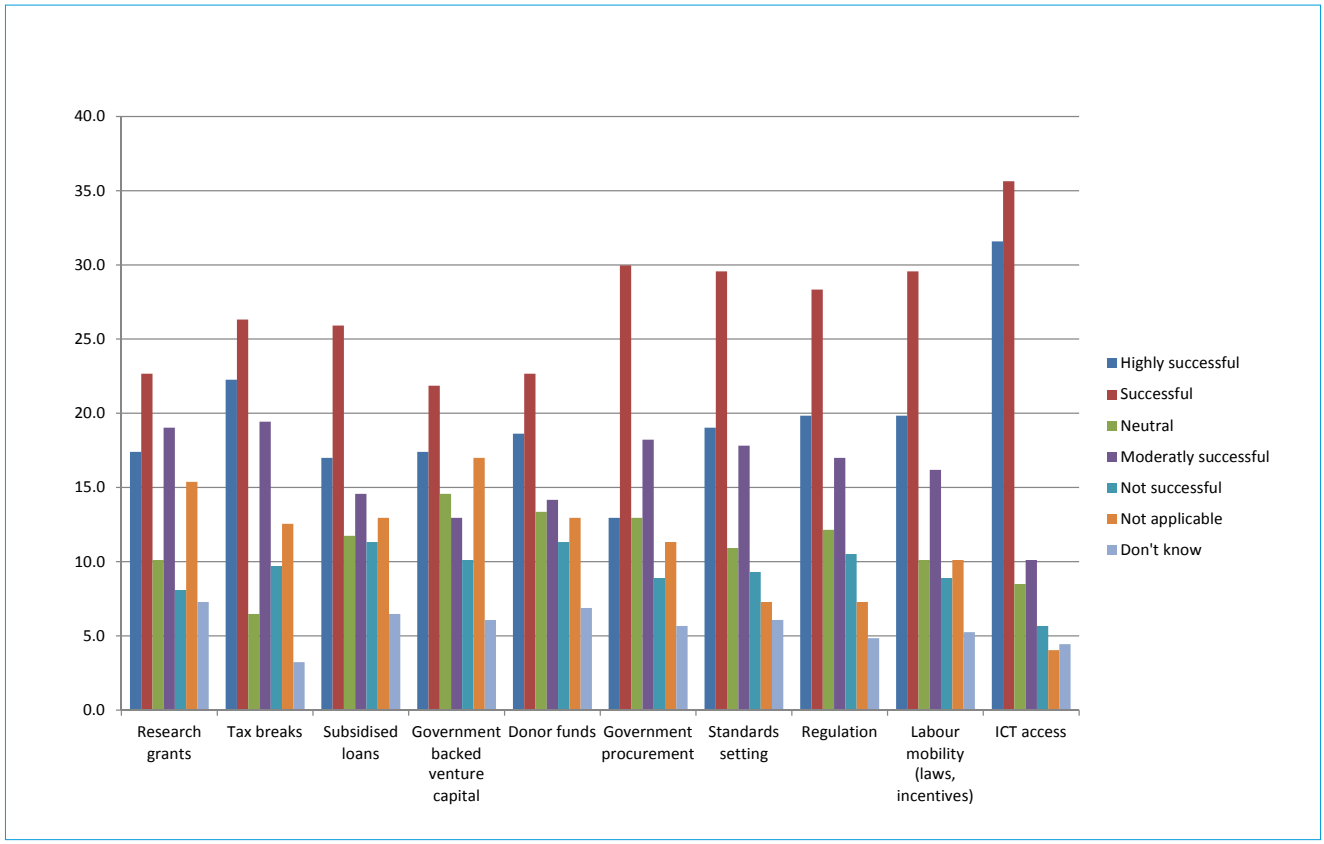
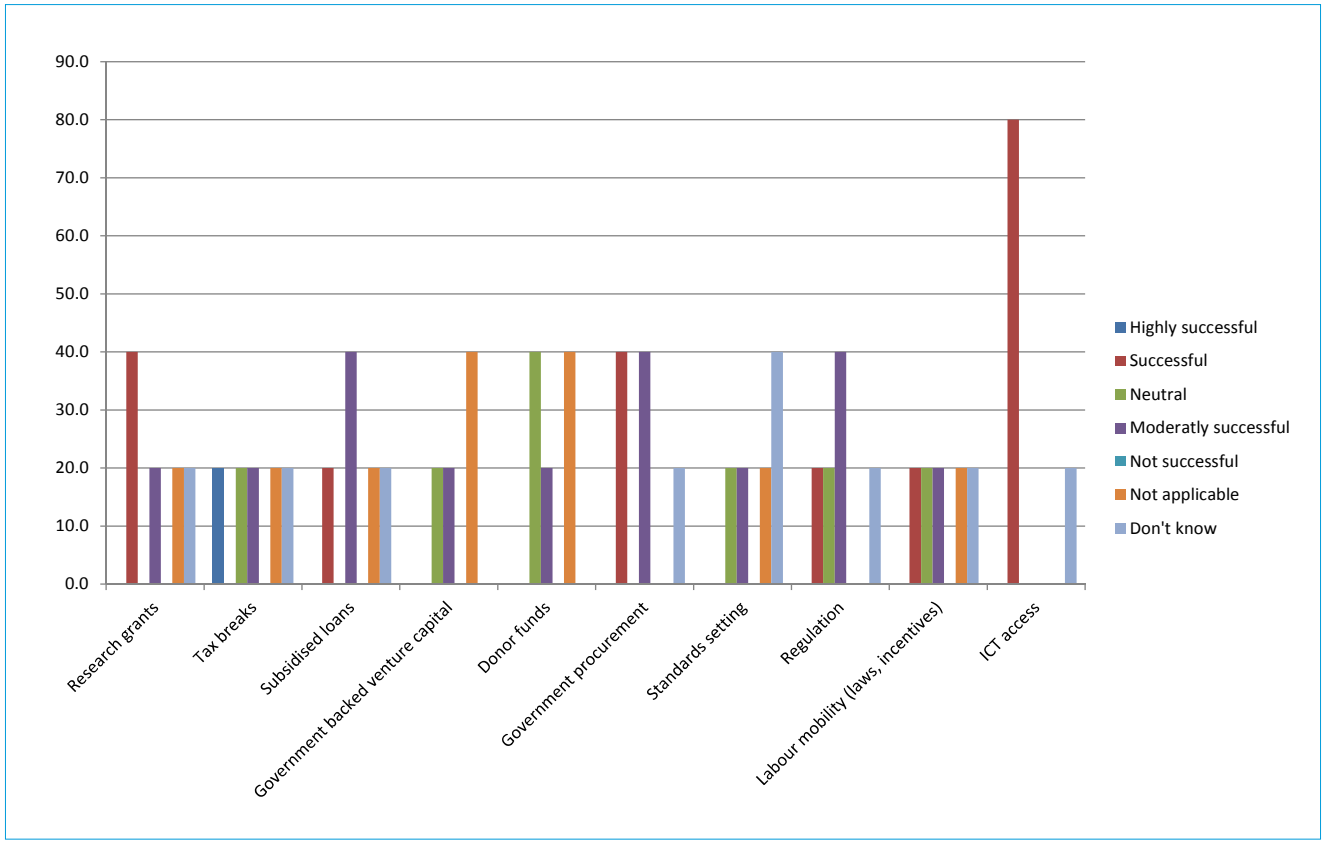


Figure 37. ***Policy success – arbitrageurs.***



12.0 Policy recommendations

Literature on innovation policy draws attention to the complex and heterogeneous nature of policy instruments at hand. It captures the growing interest in understanding the effects that different policy instruments have on innovation performance, on how (combinations of) individual instruments interact with market mechanisms and the overlapping or complementary effects that can be associated with different policy instruments within systems of innovation (Borrás and Edquist 2013; Izsák, Markianidou, and Radošević 2013; Mohnen and Röller 2001). This diversity reflects the complexity of innovation systems which entail a series of elements or subsystems that can reinforce, but also block each other (Hekkert et al. 2007; Kuhlmann and Arnold 2001). The underlying innovation-related policy objectives or policy domains subject to specific policy interventions can be grouped around one or more of the following objectives (Borrás and Edquist 2015):

- Support investment in research and innovation
- Enhance innovation competences of firms
- Support services for innovating firms
- Competence building through individual/organizational learning, involving formal/informal education and training
- Demand-side activities involving the creation of new markets
- Provision of constituents or supporting the development of agents within the system
- Strengthen linkages within innovation systems.

This list is not exhaustive but helps to illustrate the ramifications of the policy-decision tree around innovation and industrialisation. Addressing these policy problems calls for a portfolio approach in which a combination of instruments simultaneously targets several objectives and groups of policy problems (Izsák, Markianidou, and Radošević 2013; Nauwelaers 2009). Policy instruments result from policies aimed at facilitating different forms of innovation, including products or services, which denote the acquisition/development of new proprietary technologies protected by patents or other forms of Intellectual property rights (IPRs); yet some others are closer to process innovations in the form of changes in manufacturing techniques, organizational innovation, optimisation of workflows and process re-engineering. Whereas some policies aim to support forms of innovation with clear and rapid market potential, some others aim to address more upstream issues with no immediate commercial value.

The possibility of combining policy instruments is what makes innovation policy systemic (Borrás and Edquist 2013). However, finding 'optimal models' for the combination of instruments, otherwise interpreted as one-size-fits-all solutions, is problematic; significant differences result from framework conditions but also from the 'quality' of implementation (Flanagan, Uyarra, and Laranja 2011), the degree of maturity reached by certain agents or the innovation system as a whole (Izsák, Markianidou, and Radošević 2013), and even the particular governance structures around innovation (Dutrénit et al. 2010). Moreover, identifying the impacts of individual innovation policy interventions on social and economic outcomes is extremely difficult. There is a complex chain of direct and indirect, vertical and horizontal effects and the ultimate results may only be perceptible many years after implementation (Padilla-Pérez and Gaudin 2014; Santiago and Natera 2014).

Finding an optimal innovation policy mix is not a one-off exercise, but a continuous process that adjusts to the dynamics of an innovation system. The formulation of effective policy is therefore a highly complex affair.

The following section highlights short-, medium- and long-term recommendations based on the analysis conducted.

Observation	Implication	Recommendations
Fragmented system-wide actor information	Better access of public goods in order to have an up-to-date understanding of who's who and who's where in the CVNSI.	• Need to consolidate national actor databases with respect to the CVNSI • Regularly update centralised national database • Platform to be developed by NOSI and knowledge-based institutions in national stakeholders • Possibility of public procurement mechanism with triangulation as a prerequisite • To be hosted by INE with access by all major institutions • Integrated feedback mechanism for improvement (stakeholders at the national level)
Need to improve target response rate	Better clarity in systems analysis for evidence-based policy craft	• Institutionalise the CVNSI Survey within a national institution with top down mandate • Make the CVNSI Survey a mandatory census (4 years) and linked to the national database • Targeted promotion strategy
Need for better institutional coordination between islands	Ease of skills and knowledge flow	• Commonly agreed structured framework for joint activities • Regular meetings in person (every six months); Quarterly webinar • Implementation of a common knowledge-sharing platform • Virtual dissemination of Data Information Statistics and Knowledge (DISK)
Better awareness of policy terminology (NSI)	Across the board understanding	• Have a standard definition (TH-4) in all documentation • Present definition in national government bulletin • Standardisation of terminology used in policy/national documentation • Outreach to industry via industry associations
Lack of understanding by actors of each other's role within the CVNSI	• On clear understanding of actor roles and responsibilities within a system there is the increased ability for them to reach out to each other • Impact on the directionality of actor relationships (become more bi-directional)	• NSI should be an integrated component of national events, i.e. FIC, Innovation Week, roadshow by PROINVEST • National innovation event (every 2 years bringing together users, producers and service providers for innovation). It can be linked to National Science Week (10 best projects) • An integrated platform linking institutions and their services

Observation	Implication	Recommendations
Strengthen relationships of Gov with: • Domestic firms • Foreign owned firms • ISTC • Financial institutions • Arbitrageurs	• Better understanding of policy needs for domestic firms • Effective use of public funding • Increased ranking in World Bank doing business ranking. • Formalise the informal through effective support mechanisms • Better and more coherent investment by foreign owned firms; improving local environment through externalities • ISTC better able to advance the governments technological agenda • Financial institutions become less risk averse (more oriented to innovation) change in mind-set • Arbitrageurs better able to support ideation to market	• Strengthen and empowering business associations, chambers of commerce (more dialogue, competences, access to finance) • Better articulation of policies targeted to MSME's • Improve the existing protocol between government, banking and the private sector • More proactive action by the government to formalise informal enterprises
Strengthen relationships of KBI with: • Higher education • Public research institutes • Private research institutes • Domestic firms • Foreign owned firms • ISTC • Financial institutions • Arbitrageurs	• Better information flow between knowledge-base • KBIs providing services to domestic / foreign firms • Better understand the needs and requirements of domestic / foreign firms • Knowledge-base better able to align curriculum to changes in technological trends, e.g. the 4th Industrial Revolution • Possible access to bank-financed scholarships • Change in mind-set of financial sector towards strategic technological areas • Marketisation of R&D	• Allocation of time and resources to collaborate as part of the yearly schedule and articulated in contract of employment • Stipulation in calls for tender for 2 national universities and industry to jointly apply (proven triangulation) • Joint conferences • Mobility policy from KBI-IND • Need for multidisciplinary approach to pedagogy to align with new technological trends (consultation with ISTC in the development process requisite) • Active participation of KBI in PEPE programme • Employment and vocational training institute (IEFP) to reach out to both public and private KBIsDevelopment of specific training modules aimed at development of entrepreneurial mindset (e.g. management department, finance sector and arbitrageur representative).
Strengthen relationships of Industry with: • Government • Higher education • Public Research institutes • Private Research institutes • Domestic firms • Foreign owned firms • ISTC • Financial institutions • Arbitrageurs	• Provision of specific sector inputs for policy • To obtain a better business environment • Access to national technological/ research support resource • Access to skilled human capital • Ability to tailor skills and competencies to market needs	• Strengthen and empowering business associations, chambers of commerce • Joint research and calls for tender through triangulation with KBI • Mobility policy from IND-KBI • Strengthening of the PEPE programme

Observation	Implication	Recommendations
	• Access to new ideas to assist the innovation process (product, process, organizational, marketing) • Market intelligence for competition • Collective voice for lobbying sector needs • Absorption of knowledge, skills and technology • Support business activities and the innovation process	• Addition of post B2B support services as a part of FIC to accelerate international connectivity and trade • Strengthening of the ecosystem protocol (Ministry of Finance)
Strengthen relationships of arbitrageurs with: • Government • Higher education • Public research institutes • Private research institutes • Domestic firms • Foreign owned firms • ISTC • Financial institutions • Arbitrageurs	• Facilitate the marketisation research • Improving the business environment by allowing access to finance, technology and information	• Creation of a circuit for the transfer of information between the institutions
Government modes of interaction that require attention: Intra: (Gov–ISTC) Inter: Gov – Higher education/Public research institutions/Private research institutions • Gov - Foreign owned firms / Domestic Firms • Gov-Arbitrageurs/Financial Institutions	• Better knowledge flow between government institutions leading to effective decision-making and reduced duplication of resources • Government sees the knowledge-base as a resource • Create innovative markets • Enhance government strategy for financing innovation	• Mainstreaming of Common Assessment Framework (CAF) methodology amongst public institutions • Secondments/rotation across government departments • Sharing of inter-ministerial reports • Validation of courses at national level • Government contracts for research • Co-publishing • Generating calls for research • Knowledge-based institutions should be involved in the development of the technology park being constructed close to the NOSI Data Centre • NOSI to support private sector rather than competing with the private sector • Innovation summit every 2 years • Strengthening of PROINVEST – PROGRANT connectivity

Observation	Implication	Recommendations
Industry modes of interaction that require attention: Intra (foreign owned firms – domestic firms) Inter: IND – Government IND - Higher education – Public Research - Private Research IND - Arbitrageurs/Financial Institutions	• Create demanding markets through increased awareness and competition • Industry better able to provide feedback on and lobby for policies that meet their requirements • Act as a service provider for government • Better able to guide the skills requirements for development of human capital • Act as a recipient for technical solutions from the knowledge-base • Better access to funding for the innovation process	• Participation in events such as FIC • Actively participate in policy consultation process. • Participation in procurement contracts • Participation in higher education committees • Hire technicians from universities to help address technical business issues • PROCAPITAL/PROINVEST/ PROGARANTEE to be involved in events such as FIC
Knowledge-based institutions modes of interaction that require attention: Intra (Higher education – Public research - Private research) Inter: • KBI – Government • KBI - Foreign owned firms / Domestic Firms • KBI - Arbitrageurs/Financial Institutions Arbitrageurs modes of interaction that require attention: Intra (Arb – Financial Institutions) Inter: • Arb – Gov/ISTC • Arb – Higher education – Public Research - Private Research • Arb - Foreign owned firms / Domestic Firms	• Generation of collaborative critical mass for innovation • Providing strategic support to government in development of national strategies • Better understanding of industry needs • Funding of ideation to market • Reduction of conservative outlook of financial institutions • Venture capital able to prioritise areas of investment in line with government national strategy • Better funding support for ideation to market • Better visualisation of market trends by arbitrageurs	• Co-publishing • Joint research (triangulation with industry) • Participation in call for research • Contracts of academics enabling secondments in industry • Collaboration for projects • Consultation in technical areas • Industry advising content creation for syllabuses • Standing conferences where select MSc and PhD projects are presented for arbitrageurs • Regular interactions in the framework of PROCAPITAL/ PROINVEST/PROGARANTEE • Continual consultation • Standing conferences where select MSc and PhD projects are presented for arbitrageurs

Observation	Implication	Recommendations
Barrier to innovation government: • Organizational and policy functions (Organizational rigidities; Lack of explicit policy support; Lack of clear national strategy) • Investment and associated risks (Lack of finance; Innovation costs too high; Excessive perceived economic risk) • Technology dynamics (Lack of technology; Lack of technologically trained manpower) • Knowledge and information (Lack of information; Lack of demanding customers; Lack of willingness to share knowledge)	• Difficult to produce a conducive environment for innovation • Lack of investment in innovation • Stagnant economy • Inability to react and create global trends	• Internal review of practices • Exposure to different management approaches • Dynamic regulations based on evidence • Bolstering of the innovation protocol • Change of mind-set of financial sector • Ease of access to technology (imports, tax reductions) • Institutionalise triangulation • Research exercise (ARES)
Barrier to innovation in knowledge-based institutions: • Constrained human capital resources (quality of technically trained manpower) • Unsophisticated markets (Lack of innovative customers; Lack of demanding customers) • Excessive perceived economic risk (Excessive perceived economic risk; Innovation costs too high)	• Low quality of education • No demand for new products, processes, marketing and organizational approaches • Market stagnation • Lack of ideation to market	• Continuous assessment training for teachers • Exposure to global pedagogical best practices • Periodical assessment and alignment of curricula with system actor needs (industry) • Development of knowledge network • Certification of institutions • Ranking and fostering institutional competition • Incentive creation through award system • Monitoring of global technology and innovation trends • Exposure to global trends • Standard setting • Access to information • Provision of support services • Diversification of financial system • New modalities of funding (ecosystem protocol)

Observation	Implication	Recommendations
Barrier to innovation industry: • Government orientation and direction • Finance and information • ICT capacity • Lack of finance • Lack of information • Perceived economic risk • Hierarchical organizations • Lack of ICT capacity • Organizational rigidities • Lack of ICT capacity • Restrictive public/ governmental regulations	• No short-, medium- and long-term goals • Lack of innovation • Truncated flow of data, information, statistics and knowledge due to island geography	• Longitudinal mapping and monitoring • Evidence-based approach to policy • Outlook linked to SIDS • Access to information • Provision of support services • Diversification of financial system • New modalities of funding (ecosystem protocol) • Better ICT connectivity islands • Better ICT support infrastructure between islands
Barrier to innovation arbitrageurs: • Organizational rigidities; Lack of explicit policy support; Lack of clear national strategy • Hierarchical organizations) • Investment and associated risks (Lack of finance; Innovation costs too high; Excessive perceived economic risk) • Knowledge and information (Lack of information; Brain drain; Lack of demanding customers; Lack of willingness to share knowledge)	• Lack of transfer and transparency of information • Institutions with no external outlook	• Creation of a circuit for the transfer of information between the institutions.
Barriers system wide - Unsophisticated market knowledge	• No demand for innovation • No demand for new products, processes, marketing and organizational approaches	• Better connectivity • Exposure to regional/global trends

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