



Mauritius

Summarising Report on the Determinants of the
Mauritian Innovation System

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Published by: Institute for Innovation and Technology (iit Berlin), Steinplatz 1, 10623 Berlin, Germany

This study was elaborated by the Institute for Innovation and Technology starting from September 2014 until October 2014. It has been funded by European Union and the Ministry of Tertiary Education, Science, Research and Technology of Mauritius. Thanks to the attendance of Mauritian policy-makers and practitioners from the innovation system, the assessment workshop provided all parties involved with interesting insights. We are very grateful to all participants.

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Preface

As a result of accelerated globalisation and the advancement of high-technology, world-wide competition has risen to new heights. Growth – perhaps even survival – depends even more on innovation than ever. Nowadays, innovation is no longer mainly about science and technology. Industry today has to innovate in other ways since innovation is increasingly driven by co-creation, user involvement as well as by environmental and societal challenges. Key enabling technologies open a completely new dimension of functional attribution of products and processes. Collaborative global networking and new public private partnerships are becoming crucial elements in companies' innovation processes.

Existing and well-functioning regional or national innovation systems designed to support science- and technology-based innovation have to be further developed in order to be able to meet new challenges from emerging global markets for technology and new forms of global knowledge-sharing. Across all countries, governments have recently been involved in research and education; hence a need for new knowledge and new business skills will also have to be in the focus of governmental interest. Governments have constantly been called upon to react accordingly and to adopt innovation-friendly framework conditions. New policy tools have been created to be able to better meet this challenge.

The regional dimension has also become of increasing significance. Nowadays, regions have come up with own innovation strategies considering the individual regional strengths instead of spreading public investments thinly across several frontier technology research fields and, as a consequence, not making much of an impact.

Innovation policy has to acknowledge that traditional boundaries between manufacturing and services are increasingly being blurred. The success of manufacturing depends, for instance, very much on innovative services, such as design, marketing and logistics as well as on product related after-sales services, and vice versa. More and more service providers are manufacturing goods that build upon or are related to their service portfolio or distribution channels. But regional and industrial development policies and tools are still not sufficiently taking account of these changes.

Service innovation is in fact a driver for growth and structural change across the entire economy. It helps to make the entire economy more productive and provides fuel for innovation in other industries. It even has the potential to create new growth poles and to lead markets that have a macro-economic impact.

The so called systematic innovation policy approach, which has recently been introduced in many industrialised countries, is based on the assumption that an effective innovation policy has to improve all determinants that influence a given sector-specific innovation system.

The indicator-based Analysis of National Innovation Systems Approach (ANIS), developed by the Institute for Innovation and Technology (iit Berlin) includes a comprehensive examination and evaluation of the status of national innovation systems. It is mainly intended for emerging and developing countries for which standard innovation benchmarking and monitoring approaches might not be sufficient as statistical data is often missing or outdated. Policy-makers of these countries can benefit from clear advice on how to overcome weaknesses within their national innovation system and to identify determinants of specific relevance.

iit Berlin is convinced that the ANIS approach will serve as a fact-based platform initiating discussions on how to improve innovation capabilities and competitiveness.

The conduction of this specific ANIS study on Mauritius would not have been possible without the support of the **Prof. Dhanjay Jhurry** (Head, ANDI Centre of Excellence for Biomedical and

Biomaterials Research) and his team. We are therefore very grateful to them for making this project a success. The authors also thank the Financial Secretary, the MoFED, the Ministry of Tertiary Education, Science, Research and Technology as well as the European Union Delegation.

Berlin, March 2015

Dr. Gerd Meier zu Köcker

Director Institute for Innovation and Technology, Berlin

1 The Concept of National Innovation Systems

Innovation may be considered as one of the main drivers for economic competitiveness, growth and wealth creation. Therefore, innovation policy has become an important part of economic policy. The design of suitable framework conditions for innovation reflected by the maturity level of an innovation system (at national, local or sector level) has been given high priority worldwide.

Looking back in the past, innovation has been generated differently than today. One of the first (conceptual) frameworks developed for understanding the relation of science and technology within an economy has been the linear model of innovation.

This model is based on the assumption that innovation starts with basic research, followed by applied research and development, and ends with production and diffusion. The precise source of the model remains nebulous, having never been documented. This model taken for granted, research activities have completely been disconnected from market demands. Once a new idea has been considered to be promising, additional developing activities were conducted to further develop the idea towards a prototype. In a next step, the prototype has been further developed into a commercial product. Once the product or technology has reached maturity, the inventors started to elaborate a commercialisation strategy for the respective product or technology. It was the time of the creation of the term “technology transfer”.

Numerous technologies and products have been created by inventors and had then to be launched on the market. The majority of inventions has however never been commercialised, since the functional attribution did not correspond with the market demands, or simply due to a lacking or inadequate market need.

In the emerging new nature of innovation, multi-faceted skills are required for solving complex challenges. They are needed to support the development of partnerships and collaborative networks as well as the creation of symbiotic relationships among transnational companies, micro-companies and public institutions.

External sources have always been prevalent in the ranking of the most significant sources of ideas. Thus, they also included a substantial portion of the overall quantity of ideas and industrial stakeholders have started to react accordingly. Today, companies have become more open, transparent and engaged in a dialogue with their customers, providing them access to more information, sharing risks with them, and involving individual customers in their innovation process. Besides the fact of a closer collaboration with customers and users in entirely new ways, the conditions of business culture and company skills have changed, too.

The following definitions may help to clarify the concept of innovation and innovation systems:

Innovation may be defined as new solutions adding value to both, customers and firms (Nordic Innovation Monitor, 2009). One distinguishes between incremental innovations (e.g. further development of existing products and technologies, often realised by SME without involving any R&D institutions) and radical innovations (completely new solutions, technologies or products not yet available on the market, usually involving R&D institutions).

A national innovation system may be defined as “a network of institutions in public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies” (Freeman in OECD 1997, p. 10). The main elements of innovation systems are education and

research institutes, firms, industrial parks, incubators, governmental institutions. The maturity of an innovation system depends on how these actors are coordinated.

Innovation policy may be defined as the creation of framework conditions aiming at supporting innovation capabilities of companies and public entities (OECD, 1997).

Hence, an innovation system describes the relations between the actors of the different levels of an economy. For an effective innovation system, it is crucial that all “parts” of the system, i.e. **policy-makers** (those that set the framework conditions under which innovation can develop), **innovation supporters** (those that support research and development activities, and **innovation producers** (those that invent, build and sell), cooperate, communicate, create, exchange and transfer knowledge, and thus support dissemination and market penetration of new products and services. Hence, the economic and institutional regime, the information and communications infrastructure, and education are the key enablers of the innovation climate (World Bank 2010). A well-functioning innovation system can influence the country's economy in a positive way (OECD 1997).

The number of theoretical models, reports and analyses of innovation systems has been increasing since the beginning of the 21st century. Due to the various factors impacting national innovation capacities, the assessment of a country's innovation system remains a challenging exercise.

For years, economists have tried to identify the reasons leading to the nations' competitiveness and growth, and as a consequence, many reports on innovation systems have been generated. Despite the high quality of these reports which describe the essential features of an innovation system and summarise its main strengths and weaknesses, the benefits in terms of usable results have unfortunately only been limited. Policy makers, especially in emerging and developing countries, usually look for well-structured descriptions of an NIS and clear recommendations of how to improve the functionality of an NIS including a description of specific measures. They are rather not interested in receiving scientific models of the functionality of an NIS or how the single actors are linked. As far as embryonic or not well established NIS were analysed, they were mainly compared to those that are matured. As a consequence plenty of weaknesses were found and recommendations were derived from only from the discovered weaknesses. Often, policy makers are confused, rather than getting a clear guideline on how to start corrective actions. Such reports have often failed to provide clear information or recommendations how to start and how to gain a high leverage effect (especially when public investments were limited).

Instead of receiving mere scientific models of innovation systems, policy-makers – especially in emerging and developing countries – look for descriptions of an innovation system and clear recommendations on how to improve the functionality of their concept, including a description of specific measures. The ANIS (Analysis of National Innovations Systems) approach aims at filling this gap.

2 Scope and Methodology of the ANIS Approach

The aim of the following analysis within the ANIS framework is to provide a screening of the current status of the Mauritian innovation system. Besides assessing and benchmarking important determinants of the innovation system, policy-makers are often interested in receiving guidance for action. Therefore, the ANIS report provides comprehensive recommendations for improvement. At the end of the report, after a presentation of the key results, areas for policy interventions are pointed out. These areas may range from those having a high impact on the national innovation system to those that do not require large public investments or political intervention for a successful implementation. In the following, the methodology of the ANIS approach is presented first in order to give an overview of its core elements.

The major objectives of the ANIS studies are:

- Analysis of existing literature regarding the specific innovation system
- Conducting of interviews with experts regarding the specific innovation system
- Evaluation and measuring of the outcomes
- Identification of determinants that have a high impact, but cause only little costs
- Formulation of recommendations on how to improve the prioritised determinants

2.1 The Three-level Hierarchy

The study provides an indicator-based assessment of many different determinants, of which each does reflect an aspect of the complex innovation system. The determinants may be grouped according to a three-level hierarchy which includes the macro-, meso- and micro-level. **Fehler! Verweisquelle konnte nicht gefunden werden.** describes the different dimensions and its actors.

- Macro-level
 - Innovation Policy Level
- Meso-level
 - Institutional Innovation Support Level
 - Programmatic Innovation Support Level
- Micro-level
 - Innovation Capacity Level

Macro-level – Innovation Policy Level

In the macro dimension, national and regional innovation policies influence the framework conditions of an innovation system directly. At that level, laws, decrees and regulations, etc. may often be ground breaking, in a positive but also in a negative way. Public investment in innovations directly relies on decisions made at policy level. However, such political decisions may only influence the framework conditions for innovation and might not lead to a conversion of innovations into marketable products.

Meso-level – Institutional Innovation Support Level

Institutions operating at meso-level are typically technology transfer centres, clusters, innovation service providers and funding agencies. They may be considered as the relevant tools to put any

political decision regarding innovation into practice. In emerging countries such institutions are often publicly owned. They mainly aim at fostering the stakeholders' competitiveness and capability to innovate. Rather than setting up programmes to support innovation, those institutions usually provide in-kind contributions such as training, consultation, conducting applied R&D or product improvement. These institutions remain a key instrument for improving and encouraging the innovation capabilities of firms, especially in countries where public investment is limited.

Meso-level – Programmatic Innovation Support Level

Programmatic innovation support includes public funding programmes and initiatives which aim to put innovation policy into practice. This represents the second pillar in improving the innovation capabilities of stakeholders in an innovation system. Such programmes might be managed either by policy-makers or by innovation support institutions. Any measures at this level would require significant public investments.

Micro-level – Innovation Capacity Level

The micro-level provides an umbrella for the main actors and enablers within an innovation system such as SMEs, entrepreneurs, universities, public or private R&D institutions, innovators or financial organisations.

Level		Actors	Functionality within a NIS
Macro	Policy	Public authorities, policy-makers	Governing and setting up framework conditions of an innovation system
Meso	Institutional innovation support Programmatic innovation support	Institutional innovation support organisations or publicly funded initiatives/programmes	Institutions and initiatives are tools to put innovation policies into practice
Micro	Innovation capacity	Firms, academia, educational institutions, etc.	Main beneficiaries of support measures and main producers of knowledge, innovation, technologies, products

Table 1: Levels and actors within a national innovation system

As shown in **Figure 1** the ANIS approach is based on the assumption that an innovation system is mainly influenced by 30 determinants¹, each of which reflects an aspect of the complex reality of the innovation system. These determinants are of dedicated interest for our analyses since all of them directly influence the efficiency of an innovation system. They can be influenced and improved by appropriate measures.

¹ We are aware of the fact that an innovation system is also influenced by external determinants from outside the country. However, as these determinants need a different approach of adjustment, they are not regarded in our analysis.

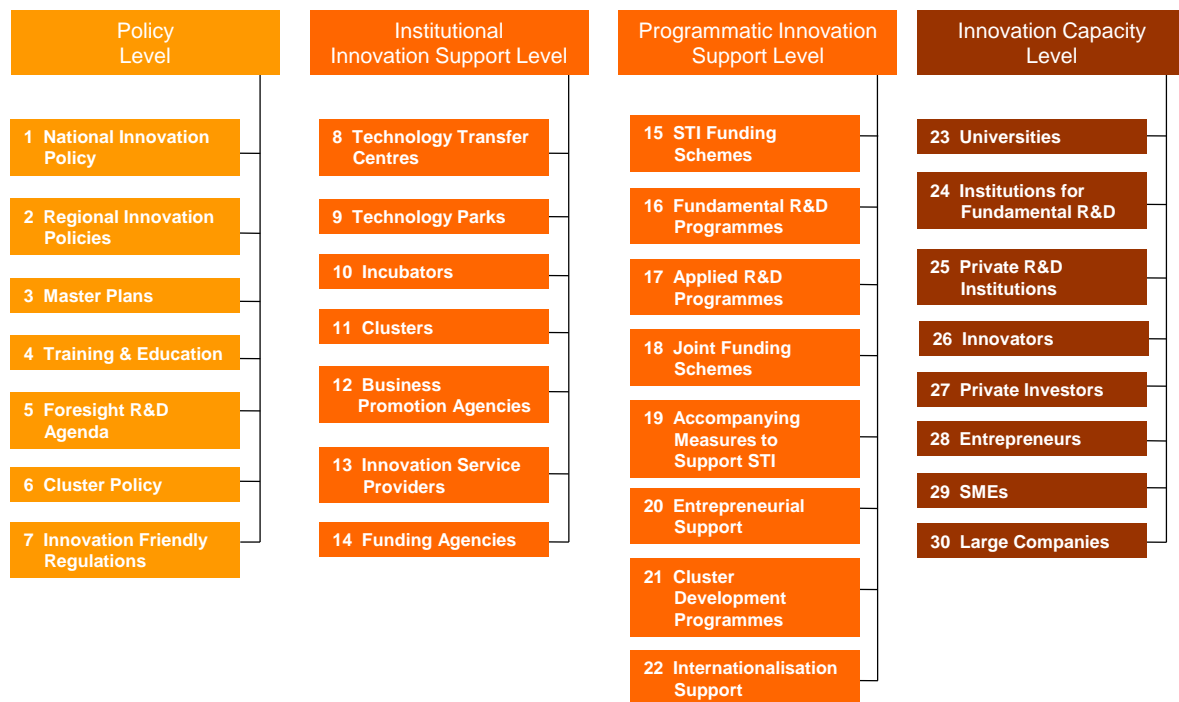


Figure 1: Main determinants of a national innovation system

A comparison between the determinants of these different levels allows the identification of key policy areas requiring a potential intervention to strengthen the innovation system. All determinants within the three different levels can directly be addressed by different measures. Some of them may be addressed in short-term and with low efforts, others may need long periods of time for the implementation of improvements, combined with significant investments. Improving a certain determinant can have manifold positive impacts.

In order to assess the stage of development of all determinants, we have designed questions (Expert Opinion Survey) for characterising the 30 determinants accordingly. The onsite assessments are done by national experts, coordinated and moderated by the authors as explained below.

2.2 Expert Opinion Survey (EOS)

The model used draws on a wide range of data from the Expert Opinion Survey (EOS). The EOS meets the need for up-to-date and far-reaching data, providing valuable qualitative information for which hard data sources are scarce or non-existent. The survey is completed by at least 48 national experts. We have asked the experts to provide their opinions on various aspects of innovation and the innovation environment in which they operate. The data gathered thus provide a unique source of insight and a qualitative portrait of a nation's innovation concept.

The questions in the study follow a structure asking the interviewees to evaluate, on a scale of 1 to 4, the current conditions of their particular innovation environment they are operating in. At one end of the scale, value 1 represents the worst possible operating condition or situation and at the other end of the scale, value 4 represents the best conditions. Thus, the interviews consist of questions describing a situation and environment within a well-established innovation system (positive

statement) and a contradicting statement (negative statement). The experts are asked to give their opinion on whether they

- fully agree with the positive statement (4 points),
- partly agree with the positive statement (3 points),
- partly agree with the negative statement (2 points),
- fully agree with the negative statement (1 point), or to give
- a statement that this issue does not exist at all (0 points).

It is also allowed to leave out certain questions if the expert is not able to answer. The experts are classified according to their relationship to and responsibility for the four different levels of the innovation system (macro-, meso-institutional, meso-programmatic, micro-).

In the following, the main findings from the EOS conducted in Mauritius are described, based on the assessed 30 determinants, and analysed in total.

The experts consulted in the context of the present study have been identified by the local partner CBBR. The interviews have been carried out on the basis of the Expert Opinion Survey in English.

2.3 The Indicator Approach

The ANIS approach fits into the new tradition of indicator-based studies relying on quantitative data generated by the evaluation of expert interviews. Such an approach differs from traditional benchmarking studies on innovation performance. The Global Competitiveness Report, the European Scoreboard and the Nordic Innovation Monitor are excellent approaches for measuring or benchmarking innovation-related performance indicators. However, since the statistical base of emerging and developing countries is often insufficient, the Nordic Innovation Monitor is rather intended for well-matured economies than for developing or emerging countries' issues. The Global Competitiveness Report uses a mix of statistical data and expert interviews. However, since it focuses on the competitiveness of nations, the issue of innovation is not sufficiently targeted. Therefore, the Institute for Innovation and Technology (iit) has developed the ANIS approach.

Based on the findings of the questionnaire and on the evaluation of the questions, we have then calculated the appropriate indicators for the respective determinants (see **Figure 1**). A scale with the following indicators has been designed:

- Indicator "1" represents the determinant under worst operating conditions or in the worst possible situation, emphasising that it is poorly developed or non-existent.
- Indicator "2" means that a determinant basically exists and has shown first positive impacts. Nevertheless, there is a strong need to improve its efficiency or functionality.
- Indicator "3" means that a determinant is mature and has shown positive impact on the performance of an innovation system over a long period of time. Nevertheless, there is still room for further improvement to reach excellent performance.
- Indicator "4" corresponds to the determinant which under its best operating condition. Although improvements might still be possible, this determinant has proved to be strongly developed and well-performing over a long period of time.

Indicator values above 3 usually apply to well-developed industrial countries where all determinants are well-established and efficient, even though some are performing better than others.

Values between 1.5 and 2.5 indicate that the determinant already exists, but needs to be further developed. Values below 1.5 mean that a specific determinant may exist, but is not yet operational.

2.4 The Comparative Portfolio

The comparative portfolio is an integrated element of the ANIS approach. It consists of the corresponding data of countries having similar comparative economies. According to the Global Competitiveness Report (GCR) of 2014-2015² Mauritius belongs to an economy, which is in the transition between an efficiency and innovation-driven economy. The GCR defines three different stages of economies. These are

- factor-driven economy (stage 1),
- efficiency-driven economy (stage 2),
- innovation-driven economy (stage 3).

According to the GCR, the efficiency-driven countries are characterised through products with better quality, mainly due to more efficient production processes. Economic advancement is achieved through “higher education and training [...], efficient goods markets [...], well-functioning labour markets [...], developed financial markets [...], the ability to harness the benefits of existing technologies [...], and a large domestic or foreign market [...]” (Schwab 2010, p. 9).

In the present study, the determinants of the Mauritian innovation system are benchmarked against the data of efficiency-driven economies (Egypt, Guatemala, Indonesia, Namibia, etc.) and economies in the transition between efficiency and innovation-driven economies (like Hungary). According to the GCR report 2014-2015 the countries used in the comparative portfolio rank between 34 and 80, whereas Mauritius is on place 39 out of 144 countries.

2.5 Data Generation

This report was drawn up based on expert interviews conducted with the help of the Expert Opinion Survey. The data was gathered between September and October 2014 during several workshops with different expert groups. About 50 experts participated in the Expert Opinion Survey.

CBBR and the Ministry of Tertiary Education, Science, Research and Technology had invited experts from the policy level, the innovation support level and the innovation capacity level to join the workshop.

All key experts have been very experienced in their respective field of expertise and very familiar with the relevant parts/levels of the Mauritian innovation system.

² http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

3 Mauritius's Economic & Innovation Background

Many know Mauritius as a vacation spot; it boasts white sands, clear waters, palm trees and hundreds of hotels. This nation of 788 square miles, or 2,040 square kilometres, was uninhabited until the Dutch took it over in 1598. Mauritius – which is located in the Indian Ocean some 1,200 miles from the south-eastern coast of Africa – is now home to 1.3 million people and a variety of ethnic groups, which coexist peacefully, although discrimination – particularly against descendants of African slaves, many of whom live in poverty – remains a problem. Climate change is another concern. Some areas of the country are at risk of literally going under water as sea levels rise and extreme weather events like cyclones and floods become more frequent.

As depicted in Figure 2, Mauritius has experienced a similar GDP growth as Singapore from the 1960s to the 1980s moving from labour-intensive industrialisation through export-oriented industrialisation to cost-competitive industrialisation. GDP has increased steadily through incremental innovation in the four main sectors of the Mauritian economy namely sugar-cane, agro-industry, textiles and tourism. In the 1990s, Singapore invested in enterprise development industrialisation and changed gear, from 2000 onwards, to foster an entrepreneurial and innovation-led industrialisation. This corresponds to a massive growth in GDP.

However, the GDP of Mauritius has increased at a much slower pace since the 1990s and is presently calculated at 15,600 USD compared to nearly 38,000 USD for Singapore.

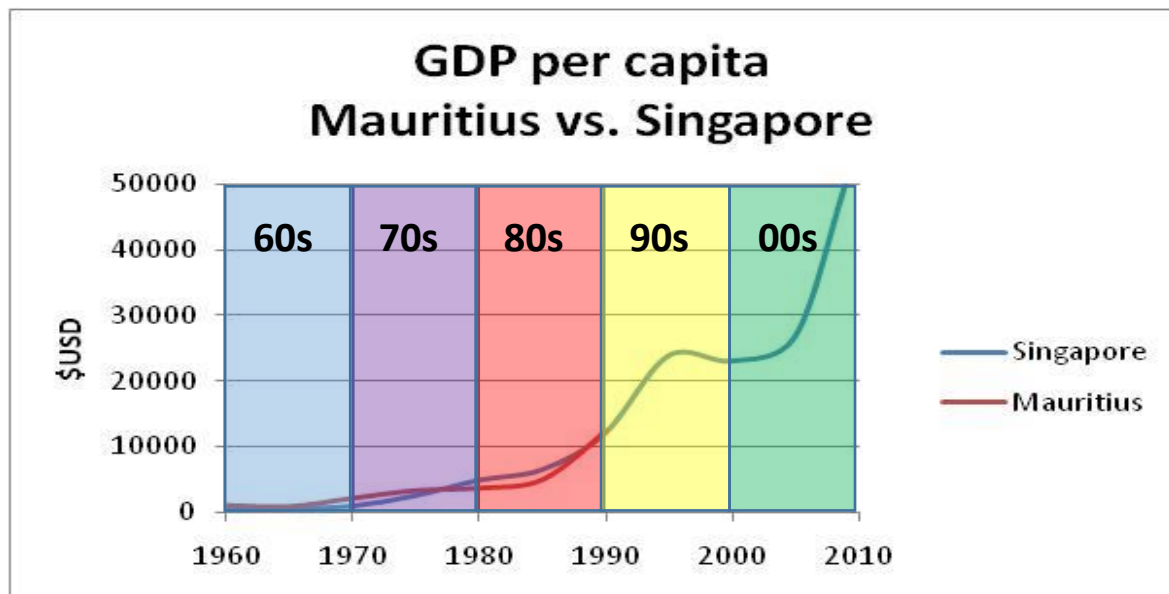


Figure 2: Comparison of GDP growth for Mauritius and Singapore

South Africa is still the continent's largest economy, and it is Africa's most prolific foreign investor. But its growth rate is now among the lowest on the continent – the International Monetary Fund downgraded the country's 2013 GDP growth projection from 2.8 percent to 2 percent. The economy is hamstrung by shrinking foreign currency reserves, recurring power outages, stubborn inflation, a persistent wealth gap and ongoing strikes in the mining, manufacturing and construction industries. In contrast, Mauritius is unburdened by such complications. Its economy depended

almost entirely on sugar cultivation until 40 years ago, but it has since diversified to include more agricultural products, textiles, tourism and financial services.³

According to the GCR 2014-2015 Mauritius currently ranks at 39th place and made considerable progress over the past years (climbed up from 60th place in 2012). Progress is driven by gradual improvements across seven out of the 12 pillars. Overall, Mauritius benefits from relatively strong and transparent public institutions, with clear property rights, strong judicial independence, and an efficient government. The country's transport infrastructure is well developed by regional standards (ranking 42). Furthermore, the country's wide-ranging structural reforms that have taken place since 2006 are bearing fruit, as evidenced by its continuous improvements in the areas of market efficiency: However, when having a closer look at the indicators innovation (rank 76) and technological readiness (ranking 63), it becomes obvious that innovation and technological readiness cannot be considered as a national strength. The high overall competitiveness ranking of Mauritius is mainly based on financial market development (rank 26), goods market efficiency (rank 26) as well as good business sophistication (rank 33).

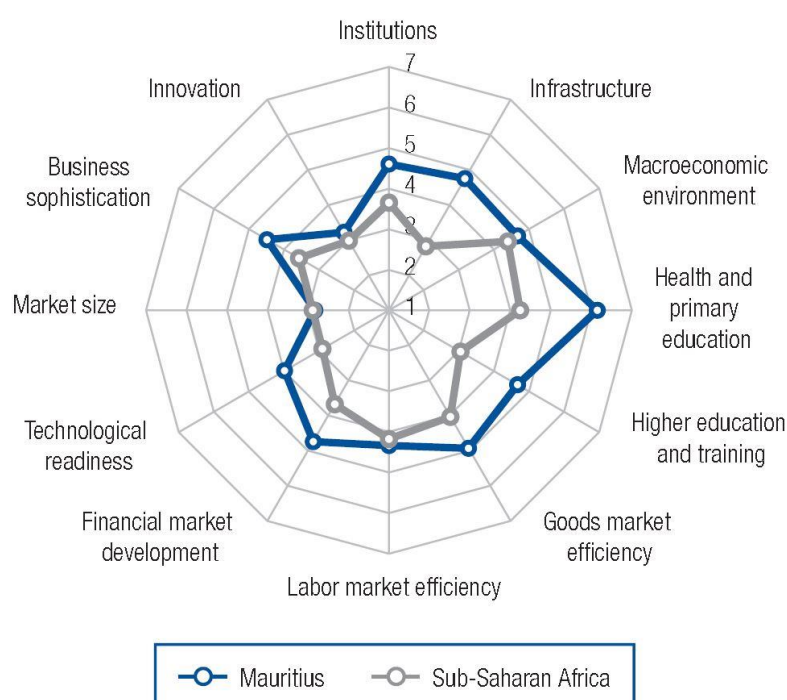


Figure 3: Spider graph of all 12 competitiveness indicators for Mauritius in comparison with Sub-saharan average⁴

For Mauritius to move to a higher income economy, improving competitiveness and innovability will require additional efforts not only to improve higher education and training, but also to mobilize the country's talent more efficiently, as evidenced by the low share of women in the labour force (ranks 115 out of 144 countries according to GCR). It is evident that Mauritian government has to invest in

³ International Business Times, September 2013, <http://www.ibtimes.com/paradise-gained-how-tiny-mauritius-became-africas-most-competitive-economy-1402694>

⁴ http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

knowledge-based industries fuelled by innovation. Industrial sectors that would allow long-term growth should be identified based on our resources and strengths and demand-driven. The Mauritian National Innovation System (MNIS) is meant to organise and structure innovation around those sectors, pooling together the public and private sectors as well as research institutions, universities and NGOs in a triple-helix model.

The sectors (Figure 4) proposed as new pillars for the Mauritian knowledge-based economy are those where the country has already some competitive advantages such as natural resources, technical expertise, high level of science and engineering enrolment and infrastructure. In addition, the development of these sectors should be in harmony with the MNIS concept championed by Mauritius.

- (i) **ICT:** the sector is now an important pillar of the economy. However, for sustained growth it has to move to high end and invest in software development and develop new areas such as infotainment.
- (ii) **Agri-Biotech:** Mauritius has built considerable technical expertise through its various research institutes and a good industry base. The use of advanced biotechnology for the development of new products could spur growth in this sector.
- (iii) **Ocean:** following the National Dialogue on Ocean Economy in July 2013 launched by the government and the subsequent setting-up of a national task force in August 2013, a roadmap for Mauritius by has been published by the Prime Minister's Office in December 2013 laying out the main areas for development of the ocean economy. Amongst others, the proposed exploitation of Deep Ocean Water (DOW) by Sotravic Ltée is a lofty project. The first phase of the project concerns the pumping of DOW through a distance of 6 km off-shore for air-conditioning purposes (Seawater Air Conditioning – SWAC) with a reduction of energy requirements of up to 80 % and estimated savings of MUR 175 M per year. The development of Deep Ocean Water Applications (DOWA) in a second phase should foster the development of a diverse range of technology-based and research-based industries such as desalination, aquaculture, bottling, etc.
- (iv) **Biomedical/Health/Pharma:** this sector includes biomedical research, medical tourism, biomedical devices, clinical and pre-clinical testing, and pharmaceuticals. These areas have experienced steady growth in terms of new investments in the recent years. The government has promulgated the Clinical Trials Bill (2010). The object is to provide the legal framework for the conduction of clinical trials for the purpose of discovering or verifying the effects of investigational medicinal products. Mauritius has virus-free *Macaca Fascicularis* and excellent breeding conditions for preclinical biomedical research. The Clinical Trials Bill should attract pharma companies to Mauritius.

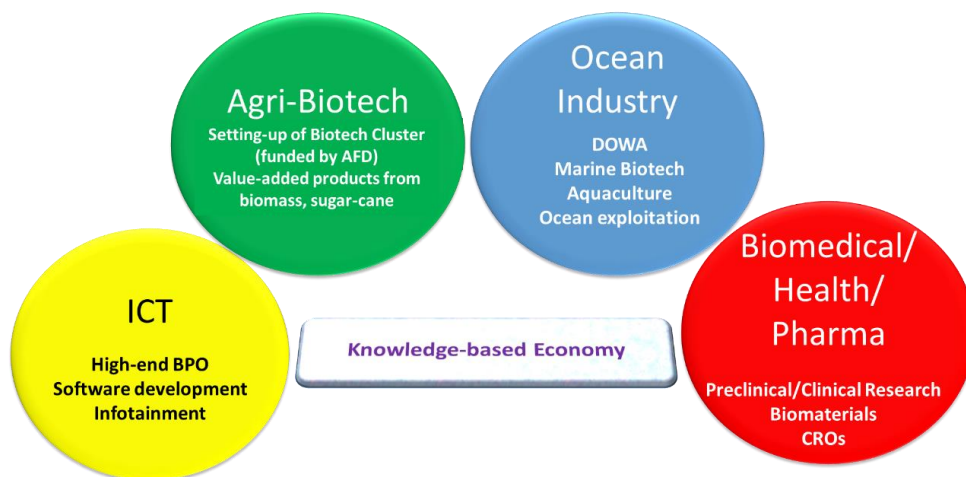


Figure 4: High potential knowledge-based industrial sectors for Mauritius

The private sector's role in Mauritius is especially to develop business sophistication, foster R&D development (especially collaborative R&D between private sector and universities), as well as to develop knowledge-intensive business. As for research institutions, they are poised to more effectively promote applied R&D and assist business. This implies building intellectual capital, providing specialised training and focused R&D, developing IP & technology transfer, and providing technical support to companies.

For a potential approach to reach the ultimate objective to lift Mauritius's competitiveness and innovability, it will require talent through intelligence, imagination, inspiration, intuition as well as invention and innovation with a good dose of investment. The setting-up of appropriate structures and their proper coordination within the NIS becomes a priority for innovation to thrive (see Figure 5).

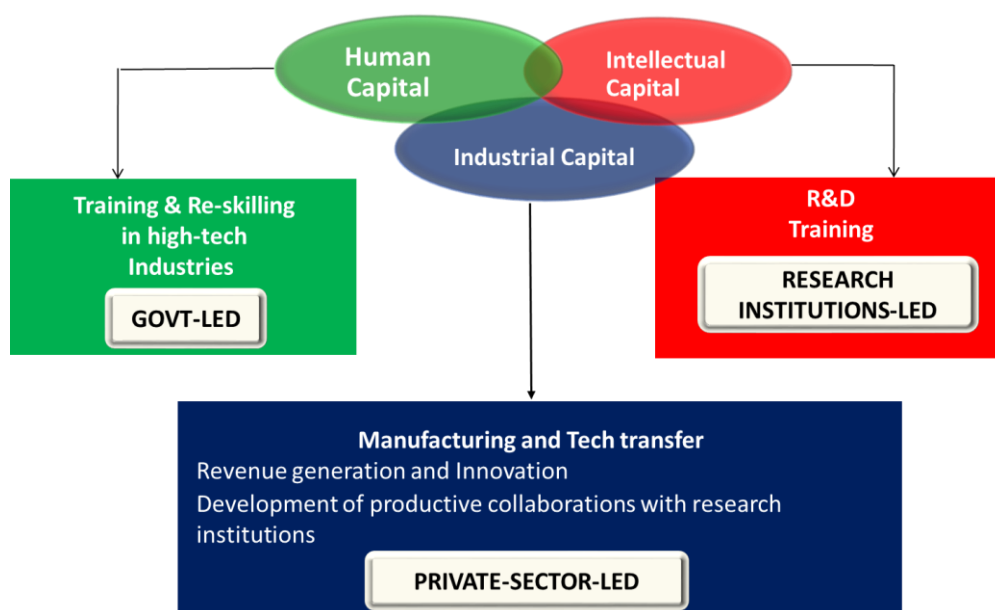


Figure 5: Developing the Mauritian capacity for the knowledge economy

4 Assessment Results for Mauritius

The following chapters present the main outcomes of the assessment of the 30 determinants according to the ANIS approach for Mauritius. This assessment has been conducted based on the Expert Opinion Survey methodology described in chapter 2.2. Selected key experts participated and contributed by providing their expertise in the relevant fields. Since the variety of opinions of the individual experts was comparably low (no extreme values), the assessment resulted in a temporarily consistent picture for Mauritius.

4.1 Macro-level: Innovation Policy Level

Figure 6 shows the results of the assessment of the innovation policy level for Mauritius. The overall picture shows that related to all policy level determinants Mauritius ranks comparably below the comparative portfolio of Efficiency Driven Economies. Only the determinants Foresight R&D Agenda and Regional Innovation Policies lie on the same level as the comparative portfolio. The National Innovation Policy is considered to be very weak. No official strategic documents exist, thus the public is hardly aware of any national strategy on innovation. Cluster policy does in fact not exist, although there are some clusters existing, e. g. in the agriculture area. However, the interviews with experts revealed that in Mauritius clusters seem to matter recently. There are a lot of discussions on where to start and how to support cluster development. Although this topic seems to be high on the policy agenda, no policy or related measures have been emerged. Other determinants rank on a comparably low level, mainly between 1,5 and 2,0. Beside conventional policies, there are not implemented many innovation friendly regulations for encouraging or facilitating innovation in industry or academia.

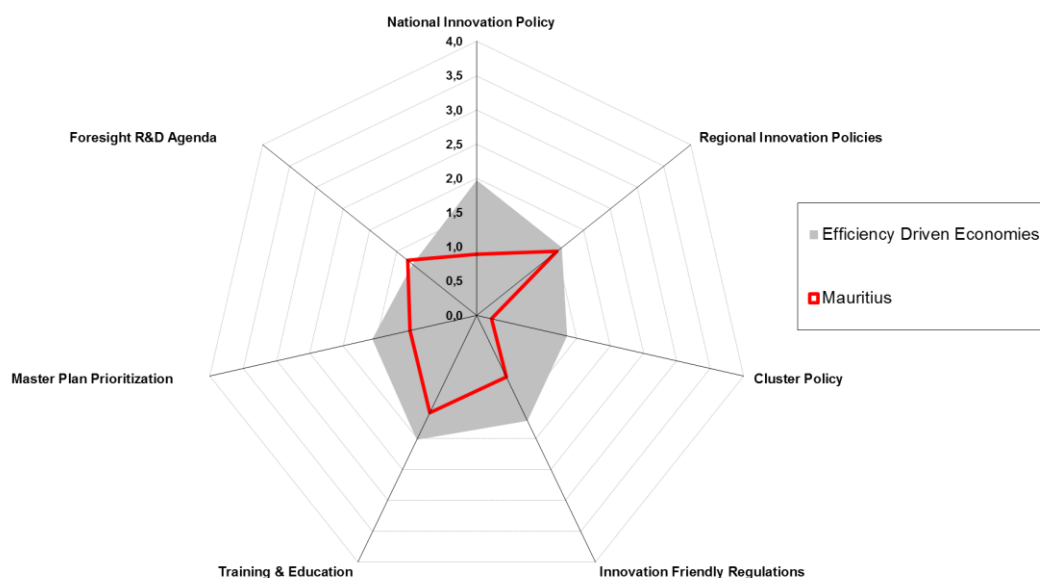


Figure 6: Determinants of the innovation policy level for Mauritius

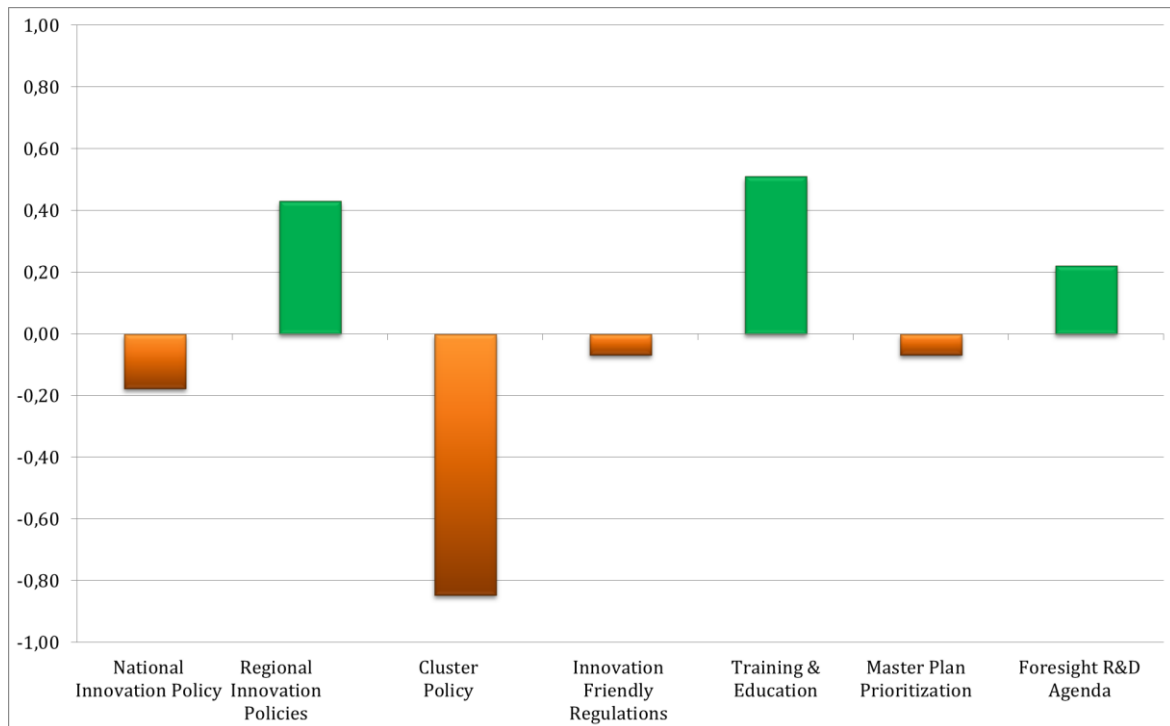


Figure 7: The seven policy level determinants compared with the average value

Figure 7 shows the values of the individual determinants of the policy level for Mauritius and their relation to the average value of all determinants of the innovation policy level. The average level is about 1,3, which is comparably low, compared to the comparative portfolio of Efficiency Driven Economies. Figure 7 also shows the determinant for cluster policy significantly under average, whereas regional innovation as well as training and education policies are comparably well-developed. As far as cluster policy is concerned, cluster mapping could be a proper way to better understand the structure and key actors of clusters. Another proper way might be to support cluster organisations, which actively network and match related cluster actors. As far as innovation policy is concerned, there are already some ideas how to start a joint effort (Kergel et al., 2014).

4.2 Meso-level: Institutional Innovation Support

Fehler! Verweisquelle konnte nicht gefunden werden. 8 shows the specific strength of the Mauritian approach as far as the institutional approach is concerned. As far as funding agencies, incubators as well as business promotion agencies are concerned, the relevant determinants are ranked over-average or at least average. Mauritius is lacking sufficient capacities of technology transfer centres. The ANDI Centre of Excellence for Biomedical and Biomaterials Research is a good example for a strong, well-established centre. Nevertheless, this is an exception. According to the expert interviews there is no real technology park existing in Mauritius, although there are some sectors, which would considerably benefit from such a park. As far as incubators are concerned, this innovation support tool is well-established in Mauritius and some of them can be considered as a real success story. Resulting from an absence of a dedicated cluster policy, clusters that exist in Mauritius are comparably weak. Cluster organisations that offer networking, matchmaking, information and experience exchange among cluster actors do not really exist. Consequently, there are no cluster initiatives existing that can be understood as coordinated common effort among the private and public sector. Business promotion agencies gained a quite strong position in the

Mauritian Innovation System and are recognised and valuable partners, especially for the private sector.

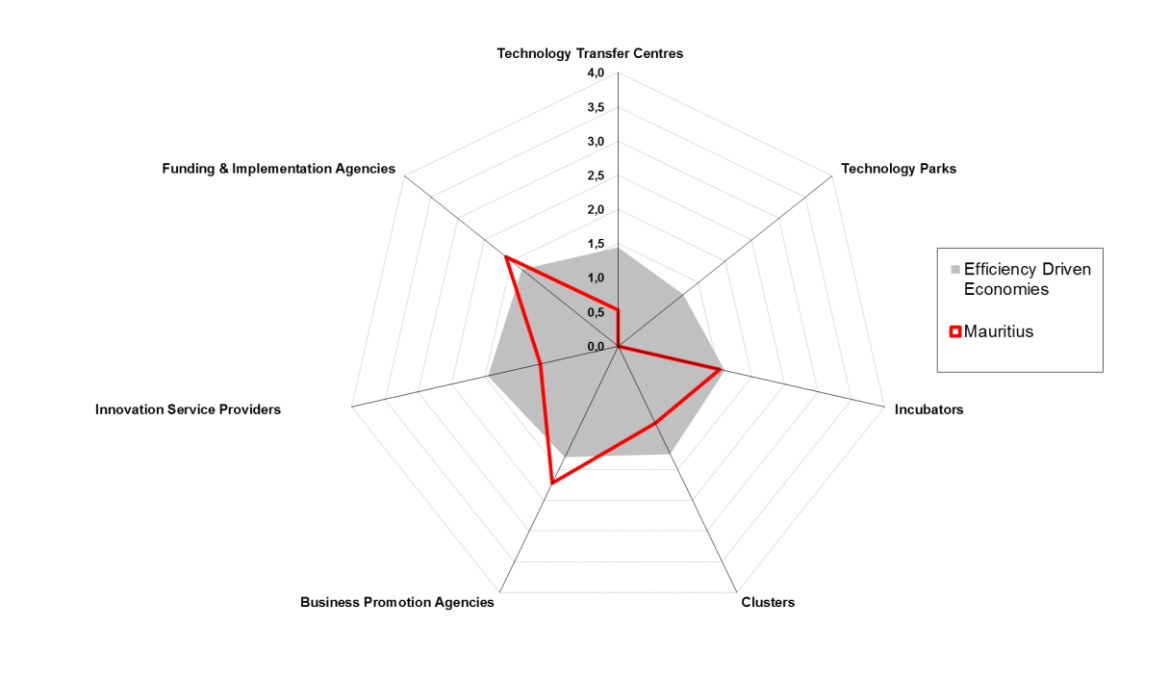


Figure 8: Maturity of the determinants of Mauritian institutional innovation support level compared to the average of selected efficiency-driven economies

Figure 9 compares the strength of all determinants of the institutional innovation support level among each other. The average value is 1,3, which is clearly below the average value of the portfolio of efficiency-driven countries (average value of 1,9). According to Figure 9, business agencies and funding/implementation agencies are comparably well-developed, whereas technology transfer centres and technology parks are lacking behind.

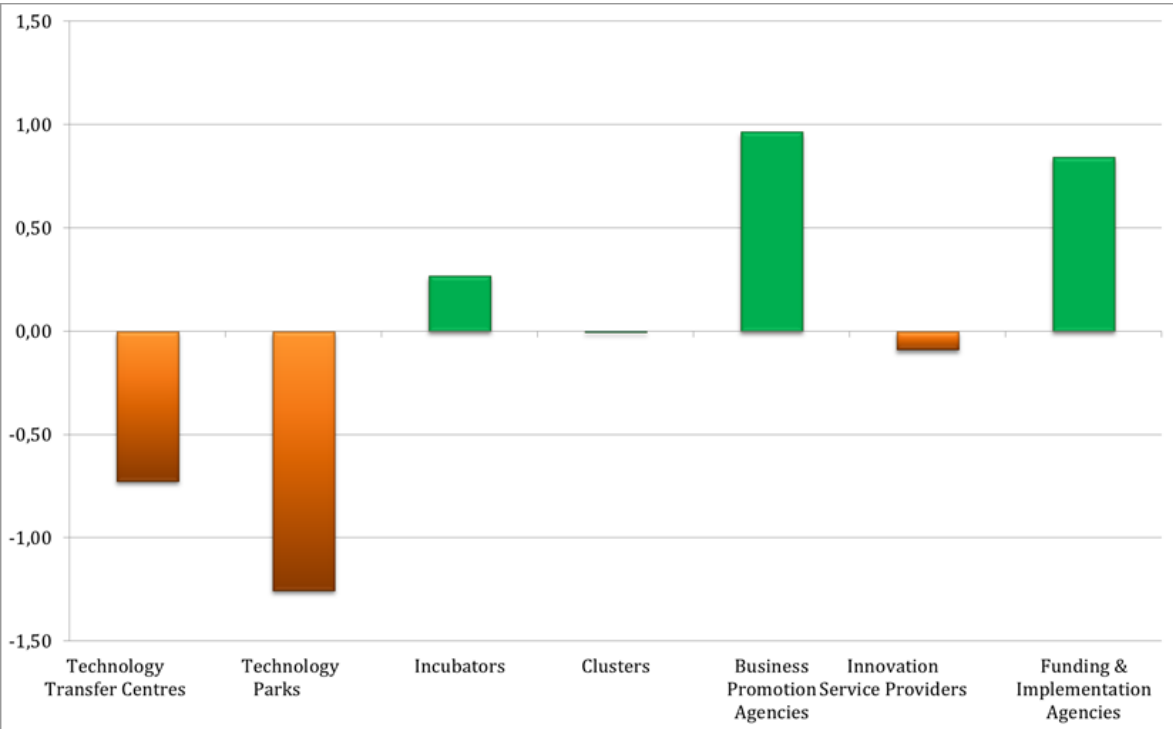


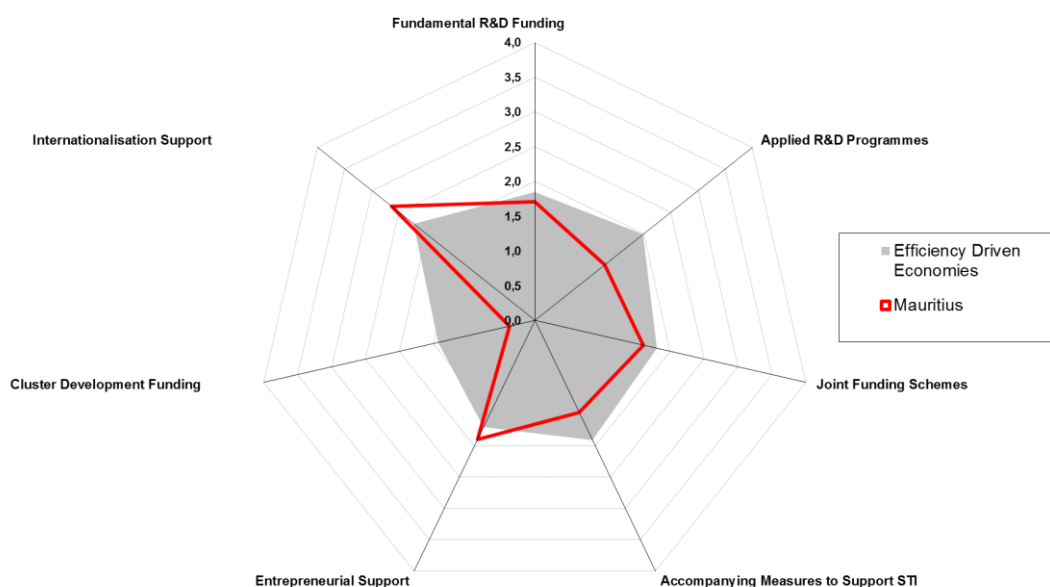
Figure 9: The seven institutional innovation support determinants (institutions) compared with the average value

4.3 Meso-level: Programmatic Innovation Support

At the programmatic innovation support level, Mauritius is comparably strong in supporting international cooperation on all levels (R&D as well as business generation or export). Since Mauritius is comparably small without any significant home market, the private sector is forced to export and to seek international business abroad. As a consequence, there are some programmes in place supporting internationalisation of the private sector (Figure 10). Programmes for enabling the academic partners to explore new paths are also in place in the field of fundamental research. However, the interviews have revealed that an application orientation is often completely missing. Figure 10 also displays that entrepreneurship is not only supported by incubators but also by dedicated entrepreneurial support programmes.

Nevertheless, Mauritius is missing to have cluster support programmes in place, which is a clear impact of any missing cluster policy. In addition, since applied R&D does not rank high on the political agenda, corresponding applied R&D programmes are missing. Further discussion and a common policy workshop in 2013 have revealed that there is a significant lack of knowledge on policy level about needs and demands of the private sector related to science, technology and innovation support in Mauritius⁵. Key actors are unknown and due to an absence of a dedicated innovation strategy corresponding applied R&D programmes are missing.

There are some programmes available initiating R&D between the academic and private sector, but far from enough to satisfy the industrial demand. This results in a remaining gap between the private and academic sector.



⁵ Biopolymer Workshop Mauritius 2013

Figure 10: Maturity of the determinants of Mauritian programmatic institutional innovation support level compared to the average of selected efficiency-driven economies

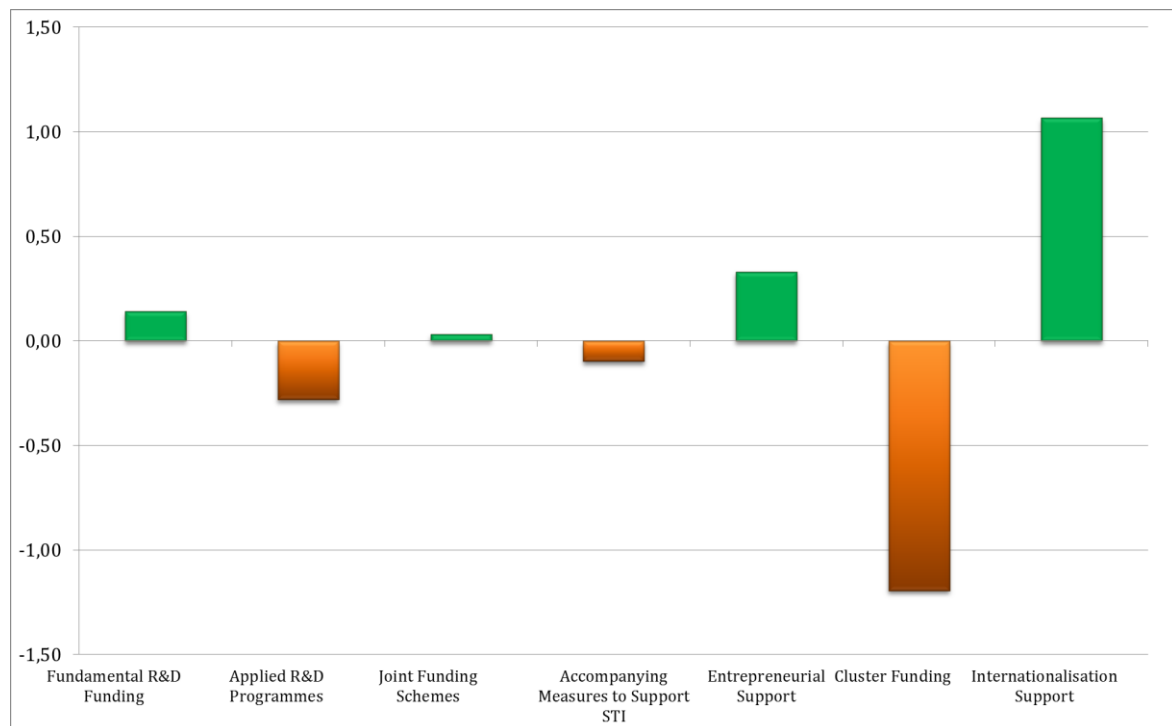


Figure 11: The seven determinants describing the programmatic support level in Mauritius compared with the average value

Figure 11 summarises the individual determinants for the programmatic innovation support level. The average value of all determinants is 1,6 and thus higher than for the policy or the institutional innovation support level. This indicates that Mauritius has a certain spectrum of programmes in place. However, it appears that these programmes are not well developed in all areas. Focus is given on international and entrepreneurial support, whereas no support schemes for clusters exist and applied R&D programmes remain an exception. All other determinants lie on average level.

4.4 Micro-level: Innovation Capacity Level

The innovation capacity level is fairly developed in Mauritius as displayed in Figure 12: the corresponding graph is well-balanced without significant maxima or minima. All values are lying between 2,2 and 2,5. The only exception is the existence of larger companies, which are clearly highly ranked since they possess a high innovation capacity. However, compared to the composite portfolio, almost all determinants for Mauritius are ranking below. The average value is about 1,8 for Mauritius and 2,3 for the countries of the comparative portfolio.

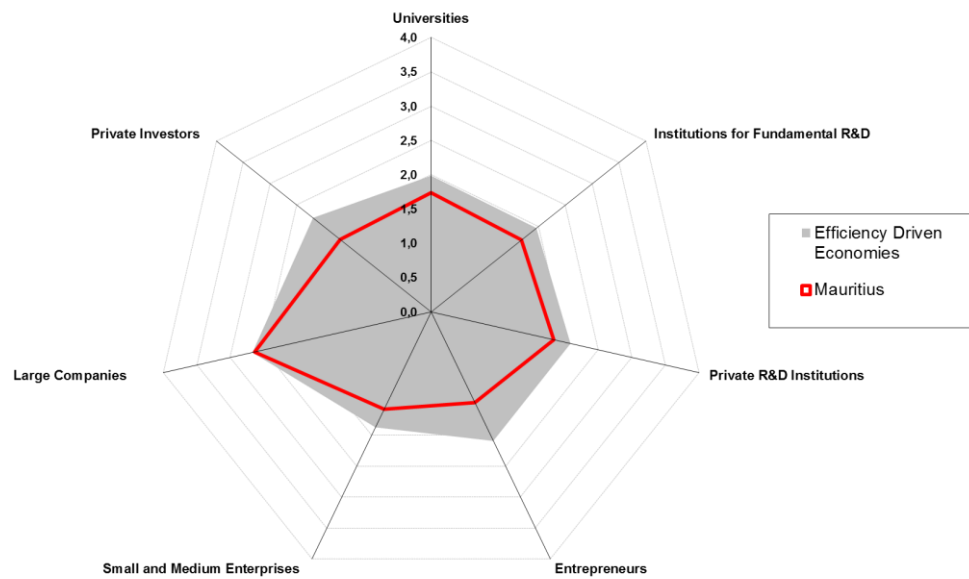


Figure 12: Maturity of the determinants of Mauritian innovation capacity level compared to the average of selected efficiency-driven economies

Figure 13 confirms the above mentioned findings; most determinants are lying around the average value, whereas that is very high for larger companies. That corresponds to reality, since the larger companies in Mauritius really have a strong market position and are the national drivers for innovation.

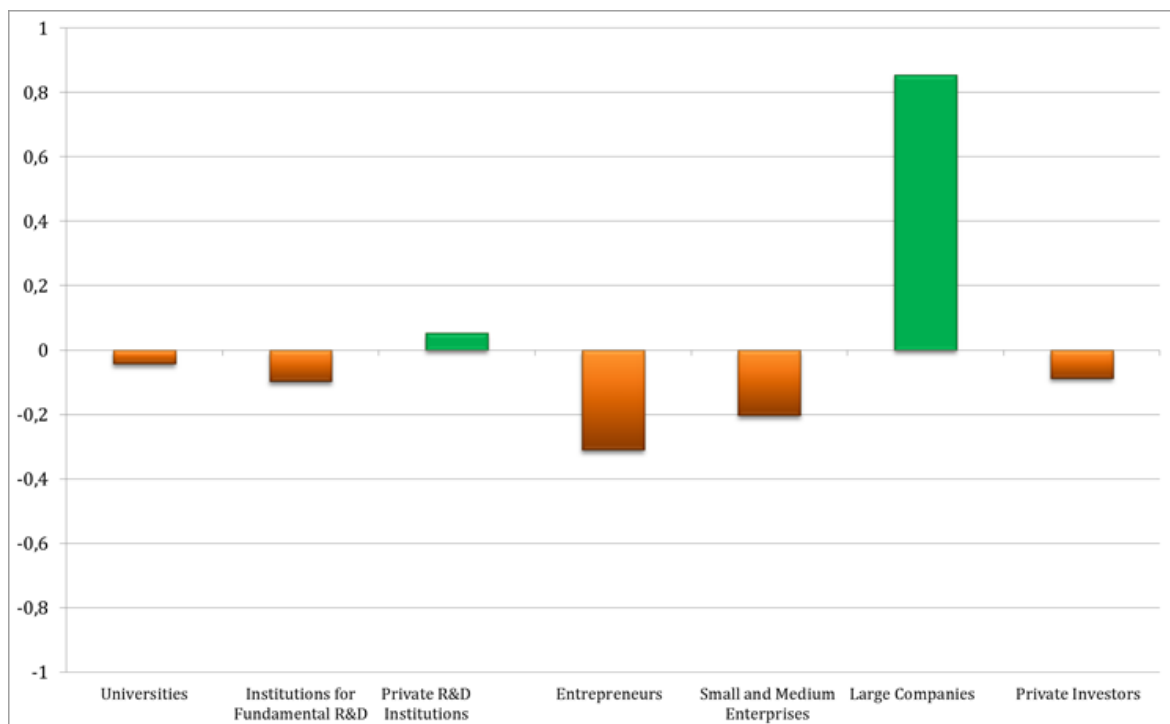


Figure 13: Determinants of the innovation capacity level compared to this level's average

5 Scope of Intervention

The framework conditions for innovation in Mauritius have improved in the recent past. However, it is still a long way to go to lead Mauritius towards a knowledge-driven economy as indicated in Figure 2, chapter 3. The status of maturity of the determinants within the Mauritian innovation system and the innovation capacity of its actors can be improved by policy measures addressing the improvements of single determinants or even several of them. The prospective impact can be expected on all three levels if policy interventions are adequately formulated and implemented with a focus placed according to the identified potentials.

However, there is always a broad spectrum of improving measures discussed, whereas the issue is more how to start and how to prioritise the measures that improve given determinants. There is no doubt that especially those determinants that rank below average shall be addressed first. Thus, easy to implement measures could have been distinguished from those that involve extensive efforts and high risks with regard to implementation.

For policy-makers ready to stark actions to improve a regional or national innovation system, it is always very crucial to know and to make use of effective policy tools in order to enhance the performance of single determinants as well as the overall performance.

Two indicators can be calculated, which help to prioritise policy interventions. Firstly, an **Impact Index** (Quality & Quantity of Impact) can be calculated that describes the expected impact of a certain policy measure on the innovation system. Without doubt the improvement of some determinants has a higher impact on a regional or national innovation system than the improvement of others.

Secondly, the **Effort Index** can be used to assess the costs and complexity of a certain improvement measure and its implementation risks. Without doubt some improving measures can be implemented fast and without too much effort, others request huge investments or are considered to be long-term investments.

In the current Mauritian case, Impact and Effort Indices have been calculated separately for all determinants of the Mauritian innovation system. If an innovation system is to be improved, certain determinants must be addressed, especially those that rank low before policy intervention.

Figure 14 displays the corresponding results when the experts have been asked their opinion about impact and complexity (efforts) expected when addressing certain determinants. The vertical scale represents the “efforts needed” (How extensive is the needed amount of investment to enhance the performance of the determinant?), the other represents the “expected impact” (What range of improvement can be expected?).

The upper right area in Figure 14 is the most promising area, since those determinants are considered to be comparably easy to improve with a high expected impact. Those ranking in the lower left area shall not be addressed, since the expected impact is low compared to the mandatory investments. Determinants in the lower right areas can be addressed, since not much effort is needed. However, the expected impact is low.

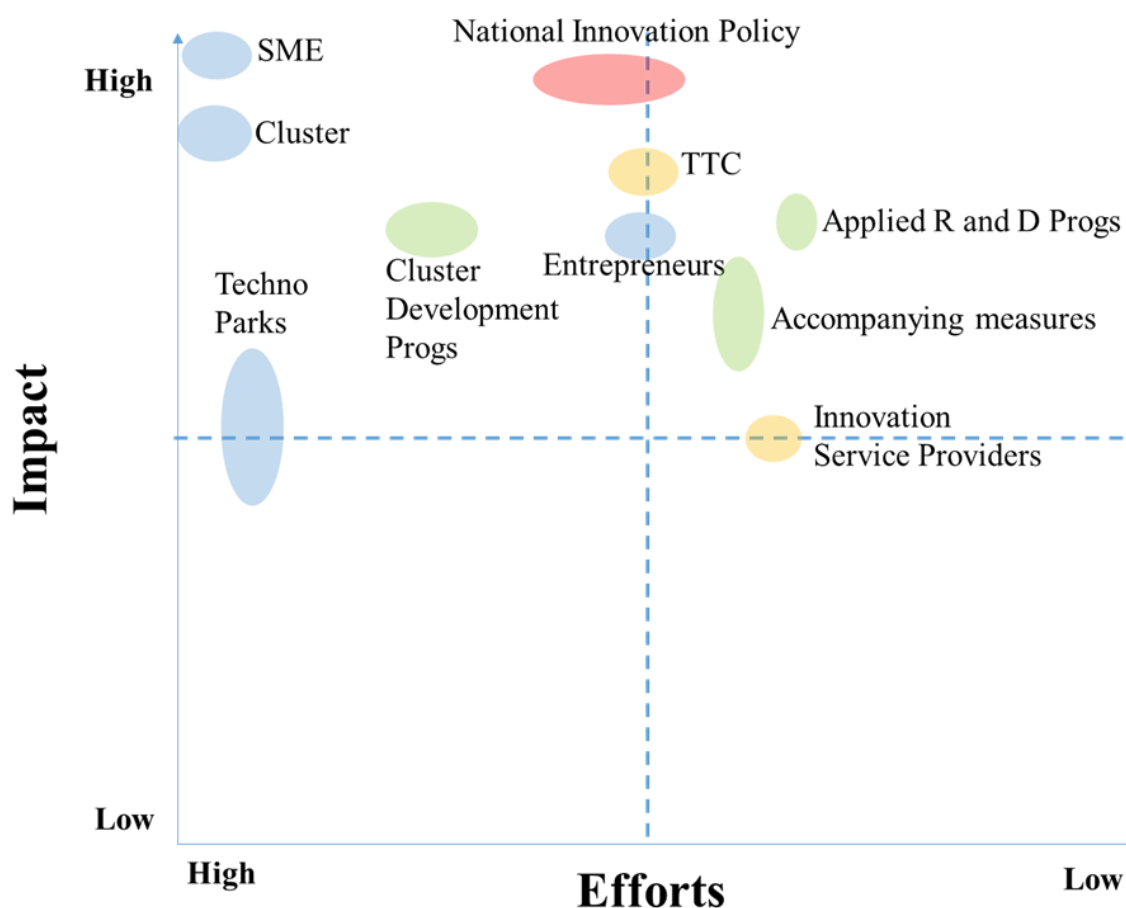


Figure 14: Scope of intervention of innovation support schemes for Mauritius

5.1 Recommendations for Policy Interventions to Strengthening the Entire Mauritian Innovation System (Focus on Knowledge-based Industries)

Based on the findings and on the ranking of determinants (see Figure 14), the following set of policy recommendations can be deduced:

1.) Recommendation: Setting up a National Innovation Strategy

Addressed level: macro-level

Rationale: Currently there is no national innovation policy or strategy in Mauritius which addresses STI objectives or sets clear primary objectives to be addressed by STI policies.

Description of action to be undertaken: Starting a process of developing a strategy by involving stakeholders from all levels would be the very first step. It can be done in an open way (public consultations) or with a limited group of representatives. Representatives from ministries shall also be involved, but not dominating the process. Based on sounding analyses and existing documents, the major target groups (who shall benefit) and the key objectives (what shall be reached) shall be defined. The final result shall be understood as a national roadmap of innovation describing the objectives and main actions to be undertaken to lift Mauritius on the next level of economic and

innovation performance. This roadmap or strategy shall also include an action plan for implementation of relevant actions.

2.) Recommendation: Industrial and institutional mapping of knowledge-based industry and assessing linkages among those actors

Addressed level: micro- and meso-level

Rationale: During the ANIS workshop, it became clear there is no knowledge about the industrial and academic landscape in the knowledge-based industry in Mauritius. In other words, the main actors (on micro-level), who are involved in increasing innovation and benefitting from a knowledge-based industry are unknown.

Description: As first action, a Steering Committee (or similar group) gathering stakeholders from all levels shall be set up by the government to monitor the upcoming mapping activities. After setting up, the first action is to clearly define what is understood by “knowledge-based industries” (especially which industrial areas) followed by a study of already existing information about industry and institutions being active in the defined areas. The involvement of business associations, Chambers of Commerce or similar stakeholders should help to get a dedicated picture of the national actors mapping. It could also be an option to tender such a nation-wide survey. However, all activities have to be monitored by the Steering Committee. Once the mapping is done, the findings shall be published for the interested public.

3.) Recommendation: Training scheme and awareness campaign on “Innovation Policy”

Addressed level: macro-level

Rationale: Most determinants on macro-level (policy level) are on an embryonic level. Thus, there is significant room for improvements. As indicated in the key notes, the nature of STI has significantly changed and heavily impacts on STI policies. This paradigm change has to be acknowledged by Mauritian policy-makers. Thus, some training and coaching activities and how to proceed with new policy approaches geared towards knowledge-based industries.

Description: Implementation of training schemes and coaching of policy- and decision-makers on how to prepare innovation policies. It shall be conducted by international experts who are doing innovation policies or programme implementation in their respective countries, and who are familiar with new tools and methods of innovation (and STI policies). Introducing real cases on how to turn policies into programmes and actions complete such training schemes.

4.) Recommendation: Using evaluation and impact measuring for a better STI programme governance

Addressed level: meso-level

Rationale: Although there is quite a number of R&D programmes in place, the analysis has shown that in the field of applied R&D programmes the number and variety of those programmes are considered to be limited as well as those design features and scopes. So far, there is no approach of continuous evaluation of projects and programmes and no impact assessments. Thus, neither policy-makers nor funding agencies know about the outcomes and impacts of those applied R&D programmes.

Description: Selection of the most relevant applied R&D programmes and setting up an evaluation design in order to measure to what extent an applied R&D programme (and its R&D projects) contributed to the programme objectives. Defining outputs, outcomes and impacts of those programmes and running an evaluation of the funded R&D projects. In the end, key success factors will be identified as well as areas for improvements. Good practices can be identified. When running the evaluation, the beneficiaries (mainly private and public sector) will be involved by asking their feedback and their input. Thus, a needed skills assessment by the industry can smoothly be implemented in such a survey. In the end, a better picture will be gained about the success of the applied R&D programmes, their success and fields of improvement. The future programme design features and addressed scope can be further developed according to the real needs.

5.) Recommendation: Setting up an innovation centre (competence centre) that will focus on applied R&D and offer innovation support services

Addressed Level: meso-level

Rationale: When it comes to applied R&D in Mauritius, only a limited number of institutions can be involved. Universities focus more on training and fundamental research. Since the number of universities is limited and due to their given focus, there is only limited capacity to conduct applied R&D in Mauritius.

Description: By increasing the number of applied R&D providers that are capable to conduct applied R&D according to industrial demand, better and more tailor-made applied R&D can be conducted in Mauritius. Such institutions, like innovation or competence centres, shall also offer innovation-related measures, like technology trend scouting, R&D foresight, innovation coaching, support of start-ups, etc. Such centres can be considered as partners for the private and public sector and working closer to the industry when it comes to STI. A public-private-partnership is advisable in this context.

6.) Recommendation: Implementation of accompanying measures to increase innovation capacities in SMEs

Addressed level: micro-level

Rationale: The awareness of the importance of innovation as well as the capacities within companies to innovate (and conduct applied R&D) is still limited. So far there are neither many awareness campaigns in place, nor training schemes for SME staff, like how to do innovation managements, innovation analyses or market research.

Description: Awareness campaigns as well as measures to increase innovation capacities within SMEs shall be offered and implemented. The corresponding needs of the industry can be analysed by the relevant Business Development Agencies or Chambers of Commerce who work closely with the industry. Once such an analysis of needs has been conducted, proper campaigns and training schemes shall be implemented.

7.) Recommendation: New support schemes for entrepreneurs/start-ups

Addressed Level: meso-level

Rationale: Entrepreneurs and start-ups are known as key drivers for innovation. Although there is quite a number of incubators in place in Mauritius, the landscape of private capital to be invested in

such firms is still limited. The framework conditions for private investors, like venture capital, investing in new firms or doing investments in innovations is not well-developed.

Description: By using new business support schemes for entrepreneurs/start-ups the number and impact of entrepreneurs/start-ups can be increased. These support schemes shall not only directly address the entrepreneurs/start-up directly but shall also increase the framework conditions for private investors doing business and investments in Mauritius. Amongst others, e. g. venture capital funds backed by the public sector and public-private-partnerships for investing in entrepreneurs/start-up can be a good way to facilitate such investments.

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