Position Paper

An Introduction to Blue and Green Innovation in Mauritius

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ABSTRACT

Innovation in the blue and green sectors has proved to be a massive contributor in the advancement of the sectors at a global level. The use of emerging technologies changed the blue and green sectors into rapidly mushrooming and lucrative sectors. The blue and green sectors benefit from significant attention in small islands developing states, including Mauritius, as alternative economic approaches to tackle financial uncertainty and susceptibility.

Mauritius has an exclusive economic zone (EEZ) of 2.3 million km^2, including the Chagos region and a continental shelf of 396,000 km^2 co-managed with the Republic of Seychelles, and agricultural land spanning over 42% of its total area. This offers the opportunity for exploratory endeavours to be launched in a bid to bolster the development of the blue and green sectors. These sectors therefore present high propensity to become a prominent economic pillar of Mauritius. The scope of the blue and green sectors is aligned with the sustainable development goals and the established national targets which focus on transforming Mauritius into a sustainable, inclusive, innovation-driven and high-income country.

Innovation in the blue and green sectors represents a substantial opportunity for Mauritius. With innovation, it becomes possible to tap into the potential of our large EEZ, to diversify abandoned sugarcane fields, to increase the visibility of Mauritius through blue and green initiatives and to form regional, international and local partnerships to access innovative technologies and expertise. Innovation in the blue and green sectors will also help to address food security and climate change issues.

This manuscript presents the current state of the blue and green sectors in Mauritius, including gaps and challenges, and technological needs. Several strategic orientations and actions are proposed as part of a roadmap to promote economic growth through research, innovation and commercialisation in the blue and green sectors of Mauritius.

Keywords: *Blue and green sectors, innovation, sustainable development goals, sustainable development*

ABBREVIATIONS

CSIRO	Commonwealth Scientific and Industrial Research Organisation
EEZ	Exclusive economic zone
EU	European Union
FAO	Food and Agriculture Organisation
MCIA	Mauritius Cane Industry Authority
MRIC	Mauritius Research and Innovation Council
MSIRI	Mauritius Sugarcane Industry Research Institute
OECD	Organisation for Economic Co-operation and Development
PAGE	Partnership for Action on Green Economy
SIDS	Small Island Developing State
UNEP	United Nations Environment Programme
UoM	University of Mauritius

INTRODUCTION

Overview

The Organisation for Economic Co-operation and Development (OECD) predicted that the global economy will grow by 2.7% in 2023 [1]. This is the lowest annual rate since the global financial crisis, except for the 2020 pandemic period. However, the outlook is uncertain due to turmoil in the financial sector, high inflation, ongoing effects of social unrest around the world and COVID-19 [2]. According to the Government of Mauritius, innovation and emerging technologies are crucial avenues for economic recovery [3].

Mauritius, a small island developing state (SIDS), faces various challenges that hinder its economic and social progress. These challenges include its geographical isolation, its vulnerability to natural hazards, its environmental fragility and its limited natural resources [4]. The World Bank temporarily classified Mauritius as a high-income country in July 2020, but the country reverted to an upper-middle-income status in 2021 due to the negative effects of the COVID-19 pandemic and the related travel restrictions on the tourism sector, which is a vital source of revenue for the country. Moreover, the sugar industry, which is another key component of the Mauritian economy, suffered from the drop in sugar prices and the termination of the beet sugar production quota in the European Union (EU) [5].

New and sustainable economic bases are required to tackle these challenges [6]. Mauritius has a vast exclusive economic zone (EEZ) of 2.3 million km^2 and 42% of its total area is devoted to agriculture [4], [5]. These assets create an opportunity for the blue and green sectors to emerge as sustainable economic pillars.

This paper adopts the definitions of blue economy from the World Bank and the Ministry of Blue Economy, Marine Resources, Fisheries and Shipping. The definition of green economy stems from the United Nations Environment Programme (UNEP).

Blue economy: According to the World Bank, the blue economy is the "*sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem*." The Ministry of Blue Economy, Marine Resources, Fisheries and Shipping defines the blue economy as '*the simultaneous promotion of economic growth, oceanic sustainability (sustaining ocean resources and ecosystem), and social inclusion*' [4].

Green economy: The United Nations Environment Programme (UNEP) defines the green economy as one '*that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities* [6].

International innovation trends related to the blue and green sectors

Innovative contributions to the blue and green sectors led to significant strides in global development. The blue and green sectors have transformed into rapidly growing and profitable industries, on the account of the widespread adoption of smart technologies, such as artificial intelligence, internet of things, machine learning, blockchain and satellite imagery.

SIDSs, including Mauritius, have been paying significant attention to the blue and green sectors as alternative economic approaches to address the growing financial uncertainty and vulnerability. The upcoming sections will delve into a few of the global initiatives undertaken to explore the potential of the blue and green sectors.

Harnessing the potential of the blue economy

The ocean is a vital source of natural wealth and a key driver of the global economy, as it enables the movement of goods and people across continents [7]. The blue economy aims to harness the ocean's potential for economic and social development, while ensuring its ecological integrity and resilience [8]. The blue economy encompasses various sectors and activities that depend on the ocean, such as fisheries, aquaculture, tourism, maritime transport, offshore renewable energy, biotechnology and seabed mining. As traditional resources become scarce and competitive pressures increase, countries are looking for novel avenues in the ocean to foster sustainable and inclusive growth through the blue economy approach [7]. The blue economy offers a way to balance the exploitation and conservation of the ocean, while addressing the challenges of climate change, food security, poverty and inequality.

Myriad strategic methods have been adopted at the global level to tap into the ocean and marine resources in a sustainable way. The sectors of blue economy have achieved new heights with the help of significant investment, technological innovations, fiscal incentives and multidisciplinary collaboration [8]. In a report, the EU has identified the scope of blue economy and highlighted the emerging and innovative sectors that can drive its development [9], [10]. Such sectors include blue bio-economy, desalination, marine minerals, coastal and environmental protection, and research and education, amongst others [9], [10].

Various countries have implemented different initiatives to advance their blue sectors. The Blue Recovery Hub was created in Saint Lucia with the support of the Organisation for Economic Co-operation and Development and the World Economic Forum to explore how innovative finance can facilitate blue economy transitions [11]. Seychelles issued the first sovereign blue bond in the world and achieved the first climate adaptation debt restructuring [8]. China established six national marine economic innovation and developed seven national industrial demonstration bases to boost the marine industry [12]. China also has other remarkable projects including Shandong Peninsula Blue Economic Zone, Blue Silicon Valley and the strategic cooperation among marine parks and bases in the Yangtze River Delta region [12].

The SAGARMALA initiative in India aimed to enhance the performance of the logistics sector and support the development of coastal communities through port-led strategies. Data from satellites were also used to identify potential fishing zones in the Indian waters, which indicated the likely presence of fish aggregations [7], [12]. In the Caribbean islands, a Climate Adaptation Swap Initiative was established, which included a resilience fund [10], [13]. In Iceland and Brazil, the Food and Drug Administration approved the use of fish skin as grafts [14] - [16]. In Kenya, Blue Fashion was launched as a blue growth project, with the collaboration of Commonwealth Secretariat, Commonwealth Fashion Council, Food and Agriculture Organization of the United Nations, and the Nordic Atlantic Cooperation [17]. In Australia, a Blue Economy Cooperative Research Centre and a Marine Bioproducts Cooperative Research Centre were formed, which involved 43 and 68 partners from industry, government and research sectors respectively, from ten countries. These centres conducted industry-focused research and training through national and

international partnerships and aimed to boost the export-oriented marine bioproducts industry [18], [19].

Exploring the untapped potential of the green economy

The world is gradually transitioning towards a new economic paradigm which prioritises environmental sustainability, social equity and resource efficiency over excessive resource use, environmental threats and social disparities [6]. The benefits of a green economy are significant and within the reach of governments and the private sector [6].

Different initiatives have been undertaken around the world to develop the green sector. In Morocco, an integrated solar energy generation project was undertaken to produce concentrated solar power systems, whereby mirrors or lenses focus sunlight onto a small area. The heat generated is then used to run a steam engine connected to an electrical power generator [13]. In Japan, drone technology is applied to pollinate flowers [14], [15]. In Denmark, Germany, Latvia and Lithuania, farmers attach ear tags with wireless radio frequency identification antennas to cows to identify each animal when they visit a smart robotic feeder. The feeder records the time each cow visits, along with exactly what dose of mineral feed supplements they were given [16], [17]. In Spain, drone and ground-based robots were developed to image the foliage on olive trees and grape vines, which when analysed using artificial intelligence algorithms, can detect the early signs of crop disease [17]. In East African countries, an innovative crop pest control tool, known as elocust3, was implemented to be used as a detection and early warning tool for Desert Locusts outbreaks [18].

Sustainable growth targets set for Mauritius

The government programme for 2020-2024 emphasises on achieving a green, inclusive, innovation-driven and high-income Mauritius. This includes accelerating the growth of the blue economy. The “Vision 2030” strategy was devised to transform Mauritius into an ocean state by promoting blue economy as a pillar of development. Moreover, the budget speech 2022-2023 accentuates cleaner, greener renewable energy and green economy. The budget speech 2022-2023 also focuses on blue economy to reduce our dependence on imports. According to the Mauritius Renewable Energy Roadmap 2030, the Mauritian government aims to generate 60% of its energy needs from renewable sources by 2030, while phasing out coal in electricity generation and increasing energy efficiency by 10% based on a 2019 baseline [19]. To achieve this target, in June 2023, the Ministry of Agro-Industry and Food Security launched the biomass framework, which aims to encourage the generation of energy from biomass sources, such as, trash sugarcane bagasse and wood biomass [20]. Furthermore, the government is steering the development of a biotechnology and pharmaceutical industry in Mauritius [3].

In 2023, the Ministry of Environment, Solid Waste Management and Climate Change released a report that presents the vision, objectives, principles and strategic actions for mitigating greenhouse gas emissions in Mauritius in line with the nationally determined contribution (NDC) under the Paris Agreement [21]. The report identifies the projected emissions and mitigation potential, and proposes mitigation actions for six sectors, namely, energy, transport, industry, waste, agriculture and forestry, in order to assist in achieving the NDC target of reducing its greenhouse gas emissions by 30% by 2030 [21].

In July 2023, the Ministry of Environment, Solid Waste Management and Climate Change in collaboration with various stakeholders, including the private sector, civil society and academia, launched the Roadmap and Action Plan for a Circular Economy in the Republic of Mauritius [22]. The report outlines the vision, objectives, strategies and actions to transform Mauritius into a circular economy by 2033. The report elaborates on the strategies and actions for five priority focus areas, namely, agri-food, construction and real estate, consumer goods, mobility and logistics and waste management, as well as the cross-cutting actions (governance, education and awareness raising, research and development, business support, public procurement, and greening of fiscal policies and financing) that are crucial for the transition to a circular economy in Mauritius [22].

To achieve sustainable economic growth in Mauritius, it is essential to consider certain core elements, for instance, policy, regulation and enforcement, technology, knowledge, resources and incentives. These are further elaborated in the Mauritian context in this paper.

Aim and objectives

The Mauritius Research and Innovation Council (MRIC) is a key agency that advises the government of Mauritius on applied research, innovation, and R&D matters. In April 2022, it held Les Assises de la Recherche et de l'Innovation, a national dialogue event on various themes that are of high priority for Mauritius (MRIC, 2022). Innovation in the blue and green sectors were considered among the thematic areas. This paper reports on the outcomes of the discussions on the blue and green sectors, covering their current situation in Mauritius, such as gaps, challenges and technological needs, as well as the proposed strategic directions. The specific objectives were to:

- Provide an overview of the blue and green sectors in Mauritius;
- Identify the gaps, challenges and needs of the blue and green sectors;
- Analyse the strengths, weaknesses, opportunities and threats;
- Identify specific sub-fields within the blue and green sectors which may be targeted;
- Develop an implementation strategy;
- Identify enabling factors to facilitate development of proposed strategic orientations; and
- Predict any hurdle which may be encountered.

METHODOLOGY

Prior to Les Assises de la Recherche et de l'Innovation 2022, the MRIC invited several leading institutions in the blue and green sectors. A scientific dialogue on the blue and green sectors was initiated by a working group composed of representatives from these institutions. The working group also sought input from other relevant stakeholders who were not part of the group. The working group convened several times at the MRIC from February to March 2022. The working group focused on specific tasks that are mentioned below.

1. To take stock of the current state of the sectors
2. To comprehend the growth target for the sectors
3. To analyse the strengths, weaknesses, opportunities and threats of the blue and green sectors in the Mauritian context

4. To identify core elements where there are gaps so as to understand the underlying issues of the sectors
5. To comprehend the needs of the sectors in terms of research, innovation and technology
6. To recommend strategic orientations to effectively engage the development of sectors
7. To define implementation strategies
8. To identify the enabling factors which facilitate development in the strategic orientations
9. To predict hurdles which may arise
10. To draft a report to be discussed during Les Assises de la Recherche et de l'Innovation 2022

A sectoral forum was organised as part of the Les Assises de la Recherche et de l'Innovation 2022 to facilitate a broader dialogue among national, regional and international stakeholders on the blue and green sectors. The forum aimed to validate and enrich the strategic orientations that emerged from the working group sessions. Figure 1 shows the process of defining the strategic orientations that can foster sustainable economic growth in the blue and green sectors.

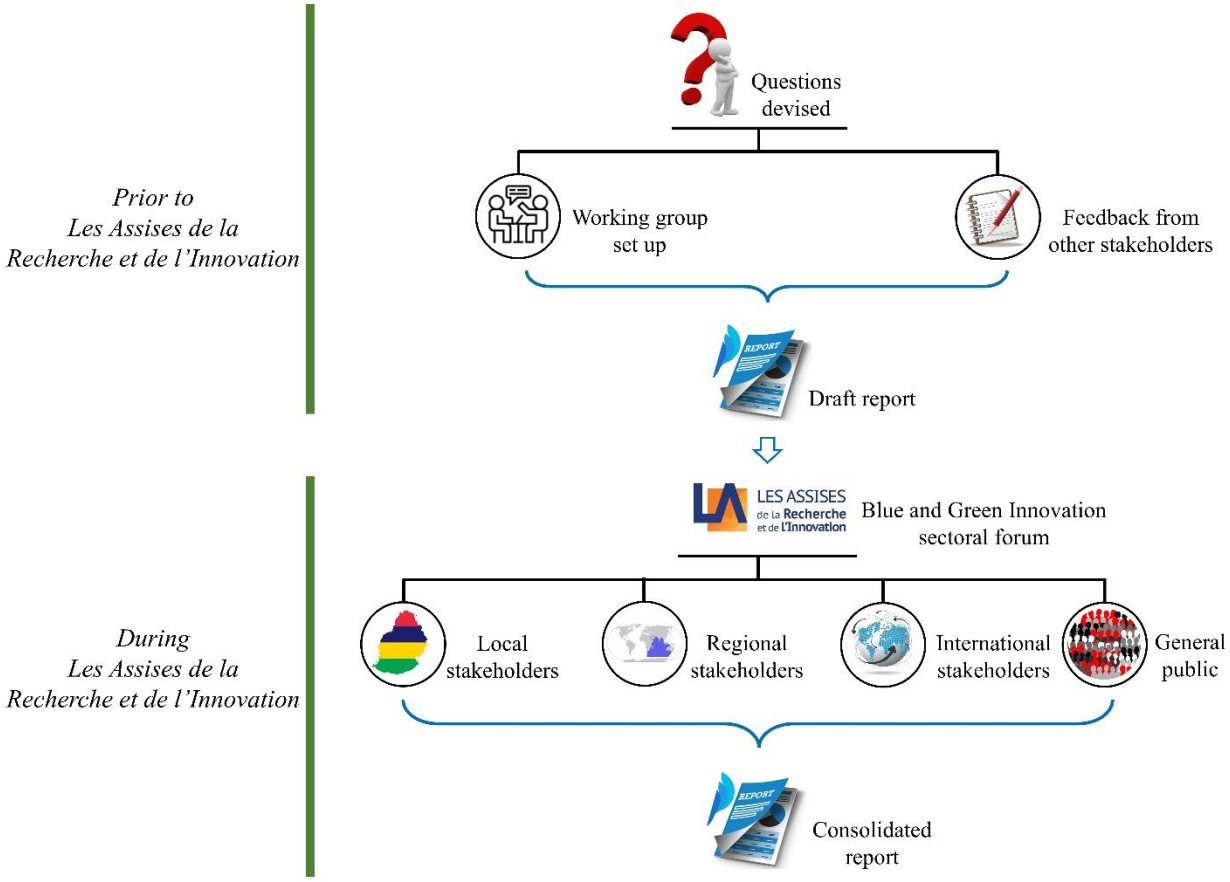

Figure 1: Process for formulating strategic orientations to promote economic growth in the blue and green sectors

RESULTS AND DISCUSSION

Situational analysis

Blue economy in Mauritius

The blue economy comprises mainly of the fisheries sector, marine and coastal resources, and shipping services. According to the World Bank, the total ocean economy accounts for around 10% of the Mauritian economy, with tourism being the largest contributor. Port activities is the second largest ocean sector (20%). Fishing and fish processing comes third [23]. The EEZ of Mauritius provides an widespread range of marine resources which can be explored and used for the benefit of the country [23]. In 2013, a roadmap was published which identified ocean economy as a key development opportunity, setting targets for the ocean economy and creating around 35,000 jobs in the process. A dedicated ministry for ocean economy, fisheries and marine resources was created to consolidate the tourism, seaport and fishing sectors and to develop the aquaculture, marine biotechnology and renewable energy sectors.

Ocean-related research in Mauritius is currently spearheaded by the Ministry of Blue Economy, Marine Resources, Fisheries and Shipping through the Mauritius Oceanography Institute and Albion Fisheries Research Centre, by the Department for Continental Shelf, Maritime Zones Administration & Exploration and by University of Mauritius (UoM). The various stakeholders are promoting research and innovation in the blue sector. As local marine science research matures, it will become important for research institutions to move from coastal research to open sea research. However, unlike coastal research which can be undertaken by individuals, open sea research requires long-term vision, institutional planning, substantial investment and considerable collaboration with regional and international partners.

Green economy in Mauritius

The green economy constitutes renewable energy, transport, agriculture and forestry. This paper focuses only on the renewable energy and agricultural aspect of the green economy. Historically, the principle agricultural activity in Mauritius was sugarcane cultivation, which accounted for 70% of cultivated land. This corresponds to 36% of the total land area in Mauritius. The current Mauritian agricultural system is based heavily on conventional methods; for instance, there is a heavy use of agrochemical products and a substantial dependence on non-renewable energies to operate machinery and factories. Hence, the Mauritian agricultural system remains susceptible to factors such as the climate, pests, diseases and the availability of resources, and the country relies heavily on food imports. The economic crisis prompted Mauritius to improve its food production and reduce its dependence on imports. It is essential for Mauritius to promote and strengthen modern agricultural methods based on new technologies and innovation to improve local production and bolster food security.

Various stakeholders, including the Ministry of Agro-industry and Food Security [24], the Food and Agricultural Research and Extension Institute [25], the Mauritius Chamber of Agriculture [26], the Bank of Mauritius [27], [28], the Mauritius Sugarcane Industry Research Institute (MSIRI), MCIA [24] and the UoM [29] are striving to transform the current agricultural system into a modern, sustainable, advanced and autonomous system.

Gaps and challenges in core elements for the blue and green sectors

The stakeholders identified several core elements which may contribute to the sustainable economic growth of Mauritius, namely policy, regulation and enforcement, technology, knowledge, resources and incentives. Gaps and challenges in these core elements were identified for the blue and green sectors. These are listed in Table 1.

Table 1: Gaps and challenges in the blue and green sectors

Blue sector	Green sector
Policy/ regulatory gaps and challenges	
• Creation of new frameworks and better implementation of available framework for the management of marine resources are required. • Spatial conflicts between the tourism and aquaculture sectors exist. • Existing policies need to be reviewed to prioritise sectors of development, to define funding mechanisms and to facilitate collaboration. • Measures to facilitate the development of blue carbon economics are limited. • Insufficient incentives are available to promote conservation of biodiversity. • Biodiversity and conservation need to become a priority in decision and policy making. • Updating existing regulations and development of marine related national standards and regulations are required. • There is a need to address conflicting regulations such as the demarcation of marine protected areas and the port area.	• There are insufficient incentives to support local production of seed and planting material. • There is insufficient knowledge of the existing support schemes and initiatives among growers. • Operational framework conducive to investments is inadequate. • There is a need for incentives to promote research at farm level.

Table 1: (*Continued*) Gaps and challenges in the blue and green sectors

Blue sector	Green sector
Enforcement gaps and challenges	
• There is a need for robust enforcement of policies, *e.g.*, excessive fishing in near-shore areas, pollution on land and in sea. • It is difficult to monitor the large EEZ due to inadequate resources and expertise. • Carrying out surveillance missions is costly. • There is a need to train personnel and improve logistics to enforce policies. • There is a need to empower more enforcement agencies. • Enforcement of conservation measures is inadequate.	• An inclusive operationalisation phase is necessary. • Measures to facilitate the development of green carbon economics are inadequate, *e.g.* Sensitisation about carbon markets, regulations for carbon credits (blue and green) generation, verification and trade.
Technological gaps and challenges	
• There is insufficient local technology available to work on blue and green economies. • Appropriate technology to support the development of maritime industry is inadequate. • There is insufficient data on biodiversity importance.	• Access to green technology is limited and resources are not geared towards supporting the adoption of such technologies. • There is a need to develop low-cost and high-impacting techniques for quicker adoption by farmers. • Mechanisation of farm activities is limited. • Design of low-cost structures for sheltered farming suitable for Mauritian climate is important. • Reluctance to adopt emerging technologies is observed.

Table 1: (*Continued*) Gaps and challenges in the blue and green sectors

Blue sector	Green sector
Knowledge gaps and challenges	
• Consolidation of available marine living resources inventories while expanding scientific exploration is important. • Stock assessment of each individual species requires more staff. • Marine spatial planning and cost-benefit analysis are required. • Sharing of knowledge, expertise and resources between institutions is important. • There is insufficient data analysis on the impact of climate change on fisheries in Mauritius. • There is no programme to explore the open ocean. • An evaluation of the contribution of conservation towards the economy is important.	• Raising awareness among end-users to support products emanating from green initiatives and to understand the inherent benefits is important. • Availability of local materials and expertise to implement green agriculture is inadequate. • Soil mapping and microbiological assessment need to be conducted to assess soil health. • There is inadequate capacity building to develop a skilled workforce and the necessary technical expertise for emerging sectors.

Table 1: (*Continued*) Gaps and challenges in the blue and green sectors

Blue sector	Green sector
Resources gaps and challenges	
• There is a need for improved access to oceanic natural resources. • There is an insufficient number of sea-going research vessels. • Enhanced regional cooperation for prospection is important. • There is a need for capacity building.	• Innovation in agricultural sector is required. • Breeding programmes to improve varieties of crops and livestock are important. • There is insufficient adoption of biotechnology tools in agriculture. • Ageing labour force combined with brain drain has created a labour shortage. • There is competition for land from other sectors which are more remunerative. • There is a reduction in area and productivity of arable land. • There is a dependency on costly and scarce imported seeds, planting material and raw materials for animal feed. • The supply of quality raw materials at competitive price is irregular. • Certain human activities endanger biodiversity. • The pool of experts for the technical follow-up during implementation of business ideas is insufficient. • Administrative procedures to acquire resources are rigid and cumbersome.

Table 1: (*Continued*) Gaps and challenges in the blue and green sectors

Blue sector	Green sector
Incentives gaps and challenges	
• Private institutions do not have financial depth post-pandemic. • There are inadequate fiscal incentives for the development of ocean-related activities. • Lack of encouragement for the development of business ideas at secondary and tertiary level is observed.	• There are inadequate incentives to adopt alternative agricultural practices such as vertical and urban farming. • There is insufficient infrastructural development for the promotion of agricultural research. • There is a need for incentives to develop biodiverse forests and agro-forests. • There is inadequate commitment from organisations to adopt green and sustainable practices. • Coordinated action among stakeholders is insufficient.

Table 1: (*Continued*) Gaps and challenges in the blue and green sectors

Blue sector	Green sector
Financing gaps and challenges	
• Innovation in the emerging sectors of blue economy is generally capital intensive.	• Inflated cost of production occurs due to the high cost of inputs and labour. • There is a lack of investment for current indoor agriculture industry with infrastructure to leverage advanced technology. • Stringent conditions laid down by funding institutions deter potential innovators. • Substantial investment is required to take a project beyond proof-of-concept stage and to start a business. • There is insufficient financial support to encourage youngsters who wish to implement innovative projects.
Other gaps and challenges	
• A national plan to encourage and facilitate innovation in the blue sector is required. • Management of fish stock in the face of a changing climate is required. • There is insufficient data on the impact of ocean acidification on fisheries. • There is a need for local resources to deal with emergencies at sea, such as oil spill.	• Climate change and weather extremes have deleterious impacts on crop productivity. • Poor management of agricultural produce and limited storage lead to losses and waste. • Green initiatives produce result on longer term with higher initial investment which is a deterrent for local producers. • There is a lack of knowledge about Mauritius as a destination to experiment with tropical agriculture.

SWOT analysis

A SWOT analysis was done on the state and needs of the sector based on the discussions during the working group meetings with various stakeholders. This is summarised in Figures 2 and 3.

Strengths

- Mauritius has several research institutions specialising in the blue and green sectors.
- Existing framework to educate, create awareness and facilitate development of the blue and green sectors.
- Mauritius is a member state of the Indian Ocean Commission and part of the ECO fish programme.
- Mauritius has in place a vessel monitoring system for the tracking of fishing vessels in the EEZ of Mauritius since 2005.
- There are incentives to innovate.
- The farming and fishing community are experienced.

Weaknesses

- Funding for research and innovation is limited.
- Applied research requires proof of commercialisation.
- There is decline of land under cultivation.
- Farmer and fishermen population is ageing and there is a shortage of labour.
- The cost of labour and agricultural/ marine input is inflated.
- The research and innovation culture is inadequate.
- Investment in research, technology and capacity building is inadequate.
- Knowledge transfer is insufficient.
- The nature of schooling is academic.
- There is limited uptake of emerging technology.
- There is lack of data sharing culture and collaboration amongst institutions.
- There is a general unpreparedness to face climate change.
- Coordination amongst research institutions is poor.
- There is dwindling of purchasing power.
- There is heavy reliance on import.

Figure 2: SWOT analysis (strengths and weaknesses)

Opportunities

- Mauritius has an EEZ of 2.3 million km^2 including the Chagos region and a continental shelf of 396,000 km^2 co-managed with the Republic of Seychelles.
- Mauritius has a strategic location (proximity to international sea routes).
- There is an opportunity to promote diversification on abandoned sugarcane lands.
- Increase visibility of Mauritius can be obtained through blue and green initiatives.
- National and international partnerships can be made to access innovative technologies and expertise.
- Existing framework for export may be modified to include products of the blue and green market.
- There is an opportunity to address food security and climate change issues.
- There is an opportunity to encourage public private partnerships.
- New technologies may be used for cross data analysis to determine illegal, unreported and unregulated activities, and for more efficient sea and air patrol.
- A database regarding the green and blue sectors can be compiled from studies carried out in public and private sectors.

Threats

- There is competition amongst different research institutions.
- There is brain drain and a resistance to change.
- Procedures to gain resources to undertake research are rigid and cumbersome.
- There is competition for resources from other economic sectors.
- There is inadequate technical follow-up with farmers.
- There is a decline in interest among the younger generation to go into agriculture, farming and fishing.
- Climate change.
- It is difficult to monitor the EEZ.
- Cost of purchasing, implementing and maintaining new technologies is high.
- Piracy at sea.

Figure 3: SWOT analysis (opportunities and threats)

Strategic orientations

Based on the discussions leading up to and during Les Assises de la Recherche et de l'Innovation 2022, seven strategic orientations were identified to lead to sustainable economic growth in blue and green sectors in Mauritius. The strategic orientations are as follows.

- Enhancing nutritional quality and food security
- Enhancing food processing from local sources
- Circular blue and green economies
- Marine technology
- Marine and plant biomed
- Blue and green bioprospecting and bioprocessing
- Blue-green production and export

These strategic orientations have been categorised as short term, medium term and long term, as shown in Figure 4. Projects under these strategic orientations are being identified and prioritised for implementation. These projects will be realised in collaboration with regional and international stakeholders.

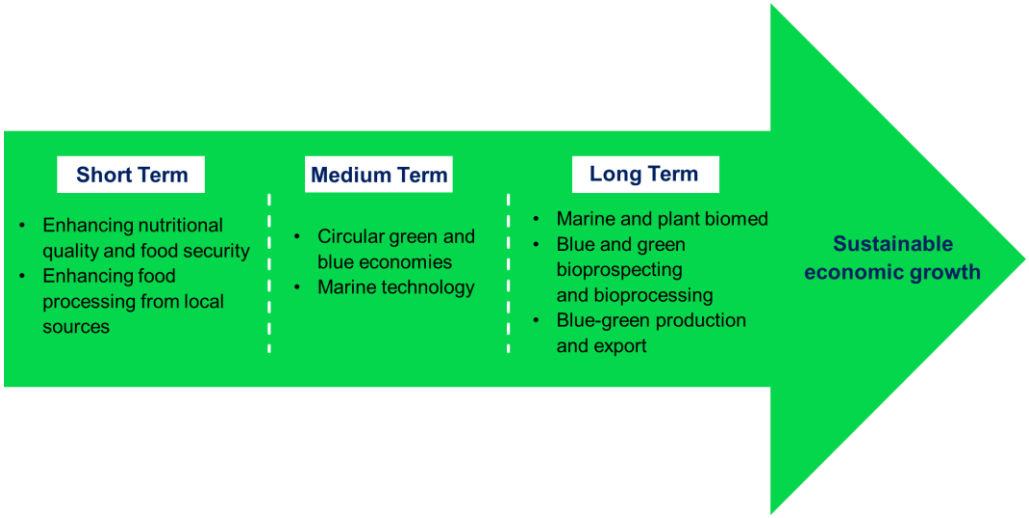

Figure 4: Short-, medium- and long-term strategic orientations identified to lead to sustainable economic growth in blue and green sectors in Mauritius

34 priority areas were proposed and action plans were developed. The strategic orientations were supplemented with activities which will be implemented in collaboration with relevant agencies in Mauritius. These are listed below.

Strategic orientation 1 Enhancing nutritional quality and food security

Priority areas

(1) Satellite and aerial imagery for sustainable land use and targeted agricultural inputs
(2) Development of smart machinery and equipment to improve farming practices
(3) Blockchain food traceability
(4) Use of IoT to monitor livestock
(5) Use of sugarcane fibres in nutrition
(6) Development of smart greenhouse horticulture structures ideal for our tropical climate
(7) Use of biotechnology tools for breeding, genetic resource exploitation, soil health rehabilitation and biosecurity purposes

Strategic orientation 2 Enhancing food processing from local sources

Priority areas

(1) Improved post-harvest techniques and development of intelligent storage facilities
(2) Mapping of agro-processing zones
(3) Use of solar energy for post-harvest techniques
(4) Using biotechnological tools to breed crops with a longer shelf life

Strategic orientation 3 Circular blue and green economies

Priority areas

(1) Blue and green fashion – innovative use of blue and green materials in the fashion industry
(2) Phytocosmetics – innovative use of plant materials for cosmetics
(3) Manufacturing of biodegradable and compostable blue and green products
(4) Upcycling waste to develop future cities

Strategic orientation 4 Marine technology

Priority areas

(1) Using modelling tools for ship management and coastal management
(2) EEZ monitoring – Leveraging on satellite observation and surveillance/ drone/ IoT
(3) Use of forecast technologies to predict weather phenomena
(4) Fish movement and monitoring
(5) Assessing marine genetic biodiversity and implementation of sustainable measures for resource conservation

Strategic orientation 5 Marine and plant biomed

Priority areas

(1) Biological wound dressing from fish skin
(2) Development of pharmaceuticals from marine organisms
(3) Development of thalassotherapy units in coastal hotels

Strategic orientation 6 Blue and green bioprospecting and bioprocessing

Priority areas	(1) Investigation of health benefits from marine biodiversity (2) Investigation of health benefits from terrestrial biodiversity (3) Development of the blue nutraceutical industry (4) Development of the green nutraceutical industry

Strategic orientation 7	Blue-green production and export
Priority areas	(1) Feasibility study for an offshore hydrogen plant (2) Feasibility study of exportation of hydrogen as fuel (3) Local manufacturing and export of raw materials for renewable energy production (4) Conversion of biomass to transportation fuel (5) PV Power generation with aquaculture (6) Feasibility for production of electricity from coconut oil in outer islands (7) Feasibility study for implementing net zero energy buildings in Mauritius

Implementation strategies

A first step to initiate development in the strategic orientations is to invite proposals for projects. The strategic orientations will also benefit from the implementation of pilot projects, feasibility studies and proof of concept initiatives. To foster the execution of projects aligned with the strategic orientations, new and revised bills, the enforcement of the Intellectual Property Act and policies to increase public funding in research and innovation are needed. Furthermore, the acquisition of national and international expertise and consultation, and of relevant software will support the advancement of projects.

Enabling factors

Business development strategies and regulatory frameworks are two factors that can enable the development of strategic orientations for innovation in the blue and green sectors. Collaboration and public-private partnerships would offer the training required in the national, regional and international context. Equipping stakeholders with multidisciplinary skills and know-how can help drive innovation in the blue and green sectors in the Indian Ocean region, and work towards a shared objective. The Government launched several schemes that can help drive progress in strategic orientations; for example, there are schemes for fish breeding and rearing, schemes for procuring equipment and expertise, and schemes for infrastructure development. Projects in the EEZ would benefit from infrastructure development, maritime safety, security and surveillance programmes. Promotion strategies can help simplify the entry of end products into existing markets and also aid in the creation of new markets.

Hurdles expected

There are several challenges that may arise, such as a general reluctance to invest in new initiatives like start-ups or novel projects due to high initial costs and production expenses. There is also a

general reluctance to adopt recent and novel technologies, as Mauritian fishing and farming population is ageing. The heavy reliance and established measures for the importation of food and food products may deter any new local food production initiative. Moreover, local and technical expertise, infrastructure and equipment are inadequate. In certain cases, the absence of well-established industries, such as the nutraceutical industry, may discourage the pursuing of initiatives in this field. Furthermore, the development of potential projects or the production of certain food products may be hindered by cultural and religious barriers in Mauritius.

First call for proposals

A first call for proposals was launched in March 2023. The short-term priority areas considered were *Use of IoT to monitor livestock*, *Improved post-harvest techniques and development of intelligent storage facilities* and *Development of smart greenhouse horticulture structures ideal for the Mauritian tropical climate*. A total of 33 applications were received. A panel of experts was set up to access the proposals. Only 6 proposals were approved for funding by the MRIC. The 6 approved projects are as follows:

- Synchronized Monitoring and Adaptive Response Technology for Holistic, Efficient, Robust, and Dynamic Livestock Management (S.M.A.R.T. H.E.R.D.)
- Developing a Container Farm for Enhancing Food Security
- Postharvest processing of shellfish from local sources: an automated facility for oyster depuration and storage
- Developing the Smart Agrivoltaic Rooftop Greenhouse
- Building capacity to determine optimal post-harvest and processing practices for the production of quality cocoa beans and fine flavoured cocoa derived products in Mauritius
- Development of smart agroecology practices in tropical rooftop geodesic greenhouses

A second call was launched in September 2023. The short- and medium-term priority areas considered were *Biotechnological Tools to breed crops with a longer shelf life* (short term), *Blockchain Food Traceability* (short term) and *Manufacturing of biodegradable and compostable blue and green products* (medium term). 17 applications were received and are currently being processed.

CONCLUSIONS

A summary of the deliberations regarding the blue and green sectors from the Les Assises de la Recherche et de l'Innovation 2022 and the projects that emanated from these are presented in this paper. The purpose of Les Assises de la Recherche et de l'Innovation 2022 was to facilitate a national dialogue on various topics, including innovation in the blue and green sectors. The paper describes the current situation of these sectors in Mauritius, as well as the gaps, challenges and technological needs that they face. It also outlines the strategic orientations that were developed based on the discussions.

The paper considers several key elements that are essential for achieving sustainable economic growth in Mauritius. These elements are policy, regulation and enforcement, technology,

knowledge, resources and incentives. A SWOT analysis was conducted to assess the strengths, weaknesses, opportunities and threats for Mauritius in the blue and green sectors.

The paper proposes seven innovative strategic orientations for the short, medium and long terms. These orientations guide the identification and prioritisation of projects that are being implemented in partnership with regional and international stakeholders. The paper also discusses the implementation strategies, enabling factors and hurdles that are relevant for these projects.

Two calls for proposals have been launched in 2023 to foster research in the priority areas emanating from the Blue and Green Innovation thematic area of Les Assises de la Recherche et de l'Innovation 2022. Projects which were approved under the first call are listed in this paper. Applications received under the second call are being processed.

It is anticipated that focused research and innovation in priority areas could pave the way for supporting blue and green innovation in Mauritius.

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