INNOVONS
La Réunion

SMART SPECIALISATION STRATEGY FOR REUNION ISLAND

S3

Smart Specialisation Strategy

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SMART SPECIALISATION STRATEGY FOR REUNION ISLAND

Smart Specialisation Strategy

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EDITORIALS

Dominique SORAIN

At the opening of the Regional Innovation Symposium in November 2009, the ambition shared by the State, the Regional Council and the Departmental Council was clear: to strengthen economic development and the creation of employment through innovation, in order to strive for economic, social and regional cohesion driven by smart, durable and inclusive growth.

After this initial Innovation Symposium, the Regional Council and its partners, the State and Departmental Council, mandated the regional innovation committee to design a smart specialisation strategy (or S3 for Strategy for Smart Specialisation) that constitutes one of the ex-ante conditions requested by the ERDF 2014-2020 Operational Programme. Moreover this project has united stakeholders in the sphere of research, innovation, technology transfer and the business world

The logic of this new strategy should allow the means for research, innovation and economic development to be concentrated on priorities and key sectors based on the island's competitive advantages, which are rich in opportunities. The so-called "4 C" rule was the guiding principle of this reflection: proceed with targeted Choices, stipulate Competitive advantages, and create a Critical mass in the economy and RDI sectors in order to conceive effective Cooperation between stakeholders from the region, as well as those from further afield.

In the end, smart specialisation in Reunion presents three main priorities based on innovation: strengthening tropical bioeconomy, developing an "experiential ecotourism", and the longing to turn Reunion into a transformation platform for a digital and carbon-free knowledge economy. At the same time it aims to promote "entrepreneurial discovery" which implies mobilising all regional talent, strengthening accessibility - the key to innovation and competitiveness - constant improvement and simplification of project leaders' progress and, ultimately, opening up to the world. Faced with major development challenges, the island has equipped itself with a particularly ambitious Smart Specialisation Strategy that has the potential of tomorrow's growth: it can count on continued support from the State in order to bring this ambition into fruition.

Dominique SORAIN,
Prefect of Reunion Island

Nassimah DINDAR

A smart specialisation strategy for Reunion.

Thanks to our island's vital forces our economy has overcome numerous difficulties to reach its current state of development. Progress made has been considerable both in terms of the size and speed at which it occurred.
The capacity of Reunion's society to adapt to these changes is remarkable, and significant growth has been achieved in several sectors.
The progress made since Reunion became a French overseas department is immense. Improvements happened fast and this development has been achieved, for the most part, thanks to public funds and, more specifically, European ones, which allowed the promotion and support of framework investments, research, innovation, economic modernisation, agriculture, and support for professional integration and training.
However, faced with the many challenges waiting for us, both local (development of employment and employability) and international (increased competition due to the globalisation of economies and markets), more than ever we need to push our limits, mobilise, strengthen and develop all the skills present on our island.
Furthermore, the concentration of our public policies and resources in priority areas identified and developed by all our partners as part of this smart specialisation strategy should guide our actions in order for the economy and society of tomorrow's Reunion Island to flourish.
In order to do this and within the framework of a partnership approach the Departmental Council will seek to use its expertise to make its contribution so that our island can be a model both in terms of tropical bioeconomy and ecotourism as well a digital carbon-free economy.

Nassimah DINDAR
President of the Departmental Council

Didier ROBERT

Turning a constraint into an opportunity. Such is the challenge faced every day by thousands of Reunionese - farmers, craftspeople, researchers, entrepreneurs, civil servants, project developers, employees - who demonstrate creativity to solve specific problems and build our prosperity. These silent innovators know that adaptation is the key to survival and performance.

Turning a constraint into an opportunity. This is also the greatest challenge for the development of our region. Like any island, Reunion must deal with its geography - small size, remoteness, lack of fossil fuels, high population growth - and changes outside of its control: climatic upheavals, collapse of biodiversity, as well as general competition and dumping. All these risks question the very basis of our economy, the sustainability of our model and invite us to collectively ponder upon the future.

Yet, resignation is not an option. Our island has the strengths, skills and talents required to respond to these challenges and take advantage of significant opportunities such as the digital revolution, the ecological economy, renewable energy other global shift towards Asia and Africa. But we do need to release the energy. Construct a framework for project emergence and development, creating wealth and jobs; such is the goal of the Reunionese Strategy for Smart Specialisation (S3).

Turning a constraint into an opportunity. Such is the core of our S3. Following the formal request from the European Union, which conditions access to structural funds according to the definition of a " Regional Economic Transformation Programme", our island responded by collective mobilisation and ambition. For nearly 18 months more than 200 stakeholders were mobilised, notwithstanding their differences, to build a shared vision of a desirable future: a green, competitive and inclusive economy, fully connected to the rest of the world. A resilient territory, able to reduce its dependencies and vulnerabilities and to treat major local issues, driving forces for innovation and export. The S3 is our response to the crisis, a lever to build the future, consolidate what exists while following its change, and stimulate the activities that will make the Reunion of tomorrow.

Didier ROBERT,
President of the Regional Council

INTRODUCTION

The emergence of the idea of "smart specialisation" occurs in a context of questioning about the sustainability of the European economic model. Confronted with a systemic crisis, in 2010 the European Commission promoted a new agenda: Europe 2020. After the disappointments of the Lisbon strategy, the European Union is now counting on the transition to a competitive, sustainable and socially inclusive economy, thanks to innovation and bioeconomy. The goals are ambitious: raise the employment rate from 69% to 75%, take the R&D effort from 2% to 3% of EU GDP, reduce CO_2 emission rates by 20% compared to 1990, reduce the poverty rate to 25%, lower the school dropout rate to 10%.

In order to propel this transformation, all EU instruments are now created, coordinated and deployed in a *"common strategic framework"*, which also applies to the cohesion policy. Henceforth, access to structural funds is conditioned by the signature of a *"partnership agreement"*, in which national and local authorities will present an action plan to the Commission designed to set the beneficiary region on the path to Europe 2020. For the Commission, the Union's recovery lies in reinforcing each region's economic potential through a process of identification and exploitation of its specific competitive advantages, a *"smart specialisation"* strategy **known as S3.**

▶ S3, A «REGIONAL ECONOMIC TRANSFORMATION PROGRAMME»

Inspired by works on endogenous growth, the S3 is defined by Dominique Foray as a "***selection process***" aimed at the " prioritisation and ***concentration of resources over a limited number of activities and technological sectors where a region has a comparative advantage in comparison to the world level, and susceptible to generate new innovative activities which will grant regions, in the medium term, a competitive advantage in the world economy***".

It can clearly be seen that the S3 cannot be reduced to a research and innovation strategy, but comprises more of a "***regional economic transformation programme***" based on three cornerstones.

First of all, the **concentration** of regional resources (capital, infrastructure, talent, expertise, public expenditure, etc.), in order to reach the **critical mass** essential to face global competition and acquire a **leadership** position. As a matter of fact, a region's competitiveness depends closely on its capacity to assemble and forge close relationships between talented stakeholders.

These continuous interactions generate scale, learning and training effects, which fuel a dynamic of innovation and the production of **specific assets** - that is of knowledge, techniques, ways of being that are **specific to a region** - and which cannot be easily copied or replicated.

Concentration also supports **economic differentiation**, essential to escape increased global competition. Rather than engage in "duplicative strategies" that grant a bonus to the regions with the most resources, the European Commission advocates implementing policies capable of sustainably enhancing the specific strengths and assets of each region. Each region is therefore called upon to **single itself out**, to specialise in a global value-chain or a sector of activity for which it has a comparative advantage. At EU level this positioning will support the effectiveness of public expenditure by avoiding the financing of similar infrastructure or activities in remote regions.

Differentiation should also support integration. Community level integration on the one hand, as complementary regions develop relationships particularly thanks to the Horizon 2020 programme, successor of the 7th FPRTD, and COSME, leveraging fund synergy. Global integration on the other hand, since specialisation could lead to the creation of clusters of global excellence, able to attract leading players. This search for integration also takes place within regions: relation, cooperation and exchange between local players and sectors will create future fields of specialisation and skill development.

The exercise imposed by the EU resonates with our local needs: while the structural crisis questions the economic model forged during departmentalisation, Reunion has taken heed of the call for transformation in order to create the groundwork for transition, and thus respond to the region's great challenges, reduce its dependency, and support new shared prosperity.

▶ LONG-TERM COLLECTIVE MOBILISATION

This construction does not start with the momentum of the new programming. It is anchored in a longer-term dynamic, which began with the Regional Strategy for Innovation (SRI) in 2009. This was already based on the public conviction of the driving role of differentiation and innovation in order to exploit new paths for growth. The challenge is now to give new breath to the SRI, to propose strong long-term ambition and to deploy an action plan to support and accelerate the renewal of our economic model.

Using the regional development guides and practical advice from the RIS3 Platform, the President of the Regional Committee for Innovation (CRI) supported by the Regional Agency for Development, Innovation and Investment, Nexa, conducted participatory work in four stages.

First, **the construction of a shared vision of the future.**

In order to break with short-term and top-down strategies, the Commission recommends the organisation of broad, open surveys allowing collective definition of the region's expectations and the desired state: a unifying and inspiring regional project over the course of 15 or 30 years. 13 CRI meetings and 7 theme workshops brought together one hundred institutional, economical and university stakeholders on several occasions, allowing them to produce

an in-depth diagnosis of the region, the innovation ecosystem, and to build a common project.

Faced with the challenges of Reunion's dependency and vulnerability, the S3 suggests taking a new look at our local characteristics - insularity, small size, remoteness, absence of fossil fuel, scarcity of materials – often only viewed as handicaps. It insists on the opportunities created by global developments: green economy, digital revolution, the "third industrial revolution", Asian and African expansion putting the Indian Ocean back at the heart of the global economy...

The S3's ambition is to turn major local challenges (ecological, energetic, economic, human, and social vulnerabilities, etc.), into a driving force to develop strong value-added products and solutions, liable to be re-exported to countries facing similar issues.

In one word, to connect resilience and competitiveness. To go from a policy based only on the compensation of market failures to an economic policy that creates durable success and competitiveness factors.

During a second work stage, the participants agreed on three priority areas that meet this ambition:

 # tropical bioeconomy: due to its insular character, Reunion faces today challenges which all regions on the planet will confront in the coming years: an increase in the cost of fossil fuel and scarcity of its stocks, peak oil, ecological crisis, etc.

By acting on these limitations, but also with the vast range of opportunities offered by its natural heritage, our island can anticipate these developments and, starting today, impose itself as a major player of the green economy in a tropical environment.

 # experiential ecotourism: innovate in order to develop the tourism potential of Reunion and maximise impact on the region while positioning itself in the tourism niches of ecotourism, heritage experiences and emotions, and well-being.

 # regional responsiveness: innovate in order to preserve and increase the value of the extraordinary resilience of Reunion, and develop solutions in order to reduce vulnerability against health, social and energy impacts.

DEFINITION OF PRIORITY ACTION AREAS

	NB MEETINGS	NB PARTICIPANTS	NB SUGGESTIONS	DELIVRABLES
Construction of a shared vision	6	27	2	# S3 preparation workshops: challenges and practical formats # Verification of the Reunionese Innovation Strategy # State of the R&D ecosystem locations # Proposition analysis grid # Towards a Reunionese smart specialisation strategy
EXPLORATION OF SUBJECTS				
Bioeconomy	07/06/2013 17/06/2013 14/06/2013 05/07/2013	35	3	# Workshop reports # Towards a tropical ecological economy: Proposal for a summary of bioeconomy and energy work groups
Energy	11/06/2013 21/06/2013	13		
Tourism	19/06/2013 07/07/2013	13	4	# Workshop reports # Innovation, the cornerstone of regional opening. Proposal for summary of digital workshops, tourism and abilities
Digital economy	18/06/2013 18/06/2013	18		
Human talents	07/07/2013	13		
Training-Education	1	19	1	# Report: Education Training
Total	**12**	**138**	**10**	S3 Proposal

IDENTIFICATION OF INNOVATION-MARKET PAIRS

SUBJECTS	NB MEETINGS	NB PARTICIPANTS	LIST OF ACTION SHEETS
Bioeconomy	13/02/2014 18/02/2014 28/02/2014 11/03/2014	16	# Knowledge, conservation and restoration of ecosystems # Development of practices and agroecological productions # Extraction and mobilisation of active ingredients and molecules # Providing value to tropical resources and processed products
Experiential Ecotourism	12/02/2014 10/03/2014	12	# Reunion of emotions: destination for exceptional outdoor sensations # Reunion: a trip with cultural diversity # Reunion: a well-being destination, soothing and secure
AGILITY OF THE TERRITORY:			
Digital economy	12/02/2014 28/02/2014	19	# E-learning # E-health # E-tourism # E-government
Energy transition	10/02/2014 06/03/2014	20	# Ecological buildings # Renewable energy # Small & Smart Grids, storage # Transport
Health	18/02/2014 25/02/2014 26/02/2014 27/02/2014	14	# Health, well-being in a healthy region # Health, prevention of risks and diseases # Health, diagnoses and therapies
Social innovation	14/02/2014	12	# Develop regional talent # Social innovation # Promote open innovation # Urban innovation
Summary - total	**12**	**84**	**23**

Once these priority areas had been identified, thematic workshops allowed stakeholders to discuss and identify innovation-market pairs, or in the absence of these, niches of activity. In order to strengthen the bottom-up character of the process, the area leaders were charged with coordinating points of view and producing a series of summary sheets, specifying the challenges, goals, actions, means and indicators typical of each activity.

At the same time, a work group led by the President of the CRI brought together teams from the Regional Delegation for Research and Technology, the Regional Council, and Nexa, to produce a transversal action plan, designed to ease the **"entrepreneurial discovery"** of promising new specialities.

A fully-fledged focus area of our S3, these horizontal actions are aimed at **developing skills and cooperation in order to produce, capture and adapt knowledge, and to transform it into productive activities that will generate value and employment.** This group was also in charge of constructing a statistical tool to monitor S3 results, which will translate, in the form of control panels, the anchoring of Reunion on the path to Europe 2020.

This document is the result of this development of a smart specialisation strategy conceived for and by Reunion Island.

It is organised into three sections. Regarding the issue of a large regional diagnosis – one that questions the principles and challenges of the Reunionese model and the emergence of new global dynamics - **the first section depicts the ambitions and guidelines of our strategy. The second part focuses on the principles of selection, challenges and roadmaps in the selected domains of specialisation. The third section is related to the presentation of an action plan for the Regional Innovation Committee in order to accelerate entrepreneurial discovery during 2014-2020 programming.**

1#

FROM DIAGNOSTICS TO PROJECT:

ANSWERING THE CHALLENGES OF A VULNERABLE ISLAND ECONOMY

Although the S3 concept was developed in Europe, this strategy cannot be see as an import product. Grounded in local realities, it aims at unleashing Reunion's potential in the field of knowledge economy by providing solutions to critical issues.

A

THE DEVELOPMENT OF REUNION'S ECONOMY: A VULNERABLE SUCCESS

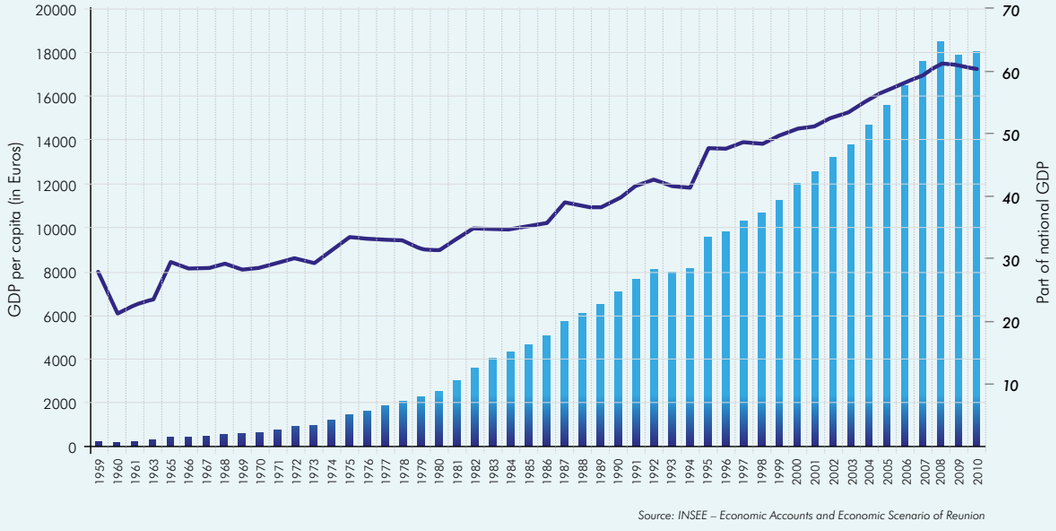
Reunion has experienced a true metamorphosis since becoming a French overseas department in 1946. This transformation, effected at a sustained and accelerated pace, has seen it transition in seven decades from a poor economy based on sugar monoculture to a modern society, a European "showcase" in the Indian Ocean. However, this apparent convergence and productive dynamism should not mask the ambiguities, dependencies and vulnerabilities of an economy faced with the risk of stalling.

1) ▶ THE DEVELOPMENT OF REUNION'S ECONOMY: A SUCCESS STORY?

In 1946, after three centuries of colonisation the elected representatives of Reunion chose an original type of emancipation: full and complete integration into the French Republic. After the 1960s, this choice resulted in the deployment of a vast social engineering programme, which aimed to transform the island into a developed economy, converging towards the standards of mainland France thanks to self-sustained growth.

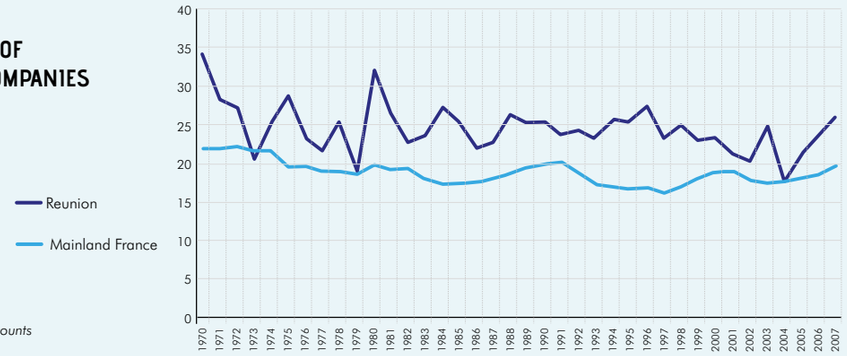
This French and European modernisation policy has equipped the island with essential factors (public infrastructure, human capital, healthcare facilities, institutions, etc.) for its take-off and growth: between 1970 and 2010, GDP was multiplied by almost 50 in value, growing from €306 million to €14,900 million. Convergence seemed well on its way: GDP per capita increased from €213 to €18,038 between 1960 and 2010.

FIGURE 1 EVOLUTION OF GDP PER CAPITA



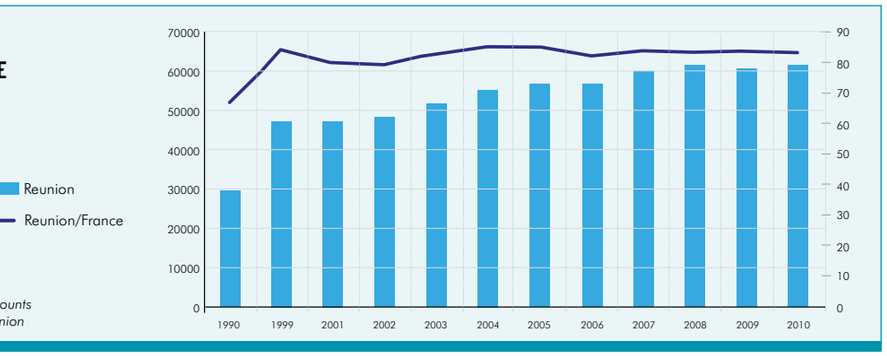
Investment has also increased noticeably; in a fast-developing market, investment rates by Reunionese companies largely exceed the national average (26% compared to 19.7%).

FIGURE 2. INVESTMENT RATE OF NON-FINANCIAL COMPANIES



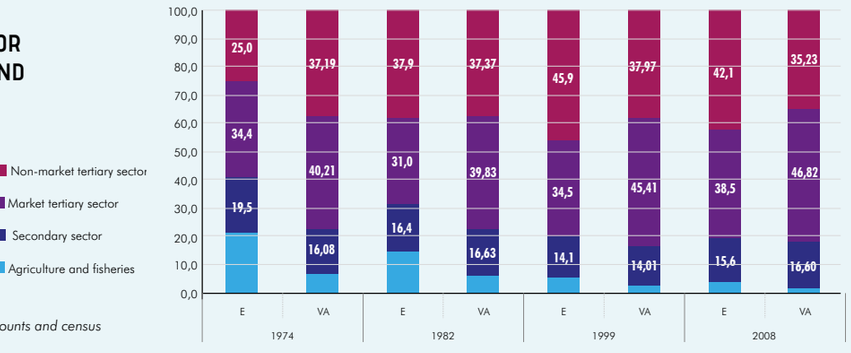
The apparent productivity of work thus grew over 3% per annum between 1974 and 2007 compared with 1.75% in mainland France, and contributed to the very strong growth of GDP per employee - from €15,733 in 1982 to €61,544 in 2008 - which shrank productivity gaps to 16.5% in 2010.

FIGURE 3. GDP PER EMPLOYEE



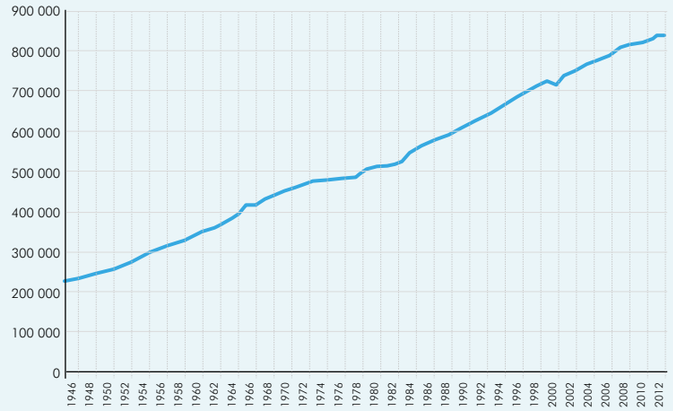
This dynamism is also expressed in the development of the productive sector: in 2013, the business creation rate stood at 14.1% compared with a national average of 14.3%. The evolution of productive structures reflect this great transformation:

FIGURE 4. ANALYSIS BY SECTOR OF EMPLOYMENT AND ADDED VALUE



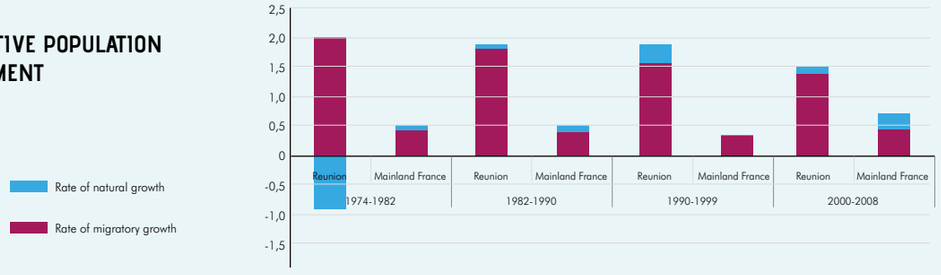
This shift can also be seen in the ability to adapt and rebound.
Reunion's economy knew how to overcome the specific limitations imposed by its geography: a small tropical island, with mountainous terrain, deprived of fossil fuel and a large hinterland. In order to overcome these contradictions it had to develop skills, innovate, adapt technologies and processes to tropical and island conditions.
Surrounded by developing countries, Reunion must also face competition from these low-cost economies, it thus seeks to differentiate with the excellency of its training and expertise. Required to apply numerous regulations (particularly for safety and traceability), it was able to use the latter as quality and performance levers in order to improve the calibre of products and processes.
The metamorphosis occurs ultimately in a context of very strong demographic growth; the population has more than tripled in 60 years, doubled in 40 years.

FIGURE 5.
DEVELOPMENT OF THE POPULATION



Source: INSEE – General information regarding the population

FIGURE 6.
COMPARATIVE POPULATION DEVELOPMENT



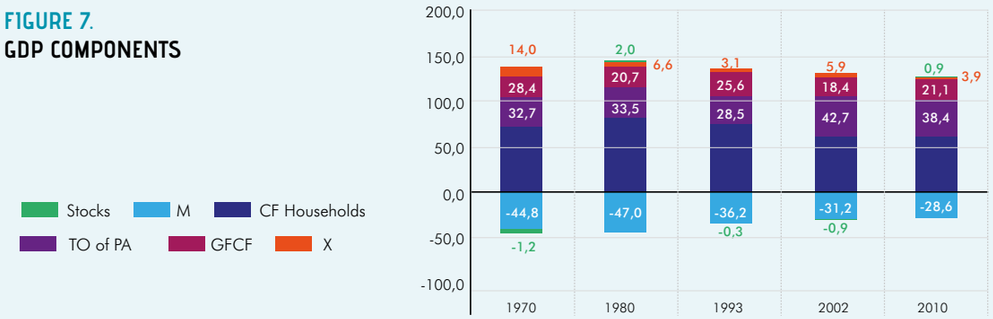
In addition to these long-term issues, Reunion managed - both in its earliest history as well as more recently - to endure numerous economic, social, demographic and ecological blows, and to develop a certain sense of resilience. Backed by political and judicial stability, this collective ability comprises one of the key factors for economic take-off and sustainability. The stable French and European institutional framework, which is sufficiently flexible to take into consideration local specificities while offering a reassuring environment to operators, appears as one of the region's key assets.

2) ▶ DEPENDENT DEVELOPMENT

This apparently strong convergence should not mask the frailties of an economic model whose dynamics and sustainability remain largely dependent on exogenous factors.

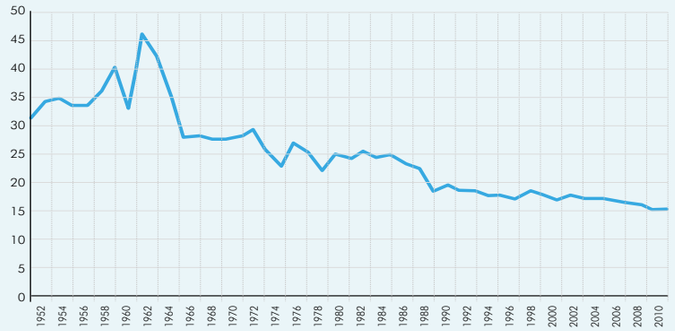
On a macroeconomic level, the main growth factors remain household and government spending, as well as investment, all strongly supported by public transfers.

FIGURE 7.
GDP COMPONENTS



By sustaining population growth and per capita consumption, these financial flows feed a limited but solvent local market, which has seen the retreat of numerous economic entities: between 1946 and 2010, the opening rate of the economy thus decreased from 46.5% to 15.3% of GDP.

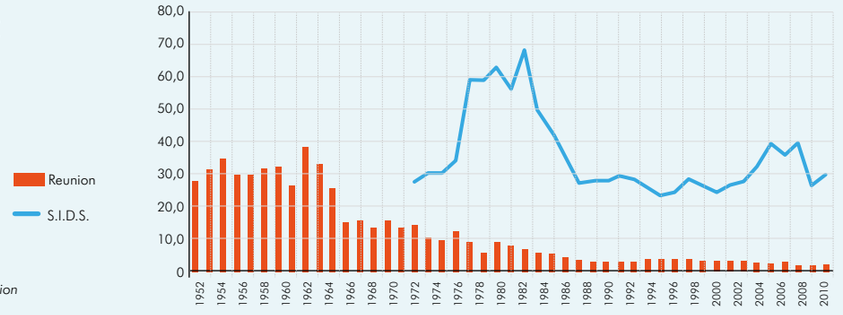
FIGURE 8.
RATE OF OPENING OF REUNIONESE ECONOMY



Source: INSEE – General information regarding the population

At the same time, the share of exports in GDP fell from 38.2% to 1.9%, compared with an average of nearly 30% in small island economies.

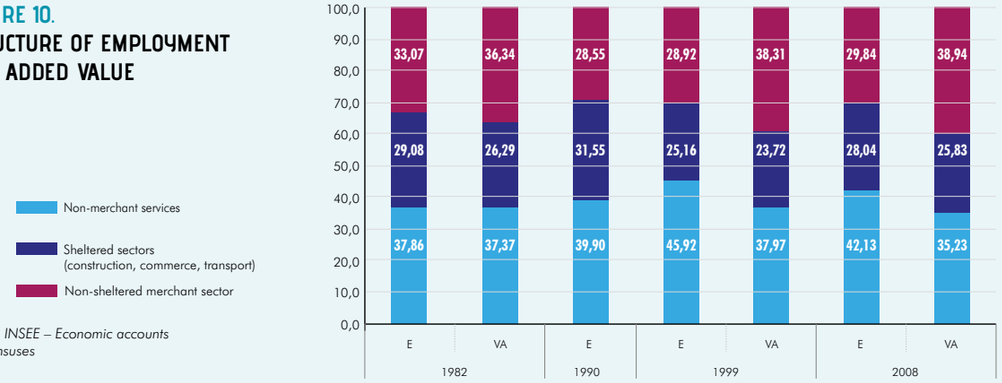
FIGURE 9.
COMPARATIVE SHARE OF EXPORTS IN GDP



Source: INSEE – General information regarding the population

The structure of employment and added value reflect this withdrawal. Besides the public economy, the main activity sectors occupy non-relocatable market segments such as construction, commerce and transportation.

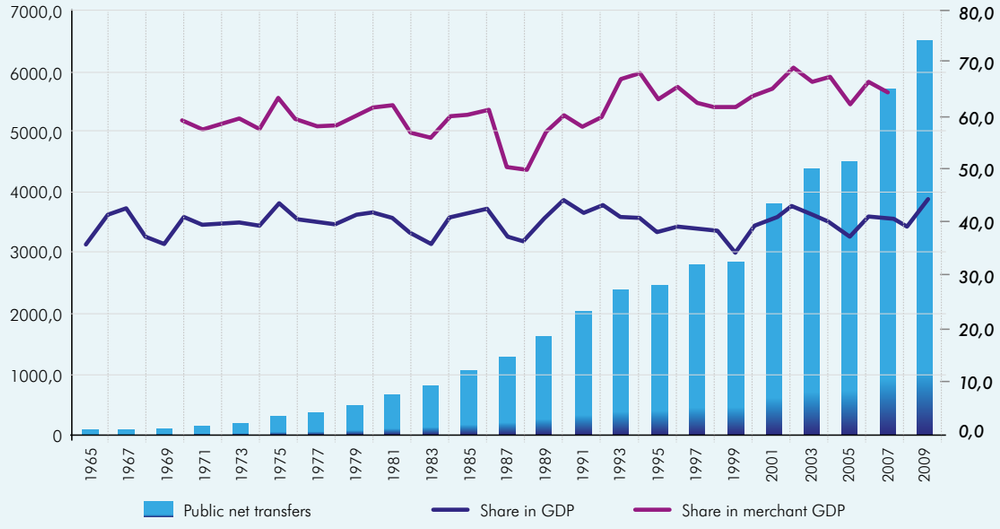
FIGURE 10.
STRUCTURE OF EMPLOYMENT AND ADDED VALUE



Source: INSEE – Economic accounts and censuses

The difficulties to generate spillover and accumulation effects with public expenditure are reflected in the noticeable increase of transfers which jumped from €537.8 million in 1980 to €6,498 million in 2009, i.e. 44.6% of GDP and 65% of non-merchant GDP.

FIGURE 11. DEVELOPMENT OF TRANSFERS AND THEIR SHARE IN GDP



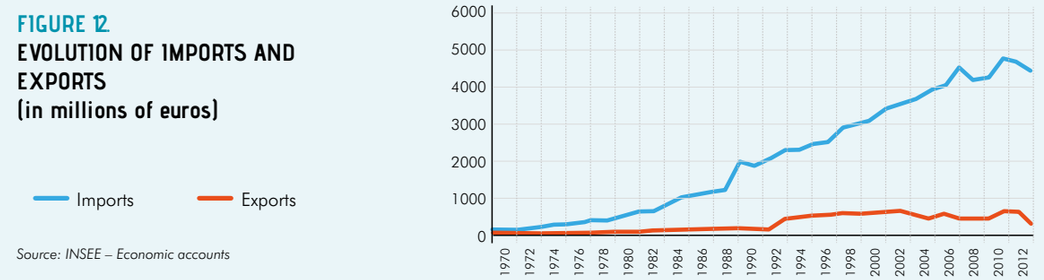
Source: INSEE – Economic Accounts and Economic Scenario of Reunion

3) ▶ UNBALANCED DEVELOPMENT

Today, Reunion's economy barely generates sufficient added value to meet the new demands arising from departmentalisation.

Importing a system based on mass consumption into a small island has inevitably led to an explosion of commercial invoicing. Between 1970 and 2010, imports jumped from €137 million to €4,265 million per year, which is close to half of Reunion's GDP, compared with 13% on average in small island economies. Support for exports has allowed them to multiply by 12 in value, an insufficient pace to cover the explosion of imports:

FIGURE 12.
EVOLUTION OF IMPORTS AND EXPORTS (in millions of euros)



Source: INSEE – Economic accounts

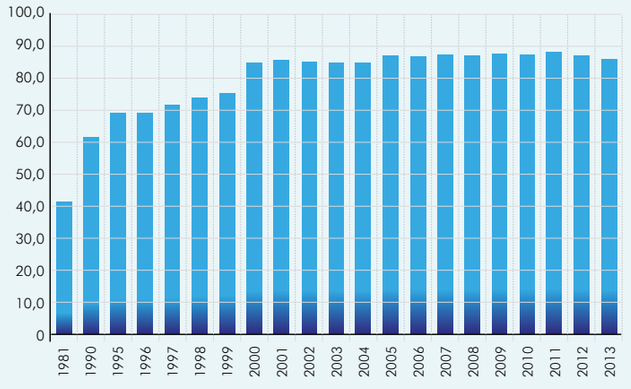
Reunion, therefore, went from a necessarily balanced commercial equilibrium in a colonial context to a growing structural deficit. The coverage ratio logically fell from 98% in 1954 to 6.54% in 2010.

FIGURE 13.
TRADE COVERAGE RATIO

Source: Economic accounts

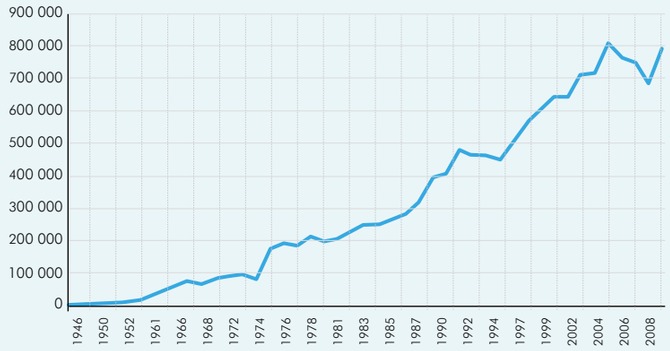
One of the main causes of the degradation of the trade balance is the increased energy dependency of Reunion; a direct consequence of the import of a Fordist system based on the consumption of fossil fuel into a small island lacking oil:

FIGURE 14.
ENERGY DEPENDENCY RATE



Source: Economic Accounts and Economic Table of Reunion – SPL Energie

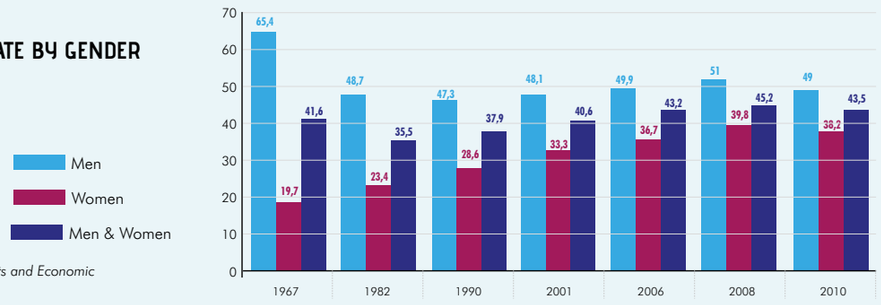
FIGURE 15.
OIL IMPORTS (in tonnes)



Source: INSEE; General population census

In a situation marked by high demographic growth, the difficulties of the economy to generate labor-intensive activities have also resulted in an explosion of unemployment. Paradoxically, departmentalisation - which was intended to reduce the population's underemployment, and allow it to rise beyond its condition - has long aggravated underemployment: one had to wait until 2006 to find employment rates equivalent to those of 1967.

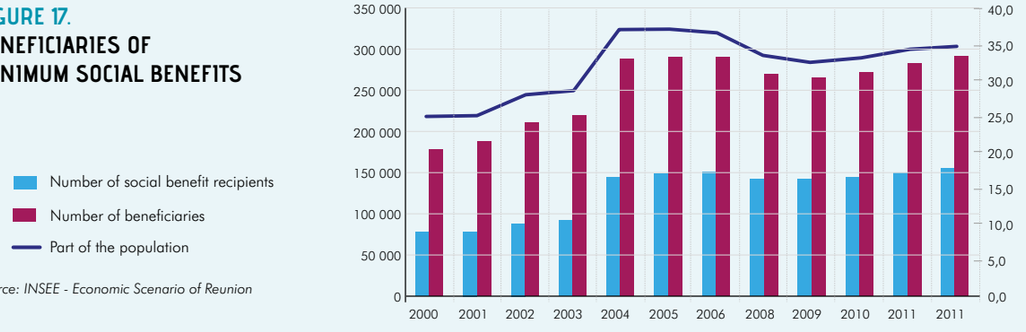
FIGURE 16.
EMPLOYMENT RATE BY GENDER



Source: Economic Accounts and Economic Table of Reunion

This situation is even more prevalent for women, young people and older workers. Women are particularly affected: although their activity rate progressed from 31.7% in 1974 to 44.9% in 2005, their employment rate remained weak from 21.4% in 1967 to 32.60% in 2005. Male employment rates, meanwhile, have fallen from 68.9% in 1967 to 48.5% in 2005. Considering the minimum social benefits in their entirety, we witness a doubling in the number of beneficiaries and a progression in the section of population involved from 22.6% to 34.6% of Reunionese.

FIGURE 17.
BENEFICIARIES OF MINIMUM SOCIAL BENEFITS



Source: INSEE - Economic Scenario of Reunion

The population's dependency on social transfer is reflected in the structure of household income. These cash transfers represent 38.16% of households' gross available income, unlike the situation in mainland France, where it exceeds primary income. By retaining the average mainland French income of €911, more than 49% of Reunion's population lives below the poverty line today, compared with 13% in mainland France.

4) ▶ A VULNERABLE MODEL

The vulnerability arises both from this situation of dependency and the exposure to numerous risks.

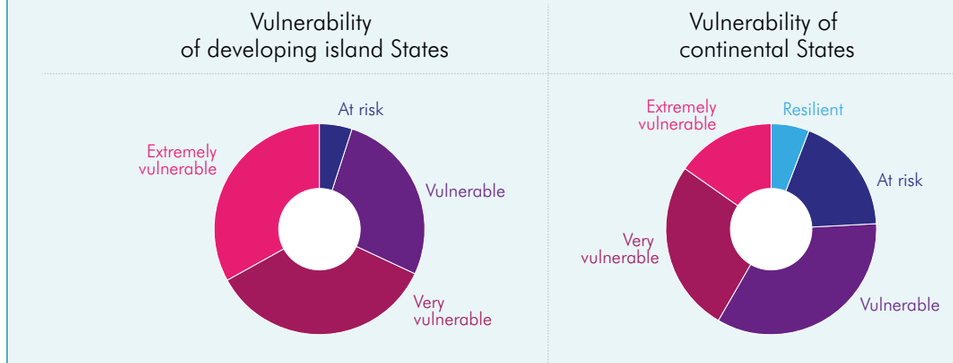
The first reflex is to consider the numerous natural risks: a mountainous terrain limiting usable space (1000 km²), a sometimes unstable geology, massive exposure to erosion and meteorological hazards (droughts, rainfall, cyclones, swell) whose violence will increase in the near future under the effect of global warming. Located at the heart of the intertropical area, Reunion also faces health risks (emerging diseases, such as Dengue and Chikungunya) and biological hazards (such as shark attacks) that can seriously affect the population and economy, in particular tourism. In addition, there are the ecological risks caused by the import, into a small, fragile island, of a system based on high population and spending growth.

The gap between the ecological footprint of the economic metabolism and the carrying capacity of the environment is a direct threat, with extractions and waste growing at a pace and intensity that exceeds the capacities of production, processing and regeneration. This phenomenon is exacerbated by the introduction in the ecological cycles of synthetic, unassimilable active substances. These pressures are increased by the systematisation of the market economy, which demands maximisation of value flows at the expense of ecosystem recovery. These ecosystems are particularly fragile in an island setting, due to its specific diversity and limited genetics, the fragmentation of habitats and marked endemism. For François Doumenge, "*The more endemic life forms are in an island, the more human insertion causes imbalances*", and, due to the constraints, "*unlike a continental environment, an island cannot support constant and quick growth of human populations*[1]".

The consequences of this shift are singularly alive and visible in the water cycle: reduction of rainfall, decrease of surface water levels and also worsening of runoff phenomena, which, combined with waste, deteriorate coral reefs and coastal structures, thus reinforcing exposure to swell and potential tsunamis. This ecological vulnerability is the subject of international recognition: point 5 in the Barbados Action Programme recalls that "*due to the reduced size of small developing insular economies, development and environment are closely related and interdependent*", and that "*ill-conceived development*" can generate "*catastrophic effects*" compromising islands' habitability.

An indicator, the Environmental Vulnerability Index[2], published by the United Nations Programme for the Environment, also demonstrates the overexposure of small insular regions to risks and degradation.

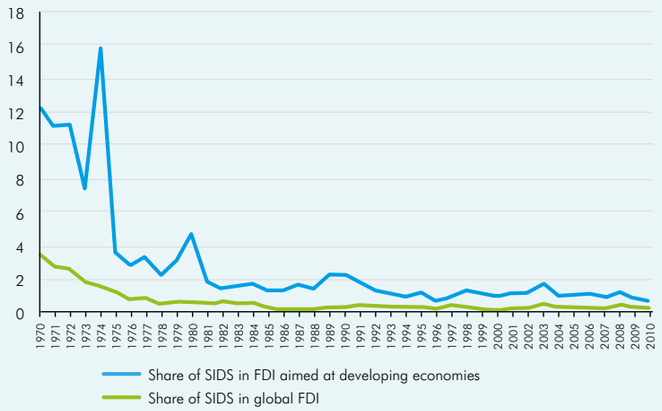
FIGURE 18. DISTRIBUTION OF STATES ACCORDING TO THEIR ECOLOGICAL VULNERABILITY



(1) François Doumenge. Some constraints of insular environment In Jean-Pierre DOUMENGE et al (dir.). Tropical islands: insularity, insularism. Pg. 11 and 13.
(2) SOUTH PACIFIC APPLIED GEOSCIENCE COMMISSION (SOPAC) and UNITED NATIONS ENVIRONMENT PROGRAMME. Building resilience in SIDS. The environmental Vulnerability Index

Looking beyond natural risks, Reunion, like all small open economies, is exposed to the effects of global shocks and upheavals that are beyond its control (change in international geopolitics, globalisation, change of economic routes and prices of essential raw materials, etc.). Its small physical and human dimension constitutes an obstacle in a world marked by a growing concentration of resources and talents in a few hubs of prosperity. Due to positive externalities induced by proximity and interactions, this concentration reinforces competitiveness of regions and their attractiveness, resulting in increased polarisation at the expense of marginal areas.

FIGURE 19.
EVOLUTION OF THE SHARE OF SMALL ISLAND DEVELOPING STATES IN GLOBAL FOREIGN DIRECT INVESTMENT (in %)



Source : UNCTAD

The island's small size and remoteness do not allow economies of scale, especially since it lacks raw materials outside its developed agricultural potential and maritime space. Consequently Reunion barely engages in exports and in conjunction sees its market dominated by continental production, whose economies of scale are sufficient to absorb transport costs. Located in the Indian Ocean region, but politically dependent on France and the European Union, our island is exposed to institutional developments over which it has little control: change in commercial agreements (Economic Partnership Agreements; World Commerce Organisation negotiations; implementation of regional customs unions from which Reunion is excluded, etc.). In this situation, a perilous alternative emerges.

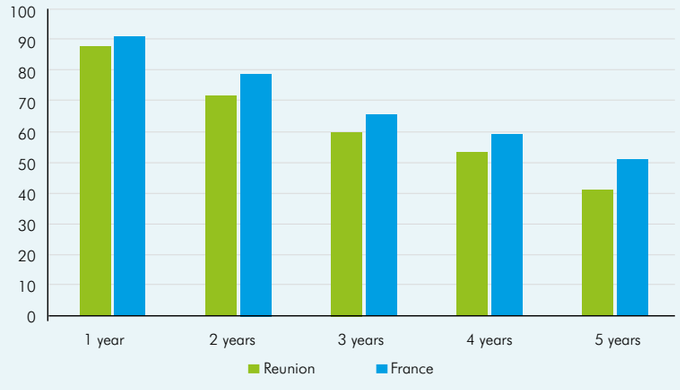
If the island is too focused on itself, its resources and its market, it seems doomed to accept a low-growth regime, despite colossal social needs. Conversely, by favouring production aimed at exports in order to develop its capacities, the island is prone to movements that outpace it.

This economic vulnerability is confirmed by international studies conducted by the Commonwealth Secretariat and World Bank.

In 2000, 26 of the world's 28 most vulnerable economies were characterised by their insularity; meanwhile no island economy has managed to climb into the category of resilient economies[1].

These macroeconomic challenges are also reflected in the productive sector. On 31 December 2011, out of the 71,234 active companies in the island, 94.6% employed fewer than 10 employees. Only 281 companies exceeded 100 jobs. Due to the small size and weakness of equity funds, the 5-year survival rate lags 10 points behind the national average.

FIGURE 20. SURVIVAL RATE OF COMPANIES

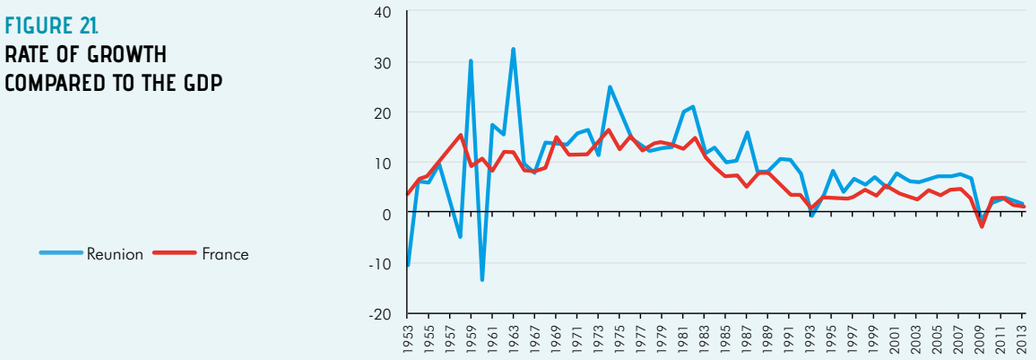


(1) The Commonwealth Secretariat / World Bank Joint Task Force on SMALL States. Small states : meeting challenges in the global economy. April 2000. p. 20

Due to its double dependency, economic and ecological, today Reunion is faced with a major question regarding the sustainability of its development model. Three basic movements threaten the driving forces of its expansion.

Firstly, the emergence of the European crisis and the systematisation of austerity policies that will quickly place pressure on the volume of transfers. Dependency, when it takes the shape of a vicious cycle of dependency-assistance, makes the economy prone to any variation of the donor's generosity. Even a slight slowdown of national solidarity or a reconsideration of certain tax measures or policies entails painful adjustments for Reunion's economy and society, whose pace of growth appears to be closely linked to the national economy:

FIGURE 21.
RATE OF GROWTH COMPARED TO THE GDP

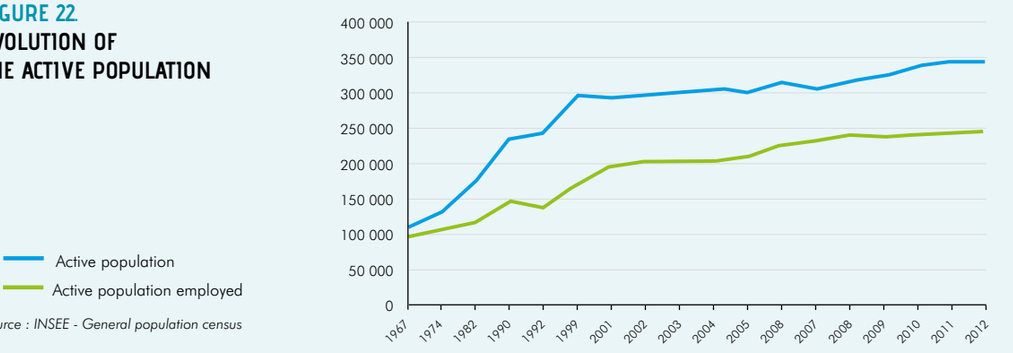


Secondly, the forecasted scarcity of energy and material flows traded worldwide under the double effect of depletion of resources and global demographic growth, could place us, in the near future, in a very precarious situation.

Finally, the completion of a trade liberalisation agenda, antagonistic to the protectionist operating of Reunion's economy, which is driven by internal consumption and import-substitution. This import-substitution strategy has sustained a large portion of industrial and commercial development during the last twenty years, but has now reached its limits: the domestic market, even at one million inhabitants, will quickly be saturated.

All these developments are taking place on an island already facing the legacy of inherited constraints: continued illiteracy, exceptional and continuous growth of the workforce which requires a growth rate typical of an emerging country in order to meet the demand for employment and limit dependency.

FIGURE 22.
EVOLUTION OF THE ACTIVE POPULATION



Source : INSEE - General population census

Reunion also suffers from a timid attitude toward risk and the lack of hedging tools regarding future risks. The presence of public financial transfer mechanisms exposes the economy to suboptimal behaviour. These are all limitations that have the inconvenience of weakening its capacity to cope with exposure to a world that is changing at an accelerated pace.

B

AN EMERGING KNOWLEDGE ECONOMY

It is precisely to address these challenges that local and regional authorities actively support initiatives that sustain the emergence of a knowledge economy.

1) ▶ THE LANDSCAPE OF RESEARCH AND INNOVATION IN REUNION

A European, insular and tropical region, Reunion holds geo-strategic assets and significant material, human and financial means to create an environment conducive to the development of Research, Development and Innovation activities (RDI). This fertile terrain has attracted numerous research structures and eased the establishment of an ecosystem more dense than that of other outermost regions.

Reunion has a total of 46 institutions dedicated to Research and twenty innovation support and transfer structures, grouped at the Regional Committee for Innovation.

SUMMARY OF INNOVATION STAKEHOLDERS

DRIVING INNOVATION

Regional Council
Departmental Council
Prefecture of Reunion
Regional Committee for Innovation
EPCI

ECONOMIC FABRIC AND INNOVATION

53% of companies declare they are innovative
43% of innovations are organisational (compared with 36% in mainland France)
84% of partner innovations are located in Reunion

INNOVATION

HIGHER EDUCATION AND RESEARCH

University of Reunion (12,000 students, over 1,000 researchers, 300 PhD students)
2 engineering schools (agri-food, environment, ICT)
2 LABEX, 2 EQUIPEX
1 "CVT Valorisation Sud"
4 national research centres
10 local research groups and centres
17 university laboratories and research centres
10 Mixed Research Units and Research Units
5 research associations and observatories

STAKEHOLDERS AT THE SERVICE OF TECHNOLOGY TRANSFER AND INNOVATION DEVELOPMENT

Professional associations: ADIR, ARMEFLHOR, Digital Reunion, CGPME, JCE, MEDEF, etc.
Clusters: GREEN, Maritime Cluster, Temergie
Consular Chambers
CRITT Reunion and CRT Hydrô Reunion
Financiers: AFD, ADIE, BPI France, Reunion Active, Initiative Reunion Entreprendre, ACG Management, La Caisse des Dépôts
Regional Incubator, Technopole
Observation and facilitation: Agorah, CRES, IRTS
Nexa (Regional Development Agency for innovation and investment)
Incubator: Incubator Réusit, CB-TECH by CYROI
Technical platforms: CIRBAT, CYROI, 3P
Competitiveness pole: QUALITROPIC
Tourist innovation pole: IRT

NATIONAL RESEARCH CENTRES

Reunion hosts four of the largest French research centres or institutes, which group more than 253 permanent researchers and engineers working on research subjects based on local Reunionese issues:

Bureau for geological and mining research (BGRM)
French Agricultural Research Centre for International Development (CIRAD)
French Research Institute for Exploitation of the Sea (IFREMER)
French Research Institute for Development (IRD)

LOCAL RESEARCH CENTRES AND GROUPS

Hydrô Reunion: Reunionese Association of aquaculture and tropical aquatic resources Development (previously known as ARDA
Aquarium of Reunion
Research and Monitoring Centre For Emerging Diseases in the Indian Ocean (CRVOI)
Clinical Investigation Centre - Clinical Epidemiology of Reunion (CIC-EC)
eRcane
Clinifutur Health Group
Image Institute for the Indian Ocean (ILOI) and Superior School of Arts (ESA)

UNIVERSITY LABORATORIES AND RESEARCH CENTRES

Economy and Management Centre of the Indian Ocean (CEMOI)
Legal Research Centre (CRJ)
University Hospital of Reunion (CHU)
Mathematics and Applied Computer Sciences Research Institute (IREMIA)
Chemistry of Natural Substances and Food Sciences Laboratory (LCSNSA)
Energy, Electronics and Processes Laboratory (LE2P)
Mathematics and Information Technology Laboratory (LIM)
Physics and Mathematical Engineering Laboratory for Energy and the Environment (PIMENT)
Languages, texts and communication in Creole and French-speaking spaces (LCF)
Ocean Spaces and Societies Laboratory (OIES)
Perinatal Studies Centre of the Indian Ocean (CEPOI)
Displacement, Identities, Visions, Writings (DIRE)
Engineering, Research and Intervention, Sports, Health and Environment (IRISSE)
Southern Cooperative Institute for Education Research (ICARE)
Science of the Universe Observatory (OSV - Reunion)

RESEARCH ASSOCIATIONS AND OBSERVATORIES

Reunion has two associations and three observatories supporting marine, agri-food and environment research, and one Observation Agency for Reunion's land planning and habitat (AGORAH).

Associations:

Association for the Medicinal plants of Reunion (APLAMEDOM)
Reunionese Association for the modernisation of the fruit, vegetable and horticultural economy (ARMEFLHOR)

Research Observatories:

Marine turtles observatory (KELONIA)
Regional anti-termite observatory (ORLAT)
Volcanic observatory of Piton de la Fournaise – Laboratory of the Paris Institute of Earth Physics (OVPF)
Physics Observatory for the Atmosphere of Reunion (OPAR)

MIXED RESEARCH UNITS AND RESEARCH UNITS

Several (Mixed) Research Units (UMR) are present on the island. These units combine research centres such as the IRD and the CIRAD as well as the University of Reunion (UR). They work mainly on subjects strongly rooted in Reunion: detection, biodiversity, vegetable and animal health, infectious diseases, marine research, and so forth.

Research Units and Mixed Research Units:

Marine biodiversity, exploitation and conservation (UMR MARBEC – Supervised by: CNRS, Ifremer, IRD, UM)
Integrated approach for obtaining quality food (UMR Qualisud - Supervised by: UR, CIRAD)
Diabetes-Atherothrombosis-Therapies Reunion Indian Ocean (UMR DETROI - Supervised by: UR, INSERM)
Diversity Adaptation and Development of plants (UMR DIADE - Supervised by: IRD – University of Montpellier 2)
Dynamic of Systems and Interactions of Biological Macromolecules (UMR DSIMB - Supervised by: UR, INSERM)
Tropical marine ecology of the Pacific and Indian Oceans (UMR ENTROPIE - Supervised by: UR, CNRS, IRD)
Space for development (UMR Espace Dev - Supervised by: UR, CIRAD)
Laboratory for Atmosphere and Cyclones (UMR Lacy - Supervised by: UR, CNRS, Météo France)
Laboratory for Geosciences of Reunion (UMR LGSR - Supervised by: UR, IPGP)
Infectious diseases and vectors: ecology, genetics, evolution and control (UMR MIVEGEC - Supervised by: CNRS, IRD, UM)
Vegetable and Bioagressive Populations in Tropical Environments (UMR PVBMT - Supervised by: UR, CIRAD)
Research Pole for the Organisation and Dissemination of Geographical Information (UMR PRODIG - Supervised by: Paris 1, Paris 4, Paris 7, IRD, EPHE and CNRS)
Infectious Processes in Tropical Insular Environments (UMR PIMIT - Supervised by: UR, INSERM, CNRS, IRD)

CLUSTERS

3 clusters are active in the following specialised sectors:

Energy: TEMERGIE
Sea/maritime: Maritime cluster
Environment: GREEN

INNOVATION SUPPORT STRUCTURES

Professional associations

Association for the Industrial Development of La Reunion (ADIR)
Association for the Right to Economic Initiatives (ADIE)
Rural Development Association of Reunion (AD2R)
DIGITAL REUNION

Consular chambers

Reunion Chamber of Agriculture
Reunion Chamber of Commerce and Industry
Reunion Chamber of Trades and Crafts

Financiers

ADIE
French Development Agency (ADF)
BPI France Reunion Mayotte, representing ex-OSEO
Deposits and Consignments Fund
Reunion Active
Reunion Enterprise Initiative
ACG Management
Reunion Angels

Specialised platforms

Regional Centre for Innovation and Transfer of Technology of Reunion (CRITT)
SEAS-OI
GIP CYROI
CIRBAT
3P
Competitiveness Pole: Qualitropic

Entrepreneurship and Innovation Support

Nexa, Regional Investment and Innovation Development Agency
Technopole – business incubator of Reunion Island
Réu.Sit, business incubator
Regional Social Economy Chamber
Management boutique network
University of Reunion, P2ER, Pépite

2) ▶ FROM SCIENTIFIC RESEARCH...

Benefitting from its dual European and tropical affiliations, Reunion has experienced noticeable growth of its research capacities:

a) Excellence platforms:

The operators mentioned below can rely on 4 excellence research platforms:

Physics of the Atmosphere Observatory at Le Maïdo, dedicated to studying the development of the climate, atmosphere and stratosphere and one of 5 fixed stations of this type in the Southern hemisphere. This observatory makes Reunion a crucial player in monitoring the atmosphere and climate change in the Southern Hemisphere.

Spatial Remote Sensing Station SEAS-OI covers all islands of the Western Indian Ocean, Swaziland, part of Mozambique, Tanzania, Zimbabwe, South Africa, and two large maritime areas which are the Western Indian Ocean and the Mozambique channel.

The SEAS-OI project aims to generate a considerable number of research and application projects based on remote sensing and spatial imaging.

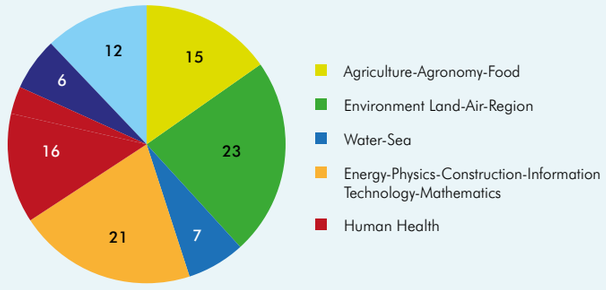
The biotechnology platform: Cyclotron Reunion Indian Ocean (CYROI) brings together the University of Reunion and the Regional University Hospital of Reunion. This bio-science technological platform manages a high-level multidisciplinary technical platform, available to public laboratories and companies who wish to develop research and/or innovation programmes.

The Plant Protection Technology Platform (3P) is a technological platform common to CIRAD, the University of Reunion, the LSV of the French Agency for Food, Environmental and Occupational Health & Safety (ANSES; ex LPNV) and the FDGDON, specialised in advanced research and plant experiments. It has been certified at national level by GIS-IBISA since 2009.

b) RDI subjects and staff in Reunion

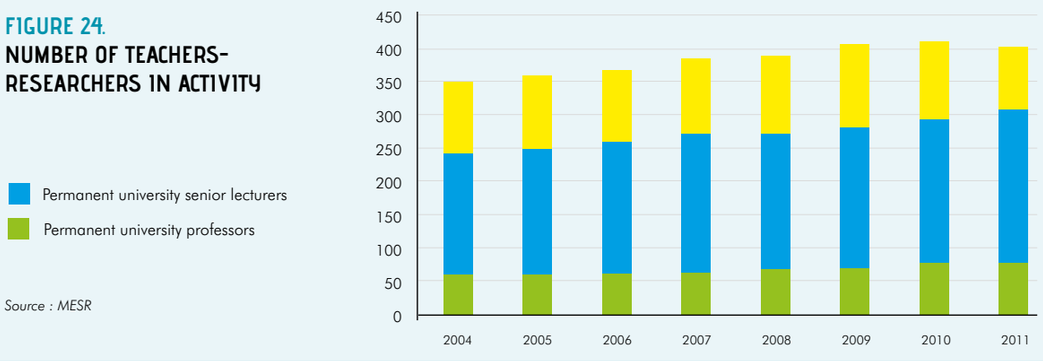
These platforms show how research concentrates on renewable energy, and natural and anthropogenic environments.

FIGURE 23.
RESEARCH SUBJECTS IN ENTITIES[1]



These activities are conducted by research staff more highly trained when compared with other outermost regions.

FIGURE 24.
NUMBER OF TEACHERS-RESEARCHERS IN ACTIVITY



Source : MESR

PhD enrolments experience regular growth, but the number of thesis defended each year remains limited to a dozen.

(1) Regional Economic Observatory – Nexa

c) Calls for project

Still nascent, Reunion's participation in national and European calls for projects demonstrates a path towards excellence and constitutes an essential lever in reinforcing capacities and integration in the network.

In regards to future investments, research teams are involved in two laboratories of excellency:

The LABEX CORAIL "Coral reefs faced with global change" comprises 9 Institutions and 4 mainland French and Overseas Universities, specifically the IRD and UR Coréus and the University of Reunion (UMR ENTROPIE). This laboratory aims to study coral ecosystems in order to improve their durable management. The experience could lead to the establishment of a French Excellency Centre for Coral Reefs where Reunionese research would be fully involved.

The AGRO project, centred on cultivated plants in order to respond to the growing demands for plant use for food and non-food purposes as well as Equipex projects:

GEOSUD operated by CEMAGREF, the University of Montpellier II and University of Reunion and CIRAD.

DURASOL centred on the accelerated ageing of components and photovoltaic and thermal solar systems and climate correlations via multi-site platforms. The Physics and Engineering, Mathematics Laboratory for Energy and Environment (PIMENT) represents Reunionese expertise in this project.

In January 2014, the ECO-EX project was chosen to develop a shared platform, specialised in the extraction of active molecules derived from biodiversity, which, in time, would allow the development of agricultural, fishing and agro-food industry by-products. Reunion is also represented at the heart of Excellency Institutes in terms of Carbon Free Energies (IEED):

Reunion's Regional Council is one of many partners of the Excellency Institute in Carbon Neutral Energies dedicated to Renewable Marine Energies constructed around a large public-private partnership.

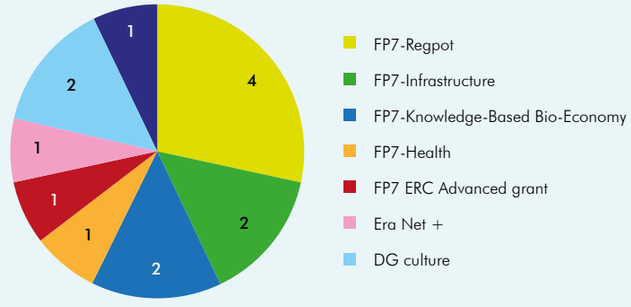
The innovative Reunionese company Bioalgostral is a partner of the Green stars project from the excellency Institute regarding carbon neutral energies: Biofuels and development of $C0_2$.

In a process of development and radiation, the University of Reunion participates in the Southern Thematic Development Consortium operated by IRD, which aims to stimulate the transfer of French technology and expertise to developing countries, tropical and equatorial regions.

The calls for research projects remain limited: in 2011, the University of Reunion replied to 12 calls from the National Agency for Research and 18 calls issued by Ministries[1].

The difficulties created by Reunion's relative isolation also weigh more heavily in the access to EU funds, specifically the Framework Programme for Research and Development, which requires the constitution of multi-national consortiums. During the last programming, 14 research projects were financed by the Commission, of which 6 were in partnership with the University.

FIGURE 25. PROJECTS IN REUNION FINANCED BY EUROPEAN COMMISSION DIRECTORATES 2007- 2013



d) Scientific exchange partnerships

In its activity report for 2011, the University of Reunion specifies having hosted 19 researchers and 742 foreign students. In general and although research networks are supported by UMRs' activities and research centres, a certain effort needs to be made in order to promote the creation of new European and international partnerships, the only ones able to reinforce the attractiveness and promote the emergence of critical mass despite the small size of Reunion Island.

(1) 2011 Activity Report of the University of Reunion

3) ▶ ... TO OPTIMUM USE BY BUSINESSES

In a memorandum dated March 2013, the French overseas departments note-issuing bank (IEDOM) concluded that efforts should be followed and intensified *"so the RDI can contribute to the development of competitive advantages to guide the island towards a more knowledge-based economy."*[1]. In particular this involves reinforcing capacities, mobilising companies, as well as developing closer relations between scientific and economic communities in order to accelerate the use of results and entrepreneurship.

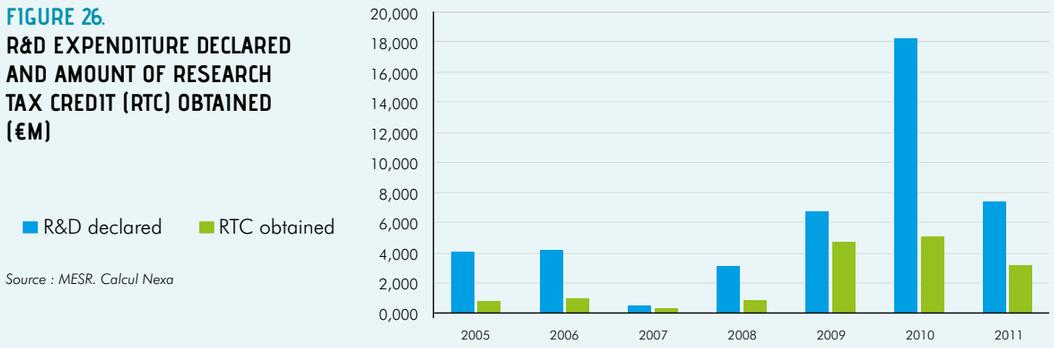
a) An essentially public RDI:

At this stage of the diagnostic, it is important to remember the main obstacle for the performance of any French Overseas policy: the highly fragmented degree of statistical information available. Thus, Reunion is not in the national statistic monitoring of the Ministry of Higher Education and Research. The elements presented below are taken from a paper by the IEDOM and INSEE, which should be considered with caution (particularly because it is mainly based on the analysis of public funding).

According to the IEDOM, the financial means mobilised for the execution of research and development (R&D) in Reunion was estimated at €86.6 million in 2010. The expenditure identified[2] would thus represent 0.58% of GDP in 2010. But the calculation method used does not seem sufficiently solid or exhaustive in order to allow inter-regional comparisons[3].

Still far from the technological frontier and primarily oriented towards the local market, Reunionese companies declare a certain interest in innovation, which nevertheless struggles to translate into investments. Therefore, if 53% of the companies qualify as innovative according to the INSEE retrospective Survey[4], the amount of R&D expenses of companies declared in terms of Research Credit Tax amounted to €7.35 million in 2011.

FIGURE 26.
R&D EXPENDITURE DECLARED AND AMOUNT OF RESEARCH TAX CREDIT (RTC) OBTAINED (€M)

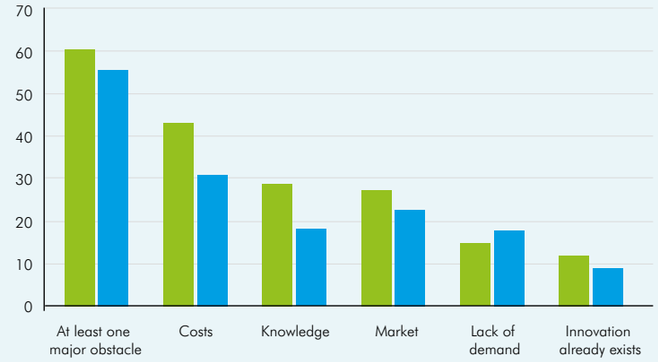


Source : MESR. Calcul Nexa

(1)French overseas departments note-issuing bank, R&D in Reunion is modest but flourishing, Express memorandum, No. 193 – March 2013.
(2) Current expenses (salary mass of R&D personnel and operational expenses) and capital expenditure (construction, purchase of equipment, etc.)
(3) It is also why the S3 will give an important place to performing studies regarding the operation and performance of the regional innovation ecosystem.
(4) INSEE. Innovation survey CIS 2010

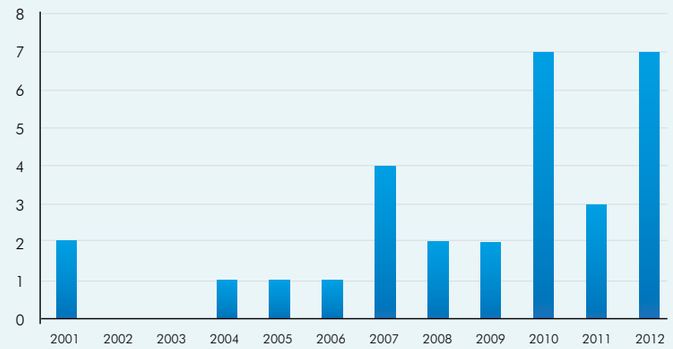
According to INSEE, the main obstacles for innovation identified by companies are the lack of financial means and the difficulties linked to the development of knowledge (specifically due to the lack of qualified personnel).

FIGURE 27.
MAIN OBSTACLES TO INNOVATION IDENTIFIED BY COMPANIES FROM 2008 TO 2010



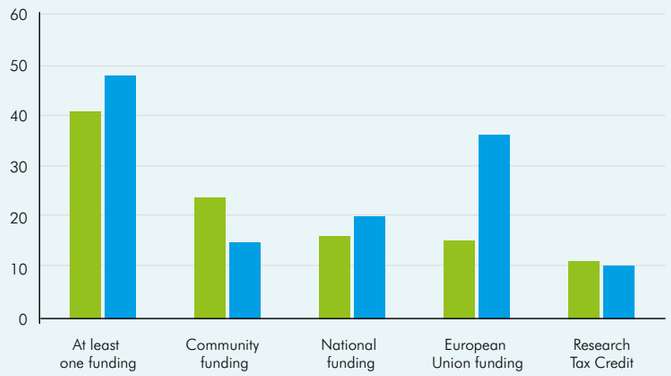
The use of PhD students remains incipient as is shown by the development of the number of CIFRE scholarships.

FIGURE 28.
CIFRE SCHOLARSHIPS GRANTED



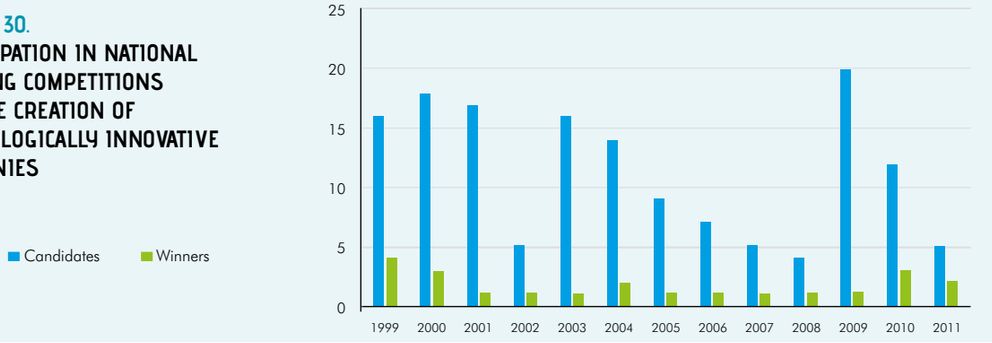
In order to compensate companies' lack of equity funds which negatively affects investment, numerous solutions have been deployed in recent years: EU financing for innovative companies, capital subsidies from the Regional Council, research tax credit (CIR), financial instruments such as guarantees, honour loans for innovation and the creation of venture capital funds, etc. Reunion stands out for its limited use of the CIR: while 41% of companies mobilised public assistance in order to conduct their R&D projects, only 15% of them used the CIR option.

FIGURE 29.
PERCENTAGE OF COMPANIES THAT RECEIVED PUBLIC FUNDING FOR R&D FROM 2008 TO 2010



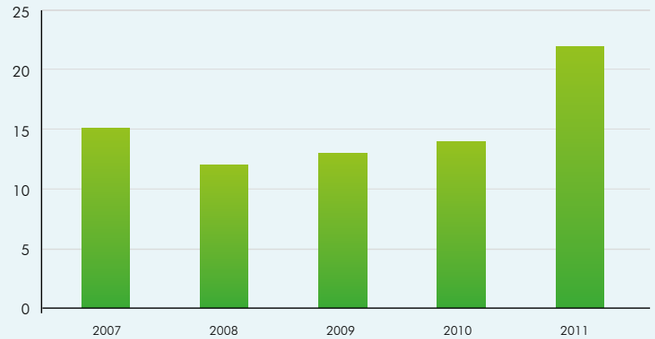
In this context, only 46 % of technologically innovative companies have indeed undertaken R&D activities, which is significantly lower than in mainland France where this ratio reaches 68 %. The involvement in the creation of innovative companies remains limited:

FIGURE 30.
PARTICIPATION IN NATIONAL FUNDING COMPETITIONS FOR THE CREATION OF TECHNOLOGICALLY INNOVATIVE COMPANIES



According to the Regional Strategic Information and Technological Agency (ARIST) of the CRITT and the INPI, 16 patents are published every year on average.

FIGURE 31
PATENTS PUBLISHED



Patents filed mainly concern handling (11%), construction (11%), specialised machines (9%), transportation (9%), consumer goods (6%) and information technology (6%). Only 15% of applications are from companies, compared with 85% from individuals. Despite such a limited performance, Reunion represents 48% of all patents filed in French overseas departments.

C

DEVELOPMENT CALLING FOR A STRATEGY BASED ON A NEW "FUEL":
INNOVATION, AT THE HEART OF THE KNOWLEDGE ECONOMY

Based on these observations, in 2009 the State, the Regional Council and the Departmental Council encouraged the implementation of a Regional Innovation Strategy (SRI) aimed at *"structuring the island in order to engage Reunion in this new development motion and create the right environment to stimulate the innovation process in Reunion"*. On the basis of progress achieved, it is now appropriate to give new impetus, by going from an innovation reinforcement policy to a strategy for a knowledge economy.

1) ▶ FROM SRI...

In response to the Lisbon Agenda, the SRI was designed essentially as a horizontal policy aimed at reinforcing the region's innovative potential and favouring coordination of innovation or supporting structures (grouped at the heart of the Regional Innovation Committee, assisted by the Regional Innovation Agency, Nexa). It thus built on a series of 17 action sheets divided into three thematic groups:
Attractiveness and performance of the training system
Distillation of innovation to SOHO/SME
Land use planning and organisation for the region

Caption

The colour of sheets is related to their origin. It corresponds to the thematic groups involved in the participatory approach (see annexe 1.3)

- Sheet related to thematic group about attractiveness and performance of the training system
- Sheet related to the thematic groups for filtering down of innovation to SOHO/SME
- Sheet connected to the subject group regarding attractiveness, organization and planning of the region
- The last yellow sheet is transversal to the thematic groups

ACTION-SHEETS INVOLVED	HUMAN COMPETITIVENESS A: Raise the level of qualification in correspondence with economic realities and potentials, especially those of DAS	HUMAN COMPETITIVENESS B: Construct innovative tools to fight against illiteracy	ECONOMIC COMPETITIVENESS C: Optimise local resources by networking structures and tools	ECONOMIC COMPETITIVENESS D: Place the companies in a position to innovate	ECONOMIC COMPETITIVENESS E: Create conditions to perform projects (from upstream to downstream)	REGIONAL COMPETITIVENESS F: Implement the integrated approach for regional planning	REGIONAL COMPETITIVENESS G: Provide Reunion with a degree of visibility in terms of innovation	REGIONAL COMPETITIVENESS H: Make innovation coherent and sustainable
Action-sheet no. 1 Promote awareness and reinforce Reunionese public research abilities			■		■		■	
Action-sheet no. 2 Create a research structure: technical response cell for calls for projects			■		■			■
Action-sheet no. 3 Establish the concept of a "consulting doctor"				■	■			
Action-sheet no. 4 Launch creativity competitions in order to promote a spirit of innovation and entrepreneurship	■	■			■			
Action-sheet no. 5 Bring the culture of innovation to places of production	■	■	■	■				■
Action-sheet no. 6 Organise and export the "training engineering" sector			■	■			■	
Action-sheet no. 7 Reinforce the emergence and implementation of innovations, especially in companies	■			■	■			
Action-sheet no. 8 Actively prospect all companies			■	■				
Action-sheet no. 9 Professionalise business innovation supporters	■		■		■			■
Action-sheet no. 10 Create financial support to drive and operate the network (RDT)			■		■			
Action-sheet no. 11 Implement a specific communication policy for innovation	■	■	■	■	■		■	■
Action-sheet n°12 Introduce innovation as a public policy goal				■		■	■	■
Action-sheet n°13 Develop and implement a project culture in terms of planning, bringing together stakeholders in the public and private sphere					■	■		
Action-sheet n°14 Structure the organisation in order to favour strategic activity sectors				■	■	■		
Action-sheet n°15 Configure and export development expertise	■		■	■		■	■	
Fiche-action n°16 Structure an "urban equipment and materials" sector			■	■		■	■	
Fiche-action n°17 Develop and organise networks of all kinds	■	■	■	■			■	

At this stage, 75% of action sheets have been implemented. Thanks to stakeholders' mobilisation, the SRI's main achievement concerns the reinforcement of the culture of innovation and operators' dedication this challenge. Since 2010, thematic events (information sessions, training courses, seminars, competitions, etc.) have grown regularly in terms of frequency and attendance. Researchers, entrepreneurs and institutional representatives increasingly place innovation at the heart of their agenda; it is seen as a lever for performance and international trade.

The second field of progress focuses on structuring the support ecosystem in order to improve its readability and performance. Proximity and regular exchanges within the CRI and its workgroups dedicated to various issues (training courses, funding, international, monitoring, etc.) have set the groundwork for networking, allowing each structure to concentrate on a specific thematic or a given stage in the chain of innovation, while receiving support from partners and shared services. During the last programming, the CRI was endowed with a project expertise unit - in order to evaluate project feasibility, potential for differentiation and affirmation in the markets, and to propose a development plan - and a European unit that supports researchers and innovators who are searching for and wish to implement national and European calls for projects. Networking is reinforced by organising frequent training courses for supporters and by implementing liaison sheets between partners.

The third reason for satisfaction concerns the introduction of new tools at the service of innovation: support for hiring PhD students in companies, implementation of Assistance for the First Innovative Project, creation of a Shared Risk Placement Fund and innovation honour loans.

The SWOT matrix below summarises the progress and challenges for the regional innovation system:

STRENGTHS

Public research and very present national research centres
World-class observation and research equipment
Flagship research sectors in ecology, biodiversity, energy, health, human and social sciences
Strong capacity for public investment
A competitiveness pole
Close relationship between stakeholders who regularly interact
A broad support system for project developers.

WEAKNESSES

Young RD ecosystem
A complex and unclear innovation system
Low rate of technical innovation
Lack of critical mass
Little private R&D (20 % of the island's total R&D, i.e. 3 times less than mainland France) and few patents filed by companies
Only 0.58% of the GDP is devoted to RDI, i.e. 4 times less than the national average, less than the overseas average.
Mainly public RDI funding
Extensive support and monitoring requirements for innovative projects
Numerous entities (but still requiring professionalization and structuring)
Few project developers with sufficient equity funds or a clear overview.
Financing: lack of clarity; gaps in the start-up/feasibility and pre-launch stages
Relational insulation regarding the ecosystem when faced with the rest of Reunionese economy and the rest of the world.
Reunion's lack of international visibility
Lack of world-class skills/talents.

OPPORTUNITIES

World revolutions in tune with local challenges and expertise
Higher RDI skills than our neighbours
Partnership policies engaged with third countries by local stakeholders
Efforts undertaken in order to develop Reunion's role as a "rebound platform"
Governance clarified by Act III of decentralisation
Restructuring and simplification of the innovation support chain
Better support coordination for project developers.
Efforts undertaken to develop patents in sectors such as bioeconomy, construction, ICT, transportation
Efforts undertaken in order to access community tools and funding
Compensate the absence of local critical mass by implementing European stakeholders
High rate of marketing innovation, organisation

THREATS

Difficulties to counteract resource and talent concentration dynamics in progress at world level
Drain of « brains» and of trained young people: weak R&D employment rate, both public and private, (almost 6 times less than the national average)
Difficulty attracting global-level players, which maintains the lack of competitiveness which, in turn, impairs attractiveness....
Risk of becoming an experimental laboratory for solutions developed in third party countries
Market characteristics unfavourable to innovation
Individualistic logics hampers exchange of the information and cooperation required for an open-innovation approach
Time-consuming and cumbersome administrative procedures that are sometimes excessive for project promoters and SMEs
The absence of a long-term strategy based on stable tools.

2) ▶ ... TO THE AMBITION OF A REGIONAL TRANSFORMATION...

Faced with the challenges and issues exposed in these diagnostics, the best response seems to implement a **new regional ambition combining the goal of a transition towards a carbon-neutral, resilient and inclusive economy and the renewal of existing activities, thanks to a policy of competitiveness, differentiation and innovation.** In order to adapt and gain influence in a changing world, Reunion must engage in new agenda.

If this first stage, centred on the island's facilities and internal market has allowed Reunion to become what it is today, a new step should now be taken to respond to the effects of the changes in the national, European and international environment. In other words, it has become essential to find new driving forces for growth, value niches capable of reinforcing its positions, and allowing it to conquer new international markets.

This strategy should obviously be part of a framework of progressive adjustments. It should integrate significant employment content and greatly increase the value produced in order to reduce its exposure to dependency on the windfall of public financing. This ambition highlights the importance of the innovation and knowledge economy, the only one capable of procuring new vectors of growth, differentiated specialisations and the conquest of foreign markets for the economies.

3) ▶ ... SUSTAINED BY DIFFERENTIATION

Since departmentalisation, the building of Reunion's economy operated according to Fordist economy standards. The transposition of this model based on the production of standardised goods in large centralised units, intensive in energy and materials, poses three essential problems for Reunion:

Dependant on scale economies, it logically transforms our characteristics - small size, remoteness, absence of resources - into natural "handicaps" and thus hinders Reunion's ability to develop real competitive advantages. The expansion of productive activities assumes the existence of a protection and support system, therefore instability weighs on players' decisions. The search for productivity gains also encourages the replacement of capital for labour, in an economy marked by the strong growth of demographics and the active population.

Based on the myth of a separation between economic activity and biospheres, it ignores the issues caused by the expansion of the human sphere in a closed and fragile insular environment.

Reducing prosperity to material production, measured by gross domestic product, it also ignores the plethora of local activities, with various purposes, that widely explain the resilience of Reunion's economy and society despite worsening imbalances and dependencies.

Long considered as the only possible path for development, this paradigm today experiences a systemic crisis, which opens up the field of possibilities. Even more so as **five revolutions** emerge opening **amazing opportunities** for Reunion, transforming the handicaps into strengths.

Firstly, there is the emergence of the bioeconomy. Faced with the exhaustion of fossil fuel reserves, economies must inevitably adapt to the new reality and develop processes integrated into, and respectful of, ecological cycles, in order to sustainably meet the needs of their populations. In this context, the small size and finite nature of the island are valuable assets, since they encourage the invention of solutions as of now in order to accelerate the transition to a green economy. Reunion can rely on relatively important research-innovation capacities, on outstanding natural heritage recognised by UNESCO, on its membership of an archipelago, a global hotspot for biodiversity and an exclusive economic area of 2.8 million km^2.

Secondly, there is the energy challenge since, in the same vein, Reunion can turn the fossil fuel constraint into a creative force. Thanks to the diversity of its topological and climatic conditions, it has key strengths to develop techniques for producing high potential renewable energy. Its tropical conditions also constitute an excellent testing ground in terms of the construction and management of buildings' energy but also in terms of Ocean Thermal Energy. Lastly, the absence of an interconnected electrical network is a strong incentive to innovate in the sectors of energy storage solutions and the management of IT-controlled integrated short circuits: "Smart grids".

Thirdly, there are challenges associated with the "third industrial revolution", born from the convergence of information and communication technologies. This digital revolution is a perfect opportunity for Reunion, since it **removes two of the obstacles** most frequently put forward for the development of its economy: **remoteness and the lack of economies of scale.** More than the exchange of goods, hindered by the scarcity of fossil fuels, global companies have now turned towards marketing solutions. At present it is necessary to develop a high-quality, reactive and differentiated offering, which benefits small, close-knit teams where communication is dense. In addition, these information products can be reproduced and disseminated at a near-zero marginal cost, thus eliminating the insular "handicap" since no digital divide keeps Reunion from this opportunity.

Fourthly, the recognition of the deeply **social character of innovation** and economic competitiveness leads us to reconsider performance factors. By focusing in particular on the "quality" of the human ecosystem, its capacity to quickly analyse problems and mobilise resources and knowledge in order to solve and develop solutions adapted to the changing needs of fragmented markets. The competitive advantage of a region derives, therefore, from a type of "heat" in the innovative environment, fed by dense interactions between the players from various horizons. Thanks to its **small size, conducive to local exchanges**, and its cultural and religious diversity, Reunion concentrates several worlds in a single place, enabling a diversity of markets and consumption behaviour to be captured, and to undertake open co-creation and innovation markets. The agility or flexibility of an island society becomes a differentiating asset against vast continental groups.

Finally, the world economy is currently going through phases of reconfiguration: the concentration of resources in western economies is yielding, little by little, to the emergence of a multipolar world, noticeably marked by the **increasing affirmation of Asia and Africa and South-South exchanges**. After a brief interlude, the Indian Ocean is regaining its historic position at the heart of the global economy, thereby changing the perspective of Reunion. It appears less as one of the outermost regional economies, far away from the centre of Europe, and more as a European platform for the adaptation and development of solutions for emerging economies in the inter-tropical region, also faced with high population growth in a world of increasingly limited resources. Taking advantage of its dual European and Indo-Oceanic affiliation, Reunion can enjoy both insular and tropical characteristics and its existence in an institutional, stable, safe and productive system. Thus the S3 aims to also focus on the geographical shift of Reunion's economy, open up new development sectors, and encourage cooperation.

2 #

SMART SPECIALISATION FOR REUNION

ORGANISED AROUND THREE PRIORITY SECTORS

All these developments demonstrate **there is no such thing as geographical fatality.** While Reunion *a priori* only has a limited number of cost-benefits due to its small size and remoteness, it can rely on several elements for differentiation, which could be converted to competitive advantages. **By shifting perspective and developing its singularities, Reunion can overcome the rhetoric of handicaps** and build an ambition that allows it to be fully involved in global value chains (see Porter 1980 (1) and 1990 (2)). Based on this observation, our S3 proposes a **long-term ambition: to turn Reunion into a pioneer in the transition to an ecological and carbon-neutral economy in insular and tropical environment,** a land of experimentation for a tropical Europe 2020. More than simple growth, the S3 is aimed at the growth of individual and collective prosperity, as well as the preservation and improvement of well-being, in its physiological, social, cultural and ecological components.

In order to determine the **priority fields,** we have sought to **reconcile two principles.** On the one hand, the expectations of the European Commission, who invites us to focus on the innovative activities **offering competitive advantages** and a potential critical mass. On the other hand, the desire to prioritise fields **capable of solving local issues, to reduce dependency and vulnerability,** and to transform the economy.

Therefore, the assessment of the proposals suggested during workshops proceeded according to five criteria: an existing or future **critical mass;** a capacity to create **added value** while responding to growing market needs and meeting local **social needs;** a potential for **differentiation** and creation of specific assets, specific to Reunion; a **spillover and diversification effect** of the economy: renewal of traditional sectors, exploitation of new niches; a leveraging effect in order to **break the relational insulation** of Reunion while favouring reinsertion in European and global networks and trade exchanges.

Three priority sectors were apparent from this analysis:
Reunion, producer of bioeconomy solutions at the service of the living economy
Reunion, supplier of solutions in experiential ecotourism: a voyage of emotions
Reunion, agile transformation platform to a digital and low-carbon knowledge economy

(1) M. E. Porter, Competitive Strategy, 1980, Free Press.
(2) M. E. Porter, The Competitive Advantage of Nations, 1990

A

PRIORITY N°1:
REUNION, PRODUCER OF SOLUTIONS IN TROPICAL BIOECONOMY AT THE SERVICE OF THE LIVING ECONOMY

In a communication entitled *"Innovating for Sustainable Growth: a Bioeconomy for Europe"*, dated 13 February 2012, the European Commission examines the goals of this approach: *"to pave the way to a more innovative, resource-efficient and competitive society that reconciles food security with the sustainable use of renewable resources for industrial purposes, while ensuring environmental protection"*. Designed to renew primary and industrial sector practices, tropical bioeconomy constitutes a major opportunity for Reunion, which faces the double challenge of preserving vulnerable ecosystems while satisfying growing social needs.

Small island regions in which truly diversified agroindustrial sectors remain are exceptions. Despite often difficult natural conditions and its remoteness, Reunion stands out due to its dynamism and performance of these activities. Thanks to land improvement work, selection of varieties, the development of irrigation, mechanisation and inputs, sugar yields have shown steady growth, which allowed the sector to cope with the reduction of agricultural surface areas, while allowing for diversification. Today, Reunion produces 68.8% of its fresh vegetables and 73% of its fruit, which places it in the forefront of tropical island economies in terms of crop self-sufficiency. The structuring of livestock sectors has also seen a significant production increase, however it has been insufficient to avoid increasing dependency on animal protein (essentially due to the energy and material costs of these productions).

Today this model allows:

The development of innovative and high-quality agricultural and industrial expertise
Limitations on Reunion's dependency on external supply
A leadership position regarding overseas economies, with 60% of agri-business in French overseas departments, and half the jobs in the sector. Agri-business remains the island's leading industrial sector with 38% of turnover and 32% of industrial jobs.
Ensuring export revenues, especially thanks to the production of sugar, rum and fish products.
Preserving a certain social cohesion thanks to numerous small and medium-sized farms (in 2011, there were more than 7,400 farms; more than 90% with a turnover of less than €100,000)
To promote the image of Reunion through niche products such as Victoria pineapple, Bourbon vanilla, Bourbon pointu coffee, etc.

Despite these successes, Reunion is confronted with numerous issues:

The opening up of markets to world competition and uncertainties surrounding the future of funding mechanisms and sector protection
Growing conflicts of use: every year population growth and urban sprawl lead to the disappearance of 80ha, while agricultural production would have to grow by 40% between now and 2020 in order to maintain the same level of self-sufficiency
The preservation of "natural" environments faced with the growing pressures caused by human impact, the introduction of invasive species, resource extraction and waste emissions.

The challenge is therefore to innovate in order to respond to these issues, to gain in competitiveness while securing productive capacities. This implies recognising the key role of ecosystems in any economy: the latter constantly offers free services - climate regulation, rainfall, stable and fertile soil, a flow of raw materials and energy - which condition all productions and life. As a subsystem of the biosphere, the economy cannot last if it undermines the basis upon which it depends. Here lies the importance of shifting from an agricultural production to a "living economy" or bioeconomy specialisation, i.e. to build an economy in which:

The extraction of resources is adapted to the productive capacities of ecosystems.
Waste complies with ecosystems' ability to process it.
Productive activities preserve biodiversity and ecological integrity.

This challenge is especially relevant in a small region of 2500 km² where 30% of the surface is covered by slopes with an incline greater than 30%. Reunion can make a strength out of this constraint, by becoming a pioneering region, developing solutions for insular and tropical regions confronted with the double problem of population growth and the need to preserve threatened ecosystems. And thus export not only products, but also expertise, around five innovation-market pairs that form a coherent value chain at the service of the ecological economy:

ecological conservation and restoration solutions for tropical environments
agroecological practices and production
knowledge and valorization of marine biodiversity
extraction of active compounds and molecules derived from tropical biodiversity
sustainably enhance tropical resources and products through agri-food industries.

This trend should give a new momentum to agri-food industries, better meet local needs, increase the self-sufficiency rates and competitiveness regarding imports, reinforce the export potential via differentiated products and new services.

In order to implement this transformation, Reunion can rely on numerous natural advantages:

Belonging to one of twenty-five world biodiversity "hotspots", granting the European Union a tropical natural heritage.
A very high rate of endemism.
A very high diversity of climate conditions.
A National Park that protects 40% of the region, registered since 2010 as a UNESCO world heritage site.
An exclusive economic zone with 2.8 million km².

As well as an innovation ecosystem which has reached relative critical mass thanks to the presence of research entities, research and experimental platforms, research associations, a competitiveness cluster, emerging clusters, higher education and economic operators.

SECTORIAL MAPPING

Sector S3: bioeconomy

FICHE-ACTION N°1:
ECOLOGICAL CONSERVATION AND RESTORATION

While climate change attracts public attention, the collapse of biodiversity on a global scale is an equally important risk. This destruction is occurring at a rate 1000 times higher than during the last great extinctions: one species every 20 minutes, 30,000 per year. And islands pay a heavy toll: since the 17th century, animal and bird species endemic to these habitats represent respectively 75% and 90% of all extinctions. However, the conservation of 25 global hotspots, representing less than 2% of land surface would suffice to protect half of known vernacular plants. Thanks to the diversity of these environments and the quality of the expertise developed specifically during the Life+ restoration projects, Reunion can become a worldwide reference centre.

a) Background and objectives

The recognition of the exceptional ecological nature of the Mascarene Islands requires specific management of this unique global heritage, in support of the economic development of populations. These habitats, largely cleared during the last three centuries and now reduced to a third of Reunion Island, are today threatened by many exotic species that have become invasive. They could, however, constitute large pools of activity:

the touristic attraction that these ecosystems represent can be reinforced by ambitious measures for ecological restoration supporting the development of economic and scientific sectors, creating employment, knowledge and added value.
the island's rich endemic flora offers potential in terms of extraction and use for pharmaceutic, cosmetic and industrial needs.

The ecological restoration of this botanical heritage involves fighting exotic invasive species, a global challenge, further exacerbated in insular tropical systems, and for which the island of Reunion aims to become a region of excellence in the research and implementation of innovative techniques.

Current efforts are still inadequate, allowing at best to slow the expansion of these weeds. It is therefore important to identify and develop all foreseeable methods of control in order to restore our natural heritage and develop expertise that can be exported to other tropical regions faced with the same problems.

The large-scale planting of indigenous species is inextricably linked to this fight. The involvement of civil society in future restoration-conservation projects seems essential in order to ensure their success, since these actions are very demanding in terms of labour (control actions, production of indigenous plants, planting). Planting of indigenous species for sustainable use by the population has already been started by certain public sector entities. It should be made systematic in order to allow this botanical heritage to be reclaimed, and to provide growth opportunities to the economic sector linked to its development.

Addressing both growing requirements and regional challenges, this specialisation should impose itself as a decisive activity niche:

For its effects: re-establishment of ecological services (climate, rainfall, maintenance of soils, groundwater, etc.)
For its high-intensity in both specialised knowledge and also unskilled work
For its social-cultural dimension and strong identity
For its strong tourist potential: reinforcing the eco-tourist image of the island by means of corridors acting as buffer zones between urban spaces and the heart of the National Park.

b) Description of actions

This action sheet is based on two complementary axes:

Make Reunion a region of excellence in the ecological restoration of tropical ecosystems

In order to structure this specialisation, two complementary actions will be pursued. On the one hand, the development of scientific, technical and educational expertise exportable in:

the capacity for early detection/characterisation of the quality of habitats
the identification of biological control solutions and implementation methods, integrating an ex-ante analysis of potential impacts;
the development of innovative restoration techniques;
the improvement of the efficiency of existing control protocols;
the development of large-scale monitoring tools (interest of planting indigenous species over time).

On the other hand, the large-scale implementation of conservation actions for preserved natural environments and the restoration of human-altered/damaged land areas. This operations will depend in particular on the location and the degree of damage to the target area:

a. urban areas:

Plant indigenous species in order to improve the conservation of numerous animal and plant species and allow their use by the population (usage as part of local pharmacopoeia). An approach for which it would be necessary to integrate neighbourhood associations, as part of social innovation.

b. secondary areas (invaded by exotic species) bordering intact natural environments:

Rally owners of such land in order to deploy restoration actions. This mobilisation of landowners, many of whom are farmers, requires innovation in the awareness of these challenges: economic development of environmental services provided by agriculture, as part of the promotion of financial incentives (AECM or others), or for positive communication regarding agricultural practices regarding biodiversity (brands, labels, etc.).

c. secondary areas (invaded by exotic species) with limited access (slope > 30%), but largely classed as part of the World Heritage site:

Introduction of bio-control agents against the most invasive species and implementation of innovative restoration actions (hydroseeding for example);

d. natural environments, slightly or highly invaded by exotic species:

Conservation of these areas with a high tourist potential and which provide numerous services to the ecosystem.

Develop and structure an economic sector that creates jobs and added values around actions oriented towards the restoration of natural environments

The demand that will result from the previous actions will serve as a springboard for the creation or the development of companies or associations specialised in:

production of little-propagated indigenous species, respecting the ecotypes and original environments.
supply of indigenous seeds and the development of expertise (improvement of germination rates, survival rates once replanted in natural environment, vitro-plants, etc.)
fight against exotic species, forestry plantation and derived maintenance;
consultancy services in the implementation of these actions (choice of areas to be restored, species to replant, methods to follow, etc.);
export of training
use of replanted essences (herbal teas, handicrafts, beekeeping, etc.) and of active principles derived from tropical biodiversity.
development of ecotourism products

c) Stakeholders involved

Local and regional authorities
CIRAD
Botanical Conservatory of the Mascarene Islands
National Park of Reunion Island
National Forestry Commission
Private companies

d) Resources Mobilised

TO6	TCOP -	Development and conservation of the environment – Biodiversity. € 3,000,000
TO6	OP -	Protection, development, observation of biodiversity and geological reference environments, knowledge of marine and land environments. € 3,990,000
TO1	OP -	Support for the observation and knowledge of biodiversity and SEAS-OI environments. € 2,500,000
TO5	OP -	Support R&D regarding natural hazard phenomenon and the adaptation to climate change. € 1,000,000

ACTION-SHEET N°2: AIMING AT EXCELLENCE IN TROPICAL AGROECOLOGY

On a global scale, 17% of cultivated soils are severely affected by erosion and 70,000 km² abandoned each year due to their depletion. Some form of erosion, salinization or desertification affects more than 25% of arable land. According to the IPCC's projections, the combination of melting glaciers feeding the great rivers and the destruction of forests caused by rising temperatures and acid rain, could place up to 5 billion people in a situation of water stress compared with 1.7 billion today[1]. And harvests could drop by one-third in the tropics due to drought and parasite invasions.

For a small region with great needs, it is therefore necessary to develop agricultural practices that preserve the complexity and resilience of agro-ecosystems, while re-establishing the specific diversity and interactions that condition their integrity. This innovating specialisation responds to both ecological and economic imperatives and presents numerous advantages:

A strong intensity in both intellectual and manual labour (design and maintenance of cultivated spaces)
Exportable expertise to tropical and island countries, dependent today on productive processes that deprive them of independence and an important part of their revenue
Productions with very high added value and quality, with a certification or approved designation that would allow Reunion to differentiate faced with standard producers who benefit from large economies of scale. And thus export to niche markets that appreciate high-level certifications and to exceptional regions such as the European Union and Gulf countries.

a) Background and objectives

This action is aimed at reinforcing the RDI activity in tropical agronomy in Reunion to support ecological intensification of agriculture and to meet the economic needs of the island and IO region countries while favouring links and synergy between farms, companies, R&D centres and higher education. Specifically, this has to do with developing durable agriculture in a highly limited tropical insular context (economically viable, respectful of the environment and mankind) aimed at food independence and the development of the agro-industrial sector. The commitment to agro-ecology will propel the region to the level of pioneer faced with the challenges of the 21st century (energy independence, food autonomy, preservation of natural environments) and will represent an opportunity to take advantage and develop Reunionese excellency, Europe in the Indian Ocean, for international impact.

Agroecology is understood to support sustainable agricultural and food development, implementing a range of tools and methods designed to improve the environmental and technical performances of agricultural system while strengthening natural processes and recreating beneficial interactions and synergies between the components of the agro-system. The final outcome of this process leads to "Organic Agriculture" production.

The local subtropical climate varies according to the island's terrain, and is strongly marked in different places and periods. These economic, demographic, climatic limitations impact the island's natural ecosystems, destabilising a very fragile balance. Therefore it is noticeable, since the early 80s, that there has been accelerated degradation of certain natural environments, pollution of rivers and groundwater, as well as of some marine areas nearby. In agriculture, the last decade was marked by several health crises all caused by epidemiological interactions between animal and plant populations.

(1) According to the Millennium Ecosystem Assessment, a report carried out by 1,360 experts from 95 countries for the UN, 60% of the world's ecosystems were being degraded or used unsustainably in 2005

For the livestock sector, the overall goal is to better understand the conditions for the emergence of diseases, in particular ailments common to both humans and animals in the Indian Ocean, in order to improve operational control methods. Certain specific diseases, zoonoses, concern humans and animals and have a direct impact on human health. Other diseases only affect livestock herds, altering to various degrees the production operations of complex island agricultural systems or household activity systems. Their impact is essentially social and economic, but it can also be environmental. The issues related to these emerging diseases appear considerable.
As for plant sectors, in particular fruit and vegetable, production losses in Reunion represent nearly €5 million per year or 4% of farmers' turnover. The introduction of invasive species and pests is one of the most dramatic effects of global changes seen on islands, threatening the fragile balance between natural and cultivated ecosystems.
Reunion is particularly affected since it imports large amounts of plants and plant products. Local producers' market coverage in Reunion is 70% of fresh produce and 5% of processed products.

However, with more than 600 agricultural diseases and pests (many of which have appeared recently), Reunion's food safety and the competitiveness of its agriculture remain at risk. A situation common to all IOC countries. In Reunion, more than 850t of pesticides are still being imported and the goal of reducing their use by 50% by 2018 seems hard to attain without major agroecological innovation and especially the rapid, generalised transfer to farmers (objectives of the Agricultural Innovation and Transfer Networks – AITN). In addition, with respect to fruit and vegetables, Reunion faces the major challenge of maintaining home-grown production and *ad minima* self-sufficiency at the current level. To do so, increasing production by 40% (moving from 100,000 T to 140,000 T) over the next ten years constitue an absolutely necessity, so that the island's food safety can be partially guaranteed. Scented, aromatic, and medicinal plants as well as other high-added value plants (coffee, cocoa, pepper) have a potential that should be developed in order to conquer niche markets, as they currently occupy as little as 1% of the island's cultivated area.

The need to produce more assumes increased yields, but also the reduction of agricultural production losses that increasingly concern the international community. Reunion can be an example of this.
Agri-food product trade in the Indian Ocean represents only 10% of imported products. The limited exchange is explained by mistrust about the quality of fresh produce not complying with health and food safety standards. Thus, improving the quality of the region's agri-food production is a major challenge: intensifying regional agri-food trade. It will be necessary to create more sustainable agri-food production systems, whose added value is given by the quality of the products and production methods.

The concept of "sustainable development" was originally used to improve agricultural production according to economic, environmental and social criteria. However, beyond the current production process, the contribution that agriculture brings to regions' sustainability is a major issue for agricultural stakeholders and public decision-makers. As such, Reunion must aim for ecologically intensive agriculture and work on a regional level to reduce health risks, ensure its food safety, and protect its biodiversity. It will also assess the positive and negative impact and the ecosystem services of its agricultural production across the territory by engaging in agro-ecological initiatives and to come up with new agro-environmental services for its agricultural activities. The need for better production entails the reduction of the technical systems' environmental impact and an increase in the efficiency of natural resource use.

This strategy also ambitions to lessen the island's dependence on energy and agricultural inputs, by relying mainly on the abundant primary production of agro-ecosystems (550,000 T/year bagasse, 70,000 T/year cane juice skimmings, 200,000 T/year distillation by-products, 1,000 T/year skins, seeds and kernels and 10,000 T/year sorting grade outs, overproduction and decommissioned fruit and vegetables, 6,750 T/year carcasses, viscera, fat and blood). Waste treatment or use, especially through agricultural recycling of organic waste products of urban, agricultural or industrial origin, is a major issue for the island. Reunion's global efficiency must be sought by reducing imports of fertiliser and energy. This endeavour can be an opportunity for specialization, which can be used for its sustainable economic and social development.

The purpose is to contribute to various stakeholders' reflection efforts with respect to three major society concerns:
1 - Increasing the production and use of biomass for dietary (plant and animal products) and non-dietary purposes, especially the production of energy from various types of biomass, in order to enhance the country's energy independence;
2. - Recycling nutrients (urban and agro-industrial waste, livestock manure) in order to reduce imports of fertilisers, which consume large amounts of energy and produce greenhouse gases, while also controlling the flux of contaminants towards the various segments of the ecosystem (water, plants, soil, atmosphere); agroecology is included here through the closure of the large biogeochemical cycles;
3. - Optimising integrated resource management (biomass, land, inputs, etc.) to guarantee the viability of the various activities across the island.

b) Description of actions

The actions aim to:

Promote excellence in agroecological agricultural production and support the farmers' shift towards and conversion to organic agriculture;
Promote excellence in Research and Development and establish international partnerships;
Structure agroecological agricultural production sectors;
Support skill centres and establish smart interconnections between farmers, businesses, research centres and higher education institutions
Rally local and regional stakeholders
Promote mutual learning and joint action

As agroecology is an integrated approach requiring mobilised, innovation-oriented professional sectors that make use of research on mechanisms and new system engineering, actions will focus on cross-cutting themes such as:

Preserving tropical endemic resources by: collecting and preserving seeds, planting arboreta, creating a dedicated organic resource centre, agro-ecologically managing pests and fighting against invasive plants ; epidemiological screening of animals and plants in order to prevent and counter diseases, a strategy to plant healthy plant material within the technological and operational framework that aims to create adapted varieties, which supports the optimisation of genetic plant resources; identifying major channels and risks of introducing diseases, as well as any factors promoting the spreading and the persistence of such diseases; setting up diagnostic and screening tools which enable verification of suspicions and promote a more effective way to fight against such diseases.

Biodiversity as a tool for wealth generation by: promoting and developing high-quality products (resulting from sustainable organic farming); researching new agroecological production sectors on land and in the water (algae), medical research, development of cosmetic products, technical expertise on conserving natural environments, expertise in ecological restoration, urban/agro-urban diversity promotion and development;

Providing technical support to local producers by: research on agroforestry and tropical agronomy; ecological restoration programmes coupled with agricultural production; promotion of local expertise; varietal adaptation; creation of an in situ preservation network for the varietal and traditional species that must be preserved; experimental cultivation under plant cover, research on ecological fertilisers in a tropical environment, developing high-quality apiculture (special types of honey and derived products) and pollination by bees and indigenous pollinating insects, controlling food zoonoses ;

Stimulating excellence and setting an example by: creating pilot experimental farms which are representative of Reunion's agroecological expertise and which serve as points of exchange and diffusion of knowledge, raising awareness/educating the local population through organic gardens or any other suitable communication method (following the example of AITN).

Structuring short agroecological production export chains by: supporting and developing existing organic production, sustainable farming and high-value niche markets, supplying school canteens by creating scale economies and pooling resources; researching new commercial niches which can create export opportunities.

Fostering sustainability in agricultural systems and agroindustrial processes by: identifying and modelling the yield determinants and the quality of agricultural and agro-food products; setting up cultural techniques, as well as innovative transformation and/or preservation systems that respond to agroecological needs, whether for sustainable farming, greenhouse farming or organic farming ; analysing the impact of routes and processes to reduce losses in the production and transformation system, in order to improve animal and plant product quality; co-creating technical and organisation systems that respond to the needs and goals of the national market; setting up ways to replace imported plant protein for animal consumption; developing organic fertilisation to replace synthetic mineral fertilisers, while producing more, especially within the sugar cane production systems.

Use of organic co-products and waste by: using multiple criteria to assess the activity systems represented by farming sectors and land, and adapting such systems to changes; understanding and modelling the biophysical processes involved in plant and animal production, but also in the biogeochemical cycles pertaining to the cultivation or livestock systems in order to recycle nutrients ; use of biomass for non-dietary purposes, with particular emphasis on combustion, gasification and methanisation technologies; integrated resource management across agricultural land.

Society's expectations by: identifying indicators for evaluating cultural practices' pressure over natural resources ; considering the impact of agricultural activities on the environment ; identifying the most significant food hazards, especially the reduction in synthetic phytosanitary products (pesticides) and the resistance to antibiotics that is manifested by the bacteria found in livestock environments, both in Reunion and neighbouring countries; analysing stakeholders' strategies and their impact on reducing the losses occurring in the production system, as well as improving product quality; considering the quality of products but also the production process, the place of origin, the local production and/or transformation know-how and thus, the traceability of products; assessing the biochemical and the sensory quality of food products ; setting up tools to support decision-making and quality product use for the benefit of stakeholders; identifying health risk factors with respect to cooked foods; highlighting infectious zoonotic or plant diseases that exist or can be introduced into the region from nearby countries, and which can severely affect the economy; setting up observatories to analyse needs, acquire data, treat and use spatial and temporal information over a long time, and promote regional networking.

c) Stakeholders involved

Farmers' associations (AROPFL, AVAB, GAB, etc.)
Associations (ADPAPAM, APLAMEDOM, ARMEFLHOR, CAHEB)
Chamber of Agriculture
CIRAD
Qualitropic
National Park
Sugar producers' union

d) Community resources mobilised

TO1 - TCOP -	Infrastructure of the Plant Protection Research Cluster: €5,000,000
EAFRD -	Measure 11 Organic Agriculture:
TO1- OP -	Supporting applied research activities in partnership, within a Regional Platform for Agronomic Development Research – PreRAD: €19,970,000
TO1 – TCOP -	Supporting cooperation on applied research projects within a Regional Platform for Agronomic Development Research – PreRAD: €8,500,000
EAFRD -	Supporting applied agronomic research activities - PreRAD: €17,565,000
TO10 – TCOP -	REAP AAOI Agricultural cooperation training programme:€500,000

ACTION-SHEET N°3:
UNDERSTANDING AND DEVELOPING MARINE BIODIVERSITY

Agroecological principles can naturally be extended and applied to the marine environment.

a) Background and objectives

The existence of a large exclusive economic zone represents an asset when it comes to overcome the limits of land areas and develope exportable production and expertise. Today, Reunion faces two issues : supporting the diversification of protein sources by placing more emphasis on seafood products (consumption rates should reach 21,000 tonnes in 2020, 80% imported) while preservingfragile habitats.

Our island is located in one of the main marine biodiversity hotspots. The most remarkable elements of this biodiversity include coral reefs, high sea environments, emblematic megafauna (sea mammals, turtles, etc.). This exceptional marine biodiversity forms the basis for strategic economic activities that help develop the region (industrial, traditional or recreational fishing, aquaculture, tourism, biotechnology).

Such diverse activities depend on the sustainable management of natural sea environments and fish populations. Reunion has several institutional research teams and a network of professional, associative and private stakeholders focused on understanding, preserving and enhancing marine resources and biodiversity.

b) Description of actions

The Institute for Development Research, IFREMER, the Entropie Mixed Research Unit and various associative, private and professional structures who wish to join their efforts in the interest of developing innovative research actions along three complementary thematic axes that promote the emergence of marine agroecology:

The first goal is to make Reunion a **European centre of excellence for observing and tracking marine environments and biodiversity**, covering various fields: characterisation and functioning of coastal and high sea ecosystems; the effects of anthropogenic pressure and global changes; adaptability and resilience of species and habitats, predictive modelling of marine biodiversity; applied research on protected marine areas (ecological, social and economic values).

The second goal focuses on **the economic development of marine resources** though ecosystemic approaches.

Developing ecologically sustainable fishing techniques and programmes, based on stock characterisation, the biology of species, the dynamics of populations and pressure assessment, will make it possible to export engineering and services, but also to safeguard high-potential production.

As for **aquaculture**, the main issues concern safeguarding juvenile supply, optimising production systems, maintaining generic diversity, and domesticating new species of regional interest.

Marine biotechnologies will also be mobilised with respect to the next action sheet, in order to lead the research on the **therapeutic, cosmetic, and energy potential of the marine environment.**

Particular emphasis will be placed on transferring knowledge to economic agents, in order to support the modernisation and the diversification of sectors, especially by introducing innovative techniques and adapting strategies.

The final action block aims to roll out tools and methods for **the integrated management of the sea and shoreline,** spatial planning and anti-erosion efforts.

c) Stakeholders involved

Maritime cluster
Institute for Development Research
IFREMER
Entropie Mixed Research Unit
Professional research and innovation bodies (Hydrô Réunion, etc.)

d) Community resources mobilised

TO 1 - OP -	Building regional innovation poles and professionalising innovation support – SEA Division: €2,990,000
TO10 - TCOP -	Interregional training on the material used to curb and counter sea- and land-based pollution: €150,000
TO1 – TCOP -	Disseminating Blue Economy expertise: €2,000,000
TO6 – OP -	Restoring marine and reef environments, as well as continental water environments and groundwater: €1,700,000

ACTION-SHEET N°4: EXTRACTION AND MOBILISATION OF THE ACTIVE PRINCIPLES OF TROPICAL BIODIVERSITY

a) Background and objectives

The endemism of the fauna and flora of Reunion and the Mascarene Islands represents a significant source of innovation in biotechnology, especially with respect to markets such as nutrition, cosmetics and pharmaceuticals. Numerous biomass deposits can be exploited in order to characterise and use natural extracts. Currently, 550,000 tonnes of bagasse are used per year, in two thermal power plants. The fruit and vegetables sector produces 1,000 tonnes of skins, seeds and kernels per year and 10,000 tonnes of grade-outs, overproduction and decommissioned products. Each year the scented, aromatic and medicinal plants (PAMP) sector generates 2 tonnes of essential geranium oil, 20 tonnes of turmeric and exports almost 100 tonnes of pink pepper. In addition, Reunion is witnessing the emergence of a biotechnology sector (centered on the use of micro-algae, micro-organisms, bacteria and fungi resulting from the tropical microbial flora). Although the production rates and the number of stakeholders are currently low, this sector's prospects for development (in terms of market and innovation) seem huge.

The challenge is to develop green technologies and processes to increase the added value of production and to develop new applications. As for deposits too limited to allow "mass" industrialisation, niche markets will be targeted (cosmetics, food supplements, chemical inputs, etc.)

Today, the main application principle for eco-extraction techniques is related to PAMP. According to *The Economist*, this global market represents an estimated US $64 billion. More than 35,000 plants are being used by the pharmacy, phytotherapy, herbalism, and hygiene industries, amongst others. They are also used as components/extracts for the production of cosmetics, medicines, natural food and other natural health products. In addition they form the base for high-value transformed natural products, such as essential oils, dry and liquid extracts, as well as oleoresins.

Specifically regarding the medicinal plants market, industrial demand is strong, as a consequence of the development of: plant extract-based therapeutic formulations, plant/plant extract-based cosmetics, and plant/plant extract-based food supplements. The global plant-based medicines market should reach US $ 33 billion in 2013, at an 11% annual growth rate (source: BBC Research). In August 2013, indigenous medicinal plants from Reunion's traditional pharmacopoeia were registered in the French pharmacopoeia, which opens the door for specialised pharmaceutical products based on extracts from plants that make up the island's biodiversity.

The food supplement market went through a slowdown period between 2008 and 2010, but started growing again in 2011. Despite the difficult economic context, it taps into the global interest in wellness and slimming products. The global market for plant/plant extract-based/biosourced cosmetics was worth US $14 billion in 2010. For instance, the American omega-3 market was worth US $4 billion in 2010, and the estimated growth of this market segment is 15% per year until 2015.

b) Description of actions

This action aims to:

Create and produce locally innovative health/wellness products of high added value, based on natural extracts from Reunion's marine and land-based biodiversity (PAMP, tropical fruits and vegetables, micro-organisms, micro-algae and so forth).

Produce pharmaceutically valuable molecules (potential medication), based on the island's biodiversity, and vectorising such molecules (through prodrugs, dendrimers, liposomes or nanoparticles) up to the preclinical study stage.

Evaluate the therapeutic effects of molecules and ecoextracts from the island's biodiversity (pre-clinical research)

Enhance its positioning as a **green technology expert** (ecoextraction processes, agrosolvent usage) that responds to society expectations and assures a high level of production, as well as optimal-quality extracts. The targeted markets are as follows:

Functional foods/health and nutrition claims: extracts from terrestrial biodiversity (tropical fruit and vegetables, medicinal plants from Reunion that are registered in the French pharmacopeia; micro-organisms and microalgae)

Wellness/cosmetics: perfumes, aromas, dyes

c) Stakeholders and skills mobilised

In order to achieve such objectives, several resources will be mobilised: university laboratories and Mixed Research Units (LCSNSA, DETROI Mixed Research Unit, PIMIT Mixed Research Unit, IUT's biological engineering department), platforms (CYROI, CRITT, Eco-Ex, Qualitropic), private structures (Aplamedom, Hydrô Réunion, Bioalgostral, CAHEB, Cilam, Extracts de Bourbon, Octans, Sapmer, Tereos, Vivea, etc.).

Skill areas are varied:

Ethnopharmacology:
Knowledge of indigenous plants and the traditional practices that are linked to the various therapeutic applications of such plants, scientific validation of traditional applications.

Chemistry/Biochemistry:
Studies of the volatile components and the secondary metabolites in Reunion's aromatic and medicinal plants, metabolomic analysis, characterisation of the natural biopolymers resulting from macroalgae, structural study on proteins and protein-ligand interactions, characterisation of the pigments resulting from microalgae;

Molecular biology:
Applied studies of the traceability of products, the molecular taxonomy of marine organisms (especially micro-organisms: bacteria and microalgae), the transcriptional metabolism and recombinant microalgae molecules;

Cellular culture:
Study of the properties of medicinal plant extracts with respect to human cells, study on phycotoxins;

Microbiology:
Collection and culture collection (bacteria used for testing cosmetic products);

Ecophysiology and microalgae:
Collection and culture collection, microalgae production strategy, culture, study on the bioactive potential of marine algae from the Indian Ocean;

Sensory analysis:
Studies and sensory analyses to characterise agri-food products;

Animals:
Research on marine biotoxins;

Process engineering:
Tests on fermentation, methanisation, enzymatic hydrolysis, and other bioprocesses;

Radiopharmacy:
Production of radio-tracers for in situ imaging (TEP technology)

ACTION-SHEET N°5:
USING TROPICAL RESOURCES AND PRODUCTS FROM AGRI-FOOD INDUSTRIES

The final action sheet aims to support the renewal of the agri-food industries through innovation and differentiation, by developing specific expertise and products, based on tropical biodiversity. Three priority development axes are proposed:

upstream, supporting the structuring of a sustainable tropical seed/plant sector in Reunion (diversification sectors), in keeping with the strategy for the development of local fruit and vegetable production, maintaining and strengthening technological and strategic mastery with respect to creating sugar cane varieties on an international scale
downstream, innovating to adapt to and conquer new markets, while also increasing the island's global IAA performance with respect to resource usage, technical effectiveness, environmental management, commercial competitiveness, and added value

a) Supporting the structuring of a tropical seeds/plants sector in Reunion

Providing a local response with respect to **creating and selecting varieties** that are more productive is the stakeholders' main technological focus. The goal is to select varieties that are optimised and adapted to the local climate and land use conditions, but also exportable on Indian Ocean and international markets.

The process of creating varieties, which takes 10 years on average, involves manipulation techniques and technologies in a laboratory setting (molecular marking/ in-vitro culture /etc.), as well as actual size experimentation (crop fields). Today, optimisation issues are related to plant biotechnologies (biomarkers).

In terms of selecting and multiplying varieties, laboratory techniques, especially preselection through in-vitro culture, will need particular attention from innovation stakeholders.

Increased cross-sectoral collaboration should lead to an increase in knowledge exchange, which will also serve to bring the island's expertise into the international limelight.

The study of the physiology of endemic plants (PAMP sector) will also contribute to an increase in the creation and the selection of varieties. Therefore, the goal is to define and apply a long-term strategy for the **structuring of a tropical seeds/plants sector** that is sustainable and relevant both locally and internationally. The focus is also on strengthening existing stakeholders, while promoting the emergence of new stakeholders in this field. This strategy should take into account the development ambitions of the local production sectors (fruit and vegetables, horticulture, etc.) and the specifics of the island (limited land, production costs, man power, inputs, etc.).

Plant behaviour changes depending on its environment.

Seeds are one of the components of innovation, with respect to developing agroecological practices that have the capacity to influence field productivity and diversification. The creation of specific quality seeds will promote smart specialisation within the realm of farming, with respect to the introduction of new products on the market. Thus, technological mastery of seeds is a competitive advantage, offering significant expansion opportunities. However, it is difficult to protect innovation (plundering is frequent and rights protection is difficult) and to position oneself (the sector is very concentrated) in this field if one is a small stakeholder.

In order to accelerate and facilitate access to the product market, it is particularly necessary to facilitate the transfer of skills and technologies from R&D centres to businesses, as well as the industrialisation of current projects.

Structuring the seed industry will improve the competitiveness of local production sectors and help the emergence of production solutions that Reunion can export.

b) Strengthening and maintaining technological and strategic mastery with respect to creating sugar cane varieties on an international scale and harnessing local issues

Given its history, the island's sugar cane sector benefits from clear competitive advantages with respect to creating and selecting varieties. The selection of varieties by natural hybridisation at the world-renowned eRcane, Europe's only sugar cane research centre, aims to create varieties that are adapted to the island's soil and climate conditions in particular, and to tropical environments in general, while also ensuring ever-growing yields per hectare.

The diversity of the island's varieties must continue to become richer, so as to respond first to the specific needs of Reunion, and then to the needs of other sugar cane growing countries as well.

Selecting a sugar cane variety currently takes 15 years on average and requires the use of a large number of technologies, especially plant biotechnologies (genetics / plant sequencing / hybridization / crossbreeding / in-vitro culture / molecular biology (e.g. biomarkers) / conservation technology / variety collection).

The research achievements of the sugar cane industry will eventually serve stakeholders in other plant sectors (especially plant biotechnologies: biomarkers, in-vitro cultures etc.).

Furthermore, sugar cane has one of the hardest genomes to decipher, and remains unknown for the time being. Genome sequencing by stakeholders in Reunion's research field would bring the island a clear competitive advantage compared to Europe and would accelerate the process of variety creation. The sector will be able to use this new knowledge both locally, and internationally.

c) Innovating to adapt to and conquer new markets, to increase Reunion's global agribusiness performance with respect to resource usage, technical effectiveness, commercial competitiveness and added value.

Due to the severe structural constraints hindering the competitiveness of its production tools, the agri-food sector in Reunion has been engaging for years in a strategy that focuses on sustainable natural resource usage and constant improvement of the island's production capacities, in order to develop competitive advantages (specifics, quality, etc.), especially in a context where the neighbouring countries have few social regulations.

Because their ability to create economies of scale is limited, agri-food industries constantly look for ways to maintain their competitiveness. The agri-food sector has industrial expertise that is sometimes unique and is constantly growing. The quality of such know-how is internationally acclaimed and disseminated. Thus, in order to maintain technological leadership, develop differentiated products or products with higher added value, the island's various agroindustrial stakeholders will need to conduct investigation in partnership with other sector stakeholders and to innovate in order to improve their performance on the local market, as well as on their respective export markets.

On the local level, for instance, 75 % of the demand for fresh products is covered by local production. While it is obvious that complete self-sufficiency is neither feasible, nor desirable (given the climate context, it is advisable to preserve external supply sources), Reunion must aim to improve its self-sufficiency whenever possible by means of innovation, in order to harmonise the production capacities of local sectors, necessary industrial investments, and the size of its market. Thus, the needs of the population of the island will be met.

ACTION-SHEET N°5: USING TROPICAL RESOURCES AND PRODUCTS FROM AGRI-FOOD INDUSTRIES

In view of the need to innovate (by separation or adaptation) on each activity level, the LCA system (life cycle analysis), which is more complete than the ordinary carbon balance, could be adapted to the tropical context, in order to identify and model the innovations that need to be introduced into the identified intervention axes. To date, ACV models have been based on North-European and American standards and do not respond to the reality of the island's context.

Aside from its innovative profile, such an accomplishment could create export opportunities.

Thus, by complying with the strictest community standards in terms of preventing industrial, environmental and hygiene pollution hazards, the island's agribusinesses should constantly innovate their production tools, in order to constantly preserve, improve and exploit the quality and the specifics of their products.

All the tools must be mobilised with respect to:

The innovation processes required by the tropical context
The innovation needed to improve local products, regardless of the origin of the raw material used
Waste and effluent usage, while also promoting agroecology

d) Stakeholders

Association for Reunion's Industrial Development (ADIR)
AROPFL
ARMEFLHOR
eRcane
Farming interprofessions
Qualitropic
Nurseries
Start-ups

e) Community resources mobilised

TO 1 -OP - Economic development of Reunion's biodiversity - ERDF strand: €4,000,000

B

PRIORITY N°2 :
REUNION – CREATING EMOTION WITH EXPERIENTIAL ECOTOURISM

With 1 billion entries, tourism is the main mobility trigger across the globe. Departure zones mainly include Western countries, but the number of Chinese tourists has increased significantly, followed by tourists from other emerging countries. By using its assets and focusing on innovation, Reunion wishes to attract a small percentage of this flow.

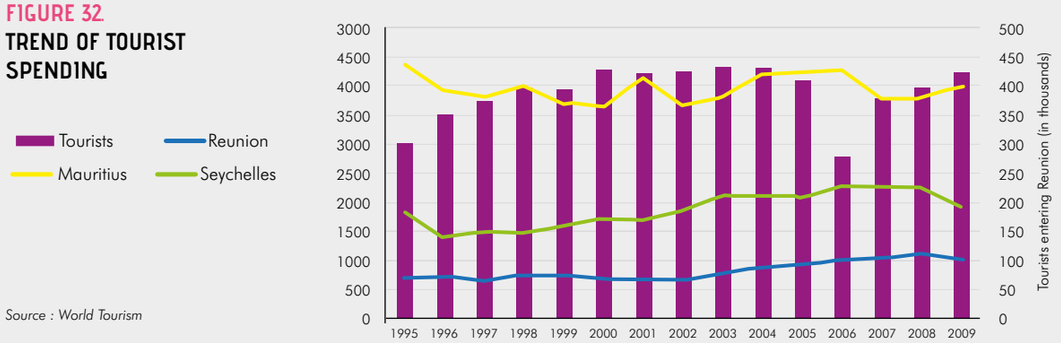
Our island hold *a priori* remarkable comparative advantages: an exceptional natural heritage (protected by a National Park, part of the Unesco World Heritage, thanks to its Cirques, Pitons and Remparts, its Volcano, biodiversity hotspot, Marine Park), tropical climate, diverse recreational activities, cultural, religious and gastronomic culture, modern equipment in a safe health and political environment, and, finally, its status as a French island at the heart of the Indian Ocean.

In 2012, tourists spent €315 million during their stay on the island, which makes tourism the island's main export, including when compared to goods exported (€307 million). As for local clients, their spending amounts to almost €480 million. In total, tourism already makes up almost 8% of the island's GDP and creates 6,750 direct jobs. Thus, tourism is a regional priority, as it has an immense growth potential to create diverse jobs and to support the development of other sectors through an integrated approach (development of farming, traditional and industrial productions; services; commerce; digital solutions; environment; developing the island's highlands, etc.).

As a driver for inclusive growth, this sector makes it possible to develop the island in a balanced manner. It has an impact on all stakeholders: citizens, businesses, communities, associations and the four micro-regions.

Margins for progress are huge: in 2009, average spending amounted to $1,000 per tourist, compared to $1,911 in the Seychelles and $3,994 in Mauritius.

FIGURE 32
TREND OF TOURIST SPENDING



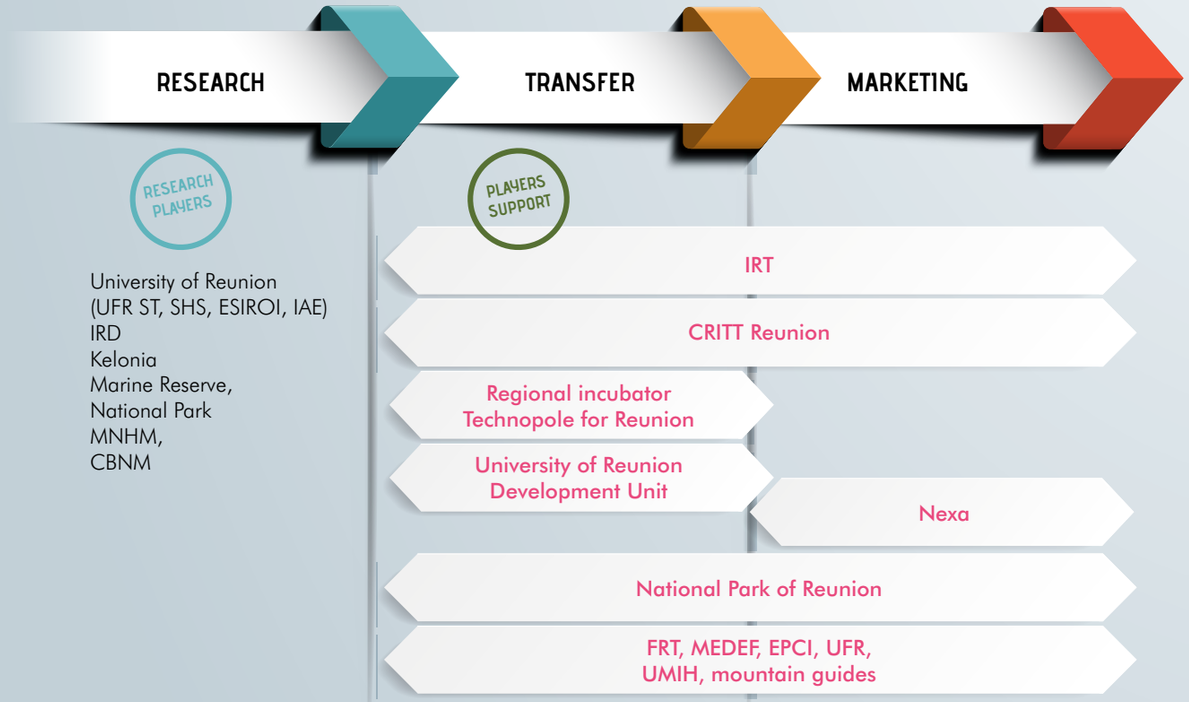
Source : World Tourism

The goal of S3 is to focus on innovating the island's tourism offering, by emphasising differentiation, capturing high-value market niches (which are characterised by a relatively inelastic demand due to transportation and accommodation costs), proposing appealing solutions, and maximising economic spin-offs. Innovation also seems to be the key to reducing the tourism industry's exposure to current risks (international competition, natural hazards, such as sharks) and future risks (increase in transportation costs, emergence of new destinations, etc.).

The tourism innovation strategy is based on three axes focusing on creating emotions and experiences:
Reunion, destination of choice for exceptional experiences in the great outdoors
Reunion, destination of choice for wellness and accessible tourism
Reunion, multicultural destination

SECTORAL MAPPING

S3 Domain: Experiential Ecotourism



KEY COMPANIES

STRUCTURING / COOPERATIVE PROJECTS

SUBDOMAINS
Tourism - nature
Tourism - culture
Tourism - wellness

COLLECTIVE DYNAMICS
Community actions
Tourism Club
PTE

INTERREGIONAL COOPERATION
IFT
Atout France

ACTION-SHEET N°1:
REUNION: DESTINATION OF CHOICE FOR EXCEPTIONAL EXPERIENCES IN THE GREAT OUTDOORS

At a time when ecotourism is becoming more and more significant for the global economy, Reunion can rely on important assets: its National Park, the diversity of its landscapes, environments and species across a limited area, the variety and quality of its outdoor activities (canyoning, paragliding, diving, hiking, etc.) Reunion can be considered an island of contrasts. Its discovery can be customised according to the rhythm and the physical abilities of each visitor. Activities are adapted to sites, in the spirit of environmental protection. One can be idle (on the beach, on the verandah of a guest house or hotel), but one can also embark on a spectacular flight over the island, go hiking, horseback riding, mountain biking or quad biking, one can explore river canyons or fly… This small island (2,500 km^2) is home to nature's miracles, with its spectacular landscapes and original life forms; this ever-evolving land allows visitors to understand volcanic activity and human settlement. An interpretation of the various micro-regions is offered to everyone, so that visitors may rediscover their own senses and their deepest emotions when coming into contact with the island's natural richness. No matter where you are accommodated, nature is right on your doorstep; in less than 30 minutes, the bustling life in cities and villages, as well as all the facilities available in Europe, make room to an out-of-the-ordinary place and the authentic spirit of a remote "world's end".

Along with bioeconomy, ecotourism is becoming an axis of specialisation in itself. Visiting Reunion means wanting to live unforgettable, extraordinary moments in the great outdoors, on an eco-friendly, environmentally responsible island!

a) Description of actions

The proposed actions belong to four axes:

First, **consolidating the infrastructure**, which is the foundation of the island's tourist offering. This chiefly entails improving accommodation on the island's emblematic sites, such as its highlands (volcano, cirques, forests, view points) and by setting up key accommodation facilities and equipment, as the island's flagship attractions can improve its international exposure. Particular attention will also be paid to the spaces reserved for recreational activities and outdoor sports : hiking, water activities, adventure sites, botanical discovery, etc.

Next, **structuring local offers and differentiated circuits**: proposing à la carte circuits (from accommodation to the actual activities) in Reunion's multiple settings: the volcano, the Northern and Eastern areas, the mountains, etc.

The third axis refers to **developing interpretations:** professional training programmes; creating multimedia content (applications, augmented reality, interactive terminals); improvement of signage.

Finally, **maximising the effects** of tourism by including sectors such as traditional arts and crafts, as well as culture: drawing and painting, sculpting, weaving, engraving, dressmaking, cooking, discovering indigenous, endemic plants, etc.

b) Stakeholders

AD2R
Local and regional authorities
Tourism Club
DDJS and sports federations
ESIROI
Tourist Office of the Island of Reunion
The University's IT and mathematics laboratory
National Forestry Commission
OTI
National Park of Reunion

c) Community resources mobilised

Cross-sectional tourism promotion activities:

TO3 OP - Development of tourism promotion: €21,970,000
TO3 OP - Investments for creating businesses - tourism strand: €12,000,000
TO3 OP - Support for collective action and professional groupings in the field of tourism: €1,500,000
TO3 OP - Assistance for tourism operators: €7,970,000

Specific actions targeting outdoor tourism:

TO3 OP – Creating exemplary mountain tourism offerings:€14,980,000
TO6 OP – Setting up public tourism equipment, creating a trailway for an island tour: €19,970,000

ACTION-SHEET N°2: REUNION: A MULTICULTURAL DESTINATION

For the World Tourism Organisation, cultural tourism is currently worth 40% of tourism around the globe, with an annual growth rate of 15%. Cultural tourism means "visiting a territory with the main or auxiliary purpose of discovering or experiencing one or several of the following components":

Cultural heritage (cultural landscapes, heritage sites, architecture, art and heritage towns, religious heritage, listed properties, archaeological sites, etc.)

People: (Artists/craftsmen, residents) and non-material heritage (expressions, traditions, historical figures)

Cultural sites: dissemination venues, entertainment halls, theatres, museums, performance centres, exhibition centres, etc.

Cultural programming: events, shows, exhibitions, openings etc.

Regional/local products: products resulting from art and artistic professions, as well as other products that illustrate regional expertise.

This approach is fully aligned to the principles of S3 because it allows to simultaneously conserve and promote the island's heritage. This approach also enables significant economic spin-offs, especially thanks to the local populations' involvement.

a) Description of actions

To respond to the requirements of new clients and behaviour, it is absolutely necessary to invent unique offers, to create original circuits and products, to suggest new activities and experiences. As a consequence, our visitors will be excited to discover everything the island has to offer, while also expanding their knowledge. The main goal is to look for complementary expenses. Digital advances offer stimulating prospects for increasing the island's visibility and accessibility, but also for diversifying tourists' experiences.

Thus, **augmented reality** will be at the heart of our approach. Emerging technological innovation will focus on superposing real and virtual elements, thereby enriching the physical environment in real time, through imagery or texts.

Circuits could focus both on culture (monuments, museums etc.), and on nature, by means of various options available in the National Park (botanical exploration, hiking, etc.)

Artistic performances will will be encouraged., notably in historical sites and museums, through light and sound shows based on an island-inspired theme (for example pirates or the East Indies Company) that could be held annually, during peak season (October to December), with a high degree of involvement on the part of the local population.

The third axis focuses on **creating itineraries,** which allow visitors to explore the multiple facets of the island: circuits on the islands registered as "Art and History Cities" (Saint-Denis, Saint-Paul, Saint-Pierre); exploring aromatic and medicinal plants, etc.

Particular attention will also be paid to stakeholders' professionalisation (training in language and history for example) and to developing suitable time schedules: 5pm/7pm or even 10pm to extend the range of products (storytellers, participatory workshops, as well as arts, crafts and photography training).

Other approaches are currently under discussion:

Working to **restore ancient heritage**, for example the "Kader Mills" and irrigation channels, for the benefit of both local and foreign visitors. Research has already been conducted. It would be beneficial to work in partnership with communities and on-site associations. The ensuing goal would be to market hiking tours, based on those themes.

Considering the possibility of creating **an internationally acclaimed botanical garden** (such as the Pamplemousses Garden in Mauritius). Before creating a new garden it would be beneficial to work with communities and existing gardens (both public and private), in order to reach a real consensus.

Creating an **application for cruise passengers** stopping over in Reunion

b) Community resources mobilised

TO6 OP - Protecting and developing heritage, creation of a House of Maloya Moringue and Maroons: €12,980,000

ACTION-SHEET N°3:
REUNION, DESTINATION OF CHOICE FOR WELLNESS AND ACCESSIBILITY TOURISM

Longer life expectancy, aging of the population and interest in wellness open up new opportunities for tourism. Over the course of a dozen years, wellness tourism has become democratised and diverse. Through its natural assets, its safe environment and its modern healthcare equipment, Reunion is in the strategic position to offer products that are adapted to those clients who are looking for relaxation, amenities or solutions adapted to their needs (age, disabilities, long-term medical conditions, etc.)

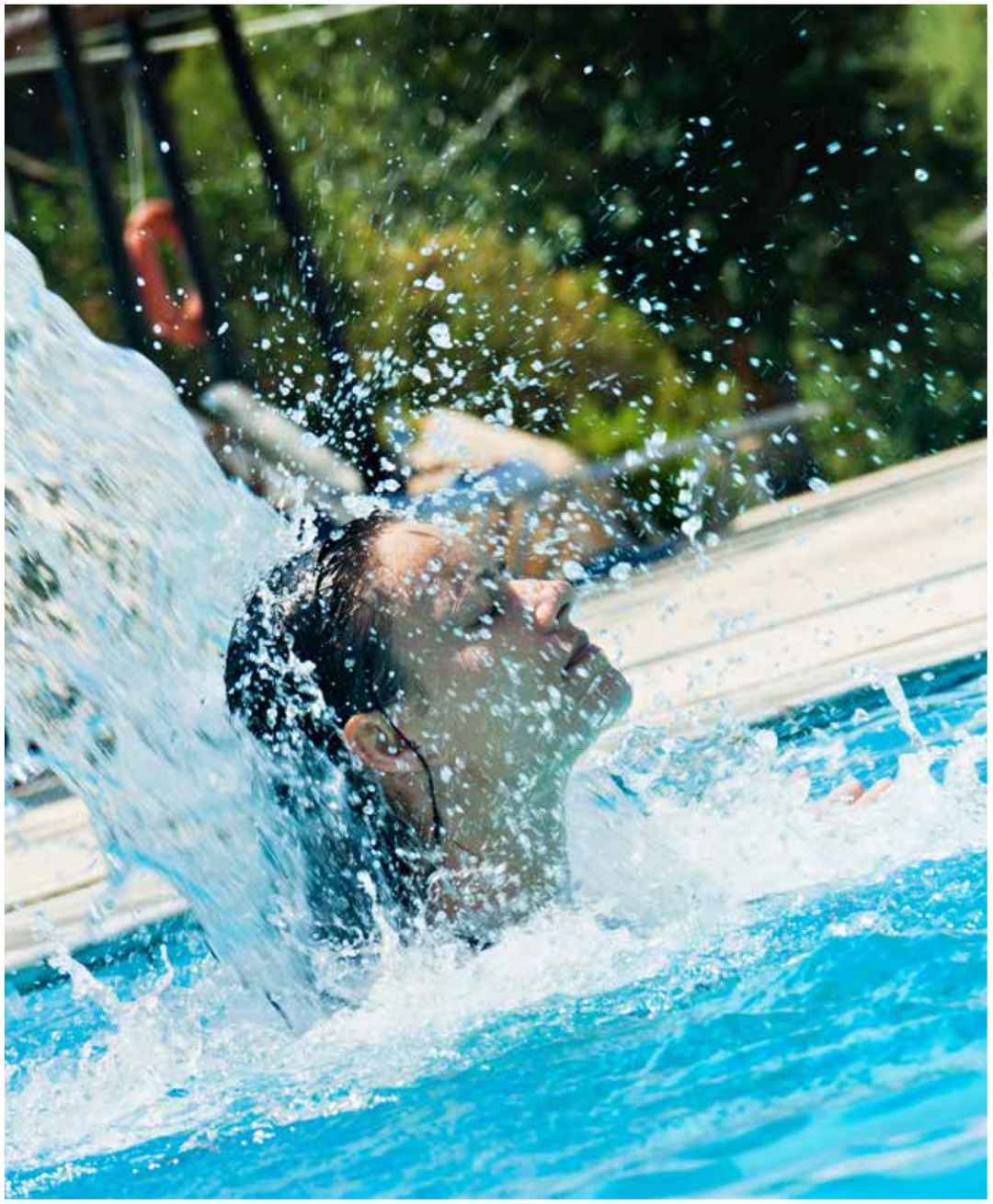
a) Description of actions

Three targets are associated with the following initiatives:

For **young professionals** (over 30) who travel in groups (family and/or friends), creation of the island's first aqua fun centre. Such a centre would guarantee access to the benefits of water in all its forms, in a "non-therapeutical" environment. This new centre would encourage young people to change scenery and discover new sensations. In addition to traditional saunas, hammams and whirlpool spa baths, the centre could feature diverse activities: water circuits, waterfalls, countercurrent swimming, theme pools, bubble beds, geysers, musical baths, relaxing lights, warm marbles and cool water caves. The centre could be split into thematic areas aiming to recreate the atmosphere of Reunion's different cultures: Indian, Arabian, Chinese... as such, several wellness concepts could be offered to clients.

For **seniors**, Cilaos thermal baths could be converted into a medi-spa: combining the virtues of a beauty centre and a medical facility, the medi-spa gives patients solutions to skin-aging and weight issues, by using the latest medical aesthetic techniques. This would be a place that combines beauty (e.g. massage, balneotherapy) and non-surgical medical aesthetics: peelings, laser, micro-dermabrasion, Botox or hyaluronic acid shots… Treatments often focus on two issues: fighting age and slimming. Cilaos, which is less popular from a mass tourism perspective, is a great choice for seniors, who prefer quiet places. It could be the right location for a medical spa if accessibility is improved, especially by helicopter.

As for **business tourists**, a proper hotel complex could be created to host seminars, conventions, and conferences. In addition to the traditional hotel services and its conference rooms, the hotel could provide additional facilities such as spa services, thalassotherapy, balneotherapy, sports equipment etc. Such state-of-the-art facilities aim to attract top business travellers. As a European actor in the Indian Ocean, which relies on exceptional natural resources (UNESCO heritage) and a thermal resort (Cilaos thermal baths), Reunion can be a strong player on the business tourism market. Such assets allow Reunion to differentiate itself from its competitors in the area by offering safety, a change of scene, and wellness services. In addition, such facilities could host professional as well as public events (conventions, industry conferences, trade fairs, etc.).



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PRIORITY N°3:
REUNION — A RESPONSIVE TRANSFORMATION PLATFORM TOWARDS A KNOWLEDGE-BASED, DIGITAL AND LOW-CARBON ECONOMY

In the spirit of analysing international trade from a traditional standpoint, *a priori* Reunion seems to have few comparative advantages, in terms of labour cost, capital, or direct technological advances compared to other competing economies. Thus, positioning the island as a focus for international value chain specialisation could be a difficult endeavour. Nonetheless, new international trade analyses emphasise the decisive importance of new factors, such as the effects of training, reactivity, the ability to satisfy various tastes, and the taste for variety.

Alongside the previous sectoral specialisations discussed above, we suggest a third local approach: positioning Reunion as a tropical European development platform for productive activity ideas, within the realm of knowledge-based, digital, low-carbon economy. In order to become acknowledged as a target for external investment and a project catalyst, Reunion already benefits from several differentiation factors:

- Its sunny tropical climate and its remarkable living conditions
- Its status as a French overseas department ensures it has stable legal and administrative institutions
- Europe's longstanding support, with respect to the "convergence" goal associated with its OMR status, which has helped the island to build a solid human environment, robust infrastructure and equipment that is adapted to current needs, even if they need to be consolidated
- Its healthcare development level, which is worthy of the most developed countries

In addition, the island's history and geography add human, cultural, and religious richness, as well as several assets in terms of international visibility: a National Park, classification of its natural assets as a UNESCO World Heritage site, and an exclusive economic zone of more than 2.5 million km². Such traits need to be safeguarded and consolidated, because they are some of the key elements that differentiate the island. Developments in the bioeconomy of the living world have revealed the potential associated with this ambition.

Another source of differentiation consists of building **a truly responsive transformation platform to move towards a knowledge-based, digital, low-carbon economy** for the entire island. This means choosing to position the island so as to target the direct foreign investment localisation market, by showing the world that Reunion is a great place to invest, thanks to its potential to transform ideas into business opportunities and its forward thinking.

In other words, Reunion could draw its localisation advantages not just from a few fiscal tools or a relative, fragile reduction in labour cost, but especially from all its human, social, technological and climate-related traits. Such factors need to be created or strengthened ; therefore, they depend on the effort to innovate, research, and develop, which the island will need to engage in if it is to consolidate its advantages. The innovation effort needed to build this transformation platform can rest on three main axes: **innovation with respect to the territory's social agility, innovation with respect to creating a real digital society, and innovation with respect to making Reunion an example of transition towards a low-carbon economy.** As such, Reunion will be able to market itself to the world as the land of "Making ideas concrete" (S. Bansky (2011)).

1) ▶ INNOVATING THE ISLAND'S HUMAN, SOCIAL, AND ORGANISATIONAL RESPONSIVENESS

Some sort of territorial agility is needed to face the challenges of change, to respond to shock, and to transform mindsets. But tuning into a responsive region cannot be a matter of improvisation. This is both an ambition, and a prerequisite for evolution.

Reunion has already acquired extensive experience in this field. Its history is marked by numerous reconsiderations of the foundation of its economy and the paradigms that its economy had been built on. The island has also gone through painful experiences that have left scars. However, the island's economy has also been marked by outstanding transformation, which has allowed it to shift from an underdeveloped economy to Europe's "showcase" in the Indian Ocean.

Reunion owes its resistance to past shocks to external human and financial support, but also to an element that is often overlooked: territorial intelligence. Across the centuries, this trait has undoubtedly allowed the economy and the island's residents to survive crises and to get back on their feet. The agility that Reunion has proven is not to be neglected; on the contrary, it must be put to good use, because it contributes to capacity building, to the ability to cope with less fortunate events, shock, reconsiderations and change such as those which are called upon or awaited. This agility, which has prevailed over the past centuries and recent decades, is not the same today. The current context is characterised by multiple international dimensions, not just domestic aspects. There is also a multitude of developments and stakeholders. The population is also much larger - it is now four times larger than when the department was created. As such, there is now the need to adapt to accelerated rhythms. High-speed living has weakened this resilience. Also, several social "shock absorbers" which used to make living together easier have disappeared as a consequence of conflict, congestion, and lifestyle changes …

The island's resilience, agility and, capacity to bounce back can no longer be considered a lifetime warranty. They must be renewed, strengthened, and adapted to new challenges. As such, far from being subordinate, this priority that touches on agility becomes a cross-cutting issue because:

- It makes change possible by reducing contortion and viscosity, and increasing social fluidity.
- It stabilises society, thus creating an economic environment that is able to generate centripetal forces with respect to international investors.
- It builds the foundation for relevant local organisation and intelligence.

In other words, this cross-cutting priority, which aims to make Reunion a responsive, organised, and smart territory, constitutes the cornerstone for the smart specialisation that relies on the three main priorities discussed above.

ACTION-SHEET N°1:
DEVELOPING INDIVIDUAL AND COLLECTIVE SKILLS THROUGH SOCIAL INNOVATION

« There is no other wealth but man ». Development is created for and by the women and men of Reunion. They need to be prepared and equipped to respond to challenges. Several emerging issues have to do with the consolidation of human capacities and talents, both on the individual and collective level.

Reducing illiteracy

The first priority axis focuses on fighting illiteracy, which affects almost 100,000 people and one in three 11-year olds. Such results put under question the relevance of existing training models and raises the need to develop innovative tools adapted to local realities. Learning to learn, acquiring methods and skills allowing each individual to realise their full potential and to use their creativity – these are current issues that must be addressed.

This type of **empowerment** can be sustained thanks to digital developments, as proven by the ongoing experiments that are taking place in India. Multiple e-learning solutions (serious games, e-books, online courses, virtual training) could be made available on a self-service basis by generalising the Laptop Plan and its Digital Working Environment facet, as well as by guaranteeing universal access to learning content servers.

These innovative means to fight illiteracy will could be exported, especially to COMESA countries, which are met with similar challenges.

Supporting training, higher education and research: becoming Southern Africa's scientific knowledge hub

In order to become a hub for scientific knowledge in the Indian Ocean area, Reunion can rely on numerous assets mentioned in our diagnostic assessment of the island's RDI ecosystem. It is the only French overseas department that relies on such a large concentration of stakeholders throughout the innovation chain. The island benefits from major national research institutions and a university with 12,000 students and 1,000 employees, the only French higher education and research institution in the Indian Ocean. Reunion is also the only French overseas department that is home to a fully functional competitiveness cluster (Qualitropic), a Regional Business Incubator for innovative start-ups, and three Technological Research Centres - CRT Hydrô Réunion and CRITT - which are certified by the Ministry of Higher Education and Research, as well as an innovation centre for tropical construction work (CIRBAT). It also features a Technopole, a Regional Innovation Agency (NEXA) and several clusters associated with influential activity sectors.

With respect to the upper part of the innovation chain, Reunion is currently a leading research force in several key areas, such as bioeconomy, which represents the first priority of our strategy.

With respect to energy, university laboratories (LE2P, PIMENT) work with professionals and national (ADEME) and regional (TEMERGIE) support structures on innovative solutions for Small & Smart Grids, energy storage, ecological tropical construction work and, on a global level, renewable energies, an area where Reunion sets a remarkable example.

In the field of land-based and marine tropical ecology and global change and environmental observation, the island also benefits from multiple resources, both in terms of preserving its unique heritage (National Park, Marine Reserve), and in terms of scientific research (UMR PVBMT Cirad-University of Reunion, IRD, CORAIL Mixed Research Unit, the University of Reunion Science Observatory, etc.). The island also relies on leading technological platforms (a satellite image receiving station SEAS-OI – Satellite-assisted environmental surveillance – Indian Ocean, established in Saint-Pierre; the Atmospheric Physics Observatory in Le Maïdo). In this science field, which is important in view of the island's resources and with respect to conservation and exploitation, marine sciences hold a prominent place. Currently, rapprochement is occurring between IFREMER, IRD and university laboratories, and CNRS's INE.

From the Scattered Islands to the French Southern and Antarctic Territories (FSAT), development potential is significant and gives way to a Blue Growth which must continue growing over the coming years through interaction between RDI stakeholders and economic stakeholders.

Regarding natural hazards, Reunion is one of the French regions most at risk. It represents an extraordinary laboratory because all natural risks are present (cyclones, flooding, volcanic eruptions, landslides, coastline erosion, forest fires, tsunamis), which explains the density and the quality of the scientific research conducted by local institutions (BRGM, IPGP-OVPF, Geoscience laboratory, etc.) now gathered at the Regional Natural Hazard Observatory

Finally, within the vast realm of humanities and social sciences, the expertise acquired by the University of Reunion's laboratories, which are part of OSOI (Indian Ocean Society Observatory), is particularly developed for the islands of the Indian Ocean. This is due to the multiple exchanges they engage in, both in terms of time and space, with the coastal countries of the Indian Ocean and the rest of the world. Within this geographical area, it is essential to test the territories' and the scales' (networks) "interlacing" in order to get to know local societies' institutional and political life (powers), as well as the international relations and the strategic specifics of the exposed peripheral insular territories (studied in the CEMOI laboratory). These tropical insular areas are known to be fragile and exposed to multiple natural, climatic, ecological, coastal, environmental, technological, health, social, economic, financial or legal threats. Today, the island's research teams address such hazards, which are typical of Reunion and, more generally, the Indian Ocean. Their work allows an understanding of development issues, which are essentially seen in terms of "sustainability" and which represent challenges for such regions.

Across large science fields, Reunion benefits from important assets which may transform the island into a scientific knowledge hub in the Indian Ocean. However, S3 is obviously not just a research strategy; it is also a global territorial project whose accomplishment is necessarily reliant on the improvement of essential training (which is, in turn, dependent on education infrastructure funding), compulsory fluency in foreign languages (English at least) and the creation of excellence sectors, in the niche areas that are connected to insular or tropical issues (tropical and marine ecology, agroecology, risk management, volcanology, meteorology, ecological economics, anthropology, social sciences, linguistics, regional metabolic or infectious diseases, etc.)...

Supporting individual and collective development depends on the strength of the training capacities. On that point, there is a twofold objective: satisfying current and future local needs (through a prospective approach) while also developing exportable solutions.

The development of e-learning, which the University of Reunion is particularly invested in - through the "France Digital University" project - and the University Hospital can also support our island's capacity to export solutions, especially by cooperating on a regional level (e.g. the Hospital's virtual surgery training).

Mobilising S3 for training purposes shows its ability to contribute to the opening of mindsets. Stakeholders drive the exchanges in knowledge, technologies and expertise. From this perspective, the scientific knowledge hub must be a tool for enhancing exchange and cross-fertilization, through the mobilisation of foreign talent (foreign professors, postdoctoral and doctoral students, twinning with international training and research institutions, etc.), to benefit the "grey matter" economy.

Thus, the development of innovative tools to acquire and develop skills would allow the island to simultaneously solve an issue, while also developing its export capacity, especially as regards COMESA countries, which are faced with identical challenges. The same applies with respect to improving the population's health and wellness, which must be dealt with before any development policy is considered.

ACTION-SHEET N°2:
PROMOTING SOCIAL INNOVATION

A territory's prosperity depends on its capacity to preserve and use its many assets – not only its natural resources, its infrastructure and its businesses, but also, most notably so, its social links, its culture, its expertise... The material and non-material heritage constitutes the basis of economic performance, through the positive outputs generated. Thus, many are puzzled about Reunion, where, despite alarming social indicators, overall social stability is preserved. This is no hazard, but rather the consequence of certain shock absorbers, notably community relationships and the co-creation spaces, which are essential components of the local economy.

Rebuilding community relationships

Indeed, social shock absorbers prove to be extremely productive in terms of positive outputs, as they allow societies to function better, to absorb shock better, thus, to improve their resilience. Such an invisible asset, which is not any less sensitive, becomes more effective in small-sized economies or in island economies because such contexts foster community relationships.

In Reunion, departmentalisation has pushed more and more residents to wait for the State or market to respond to expectations, which they previously attended to on their own or through exchanges with family members and neighbours: food production, construction work, care, neighbourhood development and enhancement. With such dynamics four negative outcomes arise:

A significant part of the active population increasingly excluded from the labour market
Certain skills become invisible and eroded
Interdependencies and solidarity become weak
Certain activities which used to be (almost) free start weighing heavily on low-income households

Exclusion from the labour market triggers skill loss and ongoing tension, as seen currently in the increase in crime rates and violent crimes.

To preserve the cohesion that is essential to development, a form of spatial and intergenerational solidarity, it is necessary to identify the mechanisms which have created relative stability despite tense social circumstances. In a context where the global economic crisis has deepened, our island can provide **innovative solutions for preserving and maintaining social resilience**, which is so fundamental. One of the axes proposed focuses on encouraging the **economy of proximity.**

Many emphasise the importance of maintaining family and social activities with respect to such resilience. Given the structural difficulties of the market and the contextual difficulties of the State, promoting self-organisation through simple tools and techniques and collective solutions can seem to further integration and social capacity.

Multiple community activities – services to individuals, maintaining and restoring neighbourhoods, small businesses, shared gardens, cultural and recreational services, etc. – do not have any commercial utility, but their social utility is crucial. According to the Commission's estimates, they represent 3 million jobs in the EU. Such endeavours create new forms of participatory organisation, new mixed spaces that work based on the principles of the market, but also the principles of reciprocity. This can lead to the emergence of a third path – the path of the economy of solidarity, which relies on the users' involvement in the production process, through variable forms including associations, mutual associations and cooperatives.

Thus, building social agility represents an invitation to go beyond the micro-economic interpretation of innovation and competitiveness, which focuses on a socialised understanding whereby the territory has not been a recipient of economic activity, but rather a full-time producer. From this perspective, the territory's characteristics have a large influence over the stakeholders' capacity to adapt and to innovate. Reunion's human and social heritage represents one of its keys to differentiation and success. **Thus, innovation must allow us to preserve integrity, strengthen our potential and our resilience, and to express our talent.** At the same time, the renewed heritage will support innovation and the territory's economic openness.

ACTION-SHEET N°3:
PROMOTING OPEN INNOVATION

A region's performance is also linked to its capacity to organise, learn quickly, understand changes, and adapt fast. Hidden costs, frictions, and adjustment costs must be minimised.

Within this framework (material and non-material), institutions and organisations are growth and development catalysts. These institutions, which form governance mechanisms, must constantly adapt to their context, so that the island is able to cope with challenges. The AGILE example illustrates Reunion's capacity to have put forward a tool that was innovative at the time, for governing, preparing and managing European programmes. From this standpoint, the island was able to prove its competence with respect to developing innovative tools for managing complex projects.

Aside from supporting modern governance tools, S3 must also support the transformation of innovative ideas into value, prosperity and jobs. However, this link is often missing and has been noted as a SRI improvement factor. Supporting the development of technological transfer tools (competitiveness poles and clusters), prototyping centres, and laboratories is vital for making S3 an inclusive strategy.

a) Description of actions

The digital revolution has disrupted the way innovation is seen and practiced. Once dependent on the R&D activities which companies kept secret, the innovation process is now increasingly reliant on exchange and openness – using, improving, recombining, and hijacking ideas.

In the knowledge economy, innovation emerges from successful interaction within interested communities. Creation makes room for co-creation, where the borders between producers and users fade out. The invention of innovative solutions means having spaces where users can express their needs, problems, and expectations. They can also create relationships with researchers and entrepreneurs. This sheet aims to support **the creation of collaborative tools that are open to diverse audiences in multiple fields** (research, teaching, economy, users and associations), allowing them to **co-create practical-oriented innovation,** by using:

Coworking spaces welcoming and fostering flexible relationships between a wide array of stakeholders (freelancers, project developers, students, researchers, SOHO, start-up, etc.).

Incubators for business creation offering a high level of service, based on principles of competition and circular economy, in order to stimulate creativity, strengthen interdependence and attain ecological excellence.

Meeting spaces where regional innovation workshops could be held to generate ideas and projects.

One or several **Fablab(s)** allowing all audience segments to develop in a simple manner, by using 3D printers and IT-piloted tools, prototypes, demos or unique items.

A **living lab,** namely a place where entrepreneurs, users and researchers can co-invent ideas and co-design products and services adapted to the needs that have been expressed and the required applications.

ACTION-SHEET N°4:
HEADING TOWARD A REUNIONESE SMART CITY

For an insular territory, the urban dimension is very important. The ability to live together is dependent on the island's ability to ensure sufficient quality living conditions for its population. The responsiveness of spatial planning is, therefore, vital. Reunion will soon need to accommodate a million inhabitants, under the pressure of its geography, its natural resource availability, and its farming lands that guarantee the functioning of the economy. At the same time, it must come up with an energetically conscious lifestyle that also emphasises the optimisation of space and travel time reduction.

In other words, the issue of spatial planning is one of the cornerstones of Reunion's ambition to become a responsive region. The island can already rely on spatial and territorial planning tools such as the Territorial Planning Schema. However, this tool must be complemented by another mechanism that is more ambitious in terms of quality and quantity. Such a tool must trigger multiple benefits in terms of the quality of life, the effectiveness of the economy, and the attractiveness of the island (in order to encourage experiential tourism). Thus, innovation must be directed at building smart cities.

a) Description of actions

To create a smart city, regional responsiveness can be built along two main axes:

Strengthening the capacity to observe, analyse, and study the region in all its dimensions. A small vulnerable island, under demographic pressure, subject to various hazards, needs the observation and analysis resources required for advanced urban engineering.

Building on the first axis, it is necessary to develop and update urban models so that they are adapted to the needs of the territory or the micro-territories of the island; such models must also respond to H2020 issues. The second axis must also help support and plan the development of tools to enhance the smart city in terms of transportation, travelling, sustainable habitats, social peace, and smart urban planning. To this end, the dynamic spirit of various economic sectors must be catalysed (laboratories, creative cities, tourist dynamics, etc.). This is a question of positioning Reunion, which is exposed to specific urban challenges, as a supplier of urban and social solutions that may be transferred to other regions of the globe with similar characteristics.

b) Community resources mobilised

TO 1 OP - Open and social innovation: €2,500,000
TO10 TCOP - Regional cooperation in the field of training, education, and social & professional integration: €2,500,000

2) ▶ CONSOLIDATING HEALTH CONDITIONS AND MAKING REUNION THE REGION'S HEALTHCARE SOLUTIONS HUB

Thanks to the modernisation of equipment and the healthcare system, the past 50 years have seen Reunion undergo revolutionary transformation, which has brought it to the forefront of the region. Given its young population, the island's mortality rate is now lower than in mainland France. This transition comes with **epidemiological change** – the infectious diseases which were responsible for almost 47% of deaths in the beginning of the 1950s only caused 2,1% in 2005. As with mainland France, the most frequent diseases are related to the circulatory system and tumours (30.3% and 20.6% of deaths, respectively).

Today, the health system must also become "glocal", in order to respond to local and global issues. The specialisation fields of Reunion's University Hospital are exemplary:

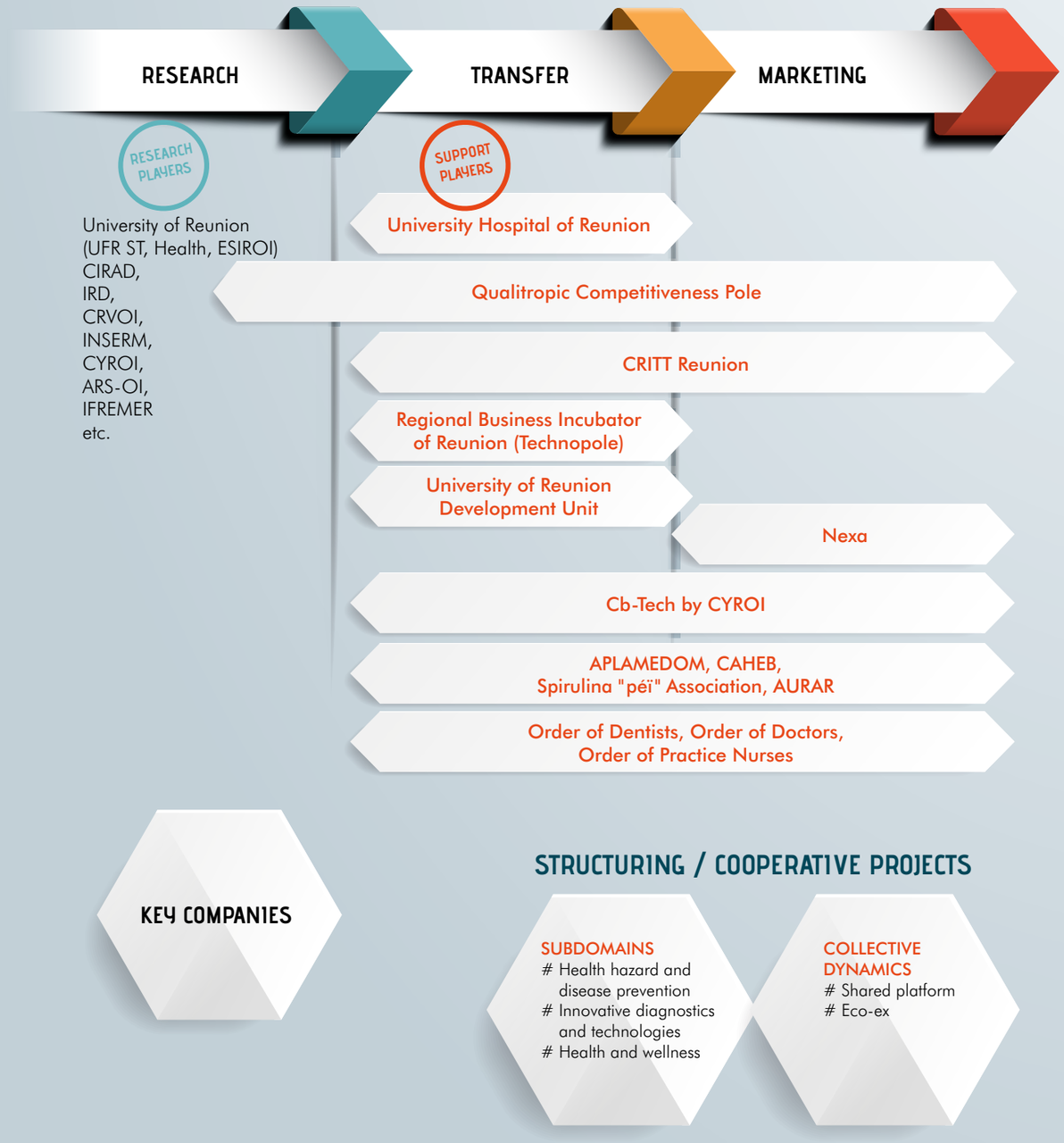
Managing and responding to health hazards caused by the local specifics, which were catalysed by departmentalisation : metabolic diseases, diabetes, obesity, kidney disease, hypertension, birth.

Monitoring and eliminating tropical hazards which affect the Indian Ocean area, most notably infectious diseases, thanks to the consolidation of educational, technical and scientific partnerships (ARS OI project).

To illustrate the principle of cross-fertilisation, health conditions provide significant support to the development of an "accessible" tourist offering, intended for tourists who are suffering from long-term medical conditions (such as diabetes or haemophilia), which need a secure environment. Reunion could fully draw on its double advantages: on the one hand, it is a rugged, green, island, and, on the other hand, it is highly developed. Focusing on the island's health architecture also constitutes an advantage, allowing the island to become a secure health hub. As such, the island can be a safe point in Southern Africa's uncertain environment. Reunion can provide safe health solutions in several sectors: tourism, international organisations, co-development, etc.

SECTORAL MAPPING

S3 Domain: Health



ACTION-SHEET N°1: IMPROVING WELLNESS

The interest in wellness is increasingly becoming a regional ambition and a growth sector.

Reunion is confronted with an ambivalent situation: despite multiple internal challenges (aging, multiplication of modern diseases caused by sedentariness and radical lifestyle transformation), the island can rely on sufficient critical assets to improve the population's living conditions and to develop exportable products (microclimates, landscapes, biodiversity, tropical fruits and vegetables, health infrastructures, etc.)

The goal of this sheet is to **showcase the island's assets, which can be used to improve living conditions and to consolidate product and service exports.** At the same time, the goal is also to deepen knowledge about Reunion's biodiversity and to support the creation of transformation activities for dietary, cosmetic, and tourist purposes.

a) Description of actions

The proposed actions can be distributed along two axes:

On the one hand, greater research to develop innovative products:
an every-day diet that is characterised by high organoleptic and nutritional quality, inspired by the island's multiple culinary traditions and adapted to various categories of consumers (infants, children, athletes, seniors, people suffering from long-term conditions)
food supplements (vitamins, oligoelements, omega-3) or therapy supplements (antioxydants, digestion regulation and control, liver regulation, kidney regulation, etc.), based on the island's biodiversity, which undergo a preliminary chemical characterisation and extraction phase
cosmetics and wellness products for various purposes (care, relaxation, aromatization, clean air), based on local farming and indigenous endemic plants

On the other hand, encouraging closer ties between research, practitioners, SMEs and users, to develop methods, technologies and innovative products that can improve wellness factors:
promoting physical activity
improving the quality of water and air
services to individuals

b) Stakeholders

University of Reunion
CIRAD
CHU
Inserm
CYROI
CRITT
Private clinics
Support structures
APLAMEDOM
SAS Eco-Ex
CAHEB
Private companies
Spirulina "Péi" Association

ACTION-SHEET N°2: HEALTH HAZARD AND DISEASE PREVENTION

As a result of rapid, massive changes in lifestyles and genetic predispositions, Reunion is **highly exposed to diabetic risk:** the prevalence of type 2 diabetes is 3 to 4 times higher than in mainland France. The complications of metabolic diseases are numerous - diabetic feet, chronic kidney disease, cardiovascular diseases – and the costs associated with their treatment is as high as €590 million per year.

In addition, the subtropical climate and the geographical proximity to Madagascar and the Comoros Archipelago, which are exposed to Africa's Eastern Coast, puts Reunion and Mayotte at risk for **infectious diseases epidemics, especially vector-borne epidemics** (Dengue, Zika, Rift), whose social, health and economic costs can be extremely high. The overall estimated cost of the Chikungunya epidemic in 2006 is more than €100 million. The need to take into account such infectious hazards concerns not only Reunion and Mayotte but the entire south-west Indian Ocean and Europe, as well, given the continuous exchanges between these islands and the continent, and also given the pathogen transfer risks. The purpose of this Action Sheet is to draw on the regional and local specifics (tropical island) in order **to create and apply innovative actions and to design prevention solutions that minimise the islanders' exposure to risk.** Such innovation can serve as an example for all the countries in the region.

a) Description of actions

The actions to be developed in 2014-2020 focus on the two major axes which have been identified as priorities by the health authorities:

1 - Risks related to chronic, especially metabolic, diseases;
2 - Risks related to infectious diseases, especially diseases with high epidemic potential and vector-borne epidemic diseases;

Axis I: chronic and metabolic diseases.

Three actions are included:

1- Developing primary prevention measures to limit the onset of type 2 diabetes
assessing nutritional status, dietary habits and life style
identifying diabetics
prevention actions
establishing a cohort of diabetics and non-diabetics, taking blood samples, and collecting information on dietary habits, life hygiene, and the use of medicinal plants

2) Improving vascular risk prevention in diabetics:
reducing risk and comorbidity factors by promoting healthy nutrition, hygiene and physical activity

3) Creating a registry for stroke patients, in order to collect data, take samples and monitor

Axis II: infectious diseases, carrying epidemic and/or vector-borne risk.

Five actions are included:

1- Investigating the infectious agents' ecosystem in the context of a tropical island: emergence factors or endemic perpetuation factors, genetic and phenotypic diversity relevant in the intra-insular context, especially those that may have an epidemiological impact.
2 - Evaluating the risk of vector-borne epidemics by exploring biotic and abiotic, endogenous and exogenous factors for relevant types of viruses.
3 - Evaluating zoonotic risks by investigating domestic or wild animal reservoirs, both endemic and introduced. Analysing the risk of transgressing barriers between species.
4- Limiting the impact of infectious agents on humans: early alert systems, quick diagnostic tools / points of care, epidemiological dynamics via longitudinal cohort follow-up, modelling, clinical polymorphism, effects of comorbidity, analysis of resistance and immunity factors, correlates of protection.
5 - Conducting field validation tests to assess the effectiveness of innovative biological control methods in regards to disease-carrying mosquito populations (Aedes albopictus), in order to limit the likelihood of such species becoming resistant to chemical insecticides and also to limit their negative impact on ecosystems.

b) Stakeholders

UMR DETROI
INSERM
LCF
IRISSE
CIC
ARS
CHU - CRB – USM
CYROI
Private practice nurses
Dentists' association
Private companies

ACTION-SHEET N°3: INNOVATIVE DIAGNOSTICS AND THERAPIES

Given its history and its geographical location, the population of Reunion is exposed to higher risks of morbidity and mortality compared to the national average, in certain areas:

National perinatal surveys show that, even if there has been improvement in the follow-up of pregnant women, perinatal mortality rates remain almost twice as high in Reunion (stillbirths 13.5 ‰ vs 8.4 ‰, infant mortality 6.8 ‰ vs 3.6 ‰, neonatal mortality 4.9 ‰ vs 2.3 ‰).

While cancer is becoming the main cause of mortality in mainland France, cardiovascular diseases remain the most frequent cause of death in Reunion. Metabolic diseases, particularly type 2 diabetes and its complications (heart attack, diabetic foot - amputations, strokes, neuropathy, kidney disease, etc.), represent the main public health risk in Reunion.

Reunion Island was confronted with a Chikungunya epidemic in 2005 – 2007, which affected more than one - (one-third) third of the population. The costs incurred as a consequence exceeded €100 million. Infectious diseases, especially those that can cause an epidemic, have a devastating impact on human and animal health, especially in tropical countries. Due to its proximity to Africa's Eastern Coast, which is considered an infectious disease emergence hotspot, the south-west Indian Ocean region (SWIO), which we belong to, is particularly exposed to zoonotic and vector-borne diseases.

Food poisoning in family environments remains limited. However, food poisoning rates grow each year in Reunion. Their effects on health can be severe, especially where fragile persons, such as children and seniors, are concerned. In Reunion, the consumption of plants and seafood increases the risk of food poisoning.

To respond to these issues, Reunion can rely on its natural assets, along with its technological and scientific assets (CYROI, research units, CHU, start-ups, associations, etc.). The goal is to make Reunion an original model with respect **to caring for patients by developing a customised, functional integrated approach to diagnostics and therapy.** As such, the approach that will really make a difference will need to take into account several aspects for each individual, including diet, physical activity, genetics, biochemistry, physiology and the environment. This goal can be reached by evaluating and adjusting risk factors before moving to the therapeutic stage.

a) Description of actions

The actions can be grouped into three categories:

1) Bio-markers:

- # Molecular targets for non-invasive disease imaging (e.g. atherotrombosis, ischemic conditions, etc.) (CYROI-RIPA, DETROI, PIMIT, DSIMB, etc.).
- # Metabolic disease bio-markers for: identifying glycosylated plasma protein with diagnostic values higher than the standards used in (glycated haemoglobin) and developing innovative dosage methods. Setting up innovative methods for evaluating HDL functionality, which makes it possible to assess vascular risk. Researching high vascular risk tissue markers (DETROI, DSIMB, etc.).
- # Researching infectious disease markers, such as leptospirosis markers (PIMIT, DSIMB, etc.).
- # Characterising the toxicity and the toxins in plants or marine organisms that cause acute and/or chronic intoxication. (CYROI, Hydrô Réunion, APLAMEDOM, etc.).

2) New products:

- # Stem cell therapy kit – autologous stem cell transplant. Treating the effects of kidney ischemia-reperfusion, diabetic foot, etc. (STEMCIS, DETROL.)
- # Active principles extracted from medicinal plants and marine organisms. The goal is to expand the therapeutic range by registering new plants in the French pharmacopoeia and to exploit the active principles that are extracted from our island's terrestrial and marine biodiversity (LCSNSA, DETROI, Hydrô Réunion, APLAMEDOM, CYROI-PEPIT et -UA, EcoEx, etc.).
- # Diagnosing emerging diseases (leptospirosis, chikungunya, etc.) by producing recombinant proteins and creating clinical diagnostic kits (Start-up project RUBY, PIMIT, etc.).
- # Designing chemical and biological molecules and macromolecules for diagnostic and therapeutic usage, based on the model of therapeutic HDL, which is used for stroke patients (DSIMB, CYROI-RIPA, DETROI, PIMIT etc.).

3) New tools or services:

- # Developing smart patient diagnostic and follow-up products. Smart sensors: physical activity sensor, stabilometer, actimeter, inertial unit, innovative Cyclo-Force ergometer: diagnostic, controlled strength or speed training. Such products would correspond to the tools, principles and methods that would allow anyone to measure their personal data, but also to analyse and share them (IRISSE, Runware, Oscadi, etc.)
- # Food toxin diagnosis: setting up a pharmacovigilance centre and a toxicology platform (Hydrô Réunion, APLAMEDOM, CYROI, PIMIT, etc.)

b) Stakeholders

- # CYROI
- # University of Reunion (IRISSE, LCSNSA, PIMIT, DETROI, DSIMB, CEPOI)
- # CHU, CIC-EC
- # INSERM
- # IRD
- # APLAMEDOM
- # Hydrô Réunion
- # Start-ups
- # Private companies
- # Private practice doctors

c) Community resources mobilised

TO 1 - OP – Strengthening health conditions and creating the "One Health" health research hub: €5,990,000

TO1 - TCOP – Health research cooperation projects (infectious diseases): €4,000,000

TO10 - TCOP – Health training cooperation projects: €4,000,000

TO2 - OP- E-health: €4,990,000

3) ▶ INNOVATING TO CONVERT REUNION'S ECONOMY INTO A "DIGITAL SOCIETY"

Reunion's smart specialisation strategy places digitalisation at its core, as it provides **new paths for growth,** which eliminate the inconvenience traditionally associated with an insular status. Digitalisation is also a means to **support sectoral dynamics** and **cross-fertilisation**, in areas such as health, energy, tourism, etc.

a) The digital economy: a sector which has rapidly taken on a life of its own

The convergence between IT and communication technologies (internet) currently changes the ways in which we produce, distribute, and consume goods and information. Whereas the post-war Fordist model rested on a vertical, descending principle, whereby passive consumers"choose" between standard goods that are mass-produced in centralised production units where capital, labour, and energy are concentrated, we are now entering the **era of networks and decentralisation:**

The digital revolution allows for the instantaneous horizontal creation and diffusion of dematerialised goods.
The offer must adapt to an increasingly diverse and segmented demand, and must respond to the consumers' desire for differentiation
Consumers are becoming increasingly involved in an active manner in the design and use of solutions (e.g., applications based on personal information)

Sources of growth are increasingly shifting from the production of goods to the reactive sale of **customised, high-quality solutions.** This new deal is changing Reunion's competitive positioning: market success now depends less on price competitiveness, as determined by scale economies that are hard to maintain on the island. Market success depends more on the small teams' capacity to innovate. The information assets they produce can be reproduced and disseminated at a cost close to 0, which eliminates the island's second inconvenience – long distance and transport costs.

This activity sector already rests on substantial assets:

1) Stakeholders' historic involvement, which translates as a high degree of dynamism: In 2011, 580 businesses accounted for 6,300 jobs and €2160 million turnover, having grown to 84% between 2005 in 2011.

2) Distinct local skills:
A young, "digitally native" population
European-standard university education: university-level Master 2 programmes, IUT, engineering schools (ESIROI, Sup Info), ILOI
University laboratories: LIM, LE2R Piment
Europe's second largest colourisation and compositing studio: Pipangaï
Strong foundation in software design, innovative solutions and servers

3) Expertise in communication and content: multimedia creation and graphic production.

4) Limited costs thanks to subsidies:
80% taxable profit allowance, as set forth by the LODEOM law
Research tax credit covering 30% of expenses, up to €100 million
Support for innovative start-ups
Support from BPI France
Support measures, as provisioned by FEDER 2.04 "Innovation and technology transfer pole to benefit enterprise competitiveness" and 2.1 2. "Investing in ICT businesses"; measure FSE 1.10 "Supporting RDI by strengthening scientific employment", etc.
Exemption from social security contributions
CIFRE scholarship mechanism

5) Stakeholders' closeness to each other and strong mutual knowledge are conducive to exchanges.

6) Reunion's simultaneous affiliation to Europe and the Indian Ocean, both physically and symbolically, means a stronger interest in exploring the growing COMESA markets.

This sector must overcome certain challenges:

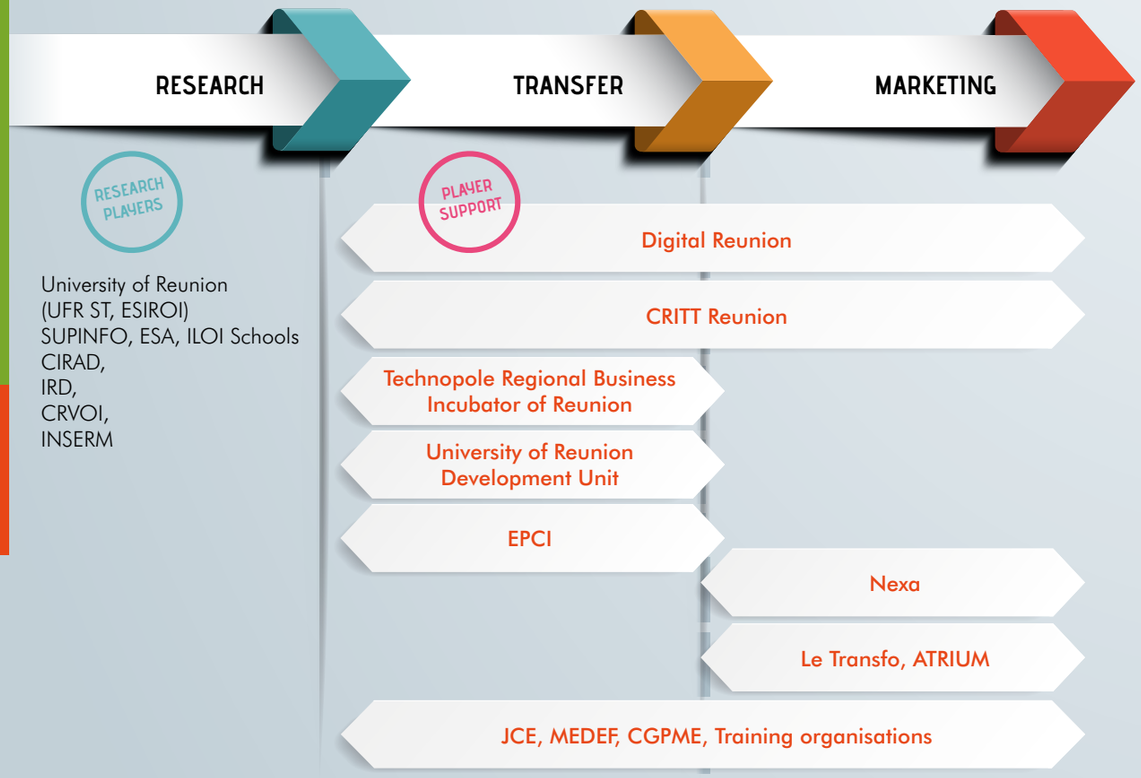
1) Opening up to the world and developing new activity fields, in order to overcome a limited local market that will soon become saturated:
90% of businesses do not have an international branch
54% of businesses obtain 80% of their turnover from less than 20 clients
60% of the market is dominated by access to telecommunications and computer-assisted distribution

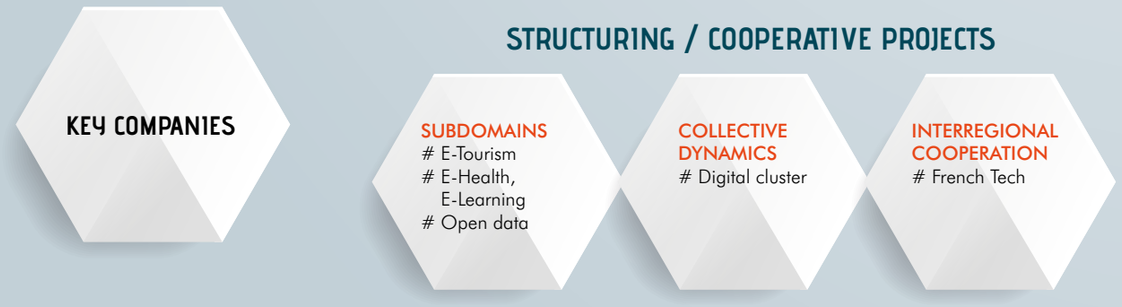
2) Strengthening relationships and territorial anchoring:
60% of businesses do not have any relationships with stakeholders in the areas of education and research
Only 1% have a relationship with business incubators
43% have a negative perception of the sector
73% have not joined any union or any professional association

3) Increasing research and development efforts:
63% of businesses do not conduct any research and development activity
1 % have used the research tax credit (CIR) and have hired researchers

SECTORAL MAPPING

Domain S3: digital economy





b) Digital economy – the cornerstone of a shift towards a digital society

The digital economy, as a specific domain, is a new driver of growth. In order to benefit fully from the digital revolution and Reunion's particular assets, the smart specialisation strategy must create competitive advantages in niches or chain segments that are valuable globally.

This ambition depends heavily on the ability to catch up regarding infrastructure:

Connection to BRICS undersea cable
Creating a very high speed network
Wi-Fi / Wimax coverage across the whole island
Creating "green" data centres that use renewable energies. Such centres allow businesses to store their data. They also make it possible to set up shared content servers that help reduce bandwidth needs.

At the same time, local resources that are drawn from research, businesses and users must be assembled under a Regional Innovation Pole focusing on the digital economy. This will promote knowledge exchange and will help identify opportunities, develop projects in partnership, improve the territory's visibility and appeal, and internationalise the economy.

At present, there are five axes in the context of which Reunion can already use its substantial assets:

1) Compensating for the lack in local critical mass by responding to European businesses' externalisation needs through the relatively low cost of qualified labour
Externalising low added-value services (especially call centres)
Externalising higher added-value services (information system management, consulting, services).

2) Developing mobile solutions and applications adapted to the needs of the European and COMESA markets (especially regarding data storage, the fight against illiteracy, etc.).

3) Creating prototypes whose development and assembling will be delocalised to more competitive countries.

4) Creating software nuclei that can generate a usage ecosystem. This can be done simultaneously on the local level (usage by other sectors) and on the international level, if the data and the algorithms are proven to create sufficient differentiation.

5) Strengthening the creation and the production of digital content and consolidating the creative industries. Such industries gather various domains (audiovisual, cinema, design, images, video games) through which Reunion's entire cultural richness and diversity can be exploited, in the interest of creating specific, original content that cannot be replicated.

c) Digital innovation – providing support to territorial dynamics

A proper smart specialisation strategy must pay particular attention to **synergies: supporting the development of existing sectors by adopting and disseminating new technologies, and the emergence of new activities that bring a high level of added value or that are adapted to the needs of leading market niches.** Digital economy naturally holds a central place in these cross-fertilisation dynamics.

Energy

The convergence between renewable energies and digital technologies is one of the core elements of the new global economy. Thanks to its small size and its substantial energy potential, Reunion can develop competitive advantages in three professional areas that might be exported to island markets, as a solution, or to global markets, as prototypes.

Green data centres represent a response to the increase in energy expenses. Such expenses increased as a consequence of the generalisation of internet usage, which accounted for 1.5% of the global energy consumption in 2011 according to a Stanford University study.

In 2020, the $C0_2$ emissions associated with this activity should exceed those associated with air transport.

Energy consumption and monitoring measures also constitute one of the key points of smart grids, as shown in priority sheet no. 2.

The last synergy axis looks at the energy efficiency of buildings, by focusing on computer-assisted architectural solutions. Such solutions allow us to make the most of environmental circumstances (sunshine, hydrometrics, exposure to wind, etc.) and to regulate consumption via smart sensors.

Health

Health monitoring and follow-up on epidemics represent a shared concern for farming and medical professionals. ICT can substantially contribute to the development of dissemination models that are a prerequisite when it comes to regulating contamination and controlling transmission vectors in a more effective way. Thanks to the quality of the research teams at CHU and CRVOI, Reunion gains a great comparative advantage with respect to managing infectious diseases that are transmitted in the Indian Ocean region.

The second convergence point refers to the digitalisation of healthcare: facilitating the monitoring of high-risk patients (seniors) or patients suffering from long-term conditions (e.g., diabetes / Di@betic project) by registering and sending metabolic parameters in case of an emergency. E-health is also a response to the low-density of the medical profession in the Indian Ocean, which is due both to a lack of trained professionals, and to the rural exodus, as well as to the accessibility problems in remote areas.

The third opportunity, which is highly technological in nature, concerns the setup of a medical and surgical simulation centre for training purposes, as well as for distance intervention purposes.

Tourist activities: developing e-tourism

Digital innovation can support the development of the island's potential through a three-step strategy.

First, in an international context where competition is fierce the island's appeal must be increased by addressing its lack of visibility. Before the digital era, travel agents, tour operators and mass media served as points of reference when one wanted to visit a certain destination. Through the internet, and now with the shift towards web 2.0, which enhances collaboration and participation, communication is becoming increasingly horizontal and differentiated. Innovation can be instrumental for increasing the island's visibility, in that travellers can now be targeted by virtual travel agents, via viral, segmented, content-rich marketing.

Next, it is important to differentiate offers, in order to respond to tourists' desire for individualisation and customization. Digital technologies allow us to identify strong sociological tendencies (membership, belonging to a group), expectations and practices that will help us to better position Reunion's offering on themes such as ecotourism, active tourism, landscape discovery, local knowledge discovery, etc. Such technologies also allow us to present a range of activities that can be combined into packages, in order to highlight the island's advantages and to strengthen the tourist value chain.

Finally, it is important to facilitate total immersion by emphasising ICT's educational and recreational virtues. Smartphones and tablets should make it easier to manage logistical parameters (especially regarding transportation, schedules, locations and reservations). They should also improve tourists' experience through rich and diverse content. Digital solutions will also help tourists find their way around the island by offering suggestions adapted to tourists' preferences.

d) Community resources mobilised

OT2 - OP – Open Data: €2,600,000
OT3 - OP – Investments for the creation of businesses – ICT strand: €1,000,000
OT3 - OP – Developing the digital economy: €2,500,000
OT3 - OP – Investing in digital production: €1,500,000
OT3 - OP – Collective action - Promoting digital technologies and businesses: €900,000
OT3 - OP – Public ICT actions to promote market economy: €600,000

e) Stakeholders

Professional associations (CGPME, DIGITAL REUNION, MEDEF)
University laboratories: LIM (IT and mathematics laboratory),
Private businesses
Educational institutions: ESIROI, IAE, ILOI

4) ▶ INNOVATING TO MAKE REUNION AN EXAMPLE OF EXCELLENCE IN SHIFTING TOWARDS A LOW-CARBON ECONOMY

Within 70 years, Reunion has undergone an energy revolution. Until departmentalisation, the satisfaction of the island's needs essentially depended on the energy produced by the ecosystems, which meant that it depended on the island's natural capacities and natural rhythm. Departmentalisation marked Reunion's entry into the "thermoindustrial" era, where techniques, knowledge and practices relied heavily on fossil fuel exploitation. This change has triggered a substantial growth in population and consumption levels, as well as a clear improvement in life conditions. However, it also came with two challenges for this small island that lacks fossil fuel sources: on the one hand, increased dependence, as shown by an annual cost of €800 million, and, on the other hand, increased vulnerability in the face of declining resources, which will also translate into an inevitable growth in exchange rates.

FIGURE 33. STRUCTURE OF THE PRIMARY ENERGY CONSUMPTION IN 2013

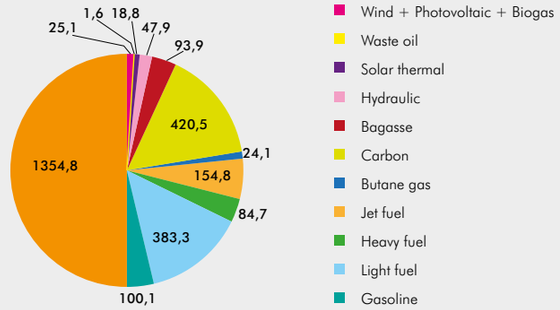
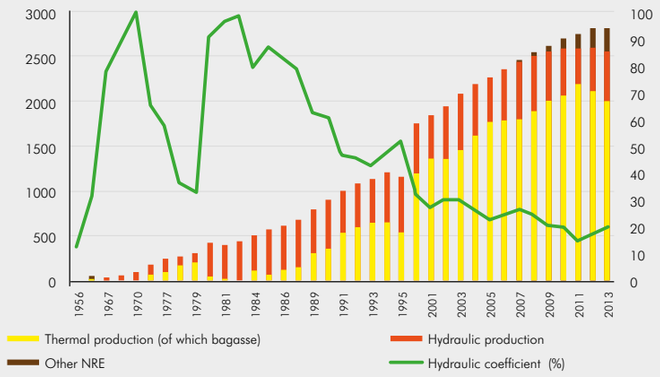


FIGURE 34. EVOLUTION OF THE STRUCTURE OF ELECTRICAL PRODUCTION

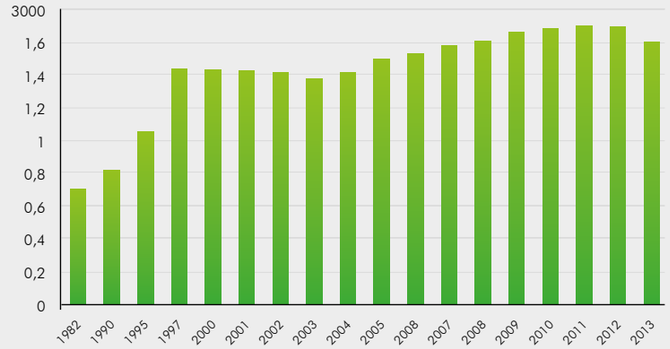


Source: Commissioner for the Plan; Prefecture; SPL Energy

As a consequence of its small size and its isolation, Reunion is a sort of **magnifying mirror that shows in advance the issues that all regions of the globe will be confronted with: inventing new low-carbon energy production, distribution and consumption models, based on the local potential.**
This challenge is also an enormous opportunity: thanks to its world-renowned technical expertise, the diversity of its environment and its climate, Reunion can become a place for inventing, not just testing, solutions that could be exported to tropical, insular areas and throughout the Indian Ocean area.
In 1967, only 29% of households had electricity; in 2009, 99% were covered. As a result of lifestyles becoming adapted to Western standards, consumption per inhabitant has increased heavily: 185 kWh per year in 1970 to 3,266 kWh in 2010. The effort to set up the necessary equipment to respond to such needs was enormous. Between 1947 and 2010, the annual electricity production rate went from 1.1 to 2.699 GWh. In the beginning, the island's energy independence was supported through a policy aiming to develop renewable energies and hydraulic energy. Subsequently, Reunion's energy independence progressively decreased, as a result of demographic growth and consumption increase.

Changes in production and living sites, and the emergence of new uses, especially the development of individual motorised transport, have led to a heavy increase in energy consumption per inhabitant, from 0.7 tonnes of petrol in 1982 to 1.68 in 2010.

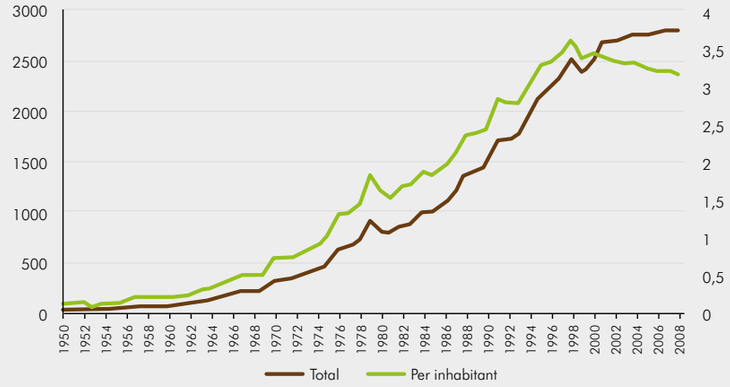
FIGURE 35.
EVOLUTION OF ENERGY CONSUMPTION PER INHABITANT (IN TEP)



Source : ARER

The difference between local energy capacities and needs has naturally led to an increase in energy dependency. In addition, growing use of fossil fuels has led to substantial greenhouse gas emissions.

FIGURE 36.
EVOLUTION OF CO_2 EMISSIONS IN TONNES



Source : Carbon Dioxide Information Analysis Centre

As such, proactive policy has been adopted based on two pillars: energy savings and renewable energy support. The results are already convincing. The demand in electrical energy is growing less rapidly: 6% per year between 1995 and 2001, 4.5% between 2002 and 2005, 3.4% between 2006 and 2009, 2.9% between 2010 and 2012. The electricity production based on renewable energies other than bagasse and hydraulic sources went from 0 to 100 GWh between 2003 and 2010. As such, more than 33% of the consumption needs are covered using low-carbon resources.

Through PRERURE, which aims for a 50% renewable energy rate, Reunion fully respects the goals set forth by the European Commission for Europe 2020, as shown in the 2008 "climate-energy" package:

- Reducing greenhouse gas emissions by 20% compared to 1990.
- Improving energy efficiency by 20%.
- Drawing 20% of total energy consumption from renewable energy sources.

Following the bioeconomic model, S3 aims to support this constructive territorial dynamics, in order to engage on an innovation-driven path allowing the island to reduce its dependency and its vulnerability, while attaining excellence and competitive advantage.

SECTORAL MAPPING

S3 Domain: Energy transition

RESEARCH

RESEARCH PLAYERS

University of Reunion
(UFR ST, ESIROI, IUT)
CIRAD,
IRD,
IFREMER,
CSTB

TRANSFER

SUPPORT PLAYERS

TEMERGIE

CIRBAT

Technopole regional business incubator of Reunion

University of Reunion Development Unit

ADEME

Nexa

ADIR, ACERBAT, CAUE, CerBTP, FRBTP, etc.

MARKETING

KEY COMPANIES

STRUCTURING / COOPERATIVE PROJECTS

SUBDOMAINS
NRE
Ecohousing
Small grids
Transportation

COLLECTIVE DYNAMICS
SPL Energie Reunion

INTERREGIONAL COOPERATION
CAP Energies ?

ACTION-SHEET N°1: PROMOTING ECOHOUSING

Reunion's climate diversity creates the challenge of ensuring thermal comfort throughout the year, without having to use individual or electrical air-conditioning on the coast or convection heating in the highlands. Buildings account for 22.3% of energy consumption. This action is in line with the goal of attaining energy autonomy by 2030 and the goal of reducing greenhouse gas emissions by factor 4 by 2050, as stipulated by the Grenelle laws. The purpose is to integrate energy efficiency into tertiary and residential housing (collective and individual houses). Beyond any regulatory aspect, this requires integrating environmental aspects, such as the life cycle analysis, which is part of the research on new sustainable material, as well as integrating innovative systems.
The positioning of this action is justified given our climate context and our distance from Europe. Reunion is a good model because it has the attributes of a hot and humid insular climate. Such traits allow the island to aim for a positioning that goes beyond the intertropical belt, so as to reach other markets and to propose new development axes for Europe. To attain this goal, Reunion can rely on assets including its research laboratories and professional centres (CIRBAT, Piment, etc.).

a) Description of actions

In order to optimise the energy efficiency with respect to housing, several research-innovation fields will be tackled:

Overall housing design, beyond thermal regulation, should be based on dynamic modular tools that incorporate or showcase technological innovations and products. Energy stewardship with respect to tertiary and residential buildings must continue to develop by promoting natural and/or mechanical ventilation, so as to optimise the use of inertia. Air-conditioning/heating must be reduced as much as possible.

Improving the overall performance of hot/cold systems, coupled with the construction of tertiary and residential buildings that promote humidity management and thermal energy storage, in order to avoid exhausting the electrical network.

Improving the results of **integrated solar heating** using bioenergy and suitable storage methods, in cooperation with existing sectors.

Designing envelopes and including passive and/or active components will contribute to energy stewardship, as well as the production of energy for the purpose of creating energy-independent buildings, and even positive energy buildings conducive to the development of several sectors. Particular attention will be paid to solar protection, material (with low environmental impact), natural ventilation issues, and energy management.

Predictive management and reliability will allow us to optimise management of the means of production, storage, consumption, in order to create energy-independent buildings whose performance can be guaranteed.

It seems necessary to **select and adapt construction materials to the local context** and to progressively increase the use of local material in construction work. Particular attention should be paid to resistance to woodworms, humidity, cyclonic winds, UV rays, and salt fog, which all have corrosive effects. This should trigger the development of local material, especially biosourced material. A powerful sectoral development driver will consist of focusing on the sustainability, performance, and life cycles of such material.

Pilot buildings that are high in energy efficiency, thanks to sustainable, reliable material and solutions with low environmental impact, will be created to show that it is possible to guarantee energy performance and reach the aforementioned goals.

b) Stakeholders

University laboratories: LE2R PIMENT.
CIRBAT
ADEME
CAUE - ENVIROBAT
EDF
CerBTP
FRBTP
ADIR
ACERBAT
Consular chambers

ACTION-SHEET N°2: PROMOTING RENEWABLE ENERGY

Reunion is confronted with several challenges: sustained growth in energy consumption rates, as an effect of demographic expansion and the multiplication of needs; a high degree of costly dependence on fossil fuel, which accounts for almost 85% of the energy mix; an insular status which makes electrical network interconnection impossible. Reunion can use these challenges to its own advantage, by showcasing leadership with respect to the production of renewable energy. Thus, it can earn a favourable position on those emerging markets that are facing similar problems.

Closely connected to the previous sheet, this sheet aims to increase the production of intermittent renewable energy promote self-sufficiency, in order to decrease individual and collective energy expenses, safeguard the network, and reduce dependency on fossil fuel.

a) Description of actions

Actions follow the entire energy chain:

1) Studying and predicting renewable energy resources
assessing intermittent and non-intermittent resources
developing predictive models based on the variability in space and time of renewable resources, through diverse methods (satellite imaging, atmospheric models, ground measurement networks, databases, etc.)
developing digital simulation and statistical data treatment

2) Deepening knowledge of energy conversion systems
physical modelling and digital simulation of the conversion processes, given the tropical topography and meteorology
testing and analysing system behaviour: quantifying performance and validating predictive models; setting up a demo

3) Improve storage: :
developing storage unit projects through the use of various energy carriers
setting up demos
modelling the territorial energy distribution

4) Developing the monitoring-control aspects of the conversion chain
modelling the conversion chain
developing technologies to optimise conversion

5) Exploring the energy and economic potential for industrialisation in three sectors
ocean thermal energy
concentrating solar power
hydrogen

b) Stakeholders

Planners
EDF
Private businesses
DCNS
SPL Energie Reunion
Nexa
Témergie
University (LE2R PIMENT)

ACTION-SHEET N°3:
SMART & "SMALL" GRIDS

The issue of transposing a vertical energy production and distribution system in a closed insular environment that does not benefit from interconnections creates several challenges:
managing consumption peaks through costly production, fossil fuel, or rolling blackouts;
network-related losses;
managing the introduction of intermittent renewable energy production.

a) Description of actions

In a context characterised by a handful of producers and a myriad passive consumers, smart grids aim to introduce a horizontal approach: each building, each neighbourhood simultaneously becomes a producer and a consumer of renewable energies. Each producer/consumer is supposed to provide and consume energy based on their capacities and their needs. The viability of such networks rests on several elements: production solutions, high-performance storage units (especially hydrogen cells), and digital measurement tools. Such elements are needed in order to ensure the regulation of interconnected networks. Reunion has already seen **strong** initiatives with respect to real-time flow measurement and network regulation tools, especially in university laboratories and businesses such as TEEO.

By strengthening its capacity in the areas of prototyping and turnkey solution development, Reunion could export interconnected mini-networks by mobilising as best as possible the renewable resources available: wind energy, photovoltaic energy, marine energy, plant-based energy, etc. The island could become the focus for Europe's third industrial revolution, by drawing on its excellence with respect to energy efficiency and digitalisation. The goal is to develop smart local networks (small grids) comprised of production units and storage means, interlinked by digital tools that help balance offer and demand in real time, at a minimal cost. Thus, the island can create exportable solutions for insular networks and networks that have a low degree of interconnectedness. This goal relies on the following actions:

1) Running a GYSOMATE project (dynamic management of a network comprised of solar production units and storage units, interlinked in a smart way, to lead to energy consumption stewardship)

2) Encouraging decentralised solar energy production, by promoting mutualisation and groupings

3) Balancing offer and demand through energy storage and de-stocking

4) Creating and designing a network that takes into account the variability of resources and consumption profiles through the interconnection of a myriad urban micro-networks

5) Deploying small grids in neighbourhoods and experimental activity areas

6) Preparing proof-of-concept in the areas of connected objects and decision-related information systems, in order to come up with a global offer based on infrastructures and software

b) Stakeholders

University (LE2P)
Planners
SPL Energie Reunion
Nexa
Témergie
Private businesses

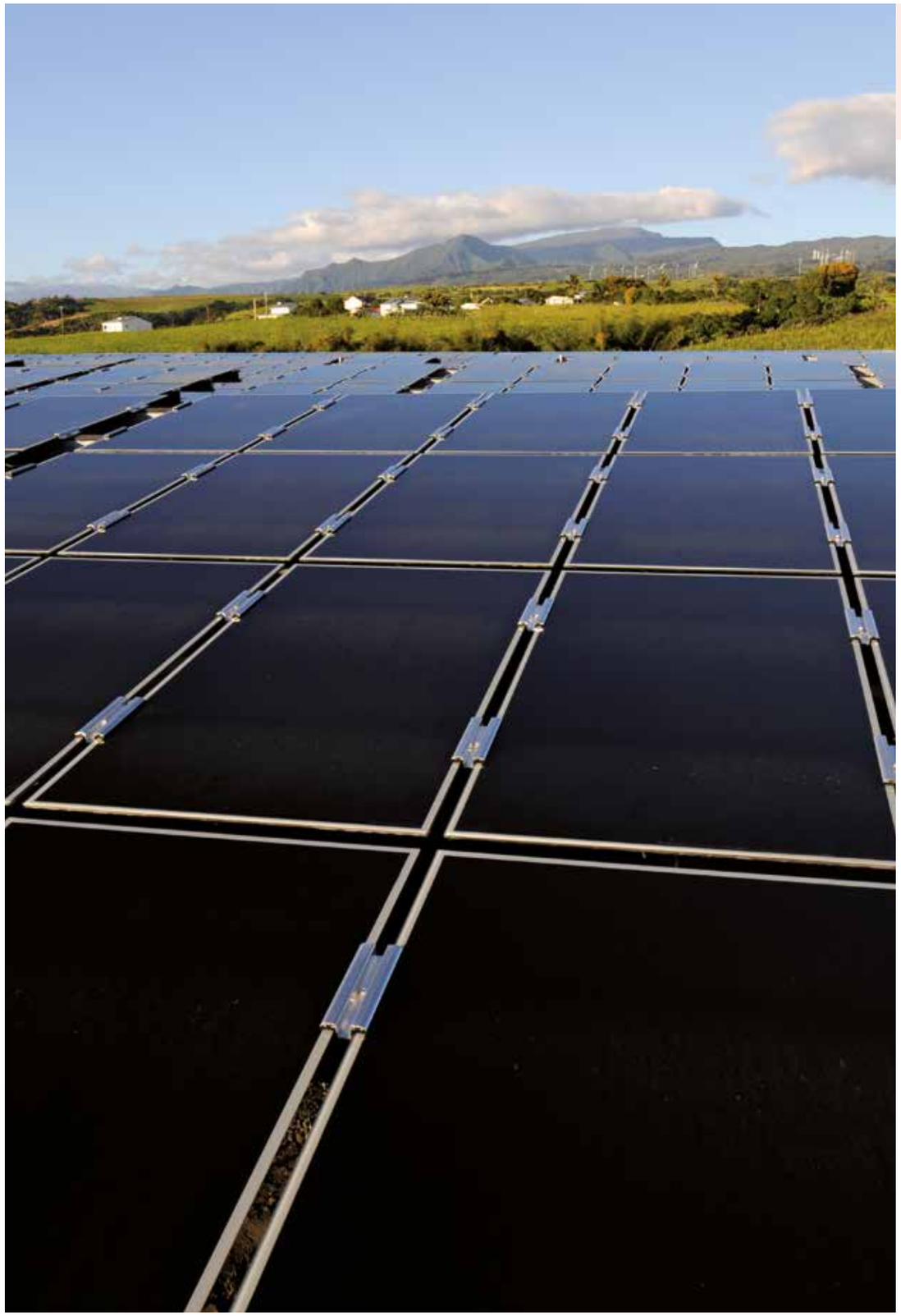
c) Community resources mobilised

OP
Promoting infrastructure projects that help improve energy efficiency through renewable energy use (biomass and biogas): €8,980,000

TO4 - OP
Promoting infrastructure projects that help improve energy efficiency through renewable energy development (SWAC): €29,950,000

TO1- OP
Research and innovation projects that help improve energy efficiency through renewable energy development: €8,490,000

TO4 - OP
Supporting innovative tertiary construction projects in order to promote low-carbon construction: €34,950,000



3 #

SUPPORTING "ENTREPRENEURIAL DISCOVERY"

For now, the specialization axes presented express a territorial ambition. The identification of leading activity niches fall out of the scope of public intervention. Such identification shall emerge as a result of a **global, continuous experimentation process based on trial and error,** led by stakeholders. In other words, this is a matter of "entrepreneurial discovery".

The challenge of a cross-cutting action plan is thus to strengthen local stakeholders' capacity to discover the ways to make Reunion a responsive "learning region", able to anticipate and exploit ongoing changes, to produce and absorb knowledge and skills, and to mobilise such resources in order to create new activities and renewed prosperity. To support this endeavour, four axes will be explored: strengthening and mobilising talents; developing the relationships needed to encourage the emergence of innovative ideas and projects; facilitating and improving projects' performance through open, collaborative support; stimulating internationalisation to reach critical mass through cooperation and to create paths for export growth.

A

DEVELOPING AND MOBILISING LOCAL TALENT

Reunion relies on solid assets to engage on the path of a knowledge economy:

- # a particularly favourable business environment that guarantees investors social stability, safe exchange terms, European standards and particularly appealing support mechanisms.
- # its natural heritage, diverse climate and physical conditions within a limited area, promote experimentation, especially with respect to bioeconomy and renewable energy.
- # state-of-the-art equipment and research centres, as well as teams of experts connected to large national and global networks.
- # its young population is increasingly skilled, thanks to in-depth and wide-ranging education opportunities.

Such assets must be strengthened, developed, and mobilised, in order to promote the major specialisation sectors that will form the foundation of tomorrow's economy.

1) ▶ DEVELOPING EXCELLENCE IN RESEARCH TOOLS

With respect to national and regional policies, FEDER 1 .a) allocates €71 million to to build **infrastructures and to develop research programmes that can both respond to local challenges and generate added value** through patent, prototype, solution trading, as well as service delivery.

While previous programmes were based on a catch-up logic, public intervention now focalizes on excellence. Research teams will be encouraged and accompanied to respond to calls for projects launched by national and European authorities in the area of research-innovation. Calls for projects based on issues relevant at that particular period will also be used to orient public fundings

At the same time, the move towards a knowledge economy will be supported through significant investment in post-graduate education, especially through doctoral grants and CIFRE scholarships.

2) ▶ STRENGTHENING COMPETENCE AND THE CULTURE OF INNOVATION AND ENTREPRENEURSHIP

Having quality resources does not guarantee the success of a regional strategy: talents across the region must be mobilised. This is the first priority for the Regional Innovation Committee (CRI), which brings together institutions are representative of the R&I ecosystem and the main opinion-makers.

The CRI will commit to getting such structures to engage in a common and ubiquitous **communication**, across all key audiences: youth, students, PhD students, entrepreneurs, employees, businesses, etc.

Messages and initiatives will be coordinated by a working group composed of the main operators in the areas of awareness and innovation: academic institutions, the regional innovation agency, the association for the promotion of culture, science and technology, , competitiveness clusters, the Technopole, the university, etc. Such messages will mainly be conveyed through digital tools - Innovons Reunion portal, social networks, etc. – and on various occasions:

Events, conferences and competitions will be held and promoted in order **to develop a culture of and interest in innovation,** and to encourage the creation of projects along S3's multiples themes.

Training will hold a central place, thanks to online content servers, online courses and places dedicated to innovation exchanges, in order to increase the population's skill level and lifelong learning. Fighting illiteracy will be particularly important: it affects more than 100,000 inhabitants but can also give way to exportable solutions, especially on COMESA markets. Entrepreneurship will be core element of the University's development policy through its Studying Innovation, Technology and Entrepreneurship Pole (PEPITE).

3) ▶ MOBILISING BUSINESSES

In connection with professional associations, consular chambers and clusters, CRI aims to develop specific actions to promote the mobilisation of businesses:

First, **regular training on innovation methods,** sectoral issues and new economic models, in the context of a collaborative economy. Business support entities will also benefit, in the spirit of knowledge dissemination.

Then, **active detection in businesses sites will help identify** potential for innovation. It will also raise teams' awareness as to the importance of this issue with respect to performance, while eliminating any potential blocks or reluctance. A network of explorers, will be equipped with common detection kits

Mobilisation will also involve the **creation of a pool comprised of approximately one hundred innovative businesses** in various development stages - start-up, spin-off, family businesses, established companies – which will become involved in an innovation management-related regulation process led by the French national standardisation organisation AFNOR.

4) ▶ EXTENDING COLLABORATIVE GOVERNANCE

The era of smart specialisation requires governance to adapt, in order to respond to a double change.

On the one hand, in terms of goals: it is not just a matter of promoting Reunion's innovation capacities, but also of engaging in a multidimensional island-wide transformation policy (strengthening human and research capacity, developing business competitiveness, undergoing energy-related and digital transition, internationalisation, etc.).

It is important to maintain and develop the collective mobilisation resulting from S3 preparation workshops by also including stakeholders from other fields, not just R&I. This will support change by including new individuals and structures wanting to contribute to the transition process.

On the other hand, in terms of means: horizontal, cross-cutting policy is now accompanied by the prioritisation of a certain number of strategic activity domains, which the island's economic development will rest upon. Their growth will largely depend on our ability to transcend barriers and bring researchers, innovators, business leaders, users and institutional decision-makers together in order to improve our ability to generate, capture and adapt the knowledge needed to build new solutions.

Thus governance should be focused on the following elements:

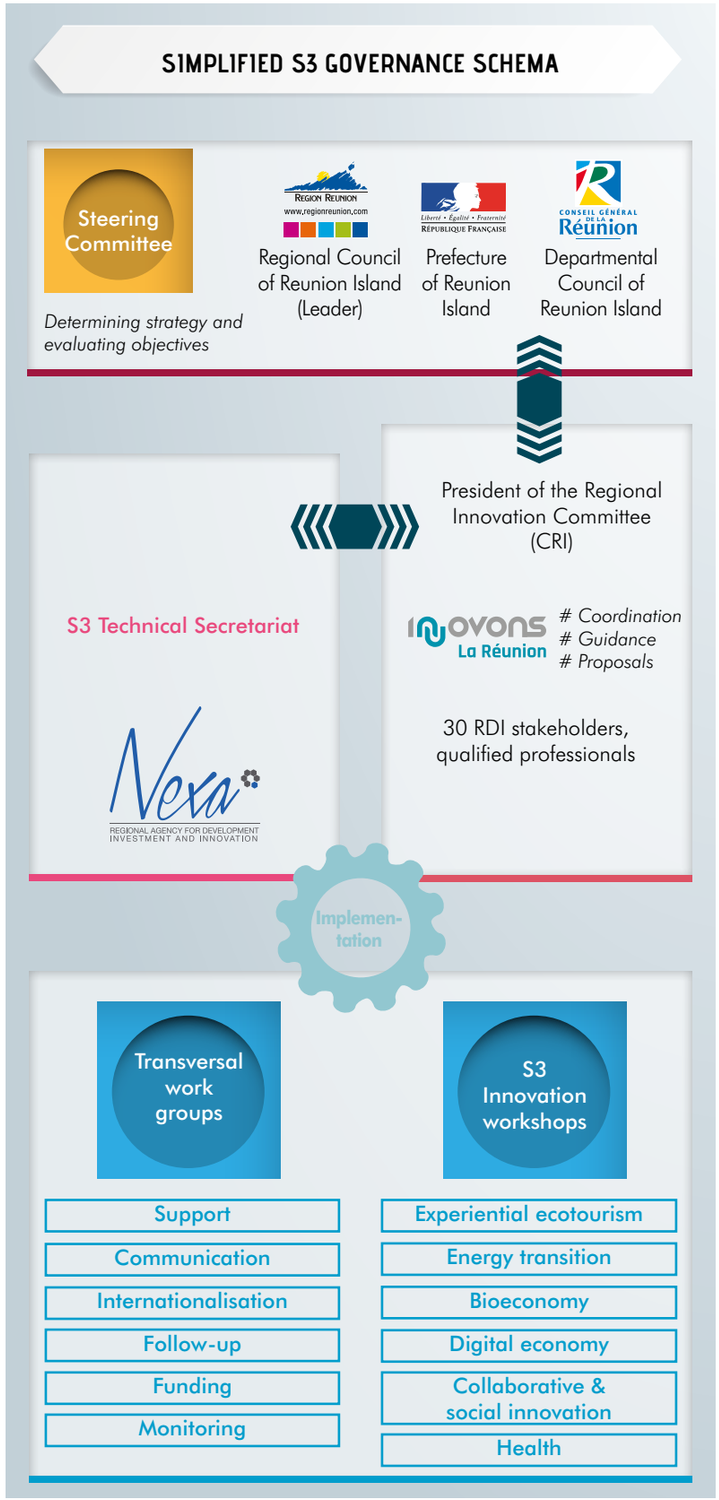
a Steering Committee, which should convene twice per year, including the Prefecture and the Presidents of the Departmental and Regional Councils and the Regional Innovation Council. The Committee's role is to define major annual priorities, follow up on achievements, and correct trajectories whenever necessary

an extended and renewed Regional Committee for Innovation, which should convene every three months, in order to strengthen ecosystem cohesion, facilitate exchanges, and propose initiatives and developments.

a CRI work group which will assemble the main core of the knowledge economy ecosystem (main research-innovation and support structures, funding institutions) on a monthly basis. Its responsibilities will include coordinating intervention and mobilising skills, in a synergetic manner, in order to use the full potential of the projects that benefit from support.

Work groups, to be structured by theme (support, communication, exploration, internationalisation, etc.) and priority domains. Such group will be in charge of applying the S3 roadmap and will represent privileged loci for exchange, in order to facilitate rapprochement between stakeholders. Leaders will be appointed, in the interest of accountability and effectiveness.

The Regional Agency for Development, Innovation and Investment, Nexa, will facilitate S3 and transversal policies, and will support local operators through shared services (technical and economic project expertise, international support, financial engineering, monitoring, etc.) that will be readily available and easy to access. It will also ensure follow-up on the action sheets, through appointed leaders.



This is a decentralised approach favouring accountability: each action will be delegated to a leader, who will then gather key stakeholders in order to draw on the force of interaction, which represents a mantra for S3.

5) ▶ COMMUNITY RESOURCES MOBILISED

TO 1 – OP – supporting research, technological development and innovation infrastructures (RDI) - CYROI, 3R PRERAD, PMR, Campus health research: €43,294,000

TO 1O – OP – Supporting RDI infrastructure – local higher education work (ESIROI, SEAS-OI, FST research facilities): €27,770,000

TO 1 – TCOP – Developing spatial infrastructure, using the SEAS-OI satellite station and maintaining its operational conditions: €3,000,000

TO 1 – TCOP – Promoting, disseminating information and setting up action programmes based on satellite data within the regional cooperation framework: €1,000,000

TO 1 – OP - Improving skills for the knowledge economy - strand 1 call for research projects: €6,990,000

TO 1 – OP – Improving skills for the knowledge economy - doctoral grants and scholarships in the S3 domains: €1,450,000

TO 1 – OP – Promoting mobility to enhance skills in S3's priority areas: €1,000,000

TO 1 – OP – Strengthening businesses' RDI efforts by recruiting young graduates: €1,800,000

TO 1 – OP – Developing tools to promote CSTI: €2,000,000

B

STRENGTHENING PROXIMITY TO DEVELOP IDEAS AND PROJECTS: THE ISSUE OF LOCAL INTELLIGENCE

The importance of relationships is expressed in a second priority: using local capital in an effective and responsive manner, so as to put Reunion in the position to anticipate and exploit future developments, to increase its resilience and its performance, and to build promising projects that create value. The experience of the Regional Innovation Strategy and the participatory workshops, which have been at the foundation of S3, shows the existing interest in a **territorial intelligence approach.** As opposed to traditional policies which were based on control over information, this approach is based on **participation and cooperation: it aims to assemble stakeholders across the island in order to produce, exchange, and share knowledge, while developing collaborative projects through shared tools.** This represents a shift to an era of networks and collaboration, to the benefit of the island's "cognitive capital"; this option is particularly relevant for an island characterised by strong social cohesion.

1) ▶ PROXIMITY, THE KEY TO INNOVATION AND COMPETITIVENESS

Regional comparisons emphasise the central role played by proximity regarding territorial development. This idea is not recent: Alfred Marshall insisted on the clustering effects of a grouping of businesses, which facilitate information and product exchanges. This also included historical clusters, such as the Italian industrial districts gathering numerous small businesses belonging to the same activity sector, which emphasised the role of concentration and cooperation, especially with respect to the development of economies of scale.

Today, the notion of proximity bears an organisational dimension: it is not so much about sharing the same physical site, but rather about belonging to the same network, where several resources are available: information, knowledge, products, etc. Such territorial networks gather many stakeholders in the areas of research, education, economy or the public sector, and create four types of positive outputs:

- The feeling of belonging creates cohesion, and allegiance to a shared project favours the mobilisation of stakeholders
- The concentration of stakeholders leads to the creation of a critical mass that is indispensable to competitiveness (thanks to scale economies); such critical mass has a say with respect to global markets and helps increase the attractiveness of the territory.
- Proximity promotes numerous fruitful interactions that facilitate coordination, creativity, reactivity, risk taking, etc.
- The dissemination of knowledge and collaboration promote competence and cross-fertilisation, but also the emergence of new applications as a result of spill-over.

2) ▶ REGIONAL INNOVATION WORKSHOPS

Proximity, and the ability to get to know one another represent a strategic advantage in terms of stimulating the emergence and use of new ideas, as shown by the concept of "**open innovation**". Such advantages provide the ideal response to the lack of critical mass. These assets also bring academia, science, and economics close together, which is crucial for the accelerated conversion of results into activities.

To this end, each S3 priority domain will benefit, within the CRI framework, from a **dedicated "regional innovation workshop"**. There will be a working group of stakeholders from different backgrounds (researchers, business leaders, institution leaders, civil society stakeholders, etc.), united by the desire to collectively produce ideas and projects. Exchanges will include a prominent **exploratory dimension** in order to **identify long-term trends, opportunities and challenges, and to react through collaborative projects.**

As a privileged interface between stakeholders and institutions, such group will play a crucial role in detecting trends and initiatives, understanding innovation dynamics at play, the development of support tools, and development of local strategy.

Each workshop will include a I skills directory, mentioning stakeholders, their resources, their projects, and their interest in cooperation. This directory will also be used to develop interregional cooperation, especially through the Enterprise Europe network (cf. *infra*).

3) ▶ PROMOTING COLLABORATIVE PROJECTS

Aside from workshops, S3 will support **stakeholders' rapprochement.**

First, by stimulating entrepreneurship and innovation culture in schools (described above) and facilitating the recruitment of young graduates, doctoral students and holders of PhDs, R&I efforts will be stimulated.

Secondly, links between academic, scientific and economic actors will deepened through the development of scientific and technical services and **the creation of collaborative projects** sustained through calls for projects.

Finally, **innovation spaces** encouraging usage (living lab) and exchange (co-working) will play a central part. Cooperation will be consolidated in future institutes for technological transformation, technological parks (Technor and Techsud), based on circular economy principles, which favour sharing and exchanging products and services.

4) ▶ DEVELOPING PROSPECTIVE

S3 is both a short- and long-term strategy aiming to support the transformation of Reunion. This ambition requires an adaptation of territorial policies: rejecting physical, historical economic determinism, which would only perpetuate the current situation, and embracing a view of the future as a "territory to build"; promoting a proactive approach aiming to react to unforeseen events and to anticipate or even trigger change. This approach is in line with the regional policies which aim to reduce dependency and promote emancipation. It also offers a response to the fast pace created by globalisation and the digital revolution, which require forward thinking and setting clear goals. **This is not a matter of predicting the future, but of preparing for and supporting change by identifying and engaging in the actions needed to create the desired future.**

This approach requires a thorough understanding of the territory and deconstructing certain ideas, if necessary : Who are we? What are our distinct traits? How does our economy work and how does it evolve? What are our main concerns and questions? etc. Finding the right answers will involve retrospective, comparative studies, diagnostic studies of sectors, and workshops to facilitate exchanges on major local issues.

Next, it is important to identify major trends, events and factors that can have an impact on our evolution: identifying signs, sources of change, opportunities or threats, and points of bifurcation. Monitoring holds a central place in this endeavour.

CRI owns an online collaborative platform that can collect operators' monitoring sources, create automated surveys or requests, and convey relevant information to partners in an easy manner. The feedback will be analysed in order to collectively formulate key hypotheses regarding key transformations, shifts, disruptions, as well as their potential impact on Reunion.

Finally, participatory workshops will question such hypotheses in order to create scenarios for the evolution of Reunion and to define the desired future, a shared vision of the future. Such a vision will be crucial in terms of guiding stakeholders' decisions and behaviour, as well as their project cooperation. Such exploration can serve as a tool for change.

5) ▶ COMMUNITY RESOURCES MOBILISED

TO 3- OP: Supporting local intelligence initiatives: €1,000,000

C

SIMPLIFYING AND IMPROVING PROJECTS' PERFORMANCE THROUGH OPEN, DIFFERENTIATED AND INTEGRATED SUPPORT

Such exchanges only make sense if they are at the root of a perpetually enduring economy. Businesses hold a central place within S3, the purpose of the strategy being to discover leading specialisations. **Today, the main issue is to increase the quantity and quality of innovative projects to reveal our strengths and build the competitive advantages we lack.** The goal is also to support businesses so that they may benefit fully from differentiation dynamics, while exploring new business models, modernising existing processes and diversifying their products and their markets.

1) ▶ ADOPTING A LOCAL APPROACH TO CREATE ADAPTED RESPONSES

The first step will focus on understanding the entrepreneurial and innovative dynamics at play in Reunion **to identify, together with stakeholders, the main blocking points and the local needs, in order to provide adapted responses.** A more complex local diagnostic could accurately identify the major obstacles, such as credit rationing, the cost of capital, the size of establishments, the lack of knowledge about external markets, obstacles in gaining access to technologies, risk management, etc.

To this end, a series of studies will question the conditions for the emergence and the transformation of innovative ideas into productive activities. Particular attention will be paid to creative interaction – relationships between stakeholders in the areas of training, research and economy; activities in technological parks, technical platforms and clusters– and their conversion into non-material assets (publications and patents). The assessments that are currently carried out with respect to support tools and mechanisms should shed light on the strengths and the weaknesses of the support structure, while also exploring paths for development.

2) ▶ PROMOTING AN OPEN, DIFFERENTIATED APPROACH

Support to businesses must respect and adapt to the **multiplicity of audiences: project** leaders, freelancers, family businesses, subsidiaries of large groups, industrial companies oriented towards the local market, export companies, highly innovative businesses, start-ups and spin-offs, etc. Diversity can also characterise their development stage: generation and initiation (development and protection of ideas and concepts), take-off (prototyping, pre-trading), and trading.

Despite its youth, the support ecosystem is very dense: more than ten structures operating across the island. This strength also induces a form of weakness, given risks of fragmentation, superposing, redundancy and a lack of visibility on the part of beneficiaries. In order to preserve assets and curb threats, S3 focuses on a network approach, based on two principles:

specialising structures in clearly identified domains,
sharing strategic support functions,

Three stages can be set up: awareness, emergence/feasibility, and development:

In order to generate innovation-oriented territorial dynamics, encourage consolidation and increase the number of innovative projects, each CRI member will be invited to run awareness-raising and support actions, which will be coordinated by CRI.

Having gone through this emergence phase, the projects will benefit from multidimensional expertise covering several aspects: technical (positioning with respect to the national and European state of the art, innovation, and feasibility), economic (market dynamics, potential for development; effects on the island), financial (business plan and strategy analysis) and human (project team). This will make it possible to assess project potential, to formulate action paths and paths for supporting development, and to provide clarification to funding institutions, in a context where public expenses are being optimised.

During the development stage, all support functions will be shared within Nexa: strategic advice, financial engineering, a response unit to tackle calls for projects concerning national and European research-innovation (in partnership with the University of Reunion), international support (with the Chamber of Commerce and Industry, the Export Club and Business France). At the same time, certain structures will provide CRI members with specialised services within their areas of excellence (intellectual property, technical services, etc.).

3) ▶ OFFERING INTEGRATED SERVICES

Although business needs are numerous, support has often been limited to subsidies. Based on an initial diagnostic, a global action plan will be created for each project. The island's service offering will be extended and consolidated thanks to structural intervention. Infrastructure-wise, Reunion will continue to invest in the development of economic real estate, which is largely insufficient, through the creation and planning of areas and activity parks, based on the principles of circular and green economy. Theme-based technical platforms, such as the CYROI, and the business incubator, hosted by the Technopole, will be supported. At the same time, centres welcoming innovative activities will include development spaces and prototype production (fab-lab) and co-creation (living lab, coworking) spaces, in order to allow leaders to create proof-of-concept, to develop complementary functions, and to adapt their solutions to market expectations. Support structures will receive funding for strategic advice, as well as for identifying partners and facilitating trade development, especially on an international level.

Financial support for businesses will also be diversified. Aside from innovation subsidies, Reunion will have financial instruments that can support enterprise capitalisation (capital-development; capital-risk), facilitate access to loans (guarantees) and reduce the cost of research-innovation (subsidised loans). Particular attention will be paid to the instruments proposed by the European Union as part of the COSME and Horizon 2020 programmes.

4) ▶ COMMUNITY RESOURCES MOBILISED

TO 1 - OP: Developing the potential for innovation and promoting innovation-adaptation: €6,990,000

TO 1 - OP: Supporting businesses' innovative projects: €11,980,000

TO 1 - OP: Creating regional innovation clusters and professionalising support for innovation: €14,980,000

D

OPENING UP TO THE WORLD

The lack of critical mass, often blamed on the island's small size and isolation, is no fatality. In a world of large communication networks, Reunion's isolation appears less physical than relational: the island narrowly focuses on itself and mainland France, while its development highly depends on increased anchoring in its region, the Indian Ocean, future pillar of the global economy, and the European Union. In order to fully exploit this position, particular attention must be paid to strengthening economic and scientific exchanges and the integration of the island into promising networks.

1) ▶ DEVELOPING THE REGION'S ATTRACTIVENESS

In a world of fierce competition, territories are fighting tooth and nail for investments. Cumulative imbalances rapidly penalise those spaces which are less well equipped for this fight: a region's competitiveness is more and more dependent on its capacity to attract talent that will support innovation, reactivity and adaptability ; conversely, attractiveness is tightly connected to the existence of a large pool of skills, top research centres and global-scale businesses. For Reunion this is a great challenge to cope with, if the island aspires to be considered not a dependend, outermost region but rather as a dynamic hub. S3 can help in these respects.

Reunion's clear positioning as a **place for experimentation with the ecological transition in a tropical context** will facilitate communication and exploration, and help showcase the island as a value creator for investors. The goal of exploration will be to identify and convince key partners in strategic sectors to develop partnerships and even to settle in Reunion, by highlighting both the privileged conditions proposed, and the specific skills that are available locally.

Beyond targeted marketing and a physical representation of the territory within the large professional conventions that are tied to S3, investment forums will be held yearly, in order to bring together specialists and major stakeholders in various fields, in order to allow them to apprehend, *in vivo*, local potential and to establish new partnerships with local operators. Support to investors in their implantation endeavours will be consolidated in order to facilitate access to land and the establishment of connections with local stakeholders, etc.

2) ▶ SUPPORTING LOCAL BUSINESSES ABROAD

Emphasis will also be placed on international development for Reunion's businesses, by exporting high-value differentiated products, services or concepts. An exploratory convention programme will be defined each year, in conjunction with CRI's main structures. Such events will explore target markets such as COMESA in order to understand needs, identify the potential for collaboration and mobilise local stakeholders by communicating widely about opportunities offered by these regions.

Knowledge of target markets will be developed with help from country monitoring. International market studies will be conducted in order to explore opportunities in given economic areas, or in order to identify leading markets for our areas of specialisation.

Each S3 sector will represent the focus of international studies, which will allow for a better understanding of Reunion's positioning with respect to world exchanges and the place it holds within global value chains; the island will also be able to better evaluate its competitive positioning and the circumstances under which it can make a name for itself on such markets; lastly, it will be possible to identify stakeholders and regions that can establish synergies.

Finally, Reunion will follow its clustering dynamics by supporting business groupings and laboratories that are interested in cooperating, in order to jointly develop a competitive advantage and reach very targeted international markets, by exchanging information, knowledge and services. The clusters will be a part of this concentration and the critical mass, thanks to the agglomeration and proximity effects. Such effects only exist if such organisations really want to stand out on the global market and serve to open up the island to the world.

3) ▶ PROMOTING INTEGRATION WITHIN THE EUROPEAN RESEARCH AND INNOVATION AREA

The last internationalisation axis focuses on Reunion's access to Europan funding schemes dedicated to research and innovation.

Competitive funding on projects launched as part of a call for projects session by the Commission within the 8th Framework for Research and Development (Horizon 2020), has four distinct advantages for Reunion:

New funding sources, which are vital in order to compensate for the expected reduction in transfers, especially EU transfers
Incentives to push for performance and originality
Support for the island's integration in networks, which require interregional collaboration
Incentives for cooperation between scientific and economic stakeholders

But our island remains largely isolated from such opportunities, because there is a lack of information, awareness and support. In order to eliminate this lack, the response cell in charge of tackling calls for projects, which is open to researchers and entrepreneurs, will categorise relevant proposals, identify potential partners and support the organisation of the consortium and the project.

In addition to research mobility incentive schemes, such as the Marie Curie programme, Reunion will provide assistance to external talent and will facilitate the participation of local stakeholders in research programmes, seminars and training sessions.

Finally, businesses will be able to rely on the Enterprise Europe Network, which aims to support SME growth by drawing on opportunities offered by the EU market. Gathering support structures in more than 50 countries, the network offers a wide range of services: intellectual property, international issues and community regulations counselling; partner research; technology transfers; European funding mobilisation, etc. Reunion aims to respond to this call for projects in order to speed up the convergence of its economy.

4) ▶ COMMUNITY RESOURCES MOBILISED

TO 1 - OP: Strengthening the response capacities with respect to national and international calls for projects: €1,000,000
TO 3 - OP: Supporting business internationalisation: €4,490,000

4 #

MONITORING INDICATORS

The message of change proposed by S3 is also consistently conveyed through public policy monitoring and assessment. The European Union aims to maximise the effectiveness of structural funds, which are henceforth compared to future investments. The traditional follow-up approach, which focused on budgetary engagement rates, is now complemented by a results-oriented approach. In this context, the construction of a monitoring and funding mechanism holds a central place with S3.

FOLLOW-UP MECHANISM:

The follow-up mechanism relies on the regular production of trend charts including a list of indicators, with at the very least the following traits:
Clear definition, recognized by all
Standardised measurement units
Regular availability and periodicity
Reliable source
Reactivity/sensitivity to actions taken.

To guarantee quality and to facilitate interregional comparison, we have used indicators supplied by renowned statistical institutions. In a practical manner, CRI currently relies on a large economic and social database, made available through a data exchange platform administered by Nexa economic observatory, which, in turn, relies mainly on public data sources.

Whereas a large number of indicators are available and accessible, information sources in French overseas departments, especially with respect to research and innovation, are limited, as shown by the lack of reliable macroeconomic data on research and development. Thus, certain indicators should be created by a more accurate data collection process where producers are concerned, or by ex nihilo creation, based on surveys conducted with CRI members. The list below includes indicators that respond to the aforementioned requirements:

RESEARCH AND INNOVATION

Authorities' expenditure - Research & technology (in M€)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
All authorities	**19.347**	**13.519**	**13.014**	**7.459**	**7.315**	**7.501**	**9.532**	**8.942**	**7.290**	**12.114**
Regional Council	15.724	10.559	10.084	7.459	7.115	7.115	8.700	8.700	3.664	11.632
Departmental Council					0.200	0.186	0.073	0.015	0.051	0.052
EPCI and municipalities						-0.201	0.759	0.227	3.575	0.431

Source: MESR - Survey on the local and regional authorities' R&T budgets

Institutional expenditure - innovation and R&D (in €M)

	2010	2011	2012
	24.650	**25.670**	**23.710**
BRGM	0.260	0.430	0.370
CIRAD	17.780	18.840	19.250
CNES	0.880		
CNRS	1.690	2.010	0.510
IFREMER		0.620	0.200
INSERM	0.030		
IRD	4.010	3.770	3.380

Source: MESR - Survey on the local and regional authorities' R&T budgets

Research tax credit

	2005	2006	2007	2008	2009	2010	2011
R&D declared	4.052	4.120	0.459	3.085	6.789	18.226	7.355
CIR obtained	0.688	0.897	0.336	0.831	4.726	5.052	3.100

Source: MESR – Nexa calculations

Doctoral students and doctorates

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PhD students	237	254	260	273	279	256	273	268	299	312
Doctorats issued			23	33	29	35	44	15	44	

Source: MENESR-DGESIP/DGRI-SIES: SISE

National competition for innovative technology enterprise creation

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Candidates	16	14	9	7	5	4	20	12	5	10
Winners	1	2	1	1	1	1	1	3	2	1
Businesses created	0	1	1	1	1	0	0	1	0	0
"Creation-development" winners	1	0	0	1	1	1	0	1	0	0
"Emerging" winners	0	2	1	0	0	0	1	22	2	1

Source: MENESR-DGRI

Patent requests per year

	2003	2004	2005	2006	2007	2008	2009	2010	2011
Publication year	16	19	7	13	16	9	12	7	15
Issuance year	8	6	7	4	7	9	4	7	4

Source: INPI-MENESR

CIFRE scholarships awarded

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
CIFRE scholarships	0	1	1	1	4	2	2	7	3	7

Source: DRRT Reunion

Scientific excellence grants

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
SEG beneficiaries (stock)	31	28	25	31	35	38	40	38	35	36
New SEG beneficiaries (flow)	8	2	7	14	12	5	9	12	9	6
SEG candidates	10	11	25	35	31	16	26	22	20	24

Source: PEDR and PES - Grant application platform

MACROECONOMIC CONTEXT

Internationalization level

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Economy openness rates	0.34	0.33	0.33	0.32	0.31	0.30	0.29	0.29	0.30	
Trade coverage rates	0.18	0.19	0.16	0.13	0.16	0.13	0.14	0.14	0.14	

Source : INSEE

Active population

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Active population (BIT)	292,569	298,920	301,719	315,131	305,400	312,954	326,282	340,600	345,700	345,200
Active population employed	203,062	203,284	212,779	228,387	237,210	243,505	237,327	242,100	243,600	246,700

Source : INSEE

BIOECONOMY

Organic farming areas or areas undergoing conversion (in ha)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Conversion C27C3						19	20	19	33	86
Conversion C1					63	30	32	156	122	69
Certified Organic					140	138	226	381	439	440
Total					203	187	278	556	594	595

Source : Agence Bio

TOURISM

Tourist spending (in €M)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Pre-holiday spending	46	46	20	32	37	31	32	45	35	46
Holiday spending	314	309	225	293	306	306	296	344	315	314
Total spending	**365**	**360**	**355**	**245**	**325**	**343**	**337**	**329**	**389**	**350**

Source: INSEE, Tourism Observatory

Tourist numbers by category

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Affinity	164,900	180,316	184,403	134,915	184,987	197,840	222,762	197,953	211,900	210,000	197,600
Recreation	208,500	183,035	161,935	80,136	124,581	136,063	143,303	162,501	197,400	180,300	168,400
Business	44,200	51,563	46,880	47,048	51,981	49,958	41,112	39,797	43,400	42,600	35,500
Others	14,400	15,086	15,782	16,701	18,998	12,561	14,723	20,074	18,600	13,600	14,500
Total	**432,000**	**430,000**	**409,000**	**278,800**	**380,547**	**396,422**	**421,900**	**420,325**	**471,300**	**446,500**	**416,000**

Source: INSEE, Tourism Observatory

ENERGY

Renewable energy production (in KToe)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Electrical power from renewable energy	74.1	74.7	66.4	73.6	78.3	79.1	73.2	78.4	71.5	83.7	91.4
NRE weighting (penetration rates) in total electricity production	0.42	0.40	0.34	0.36	0.37	0.36	0.33	0.34	0.30	0.35	0.38
Local production resource	5.0	6.8	8.5	10.1	11.6	13.2	14.4	15.7	16.9	17.9	18.8

Source : OER

Greenhouse gas emissions (GES)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total emissions in ktCO2eq						3981	4075	4120	4107	1080
Electricity emission factor in gCO2eq						819	809.1	823	801	749

Source : OER

ICT

Internet and mobile services

	2009	2010	2011	2012	2013
High and very high speed internet subscriptions	145,000	157,000	176,000	200,000	223,000
Broadband access - bought by bitstream	18,000	12,000	17,000	18,000	16,000
Broadband access - bought unbundled	31,000	51,000	73,000	83,000	100,000
Subscriptions to mobile services	917,000	911,000	922,000	906,000	897,000

Source: ARCEP

ANNEXES

A - SUMMARY OF ACTION SHEET THEMES

	SUBJECTS					
			Territorial responsiveness			
	Tropical bioeconomy	Experiential ecotourism	Human responsiveness	Social responsiveness	Digital society	Energy transition
ACTION-SHEETS						
Priority No. 1: Reunion, producing tropical bioeconomy solutions for the economy of the living world						
Ecological conservation and restoration	■	■		■		
Aiming at excellence in tropical agroecology	■	■				
Using tropical resources and products from agri-food industries	■					■
Extraction and mobilisation of active principles of tropical biodiversity	■					
Priority No. 2: Reunion, supplier of solutions in experiential ecotourism: a voyage of emotions						
Outdoor tourism	■	■			■	■
Cultural tourism		■		■	■	
Wellness tourism		■	■			
Priority No. 3: Reunion, transformation platform for knowledge-based, digital and low-carbon economy						
Individual skill development			■	■	■	
Wellness improvement	■	■	■			
Risk and disease prevention	■		■		■	
Innovative diagnostics & therapies	■		■	■	■	
Social innovation		■		■		
Open innovation				■	■	
Smart territory				■	■	■
IT services & development					■	
E-learning			■		■	
E-health			■		■	
E-energy					■	■
E-tourism		■			■	
Ecological buildings					■	■
Renewable energy	■				■	■
Small grids					■	■
Transportation	■			■		■

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