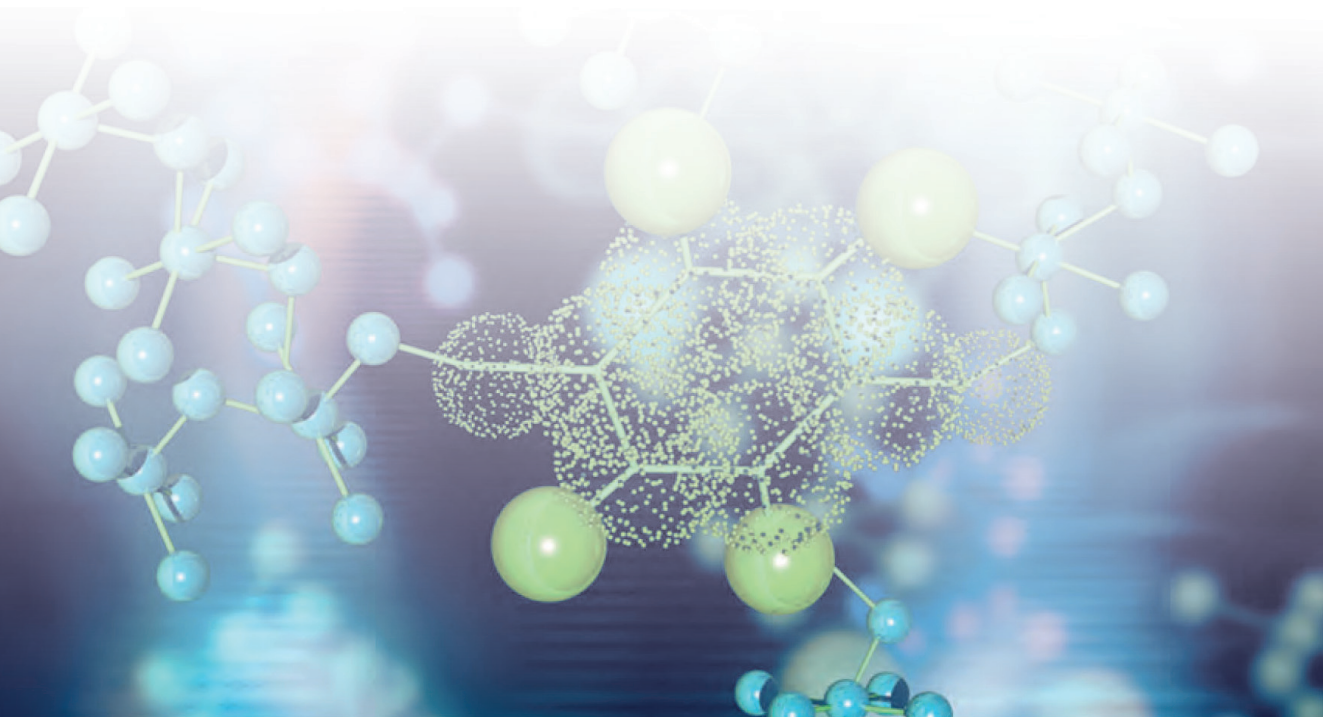




Republic of Tunisia  
Ministry of Higher Education  
And Scientific Research

# **Scientific Research:** **Priorities, future directions,** **and key initiatives** **2017 - 2022**





# Table of Contents

<b>Opening Remark s</b> .....	<b>3</b>
<b>Key Figures</b> .....	<b>4</b>
<b>National Priorities</b> .....	<b>5</b>
1. Water, Energy, and Food Security .....	6
2. Emerging democratic society: Education, culture, and youth .....	7
3. Quality healthcare .....	8
4. Digital and industrial transition.....	9
5. Governance and decentralisation .....	10
6. The Circular Economy.....	11
<b>Future Directions &amp; Key Initiatives</b> .....	<b>12</b>
Level 1: National Governance: Priorities, Strategy and Coherence .....	12
Level 2: Research Funding and Assessment .....	13
Level 3: Internal Governance and quality assurance .....	14
Level 4: Transfer of technology, innovation and outreach .....	15

# 1. Opening remarks

Our country is today compelled to migrate to a new development model, leveraging its highly trained human resources and unleashing the demographic opportunity locked in its predominantly young population of multi-lingual and trainable talent to rally its economy to climb up the value chain. This transformation is key to consolidating the democratic transition, enhancing comprehensive regional development and providing much needed employment opportunities for university graduates. The national system of scientific research and innovation (SRI) has a fundamental role to play in this transition as it forms the cornerstone of the knowledge economy and a platform for the generation of innovative products and services. Our country is ranked 60th internationally in terms of scientific production, and leads the continent in terms of scientific output averaged by GDP or population. This has enabled it to become a partner country in the European Research and Innovation Program, Horizon 2020. The SRI system counts more than 20.000 researchers in Tunisia in addition to thousands residing abroad. The portfolio of research projects boasts great diversity and the country counts several research laboratories and centres with regional outreach and an international reputation.

Despite of the breadth of research activities and the quality of its human resources, the SRI systems does not yet contribute significantly to the country's development due to several shortcomings such as limited national funding, a weak participation of the private sector, complex bureaucratic procedures in the management of research units and projects, the absence of solid quality assurance standards for training and doctoral programs, the absence of incentive systems for research staff and associated personnel, and the continued gap between research activities and national needs and priorities, and between research labs on one end and the socioeconomic environment on the other. An additional major shortcoming is the lack of clarity regarding the mission of the SRI system among the key stakeholders. The research system has traditionally always focused on training professors to meet the recruitment needs of higher education institutions. However, today, as the number of students continues to decrease due to demographic and societal developments, we find ourselves faced with the need and the opportunity to transform our vision of scientific research from one geared towards training future professors into one focused on technology transfer and playing a more central role in the country's development.

The new mission of the SRI system is to direct its research capacities to support the country's development in all its dimensions, without neglecting the essential role of scientific research in promoting the quality of higher education programs and in boosting the international ranking of our universities. In this context, the strategic plan 2017-2022, launched after a participatory approach, defines a shared vision of making Tunisia a regional centre of excellence in research and innovation, in order to promote development and improve the quality of life of citizens, specifically by contributing to five main objectives: 1) Excellent universities, 2) innovative and pioneering enterprises, 3) modern public services, 4) innovative and prosperous regions, and 5) a free, democratic and secure society. The five year plan includes 20 specific goals and 60 initiatives summarised in this document. Among the important initiatives in the plan is the identification of national priorities for the scientific research system. This has been recently concluded subsequent to a broad consultation that involved nearly 2,000 participants. This document summarises the outputs of this consultation, the six national priorities, as well all the 20 specific objectives of the plan and a number of important programs and initiatives designed to achieve them.

In conclusion, it is clear that the reform of SRI system counts numerous challenges and the scope for improvement is vast and extended. However, achieving the desired qualitative transition in a short period remains within reach given the availability of a significant number of strengths. To migrate through this change successfully, it is necessary to prioritise reform initiatives, starting with public policy areas that are likely to simplify subsequent reforms, liberate energies, and build trust among the various stakeholders. There is also little doubt that the success of this transition cannot be achieved without the concerted efforts of all stakeholders within a positive atmosphere of constructive debate and interaction. We count on each and everyone to contribute to the realisation of this ambitious plan and to help fulfil the shared promise of placing the SRI system in the heart of the country's future development strategies.

*Dr Khalil Amiri, Secretary of State for Scientific Research, July 2017*

## 2. Key figures

- Ranked 60th internationally in scientific production, and first in Africa in terms of production averaged to population or GDP (figure 1)
- 13 universities with 205 higher education and scientific research institutions, and 37 doctoral schools
- 40 national research centers, including 21 research centers with active units and labs recognised by the National Authority for Evaluation of Research Activities.
- 314 research laboratories and 324 research units distributed across the universities and research centers
- Research funding is distributed as follows: higher education (73%), agriculture (12%), health (12%); defense, interior, social affairs, youth, sports and communication technologies ... (3%)
- Approximately 20.000 researchers, about half of them hold a doctoral degree and 14 % hold a senior rank (associate and full professors)
- The total funding of scientific research is 0.66% of GDP and is almost entirely dependent on public funding

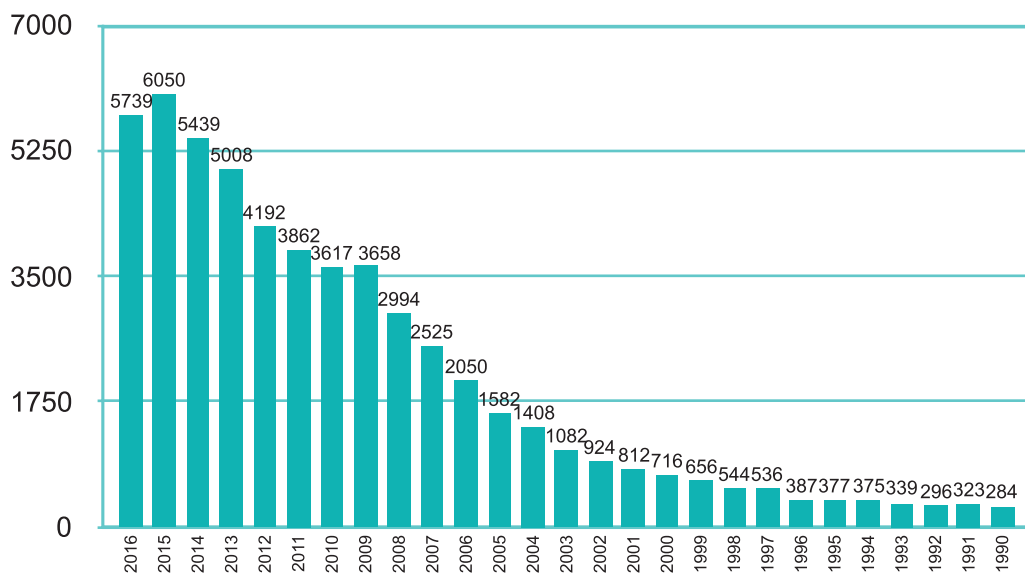


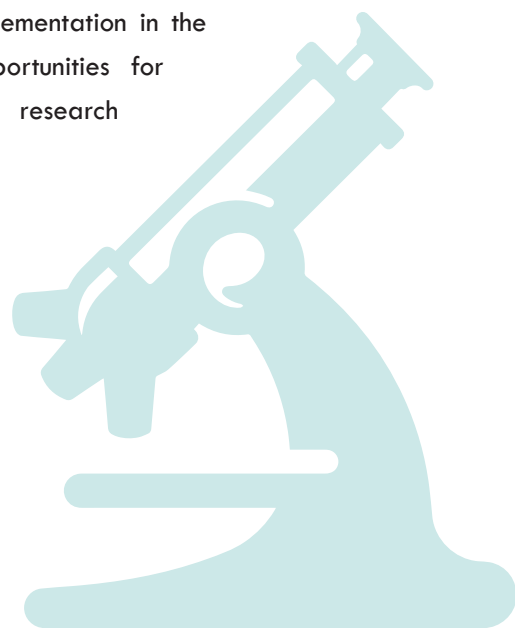
Figure 1. Evolution of scientific publications (Scopus)

### 3.National Priorities of the Scientific Research System

The National Consultation on scientific research priorities was launched in November 2016 and concluded in May 2017. It included several actions, a wide online consultation, two workshops to discuss the methodology of priority setting, a national conference and 3 regional workshops. These actions involved about 2000 representatives of all stakeholders—research centers, universities, public institutions and ministries, business and labor organizations, and civil society associations.

The criteria adopted in setting priorities were divided into four main axes:

- Actual or potential added value (contribution to sustainable development, positive discrimination, quality of life, employment, exports, scientific excellence ...)
- Degree of alignment with sector-level strategies, national plans, and international agreements and commitments
- Feasibility (the availability of human, natural, financial and material resources; the feasibility of implementation in the local and/or international context; opportunities for synergies between different scientific research disciplines)
- Need and urgency levels (risk for the state or population, terrorism, epidemics, natural disasters, electronic threats ...)
- The consultation concluded with six major priorities with a number of sub-priorities under each.



# 1. Water, Energy, and Food Security

## Sustainable management of water resources

Governance and planning of water resources. Databases, information, earth observation, and monitoring systems. Grey water reuse. Smart and economic irrigation systems. Desalination. Renewable energy and desalination. Water economy and efficiency.

## Renewable energies and energy efficiency

Solar energy for heating and cooling for households and for the industry. Solar energy systems (PV and CSP). Biomass and biofuels. Energy from wind and marine waves. Energy storage and conversion. Smart grid. Hydrogen production and storage.

## Preserving biodiversity and taking action on climate change

Climate change and its impact. Taking actions on climate change. Biodiversity preservation and valorisation. Preservation of genetic resources.

## Smart agriculture, locally adapted automation, and exports

Small farmer support (adapting technologies and automation). Smart irrigation and smart agriculture. Boosting quality and productivity of export oriented products. Protection of marine ecosystems, fish populations and diversity.

## Pest and disease management, desertification and coastal erosion

Pest and disease management. Pest and disease management in organic agriculture. Desertification, soil and coast erosion.

## 2. Emerging democratic society: Education, culture, & youth

### Identity, citizenship, and emerging democratic society

Emerging democratic society. Identity and language. Civil liberties, citizenship, tolerance, and diversity. Demographic transition. Social justice and social welfare programs. Poverty and unemployment.

### Education, training, quality assurance, and new teaching approaches

Education and vocational training systems. Governance of education. Quality assurance and accreditation in higher education. Training of teachers and pre-school teachers. Soft skills, entrepreneurship, and innovation in early school curricula. Modern pedagogical approaches and educational curricula. Tunisian transition in religious tolerance. Critical thinking and protection from extremism.

### Culture, arts, media, and quality of life

Citizens, culture, and fine arts. Entertainment and quality of life. Public media reform, medial and cultural and emerging challenges. Arab and Islamic heritage. Reform of Islamic thought. Cross-cultural dialogue.

### Youth issues

Contemporary challenges facing Tunisian youth. Unemployment, school drop-out rates, crime, substance abuse, migration, globalisation and the internet. Youth and participation in public affairs. Early education, citizenship and democratic society. Youth and radicalisation.

### 3. Quality healthcare

#### Drug design

Drug design - Vaccine and biosimilar development. Support for the development of a pharmaceutical industry.

#### Health economics and health system governance

Governance of the public health system. Quality controls. Elaboration and evaluation of public health policies. Health Economics.

#### Demographic transition, and well-being

Demographic and societal transition and well-being. Chronic and emerging diseases. Genes and inherited diseases/Databases. Epidemics.

#### Quality of healthcare and e-health

E-Health. Telemedicine. Quality of care.



## 4. Digital and industrial transition

<b>Digital transition</b>	Knowledge management. Electronic government. Enterprise resource planning systems. Electronic commerce. Financial services. Next generation networks. Software engineering. Artificial intelligence. Data science/Big Data. Cloud computing. Space technologies and earth observation. Search of complex and rich content. Social networks.
<b>Smart cities and internet of things</b>	Smart cities. Sensor networks. Geographic information systems. Smart applications for various public services (transport, environment, health, ...). Security and privacy in smart cities.
<b>Security of information systems and networks</b>	Security of networks and information systems. Rapid response to emergencies. Security and open source software. Electronic payment systems.
<b>Infrastructure and border surveillance and security</b>	Border and infrastructure surveillance. Command, control and communications infrastructure. Big Data and security. Information technology for national security.
<b>Nanotechnology and smart materials</b>	Nanotechnology and applications in medicine, manufacturing, smart cities, etc. Smart materials.

## 5. Governance and decentralisation

### Political and economic decentralisation

Political and economic decentralisation. Power sharing between central, regional, and local governments. Coordination. Regional development under decentralised governance. Positive discrimination. Change management. Role of constitutional commissions.

### Local governance and participative democracy

Local governance and participative democracy. Role of citizens and civil society. OpenGov, public policy evaluation, participative policy making, citizen oversight. Fighting corruption. Public financial management for local governments. Public private partnerships. Ex-poste audit and evaluation systems. Co-construction.

### Regional development models

Sustainable and innovative regional development models. Infrastructure and urban planning and regional development. New urban conglomerates. Rainwater management. Local services. Quality of life.

### Capitalising on the historical and cultural heritage of the regions

Mapping, documentation, virtual modeling, and security of historical and cultural sites. Integration of important sites in tourism circuits and in educational curricula. Applications for museums. Maintenance, restoration, and excavation research.

### Governance of public and private companies and public service reform

Governance of public institutions. Governance of private organisations. Integration of modern management practices. Innovation. Quality. Financial markets. Financial sector reform. Economic indicators. Public policy evaluation. Fight against corruption. Transparency and good governance indicators. Public private partnerships. Social and environmental responsibility.

## 6. The circular economy

### Sustainable agriculture and industry

Sustainable agriculture and industry. Industrial process re-engineering for sustainability. Waste reduction, treatment and recycling. Organic agriculture, productivity, and pest management. Fish population and biodiversity protection.

### Mineral resources and rare earth metals

Governance of mineral resources. Databases and detailed maps. Use of mineral resources in new materials, industrial applications, and chemical processes. Rare earth metals. Tracking supply and demand, extraction, and applications of rare earth metals. Fracking and its environmental impacts.

### Fighting pollution and its effects

Characterising air and water pollution and its effects. Tracking the pollution sources, flow, rates and their evolution. Fighting pollution. Protection of surface and ground water resources. Traces of pollution in food products.

### Treatment and recycling of household and industrial waste

Governance of waste management systems at the local, regional, and national levels. Treatment of household and industrial waste. Recycling.

## 4. Future directions and key initiatives

The five-year strategic plan includes 20 specific objectives and 60 initiatives designed to achieve them. The initiatives range from updating and issuing new legal texts, launching new programs, modernising procedures and engaging structural reforms. The objectives and initiatives are divided into four categories according to the target level. The first level concerns the governance of the national SRI system, setting overarching strategic direction, defining national priorities and system-level evaluation criteria, as well as ensuring policy coherence across sectors and ministries. The second level consists of the funding, evaluation, and structuring of research activities and units. This level is responsible for translating the strategic directions and national priorities into a complementary array of research activities. The third level covers the execution system and its efficiency, specifically the internal governance of research units and labs and the promotion of standards of quality in the management of research projects and units. Last but not least, the fourth level purports to ensuring the outputs of the research systems contribute effectively to the country's development, specifically through the dissemination of knowledge, the transfer of technology and the creation of innovative startups.

### Level 1: National strategy and policy coherence and steering resources towards priorities

#### Objectives

- 1 Promote the coherence of the national SRI system and improve coordination among stakeholders**
- 2 Formally identify national priorities and steer resources and activities toward priorities**
- 3 Diversify international cooperation programs and ensure their alignment with national priorities**

#### Main programs and initiatives

- Establishing a Supreme Council for Scientific Research and Innovation: This is a strategic level council whose principal mission is to discuss and validate the national strategy for research and innovation, set major directions of the SRI system, approve the national priorities for research and innovation, set overall objectives and evaluation criteria for the national system of research and innovation, provide periodic review and suggest directions for improvement to ensure coherence across ministries and sectors.
- Establish a methodology and institutionalise a periodic process to identify the national priorities for the scientific research system
- Diversify the network of international partnerships and identify clear objectives for the various cooperation programs to ensure their alignment with national priorities
- Establish a diverse thematic network of national contact points and a professional support system to ensure optimal benefit from the opportunities provided by the Horizon 2020 program

## Level 2: Research system organisation, funding and evaluation

### Objectives

**4** Migrate to a competitive transparent project-based research funding system aligned with priorities

**5** Increase the funding of scientific research to 1% of GDP by 2022

**6** Establish research centers of excellence and build their capacities

**7** Enhance the effectiveness of the reporting and evaluation systems

### Main programs and initiatives

- Increase the proportion of competitive call-based funding compared to that of block (regular) funding
- Set objective and transparent criteria for the distribution of block funding to research laboratories and units
- Multiply joint research projects with the socio-economic environment
- Launch the Early Career Award Program (for Assistant professors at the beginning of their career)
- Elaborate a draft law to encourage private companies to invest in research and innovation
- Simplify the financial management of international projects, especially Horizon 2020 projects
- Create research consortia in priority areas and support the creation of research centers of excellence
- Enhance the flexibility of research unit/lab creation and modernise their management (procurement, contracting)
- Build the capacities of the National Authority for the Evaluation of Scientific Research Activities and ensure its conformity with international best practices
- Develop a governance dashboard and a reporting system to monitor the KPIs of research units and researchers

## Level 3: Governance, quality assurance, and management of research labs and centers

### Objectives

- 8** Enhance the administrative and financial autonomy of HER institutions and modernise their management
- 9** Establish a quality assurance system in research institutions and laboratories
- 10** Ensure optimal use of valuable scientific equipment and further develop research infrastructure
- 11** Promote the quality of doctoral training programs
- 12** Promote incentives for research personnel and leverage the network of Tunisian competencies living abroad
- 13** Promote ethical standards in scientific research

### Main programs and initiatives

- Complete the transition of research centers into administrative and financial independence, and accelerate the transition of higher education institutions into a similar status granting them administrative and financial independence
- Modernise financial management of research units and labs by generalising the application of information technology and disseminate the use of smart cards to modernise the public research procurement system
- Obtain accreditation according to national and international standards for research centers and labs in all key management and scientific processes
- Establish an academy for the training of all research personnel in the areas of research project management, fund raising, financial management, intellectual property protection, management of innovation, communication, and ethics.
- Establish a national ranking and classification system for research units and labs according to defined standards of excellence
- Establish a program to ensure the optimal use of valuable scientific equipment, launch regional platforms to effectively share this infrastructure, and set up mechanisms for adequate maintenance
- Develop research information infrastructure (cloud and grid computing services, high-bandwidth access, and a high performance computing center)
- Improve the quality of doctoral programs and the governance of doctoral scholarships
- Adopt a new legal status organising the recruitment, career progression and evaluation of research personnel, including researchers, engineers, technicians and managers.
- Review the recruitment and promotion systems within national research centers to take account of their specificities
- Establish a program to attract Tunisian competencies living abroad, promote joint research projects with them, and provide researchers in Tunisia and abroad shared access to a virtual network of labs and associated research infrastructure
- Develop the ethical frameworks and standards of scientific research activities including codes of conduct, anti-plagiarism systems and awareness programs, and ethical frameworks for animal experimentation.

## Level 4: Leveraging research results –knowledge dissemination, technology transfer, and the creation of innovative startups

### Objectives

- 14** Promote the mobility of student researchers to the socio-economic environment
- 15** Promote the system and culture of intellectual property protection
- 16** Promote the governance of techno parks and establish the missing components of the parks
- 17** Accelerate the process of technology transfer and the creation of innovative startups
- 18** Widely disseminate the outputs of the research system and raise awareness about its capacities and results
- 19** Strengthen the links between research units/labs and their socio-economic environment
- 20** Promote research and innovation within the private sector and within private higher education institutions

### Main programs and initiatives

- Launch the MOBIDOC program to accelerate the transfer of research findings conducted in the context of doctoral theses and help integrate doctoral students and graduates in the socio-economic environment
- Launch the Post-PFE program to accelerate the transfer of research findings conducted in the context of final year engineering projects and help integrate engineering graduates in the socio-economic environment
- Set up an online platform to link research and thesis projects with the needs of the socio-economic environment
- Complete a national map of research results that are candidate for transfer to the socio-economic environment.
- Develop a program to transfer research results and organise annual “national days for research result dissemination”
- Establish programs to build competencies in emerging professions related to the transfer of technology and valorisation of scientific research results
- Develop incubation and support mechanisms to accompany early phases of high-potential innovative projects
- Promote the intellectual property protection system, and enhance the governance of collaboration between research labs /centers and the private sector
- Review the strategic positioning of techno-parks, accelerate the completion of the planned components, and improve their governance and integration in regional development policies
- Launch a national portal for scientific research and encourage Tunisian and regional scientific journals
- Encourage the creation of research units in private higher education institutions and in public and private enterprises

