How to harness the National Innovation System in Tunisia.

To enable Technology Transfer and strengthen the Innovation capability

Final report
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Authored by Mondher Khanfir
How to harness the National Innovation System to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

This report is based on a master set of data and observations compiled by the author1, as expert in Innovation, Policy Advisor, Strategist and practitioner in Technology Transfer.

The main documentary sources mentioned in this report and attached in the annex, include research studies, academic and gray literature, numerous exchanges with key players in the innovation ecosystem in Tunisia, with no formal interviews. The qualitative and quantitative information collected in this report has been confronted and analyzed through a dialogue with the main stakeholders, in the frame of a national workshop, which gave orientations on ways to enhance the Innovation capacity and develop action plans to address this issue. In particular, the proposal to implement a National Technology Transfer Offices network in the MENA region has been approved as a key initiative that will provide guidance on policy formulation on Science Technology and Innovation, and the commercialization of research findings in the region. The recommendations gathered in this report cover only Tunisia.

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My gratitude goes to everyone who contributed to this work of formalization of a vision for an effective and efficient National Innovation System in Tunisia. I would like to address my special thanks to the whole team of the “Agence Nationale de Promotion de la Recherche”, in particular Pr. Khaled Ghedira, Mrs Souad Boussaid, Mr Mohamed Larbi Ben Younes, Dr Abdelhamid Abidi for their support and information exchange, as well as Dr. Zahar Balkiss Bouhawala from the “Institut Pasteur de Tunis” and Mr Walid Triki from Wiki Start Up for their review of this report.
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GLOSSARY

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<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AFD</td>
<td>French Development Agency</td>
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<tr>
<td>ANPR</td>
<td>The National Agency for Scientific Research Promotion</td>
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<td>APII</td>
<td>The Agency for the Promotion of Industry and Innovation</td>
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<td>APIA</td>
<td>The Agency for the promotion of Agriculture</td>
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<td>BuTT</td>
<td>Tunisian Technology Transfer Office</td>
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<td>CBBC</td>
<td>Center of Biotechnologies of Borj-Cédria</td>
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<tr>
<td>CBS</td>
<td>Center of Biotechnologies of Sfax</td>
</tr>
<tr>
<td>CDC</td>
<td>Deposits and Consignments Fund</td>
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<tr>
<td>CERT</td>
<td>Centre d’Etudes &amp; de Recherche en Télécommunications</td>
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<td>CERTE</td>
<td>Centre de Recherche &amp; des Technologies des Eaux</td>
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<td>CITET</td>
<td>Centre International des Technologies de l’Environnement de Tunis</td>
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<tr>
<td>CNSTN</td>
<td>Centre National des Sciences &amp; Technologies Nucléaires</td>
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<tr>
<td>CRTEN</td>
<td>Centre de Recherche et des Technologies de l’Energie</td>
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<tr>
<td>FOPRODI</td>
<td>Fund for Industrial Promotion and Decentralization</td>
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<td>GCI</td>
<td>Global Competitiveness Index</td>
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<td>ICT</td>
<td>Information and Communication Technology</td>
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<tr>
<td>IKDAM</td>
<td>Public Seed Funds managed by SAGES Capital</td>
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<td>INTECH</td>
<td>Public Investment Fund dedicated to Tech Startups managed by SAGES Capital</td>
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<tr>
<td>INARP</td>
<td>Institut National d'Analyse et Recherche Physico-chimique</td>
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<td>INNORPI</td>
<td>Institut National de la Normalisation et de la Propriété Industrielle</td>
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<td>INNTA</td>
<td>Institut National de Nutrition et de Technologie Alimentaire</td>
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<td>INSTM</td>
<td>Institut National des Sciences et Technologies de la Mer</td>
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<tr>
<td>IP</td>
<td>Intellectual property</td>
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<tr>
<td>IPEMED</td>
<td>Institut de Prospective Economique du Monde Méditerranéen</td>
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<td>IPP</td>
<td>Intellectual Property Protection</td>
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<tr>
<td>IPT</td>
<td>Institut Pasteur de Tunis</td>
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<tr>
<td>IRA</td>
<td>Institut des Régions Arides de Médenine</td>
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<tr>
<td>ISET</td>
<td>Institutes of Technological Studies</td>
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<td>ITP</td>
<td>Priority Technological Investment Grant</td>
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<tr>
<td>KBE</td>
<td>Knowledge Based Economy</td>
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<tr>
<td>MENA</td>
<td>Middle East and North Africa</td>
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<tr>
<td>MESRS</td>
<td>Ministère de l'Enseignement Supérieur et de la Recherche Scientifique</td>
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<tr>
<td>MIEM</td>
<td>Ministère de l’Industrie des énergies et des mines</td>
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<tr>
<td>NIS</td>
<td>National Innovation System</td>
</tr>
<tr>
<td>ONUDI</td>
<td>Organisation des Nations Unis pour le Développement Industriel</td>
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<tr>
<td>PASRI</td>
<td>European Project to support the Research &amp; Innovation System in Tunisia</td>
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<td>PIRD</td>
<td>Grant for investment in research and innovation</td>
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<td>PNM</td>
<td>Upgrading Industrial capacity Program</td>
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<td>PNM</td>
<td>Programmes Nationaux Mobilisateurs</td>
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<tr>
<td>PNRI</td>
<td>Grant for collaborative research and innovation</td>
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<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>RDI</td>
<td>Research, Development &amp; Innovation</td>
</tr>
<tr>
<td>RBSO</td>
<td>Research Based Spin-Off</td>
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<tr>
<td>RIICTIC</td>
<td>Incentive tool for creativity and innovation in ICT field</td>
</tr>
<tr>
<td>SAGES Capital</td>
<td>Asset management company partially State owened</td>
</tr>
<tr>
<td>SERST</td>
<td>Secretariat of State for Scientific Research and Technology</td>
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<tr>
<td>STI</td>
<td>Science, Technology &amp; Innovation</td>
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<tr>
<td>TTO</td>
<td>Technology Transfer Office</td>
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<tr>
<td>TUNISIE DIGITALE 2018</td>
<td>The National Strategic Program of Digital Economy</td>
</tr>
<tr>
<td>TPP</td>
<td>Technological Product &amp; Process</td>
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<tr>
<td>VRR</td>
<td>Grant for the Research Findings Valorization</td>
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1. National Innovation System definition

Innovation is an important driver of value creation, economic growth and social welfare. It’s driven by an interest to find new sources of economic growth, raise productivity and international competitiveness. In Tunisia, it’s recognized as a major concern of public policy since at least two decades. Thus, it’s still very common to find Innovation as rhetoric in political discourse concerning all sectors, including the administrative reform and governance of public affairs.

By National Innovation System (NIS), we mean all institutions, private and public organizations contributing to the generation and commercialization of science and technology in a global value chain of Research, Development & Innovation. NIS aims to improve the innovation capability of the country through interactions between the actors and institutions in both business sector and academia, which includes enterprises, universities and government research institutes to better identify and exploit technologies, and to produce an enabling environment for knowledge dissemination and commercialization. The flows of technology and information among people, enterprises and institutions are the essential elements produced by NIS. Before mapping and assessing the NIS performance, we recall the definition of innovation we will refer to it in this report.

1.1.1. About Innovation

Innovation is the process of turning an idea or invention into goods or services that create value on the market, produced with a scalable industry. To be called an innovation, an idea must be replicable at an economical cost and must satisfy a specific need, such as food, water, sustainable environment or quality of life. Innovation involves deliberate application of information, imagination and initiative in deriving greater or different values from resources, and includes all processes by which new ideas are generated and converted into useful products.

The Oslo manual\(^2\) concentrates especially on technological innovation of products (and services) and processes (technological product and process - TPP - innovation). TPP innovation comprises implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovation involves a series of scientific, technological, organizational, financial and commercial activities.

The Oslo manual makes difference between TPP and other innovation (new or improved management, etc.). Therefore, it discards from TPP innovation any organizational innovation (concerning organizational structures, management methods, corporate strategies) and other changes in products and processes (of aesthetic character, fashion changes, etc.). In this report, we will address innovation in terms of TPP, as described by the Oslo Manual, to keep up with innovation that is based on the Technology Transfer.

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\(^2\) OECD, 1997
1.2. **Innovation policy, strategy & legislation in Tunisia**

The National Innovation System (NIS) is commonly defined as a set of institutions and entities, which jointly and individually contribute to the development, and dissemination of new technologies and provides a framework on which governments formulate and implement public policies in order to influence the innovation process.

According to a paper\(^3\) authored by Refaat Chaabouni\(^4\), the first concrete step to formally organize research activities in Tunisia and provide structures with which a national policy could be implemented was the creation of a Secretariat of State for Scientific Research and Technology (SERST) in February 1991. The main mission of SERST was the use of research as a tool to address problems of development in areas such as agriculture, health, industry, energy and the environment. It was set up under the authority of the Prime Minister to play an inter-ministerial role in formulating proposals for a research and innovation policy at the national level in coherence with the social and economic development needs, and looking forward to monitoring the implementation of this policy via the activities of the different involved ministries. To facilitate the job of inter-ministerial coordination, a Higher Council for Scientific Research and Technology was created in 1992. It was chaired by the Prime Minister in person and brought together representatives of the ministries, the labor unions, the heads of industry and indeed any other organization or person whose input was considered helpful to their work. The first major achievement of SERST was passing the country's first legislation dedicated to the organization of research and technological development in early 1996 –see full decree text in annex 1-.

Significant efforts were made to increase funding for research and the SERST established a target of 1% of GDP by the end of 2004. All ministries played a role in trying to achieve this goal. In addition to its role in policy formulation, the SERST also financed and led a number of research programs, among which are the ‘Programmes Nationaux Mobilisateurs’ (PNM) launched in 1992 along with the program for the valorization of research findings (VRR)\(^5\), and the grant for investments in R&D (PIRD)\(^6\). The PNM focused on Agriculture and Fisheries, Environment and Natural Resources, Industry and Energy, Computing and Telecommunications, Healthcare and Pharmaceuticals and Socio-economic Research. The PNM programs were discontinued in 1998. According to the same paper, all in all, they provided support for a total of 600 projects costing about 20 millions $. Agriculture as well as healthcare and pharmaceuticals accounted for 67% of this expenditure.

The VRR program was launched in 1992 and this was the first attempt of promoting the commercialization and the application of research results to the social or economic business.

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\(^3\) Progress towards the Implementation of the National Innovation System in Tunisia, R. Chaabouni 2008  
\(^4\) He was named Secretary of State in charge of the Scientific Research and Technology in 2010  
\(^5\) Detailed in the next section  
\(^6\) Detailed in the next section
environment. To 2012, it supported around 90 projects with a total value of about 5 million $, where agriculture represented 25 % of this investment, IT 21%, Energy 15% and Biotechnologies 11%.

1.2.1. Incentives and programs supporting innovation

Since the development stage of each country varies, the identified needs govern the NIS formation and its related policy; Tunisia has produced a large set of incentives during the period from 1996 to 2008, in particular national programs, and financial measures supporting the National Innovation System inception. Yet, the Tunisian economy was dominated by public sector with an excessive control and a centralized authority. This led to a fragmented vision and strategy of the Research, Development & Innovation value chain, biased by a sectorial approach. An attempt to gather all stakeholders and to produce a common ground for a coherent Innovation Agenda was undertaken by the creation of the ANPR in 2008, with the mission to support interface agencies involved with scientific research, to assist the R&D programs and initiatives implementation, to facilitate the Tech Transfer through collaborative projects and the PPP.

The ANPR mission has been consolidated by the PASRI, which produced a very wide and useful corpus of knowledge to enable an Innovation Policy and the strategy formulation for an effective NIS.

The mapping of the National Innovation System—see figure 1—shows how rich the Innovation Agenda in Tunisia is. The number of incentives and State supported initiatives that are running under the governance of different Ministries raises the question of why the outcome and results are not there.

These are the most important programs and incentives:

- **PMN (Ministry of Industry, Energy and Mines): Programme de Mise à Niveau – Upgrading Industrial Capacity Program**: Launched in 1995 to mark the signing of the free trade agreement with the EU, the PMN is a national program that aims to upgrade the Tunisian industry. Implementing a PMN program involves the participation of several stakeholders (companies, the PMN Office, technical centers, design offices, etc.). The process includes two phases; a first one triggered by the membership of the business demand and leading to the approval of its upgrade investment plan. And a second phase for the Release of investment grant after complying with some governance rules. PMN has reached 5256 approved requests from SMES, for a total investment of 8.9 Billion TND, and has committed around 1.2 Billion TND of Grants. The most significant stake of this investment was dedicated to production capacity and very little was allocated for the intangible assets.

- **ITP (Ministry of Industry, Energy and Mines): Investissement Technologique Prioritaire - Priority Technological Investment**: In addition to the PMN Grant, ITP grant ensures the financial support of intangible investments, the implementation of quality management

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8 It’s a public Agency with administrative and financial autonomy and placed under the Ministry of Higher Education and Scientific Research.
system and also certification. Industries and services companies related to the industry which are running for at least one year and having no economic difficulties are eligible to this program. Since its launch, ITP approved 7951 requests for a total investment of 405 Million TND including 171 Million TND of Grants.

- **PIRD (Ministry of Industry, Energy and Mines): Prime d’Investissement à la Recherche et innovation – Grant for investment in research and innovation**: The PIRD was created in 1995 in the wake of legislation intended to support investment in activities such as R&D conducted by enterprises. It was the first research program dedicated to the needs of the enterprise. It provided a 50% grant of up to 20000 $ towards a feasibility study as well as 750000 $ towards the testing or adaptation of new technologies or the development and evaluation of prototypes. The PIRD includes now public and private enterprises as well as scientific associations, from all sectors including Health and Agriculture. The PIRD is part of the strategy of the State to raise the technological integration level of the economy.

- **PNRI (Ministry of Industry, Energy and Mines): Programme National de la Recherche et de l'Innovation – The national program of research and innovation**: PNRI is a program that finance R&D, innovation projects, improvement industrial capacities, the modernization of production processes, through the consolidation of the cooperation and the partnership between industrial companies, the research structures and the technical centers.

- **Digital Tunisia 2018 (Ministry of Technology and Digital Economy): The National Strategic Program of Digital Economy**: This project aims to move towards a new development model which favors the shift to a digital economy. This program is built around several pillars notably: enhancing the network communication technology infrastructure through enabling all Tunisian families to have access to internet services and to reach 80% of the Tunisian families by 2018; providing students with computer tablets to replace books and school supplies; in parallel with the development of digital public services and e-payment facilitation for all citizens specifically though post offices.

- **PCAM (Ministry of Industry, Energy and Mines): Programme d’Appui à la Compétitivité des entreprises et à la facilitation de l’accès au marché**: PCAM is the support program for the Competitiveness of enterprises and the improvement of access to markets. With a budget of 23 million Euros, the PCAM will benefit from the implementation of its operational structures and started its operations on 24 December 2010. The overall objective of this tool is to facilitate access of Tunisian companies to international markets.

- **PASRI (Implemented by the ANPR): Le Projet d’Appui au Système de Recherche et de l’Innovation - The Support Project for Research and Innovation System**: Is a project funded by the European Union with an amount of 12 million Euros for four years (2011-2014), it has the ambition of providing solutions to the main problems identified at the different levels and the different actors in the innovation chain. It targets the full range of institutional, administrative, financial, technical and academic stakeholders supposed to support the transformation of technical knowledge to a product, or a tangible service.

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9 Progress towards the Implementation of the National Innovation System in Tunisia, R. Chaabouni 2008
How to harness the National Innovation System
to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

- TATRAC (ANPR, European Union) Tissu Associatif et Transfert de Connaissances-Associative Network and knowledge transfer: It’s a project funded by the European Union through the IEVP cross-border cooperation program Italy-Tunisia 2007-2013. Its role is to strengthen the role of associations in the national innovation system (NIS), to enhance scientific knowledge and the sharing of best practices & to promote root growth of a strong culture of innovation;

1.2.2. Financial measures and equity funds

- RIICTIC: Régime d’incitation à la créativité et à l’innovation dans le domaine des technologies de l’information et de la communication - Incentive tool for creativity and innovation in information technologies and communication field: RIICTIC supports the projects in the innovative and high added value activities based on eBusiness.

- FOPRODI: Fonds de Promotion et de Décentralisation Industrielle - The Fund for Industrial Promotion and Decentralization: It has for object the creation of new generation of entrepreneurs, the promotion and the development of the small and medium-sized enterprise in the industrial, services and the small business sector and the implementation of incentive measures for the regional development.

- IN’TECH: Investment Grant: It’s a mutual investment fund intended to support the investment, the innovation creation and the technology development. This fund is managed by SAGES Capital, a public asset management company.

- IKDAM: Public Seed Funds: IKDAM is a seed fund that aims to strengthen the innovative activities of start-ups at the early stage. The fund operates mainly for exploiting patents, drafting technical and economic studies for projects, developing manufacturing processes, before the commercialization phase and completing the financing scheme at the early stage of the company.

1.2.3. Institutional supporters and enablers

- CDC: Caisse des dépôts et des consignations - Deposits and Consignments Fund: CDC is a public Finance group, a long term investor serving general interest and the economic development of the country. Created in 2011 with the deposit of La Poste, CDC has to invent new ways of supporting national and local public policies. It anticipates, innovates and adapts to tomorrow’s challenges. It contributes to the territory development alongside the local authorities, it invests in the service of the economy with a long term focus and participates in the economic development through its subsidiaries.

- SAGES Capital: Société d’Assistance et de Gestion des Fonds d’Essaimage—Asset management of Spin-Off Funds: SAGES Capital is a public venture capital firm specializing in investments in seed/start-ups, growth capital, leveraged buyouts, turnaround, and restructuring transactions. It invests in small and medium sized companies operating in all
business sectors with a focus on biotechnology, agri-food, solar energy and technology sectors.

1.3. The Tunisian National Innovation System map
To draw the NIS landscape in Tunisia, we adopted a referential model that puts in a single board the different stakeholders, institutions and enablers, acting from Policy Formulation on the top line, to governance, then to the policy implementation through the key initiatives or programs supporting Innovation, and positioning the interface agencies and the IP protection entities in the bottom line. The full map is drawn in the following layout -see figure 1- knowing that a more detailed list with a contacts directory is in an Excel file attached as annex to this report.

In the following, we'll introduce the main stakeholders of the Tunisian NIS with their expected roles and responsibilities within the innovation ecosystem.

A. Governance structures
Since the organic law of 1996 –full decree text in annex-, Governance and Consultative bodies have been created in Tunisia, as following:

- Le Comité de Haut Niveau pour la Science et la Technologie - The High-level committee for Science and Technology.

- Le Conseil Supérieur de la Recherche Scientifique et de la Technologie - The High Council of Scientific Research and Technology

- Le Conseil Consultatif National de la Recherche Scientifique et de la Technologie - The National Advisory Council for Scientific Research and Technology


- Le Comité Technique de la Recherche Scientifique et de la Technologie - The Technical Committee for Scientific Research and Technology.

- Conseil Stratégique de l’Economie Numérique - Strategic Council of the Digital Economy: Its role is to set up the pillars of the digital economy and lay the foundation for a true digital transformation of the national economy. This Council is characterized by its parity between the public and the private sector represented each by nine members.

The mission of these bodies, their composition and their scope of responsibility are not clear for the actors of the NIS. In fact, most of them are no more operational since the Revolution. In his report on Tunisian NIS\textsuperscript{10}, Emmanuel Hassan related that the co-existence of many Governance entities explains the weak achievement in terms of Innovation. In addition, the vertical governance mode failed to provide effective guidance, programming, and research directions within the Ecosystem, neutralizing \textit{de facto} any attempt of formulating a global

\textsuperscript{10} Etude PASRI : Diagnostique du système national de recherche et d’innovation en Tunisie. Emmanuel Hassan 2015
B. Interface Agencies

- **APII (Ministry of Industry, Energy and Mines): Agence de promotion de l’Industrie et de l’Innovation - the Agency for the Promotion of Industry and Innovation:** APII is a public establishment, which is responsible for the implementation of the Government’s policies relative to the promotion of the industrial sector and innovation. APII provides support services to entrepreneurs and enterprises. Its mission is to spread the culture of innovation among businesses by promoting programs of capacity buildings and incentives mechanisms.

- **ANPR (Ministry of Higher Education and Scientific Research): Agence Nationale de Promotion de la Recherche Scientifique - The national agency for scientific research promotion:** ANPR is a governmental agency whose primary mission is providing services to professionalize the management of research activities in partnership with the effective socio-economic operators. It plays a crucial role in interfacing and supporting the implementation of the R&D valorization process and the transfer of research results.

- **APIA (Ministry of agriculture, Hydraulic resources and fisheries): Agence de promotion des Investissements Agricoles - Agency for Agricultural Investment Promotion:** APIA is a public institution dedicated to the promotion of private investment in agriculture, fisheries and related services as well as primary processing activities.

- **BMN, Bureau de Mise à Niveau (Ministry of Industry, Energy and Mines) Industrial capacity upgrade Office.** Given the number of privileges associated with the Innovation, Tunisia has entrusted a government agency, the Bureau de Mise à Niveau, in charge of the implementation of the industrial capacity upgrade program, and operating under the auspices of the Ministry of Industry, Energy and Mines, to evaluate and deliver the certificate of Innovation to industrial companies who will apply for it. This document is needed in particular to access public funds supporting R&D and innovation.

- **BuTT: Bureau de Transfert de Technologies – Office of Technology Transfer:** It is a local interfacing structure and a skills center serving the exploitation of research results, transfer and partnership between supply and technology demand. 13 universities, research institutions, research centers and technology parks have been selected for the pilot phase of the implementation of the first generation of BuTT. Their role is to set up a structured process of IP management in support to the Technology transfer between the University and the Enterprise.

C. International cooperation institutions and enablers

- **EUD: European Union Delegation:** For 35 years, thanks to the EU-Tunisia Financial Protocol signed in 1980, the European Union has been supporting Tunisia in the fields of economy...
and trade, education and employment, agriculture, energy and environment. The delegation has the task of managing the bilateral cooperation between the EU and Tunisia, in collaboration with the Ministry of Development and International Cooperation and other sectoral Ministries. This function relates each year to a volume of order commitments of € 80 million Euros, both in payments and some 400 payment transactions. This cooperation covers both technical assistance to privatization and support for rural development, through education and sustainable development. PASRI is one of the projects funded by the European Union with an amount of 12 million Euros for four years (2011-2014).

- **GIZ: The Deutsche Gesellschaft für Internationale Zusammenarbeit**: GIZ has been working in Tunisia since 1975 and opened an office in Tunis in 1999. GIZ implements projects and programs on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) and other donors. GIZ is providing support for institution-building by partners at the national, regional and municipal level, delivering training for specialists, and strengthening regional and sectoral networks. Its aim is to strengthen participation and build democracy wherever reforms are expected to have the greatest impact. GIZ is implementing projects in four sectors: Protection of natural resources, Renewable energies and energy efficiency, Sustainable economic development and promoting employment & Regional development, local governance and democracy.

- **AFD: Agence Française de Développement – French Development Agency**: is a financial institution and the main implementing agency for France’s official development assistance to developing countries and overseas territories. AFD is present in Tunisia since 1992. Through its funds, it supports the Tunisian authorities in the implementation of transport policies, vocational training and employment, rehabilitation of popular neighborhoods, city management, access to drinking water and sanitation, rural and agricultural development and environmental preservation. It also supports the private sector through various financial tools and supports the microfinance and the entrepreneurship ecosystem.

- **AfDB: The African Development Bank**: It is a regional multilateral development finance institution established to contribute to the economic development and social progress of African countries. In Tunisia, AfDB finances projects, programs and studies in the areas of agriculture, health, education, public utilities, employment, telecommunications, the industry and the private sector.

- **WB: The World Bank Group** strategy focuses on increasing employment opportunities through transforming the Tunisian economy into a higher value-added, knowledge intensive one and is based on the following three pillars: 1. employment, growth and competitiveness; 2. sustainable development and climate change; and 3. improving the quality of service delivery. The Bank supports Tunisia through various instruments such as direct investment lending for a specific project, policy lending that goes toward the country’s budget, or through analytical support and technical assistance.

- **JICA: The Japan International Cooperation Agency**: It is advancing its activities around the pillars of a field-oriented approach, human security, and enhanced effectiveness, efficiency, efficiency, efficiency.

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and speed. In Tunisia, JICA focuses on industrial development and reducing regional disparities. It intervenes to support infrastructure development and to strengthen the economic and industrial capacity.

- **KOICA: The International Cooperation Agency of Korea**: It aims to build a better world by helping to achieve the Millennium Development Goals (MDGs) and promoting equitable and sustainable development in partner countries. KOICA tries to strengthen the capacity of Tunisia to fight against poverty and improve the quality of life.

### D. Academia and R&D Institutions

<table>
<thead>
<tr>
<th>13 Universities</th>
<th>DGET: Technological Studies Branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>38 Public research institutions</td>
<td>271 research Labs</td>
</tr>
<tr>
<td>271 Research Units</td>
<td>70 common services Units</td>
</tr>
<tr>
<td>37 Graduate schools</td>
<td>198 Higher Education and Research Institutions</td>
</tr>
<tr>
<td>Number of Students in the Public Sector (2012)</td>
<td>339,619</td>
</tr>
<tr>
<td>Number of Students in the private sector (2012)</td>
<td>17,773</td>
</tr>
</tbody>
</table>

#### D.1. Public Universities

<table>
<thead>
<tr>
<th>Université de Carthage</th>
<th>Université de La Manouba</th>
<th>Université de Tunis – El Manar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Université de Gabes</td>
<td>Université de Monastir</td>
<td>Université virtuelle de Tunis</td>
</tr>
<tr>
<td>Université de Gafsa</td>
<td>Université de Sfax</td>
<td>Université Zitouna</td>
</tr>
<tr>
<td>Université de Jendouba</td>
<td>Université de Sousse</td>
<td>Université de Kairouan</td>
</tr>
<tr>
<td>Université de Tunis</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

In addition to Universities, Academia is enriched by a network of ISETs (Instituts Supérieurs des Etudes Technologiques) that delivers degrees for initial training, vocational training in close partnership with centers of technological resources, centers of competences and business incubators.

#### D.2. Private Universities

<table>
<thead>
<tr>
<th>École polytechnique internationale privée de Tunis, Tunis</th>
<th>Institut des hautes études, Tunis</th>
<th>Université méditerranéenne privée de Tunis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecole polytechnique privée, Sousse</td>
<td>Institut des hautes études à Sousse, Sousse</td>
<td>Université Montplaisir Tunis, Tunis</td>
</tr>
<tr>
<td>École privée d'ingénieurs, Sousse</td>
<td>Institut international de technologie, Sfax</td>
<td>Université privée d'enseignement supérieur El Amel, Tunis</td>
</tr>
<tr>
<td>Ecole privée de technologies de</td>
<td>Institut supérieur des</td>
<td>Université privée de</td>
</tr>
</tbody>
</table>
How to harness the National Innovation System to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

<table>
<thead>
<tr>
<th>l’information et de management de l’entreprise (Time Université), Tunis</th>
<th>sciences infirmières ELAMD, Tunis</th>
<th>l’aéronautique et des technologies, Tunis</th>
</tr>
</thead>
<tbody>
<tr>
<td>École supérieure d'audiovisuel et de design, Tunis</td>
<td>Institut supérieur des sciences infirmières de Sousse, Sousse</td>
<td>Université privée de Sousse, Sousse</td>
</tr>
<tr>
<td>École supérieure des études administratives et commerciales, Sfax</td>
<td>Institut supérieur privé des sciences infirmières Étoile de formation, Tunis</td>
<td>Université privée de technologie, Tunis</td>
</tr>
<tr>
<td>École supérieure des sciences appliquées et de la technologie privée de Gabès, Gabès</td>
<td>Institut Tunis-Dauphine, Tunis (filiale de l’Université Paris-Dauphine)</td>
<td>Université privée des arts et du design, Tunis</td>
</tr>
<tr>
<td>Ecole supérieure privée d'administration des affaires et de droit « Avicenne », Tunis</td>
<td>Mediterranean School of Business, Tunis</td>
<td>Université privée des arts et du design, Tunis</td>
</tr>
<tr>
<td>Ecole supérieure privée d'administration et de management, Tunis</td>
<td>Université arabe des sciences, Tunis</td>
<td>Université privée des sciences, arts et techniques de Sfax, Sfax</td>
</tr>
<tr>
<td>Ecole supérieure privée d'ingénierie et de technologie (Esprit), Tunis</td>
<td>Université privée Tunis Carthage, Tunis</td>
<td>Université privée des sciences, arts et techniques de Sousse, Sousse</td>
</tr>
<tr>
<td>École supérieure privée de technologie, d’informatique et de gestion de Sousse (ESTIM Université), Sousse</td>
<td>Université centrale, Tunis</td>
<td>Université privée des sciences, arts et techniques de Tunis, Tunis</td>
</tr>
<tr>
<td>Ecole supérieure privée de technologie et de management (SUPTECH), Tunis</td>
<td>Université Ibn Khaldoun, Tunis</td>
<td>Université privée du Sud, Sfax</td>
</tr>
<tr>
<td>Université internationale de santé, Tunis</td>
<td>Université internationale de Tunis, Tunis</td>
<td>Université libre de Tunis, Tunis</td>
</tr>
<tr>
<td>Université Mahmoud El Materi, Tunis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D.3. R&D Institutions

With 14 Research Centers, and more than 18 000 researchers (full time equivalent) Tunisia counts among the countries with the best capacity in STI rather than in R&D. The later capability needs a knowledge commercialization cycle with integration of technology to scientific research achievements. The researchers are mainly focusing on their academic career and are spread over a large spectrum of public R&D institutions listed below:

| CERTE | Centre De Recherche Et Des Technologies Des Eaux |
| CRTEN | Centre de Recherche et des Technologies de l’Energie |
| CBBC | Centre de Biotechnologie De Borj-Cédria |
| CNSTN | Centre National des Sciences Et Technologies Nucléaires |
| INARP | Institut National de Recherche Et D’analyse Physico-chimique |
| INSTM | Institut National des Sciences et Technologies de la Mer |
| CBS | Centre de Biotechnologie De Sfax |
| IRA | Institut des Régions Arides De Médénine |
| INNTA | Institut National de Nutrition et des Technologies Alimentaires |
| IPT | L’Institut Pasteur de Tunis |
How to harness the National Innovation System to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

<table>
<thead>
<tr>
<th>CRMN</th>
<th>Centre de Recherche en Microélectronique et Nanotechnologie de Sousse</th>
</tr>
</thead>
<tbody>
<tr>
<td>CETIC</td>
<td>Centre de Recherche en Informatique, Multimédia et Traitement Numérique</td>
</tr>
<tr>
<td>CITET</td>
<td>Centre International des Technologies de l'Environnement de Tunis</td>
</tr>
<tr>
<td>CERT</td>
<td>Centre d’Etudes et de Recherche en Télécommunication</td>
</tr>
</tbody>
</table>

E. STI Support Organizations
E.1. Technical Centers,

Tunisia is also endowed by 12 sectorial technical centers, listed in the table below. Their role is to act as an interface between industry and public R & D, especially for projects of national interest. Specific funding mechanisms are made available through technical centers, such as the PNRI (National Program for Research and Innovation).

<table>
<thead>
<tr>
<th>Technical Centre</th>
<th>Scope / Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CETIBA</td>
<td>Wood Industry &amp; Furniture</td>
</tr>
<tr>
<td>CETIME</td>
<td>Mechanical and Electrical Industries</td>
</tr>
<tr>
<td>CTC</td>
<td>Chemistry</td>
</tr>
<tr>
<td>CETTEX</td>
<td>Textile</td>
</tr>
<tr>
<td>CNCC</td>
<td>Leather and Footwear</td>
</tr>
<tr>
<td>CTAA</td>
<td>Agrifood</td>
</tr>
<tr>
<td>CTMCCV</td>
<td>Building Materials, Ceramics and Glasses</td>
</tr>
<tr>
<td>PACKTEC</td>
<td>Packing and Packaging</td>
</tr>
<tr>
<td>4 Agriculture Centres</td>
<td>Cereals, Potatoes, Aquaculture, Organic farming</td>
</tr>
</tbody>
</table>

E.2. Certification and Calibration Bodies
- TUNAC (Ministry of Industry, Energy and Mines, Ministry of Higher Education and Scientific Research): The National Board of Accreditation: It is a public non-administrative institution. Its role is assessing and accrediting conformity assessment bodies (laboratories, inspection and certification bodies) in accordance with relevant national and international standards.

- ANCE (Ministry of information Technology and the Digital Economy) Agence Nationale de Certification Electronique - The National Digital Certification Agency: It is the root certification authority in Tunisia. It represents the highest level of trust in the field of digital certification and security of electronic transactions and exchanges. It was created according to Law no. 2000-83 of 9 August 2000 governing electronic exchanges and commerce. Via the services it provides, NDCA aims at fostering a climate of confidence and trade security on internet.
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F. Technoparks and Business Incubators

F.1. Technoparks (Pôles de Compétitivité et Pôles Technologiques)
As a support to its industrial strategy based on Innovation as a key factor of competitiveness, Tunisian government has set up since the end of the 90s a strategy of developing a wide infrastructure of Technoparks to host in the same area different actors from the Universities, R&D institutions to the Companies, called “Pôle de Compétitivité” and “Pôle Technologique” – we’ll refer to them in this report as Technoparks without any distinction. This was supposed to ignite a better cooperation between enterprises, research centers in some targeted strategic sectors in order to stimulate the transfer of knowledge and technology and strengthen collaboration across engineering R&D projects and clustering initiatives. With a specific sectorial focus, each Technopark was supposed to leverage the development of the region in which it is located. The management of each Technopark is generally ensured by a dedicated management company created under the umbrella of a public-private partnership, in order to fund the extension and the construction of the infrastructure, and to provide quality services to companies hosted in the Technopark. The network of Tunisian Technoparks is today grouped into an association; each one is positioned on a promising sector of value chain, with a competency focus on ICT, Environment, Renewable Energy, Textiles and finally Biotechnologies. Two poles have a multisector vocation.

<table>
<thead>
<tr>
<th>Pôle de Compétitivité Monastir/El Fejja (Manouba)</th>
<th>Textile &amp; clothing. Hosting the nascent Textile Cluster.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technopole Borj Cédria</td>
<td>Renewable Energy, Water &amp; Environment</td>
</tr>
<tr>
<td>Pôle de compétitivité de Bizerte</td>
<td>Food processing. Hosting Lactimed Cluster.</td>
</tr>
<tr>
<td>Pôle El Ghazela</td>
<td>ICT</td>
</tr>
<tr>
<td>Technopole de Sousse</td>
<td>Mechanical, electrical and electronic industries. Hosting the Mechatronic Cluster.</td>
</tr>
<tr>
<td>Technopole de Sfax</td>
<td>ICT &amp; Multimedia</td>
</tr>
<tr>
<td>Pôle Industriel et technologique de Gabès</td>
<td>Multisectoral</td>
</tr>
<tr>
<td>Pôle de Compétitivité de Gafsa</td>
<td>Multisectorial. Hosting the Dates Cluster</td>
</tr>
</tbody>
</table>

F.2. Business Clusters
Tunisia is still in early stage in the formation of clusters. The emergence of business clusters has formally started by the beginning the 2000s with first groups under the form of export consortia. After the release of the industrial strategy study Tunisia 2016, published by the Government in 2008, and which has retained the idea of clustering as a growth driver, several industrial networks tried to establish, in partnership with Technoparks, “innovation clusters”, in particular on three sectors deemed strategic, namely textiles and clothing, agribusiness, renewable energy and information and communication technology. The mobilization caused by the strategic study was not accompanied by the means which would then have enabled the emergence of Innovation-oriented clusters.
An IPEMED study\textsuperscript{12} shows that clustering strategy implementation took too much time in Tunisia. Therefore, some enabling interventions have been initiated by international agencies to help the acceleration of the clusters formation and their operationalization. The German cooperation agency GIZ (AgriFood Clusters), the French Development Agency AFD (Mechatronics), ONUDI (Creative Industry Cluster) massively supported some pilot projects.

For the case of Mechatronic, based in the Technopark of Sousse, the support includes R&D funding, gathering experts to work on the levers of competitiveness, including business development, training, human resources management, Technology Transfer and business intelligence.

Furthermore, reflections on methods of supporting clusters have been conducted under the PASRI program and forecast the emergence of 10-15 clusters in the coming years, in high potential sectors that will include the territoriality dimension.

Further experiments are currently outstanding, especially in the creative industries with the support of UNIDO, Renewable Energy, Textile, Biotechnology.... But they are at an early stage to have a visible impact.

F.3. Public Startups nurseries (Pépinières)

Public Startups Nurseries are infrastructure spaces dependent to the public agency APII and equipped to host entrepreneurs when they start launching a promising business. They constitute now a network of 30 nurseries distributed throughout all the territory. They are generally located in the Higher Institutes of Technological Studies (ISET), engineering schools research centers and science parks. Incubation services are supposed to be provided to incumbents in order to help them to realize their innovative ideas and transform them into operational projects. Public Startups Nurseries host for a definite period of one renewable year, and help them to relocate outside the nursery after the incubation period.

F.4. With a capacity of 250 Startups, they represent an important component of the national innovation system. The national program for the establishment of Startups nurseries incubators started in 2001. Since 2011, we saw the irruption in the ecosystem of private Business nurseries with different business models to which we’ll come back in the following chapters. Scientists Society

Tunisia has a very active civil society, and of course, the category of Scientists association is no exception. Many scientists’ associations are running for different purposes, mostly to enable extra academic initiatives. To give an idea on the maturity of the scientist society, these are a selection of NGOs focusing on Technology Transfer and Research Based Spin-offing, or that are concerned and contributing to the policy formulation on Innovation:

- **TAASTI: Tunisian Association for the Advancement of Science in Technology and Innovation:** It is a scientific association, founded after January 14, 2011. It expresses the will of its founders to participate in the national process of building a Sustainable Knowledge Society based on social justice, knowledge and sustainable development. It participates in the design and the completion of a National Innovation System by contributing to the adoption and implementation of relevant policies; the improvement of

\textsuperscript{12} Clusters au Maghreb, Paulette Pamier 2014
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higher education and scientific research & the modernization of the industry and services sectors.

- **ADRI: Association of Development, Research & Innovation**: It is a Tunisian scientific and not profit association founded April 19, 2011. Its main objective is the promotion of scientific research and technological innovation through strengthening the links between those involved in R&D and the economic environment. It develops initiatives that are boosting the technology transfer and developing synergy between the University and the Enterprise.

**AT Biotech: Association Tunisienne de Biotechnologies – Tunisian Association of Biotechnology**: It gathers scientists in Biotechnology and helps its members to improve their professional knowledge and facilitate scientific and cultural communications between them, in order to develop a vision of the future Bio-Economy. It encourages innovation through spin-offing in different areas of biotechnology in research and industrial applications.

### G. Incubators and Accelerators
#### G.1. Business Incubators and accelerators
Beside the network of Startups nurseries owned by the State, and which are switching gradually to Business incubators model, to better serve the 250 Start Ups hosted per year, Tunisia has seen the birth of several initiatives of the private sector and civil society, to support innovation. The most significant entities are the following:

- Wiki Start Up, the first private Business Incubator launched by Carthage Business Angels network and has its own seed fund named CapitalEase.
- Start Up Factory / IntilaQ for Growth Fund launched by the Telco operator Ooredoo, Microsoft Tunisia and the Tunisian-Qatari Friendship Fund (QFF).
- ESPRIT Incubator launched by the private University leader in the field of ICT in partnership with the association Tunisie Croissance, backed by Tuninvest Fund.
- Yunus Social Business the accelerator launched recently by Yunus Foundation in partnership with the African Development Bank to promote social innovation and contribute to the Social Business Development in Tunisia.

#### G.2. Business Centers
Many Business centers are available in Tunisia. Most of them are depending on regional chambers of Commerce and they offer technical assistance to entrepreneurs to set up companies, and to access public funding in particular for the enterprises that aim to boost the inland regions. It concerns the different economic sectors: industry, services, agriculture, trade, crafts, small & micro businesses and tourism.

Due to the complexity of the regulation, many foreign investors are looking for this kind of services in order to implement their projects in Tunisia. Many private Business Centers are now running and providing packed services for hosting, technical assistance, legal and tax advisory, in addition to services to support the launch and development of new ventures.
H. Business Unions and Representatives

- **INFOTICA: Fédération Nationale des Technologies de l’Information et de la Communication - The National Federation of Technologies of Information and Communication**: It works under the umbrella of UTICA, the historical official representative of employers in Tunisia. INFOTICA is dedicated to ICT sector, which counts now few hundred companies in the private sector. Its objectives are the realization of sectoral measures for the development of the ICT sector; Supporting the Industrial action, development and promotion of the different national trade associations. INFOTICA contributed to the national strategic plan Tunisie Digitale 2018.

- **CONNECT: Confederation of Tunisian Citizen Entreprises**: It's an employers' corporatist organization that has been launched after the Revolution, and that aims to bring together small; medium and large private and public companies. This organization is very active and developing many initiatives in favor of entrepreneurship. It has just launched an innovation and entrepreneurship platform. This platform dedicated to business creation is offering specialized training in business plan development, and provides support and fundraising.

I. Financing & Funding

- **CBA: Carthage Business Angels**: It is the first Angels Investors Association in Tunisia. It gathers investors seeking projects led by young entrepreneurs with an innovation project but do not have the financial means to set up their businesses. CBA began its activities in 2011. It is now considered a key player in the funding chain at the time of the overhaul of the economic development model in Tunisia. CBA's mission is also to design and implement initiatives that are impacting the entrepreneurial ecosystem and to support entrepreneurship based on innovation.

- **CapitalEase Seed Fund**: It was created in 2012 following an initiative of Carthage Business Angels and the stakeholders of Wiki Start Up in order to strengthen the funding chain of innovative projects in pre-seed and seed stages. This fund is running its second round with a target of 7 Million Euros to finance innovative projects, from support for prototyping, IP protection until the stage of strengthening the equity capital to scale up the business. It provides support for innovative companies in need of substantial equity capital to finance the industrial phase of their projects. CAPITALEase Seed Fund II targets investment on sectors identified as priorities: biotechnology, health, agribusiness, energy and Media & ICT.

- **IntilaQ for Growth**: It is a Fund of 10 Million Euros launched by Qatar Friendship Fund. It invests in projects characterized by significant competitive advantages with a strong potential for growth and development. The investment range is between 30k Euros and 200k Euros.

- **Réseau Entreprendre**: it represents an international network where experienced entrepreneurs mentor new entrepreneurs. Laureates accepted to the program receive free mentoring and are granted funding in the form of loans on trust. These are interest free and no-collateral loans that have the added benefit of helping to secure other funds, notably from banks.
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- **Tunisie Croissance**: It is a Non-Profit Organization that provides strategic assistance and financial resources to a number of Tunisian SMEs among those funded by the Tuninvest Croissance Fund and its successor Funds in order to accelerate their development on the local market and abroad. The Tunisie Croissance initiative, funded by the Qatar Friendship Fund, is promoted by the Tuninvest-Africinvest Group as a technical partner that will assist those SMEs in their development program.

**J. Agencies in charge of the IP protection in Tunisia.**

The IP rights protection procedure is attributed to different agencies, depending on the nature of the IP, e.g. Industrial Property falls under the INNORPI scope, copyright is within OTDAV, Vegetal Variety Obtainment Certificate are under the responsibility of the Ministry of Agriculture. Nothing for the Intellectual property out of these three categories and almost no local IP Advisor specialist in patent writing is there to assist inventors or entrepreneurs. This creates many barriers to knowledge dissemination and cross Opportunities innovation.

- **INNORPI**: *Institut National de la Normalisation et de la propriété Industrielle* - **National Institute of Standardization and Industrial Property**: is a public entity depending on the Ministry of the Industry Energy and Mines, with a legal entity and financial autonomy. INNORPI's mission is "to undertake any action concerning standardization, the quality of products and services and the protection of industrial property."

- **OTDAV**: *Organisme Tunisien des Droits d'Auteurs et des Droits Voisins* - **The Tunisian Agency of Copyrights and Related Rights**: It is a public agency that aims to safeguard copyright and related rights and to defend the moral and material interests of copyright owners.

At a first sight, the NIS structure shows the dominance of a vertical governance mode of the different initiatives and programs supporting Innovation in Tunisia. Each Ministry has its own strategy and agency to implement it, and there is a very few common programs, except for Digital Tunisia 2018 where many ministries are associated to implement a wide and ambitious national program of digitalization.

The high number of agencies and interface organizations proves the fragmented Innovation strategy. This fact also confirms the absence of a formal policy paper on innovation in Tunisia, and the lack of an established Innovation independent observatory to measure globally NIS performance.

Finally, with this listing, we can show a global landscape of the NIS by placing the actors and the related initiatives supporting Innovation in Tunisia in a single board shown in figure 1.
<table>
<thead>
<tr>
<th>Key Interface</th>
<th>APII</th>
<th>ANPR</th>
<th>CEPEX</th>
<th>ANCE/CNI</th>
<th>ANPE/CITET</th>
<th>ANETI</th>
<th>APIA</th>
<th>DGTI</th>
<th>Offices Dvp</th>
<th>CDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Actors</td>
<td>Technoparks</td>
<td>Universities &amp; Labs</td>
<td>eCommece Incubator</td>
<td>Technopole El Ghazela</td>
<td>Institut Pasteur de Tunis</td>
<td>CITET</td>
<td>Centres sectoriels de Formation</td>
<td>IRESA</td>
<td>State owned companies</td>
<td>ITCEO</td>
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<td></td>
<td>Technical Centers</td>
<td>BuTT</td>
<td>CERT</td>
<td>Bio Technopole Sidi Thabet</td>
<td>ONAS</td>
<td>CENAFFIF</td>
<td>INRAT</td>
<td>INS</td>
<td>BTS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TUNAC</td>
<td>CNLIDST</td>
<td>Chambres de commerce et d’industrie</td>
<td>Cifode’com</td>
<td>Research Institutes</td>
<td>APAL</td>
<td>ANETI</td>
<td>FIPA</td>
<td>SOTUGAR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ANME</td>
<td>Research Centers</td>
<td>CEPEX</td>
<td>INFOTICA</td>
<td>ANGED</td>
<td>CNFCPP</td>
<td>TTN</td>
<td></td>
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<tr>
<td></td>
<td>Laboratoire Central d’Analyses et d’Essais (LCAE)</td>
<td>TAASTI</td>
<td>CONECT</td>
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</tr>
<tr>
<td></td>
<td>Business Centers &amp; Incubators</td>
<td>ADRI</td>
<td>ANM</td>
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<tr>
<td></td>
<td>Institut National de la Consommation</td>
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<tr>
<td>IP Protection</td>
<td>INNORPI</td>
<td>DPI</td>
<td>OTDAV</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Policy Formulation</th>
<th>MIEM</th>
<th>MESRS</th>
<th>MC</th>
<th>MTEN</th>
<th>MS</th>
<th>MEDD</th>
<th>MFPE</th>
<th>MAP</th>
<th>MT</th>
<th>MDICL</th>
<th>MF</th>
<th>PG</th>
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</thead>
<tbody>
<tr>
<td>Governance</td>
<td>CNMIR / IRASS</td>
<td>Conseil de la concurrence</td>
<td>Comité National du Fléau Numérique</td>
<td>Comité National du Fléau Médicale</td>
<td>COMIQ</td>
<td>Comité National du Développement Durable</td>
<td>DUE</td>
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<tr>
<td>Policy Implementation</td>
<td>PCAM - TATRAC</td>
<td>PASRI - H2020</td>
<td>PACS</td>
<td>Tunisie Digitale 2018</td>
<td>DUE</td>
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<tr>
<td></td>
<td>Jobs &amp; Economy</td>
<td>Creative Ind. Cluster</td>
<td>Souk At-tamnia</td>
<td>CEED</td>
<td>BRCP</td>
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<td>Mecatronic Cluster</td>
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<td></td>
<td>Univenture</td>
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<td>GDEO</td>
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<tr>
<td>Public Fundings</td>
<td>PMN</td>
<td>VBR/PBF</td>
<td>FCFR essaimage</td>
<td>INTECH</td>
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<td></td>
<td>Fonds Amorçage</td>
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<td></td>
<td>BiCITIC</td>
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</tbody>
</table>

Figure 1 - NIS Mapping - see Excel File in attachment
1.4. How and why NIS is underperforming

The Tunisian NIS mapping reveals that public policy formulation and the governance are fragmented and spread over different Ministries. Some sectors like Industry, ICT or Agriculture have their own compartmented RDI value chain or Innovation system. Some other sectors like the drug industry are not supported by a specific entity in charge of innovation, neither do they have interface agency of technical center. We discovered that the Technical Centre of Chemistry is partially covering the needs of testing for the pharmaceutical sector, for instance. This confirms that there is no coherent innovation strategy, whereas the potential of innovation in the health sector and pharma industry is extremely high in Tunisia.

In addition to these facts, the support to technology transfer at the company level is poorly defined and chaotic, with a lack of sectoral eco-systems integrating R&D in one national agenda articulating the NIS policy. The number of grants that companies are benefiting each year to engage R&D was low (and it becomes even lower after 2011), as the funding of innovation became too complex and takes too much time with the proliferation of actors involved in examining cases. All the instruments dedicated to innovation would gain in obeying to a readable logic of "financing chain" under the management of a single entity, with a clear governance and funding policy in phase with the priorities of the country.

Transferring research findings to economic sectors ultimately is one of the missions of the NIS. One way to measure this transfer is to check the number of IP claims filled by the R&D institutions and companies.

The last report of WIPO shows that in 2013, the global deposits of patent applications have exceeded the 2.5 million, or 9% more than in 2012, thus showing the largest increase in almost two decades. The requests for titles of intellectual property have rebounded strongly since the decline recorded in 2009, at the height of the financial crisis.\(^\text{13}\)

Almost a third of the applications for patents concern 5 sectors called "high potential", namely, computer technology, electrical machinery & energy, measurement, digital communication, and medical technology.

Despite of the R&D capacity proved in those sectors, Tunisia figure at the bottom of the ranking disclosed in the annual report of WIPO in relation to IP filling activity by origin, cf. table 1-. Thus, Tunisia occupies the 73rd place in 2013 compared to the African countries included in this classification.

In addition, the number of patent applications (resident and non-resident) deposited in Tunisia has been of 542 in 2014, down since 2011, with a number of requests capped at 150 for the patent registered residents to the INNORPI, see figure 2. The huge gap between the number of resident and non-resident patent applications could be attributed at least to:

How to harness the National Innovation System to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

- the absence of an easy and electronic application system, this architecture still not made operational by INNORPI agency, at a macro level,
- poor coaching capabilities, at a meso level,
- and weak science diplomacy and effective incentives for inventors at a micro level

So, Tunisia appears at the bottom of the ranking of countries of the MENA region, and this despite one of the highest rates of researchers per capita.

![Graph showing the number of patent applications from INNORPI 2008 to 2014](image)

**Figure 2**

Source: INNORPI

### 1.4.1. A very low R&D investment flows

Like most of the countries of MENA, Tunisia allocated an insufficient amount of financial resources to the R&D, as suggested by the low estimated level of its expenditure of the GDP. This indicator called R&D intensity is commonly used by governments and international organizations to measure the national effort of the countries in terms of R&D. It showed an insufficient effort in terms of R&D which is mainly directed to the public sector. And for cause, the stock of researchers is relatively high and exceeds the 18000 full-time equivalents researchers in the public sector, and almost inexistent in the private sector. In addition, this growing stock of researchers is not much lower than European countries and the United States. However, the statistics on the researchers in Tunisia include a non-negligible proportion of student researchers with master and doctorate degree. These students are representing more than half of the total researchers. Moreover, most of the researchers are working in the public sector because of the low investment of large firms in R&D. The inadequacy of the national effort of Tunisia in R&D is in large part due to the withdrawal of the business sector in financing R&D and its execution, although this sector is the main contributor to the effort of R&D in many developed countries.
The funding and implementation of the R&D in Tunisia are dominantly done by the State, in opposite to the prevailing trends in the advanced economies. For example, the corporate sector in the European Union funded approximately 55 per cent of the gross domestic expenditure on R&D and executed nearly 65 % of the latter.

The results of a recent survey on the enterprises with more than five employees, led by the World Bank, revealed that a little less than a fifth of companies in Tunisia declare have invested in R&D internal or external. The withdrawal of the enterprise sector of R&D activities is even more pronounced for the smaller businesses or those who are not exporters, which constitutes more than 96% of the total number of companies in Tunisia.

In addition, it should be noted that productive sector in Tunisia is dominated by very small enterprises with less than five employees, with little money to invest in an R&D department and more generally in the innovation activities.

Since the mid-1990s, the public research sector has significantly increased its scientific production, measured by the number of scientific articles published in journals of reference. Tunisia is ranked among the main actors of the scientific production of MENA, beside Iran, Israel, Egypt, and Saudi Arabia. In addition, when this production is normalized by the number of inhabitants, Tunisia ranks before Egypt and Saudi Arabia. Nevertheless, its scientific production normalized by the size of its population is more than four times lower than Israel, the regional leader in terms of R&D and innovation, indicating a lower scientific productivity with insignificant economic impact.

The conditions in which the Tunisian economy evolved are marked by a break with the strategy called "of the economy at low cost" which uses as a source of competitive advantage tax incentives and low wages. Post-Revolution Tunisia is definitely spirited to prepare itself for a higher competitiveness level with a larger liberalization of its economy. This is particularly palpable with the imminent ALECA agreement with the European Union, which allows to make Tunisia as 14th associated country to H2020 European R&D program (first African country) and to integrate innovation strategies to empower its industry and commerce and to make the country more competitive. This puts the transfer of technologies and IP at the heart of the concern of policy makers. In particular, the Ministry of Technology and the Digital Economy, which aims to implement the program TUNISIE DIGITALE 2018 that includes more than sixty projects, mainly in PPP mode, for a total budget of 5 billion US$, ten times the annual expenditure budget of R&D in Tunisia.

The channel to higher investment in technological and scientific projects will contribute to make profits of the expenditure in the public R&D.

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14 **Horizon 2020** is the biggest EU Research and Innovation program ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

15 **Tunisia Digital 2018** aims to make Tunisia an international reference in the field of digital and information and communication technologies by implementing a Strategic National Plan containing high impact Digitization projects.
How to harness the National Innovation System to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

1.4.2. A vertiginous decline in the GCI ranking

Competitiveness is defined as a set of institutions, policies, and factors that determines the level of productivity of a country. The level of productivity sets the level of prosperity that can be reached by year for a specific economy. The productivity level determines the rates of return obtained by investments in an economy, which in turn are the fundamental drivers of its growth rates.

According to World Economic Forum, Competitiveness is a set of static and dynamic components modeled around 12 pillars that aggregate the competitiveness index as shown in figure 3.

In 2015, Tunisia decreased to the 92 position\textsuperscript{16} with a score of 3.9 in decline in comparison to 2014 where its score was 4 and the ranking 87.

\textsuperscript{16} More information on the following link
How to harness the National Innovation System to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

Although all the components of the GCI model are directly or indirectly impacted by RDI value chain, we can notice that 6 pillars over 12 are specifically based on knowledge and technology absorption capacity. The following pillars are:

- Innovation,
- Business sophistication
- Technological readiness
- Higher education and training
- Health and primary education
- Infrastructure

So, we can consider, at a first sight that GCI ranking is giving a good indication on the Technology Transfer absorption capacity, and the steady decline since 2010 is an indication that Tunisia economy is sinking and reducing its Technology investments flows.

The low performance of Tunisia in terms of labor productivity is also reflected in the entries of foreign investment. Tunisia has certainly succeeded earlier than most of the countries of MENA to attract foreign direct investment. However, the inflows of direct investment and the investments in companies leading to the creation of new physical infrastructure did not improve the productive capacities in Tunisia.

Thus, the deterioration of the competitiveness of Tunisia on the international markets and its low technological integration are emblematic of the difficulties experienced by the country.
since the Revolution. One of the aggravating facts, which exacerbated this decline, lies in
the fact that Tunisia had difficulty to recoup its investments in R&D, and to deploy a strategy
of innovation in a perspective of Knowledge Based Economy (KBE), in order to compete with
the advanced economies. Hence, creating value from first movers and developing a great
integration system in addition to strong IP rights protection with preserving natural resources,
is decisive for any strategy enabling social progress, economic growth and sustainability.

1.4.3. A weak participation in the international Value Chains
Despite its strengths, Tunisia has failed to increase its participation in the global value
chains. An important part of the exports of products is based on the foreign added value
produced by companies under the off-shore regime, and reflecting the participation of Tunisia
in segments that are not generating high added value. Tunisia is hardly positioning itself on
the global markets with its own brands, and also it is losing shares on its historically
European clothing market. Between 2000 and 2012, the growth of world exports of Tunisia in
this area has been much less rapid than the rest of the world.

The same observation could be done to the essential oils value chain. Despite its best
environmental biotope which favor extremophiles animal, plant and microbe biodiversity
(preferential source of natural products and drugs), and its R&D capability in
Biotechnologies, Tunisia is not positioned as a leader in the international marketplace,
because of the lacking of a national strategy to invest massively in the Biotechnologies
industry.

The question which arises, how to reverse this trend, and find ways to resume a competitive
position through innovation?

1.5. Industrial and commercial competitiveness based on
Innovation
When the competitive capacity of a country relies essentially on temporary or artificial
benefits (such as low wages, tax barriers or tax exemptions), there is a risk that this situation
damages the role played by the R&D as a vector of innovation in society, and to lead
ultimately to a dissatisfaction of operators. A model, based on the exclusivity of the science
and the separation of R&D results from the practice, has been promoted for years in Tunisia;
this has led to a low coordination between the world of scientific research and the productive
world. Despite the existence of numerous institutions of interface supported by activities and
initiatives of encouragement of technology transfer and an infrastructure richly endowed with
technological parks, regulatory barriers, material, financial and cultural factors have
prevented the commercialization of the results of public research.

The analysis of the value chain can be a good way to view and identify the potential for
innovation. We remember that the value chain generic contains 4 key links, namely, the
Product Design, the Market development, the Production and Distribution & After Sales
Services. The input of any Value Chain remains Science & Technology. The maturity level of
each link relies on ways we capitalize on Knowledge, which determines the competitiveness
of the sector and can give useful indications on the needs in R&D for the operators in the
sector.
To master a Value Chain, we need to master the related Science & Technology. An illustration of this approach, applied to the business case of the Olive Oil sector is detailed in the annex. It shows how many rooms for innovation there are, even in a secular and traditional value chain like Olive Oil, in different disciplines like Biotechnologies (Biopesticides, Fertilizers,), Genomic, ICT, etc.

2. The State of the Art of Technology Transfer in Tunisia

To achieve value effectively, from its public R&D capacity, Tunisia should create a National Innovation Strategy aligned with country global interest, and involving all the NIS stakeholders. This relies on linking Technology Investment flows with IP Value Stream in a business oriented process that enables the emergence of a Knowledge based Economy.

For this, Tunisia needs a higher integration level in the global economy with huge Technology investment flows, and this could be partially brought by its own R&D capacity. This represents a unique opportunity for Universities to contribute to raising a Knowledge Based Economy, which represents also a unique chance for Tunisia to solve the problem of higher education graduates unemployment. In this perspective, it must favor the development of the **technology transfer not only to consolidate industry but also as industry**, and this requires to master three businesses: commercialization of R&D findings, engineering of innovation projects and finance & venture capital.

2.1. Key drivers for a Knowledge based economy

In a classical industrial economy, these are large companies or Governments that determine the main axis of R&D and induce the major trends in Research and Innovation. This is the case, for instance, of France, who has developed its transportation industry thanks to large state owned groups that have mainly produced the needed technologies to serve the monopoly industry of railway transportation as a first targeted market. So, Alstom invested a huge amount of money to develop technologies embedded in the TGV that has been sold to SNCF first, before addressing the European and then the international markets.

In another side, in a knowledge based Economy, Technology Transfer is more than a driver, it is the Business. It requires collaboration of different entities thanks to the options made possible by ICT and developing specific processes of IP production, valuation, protection and valorization. In a KBE, IP value stream is supposed to be very fluid. What we call IP Value Stream is in fact a visualization tool inspired from “Lean Manufacturing” and means recording all the processes that are required to bring an IP from the R&D lab to the market.

Many attempts to highlight the KBE model were unsuccessfully initiated by various governments in Tunisia before the Revolution. The KBE model was justified by the dominant share of services in GDP, which reaches 60%, with a relative good technology infrastructure from one side, and a proven ability to R & D.

Inevitably, a performing KBE model unfolds into global value chains, and is structured in a quadrant of four types of services, namely, infrastructure services, support services, inter-connection services and business services.
To illustrate this, we take an example in the health care sector in Tunisia, the hospital services and in particular cosmetic surgery for foreign patients, where Tunisia has made it a specialty in recent years. This value chain activates several services provided by a number of entities that could be categorized into four types of services, namely:

- Infrastructure services which mainly concern clinics, hotels, airports ... and generally all physical facilities that allow the reception of patients with their companions, their accommodation before, during and after clinical care.

- The support services may be in this case, the flow of patients from the place of origin, including the preparation of travel arrangements and transport.

- Inter-connection Services, which in this case may cover the recovery of medical expenses from insurance companies, organizing excursions and leisure stays for accompanying and / or for patients after surgeries ... etc.

- And the core business service which is obviously the health care services and medical acts with the provision of all the necessary treatment, until the post-operative phase.

Technological and scientific capability deployed in this value chain is based primarily on the knowledge and expertise of the medical and para-medical bodies, and also on the availability of high-tech equipment required for cutting edge clinics. The other services of the quadrant also need technology to operate effectively, particularly ICT to optimize the delivery of end-to-end quality services and ensure the competitiveness of the whole value chain.

Today, the health sector in Tunisia has a huge potential of innovation, and could invest much more on Technology in particular in the periphery services around the core business, in order to attract more patients and create more value. This is in addition to the collateral effect on Pharma Value Chain and Tourism. Developing new medical devices and active biomolecules as well as biomaterials for drug delivery is a big challenge that Tunisia could win. This innovative sector is in a junction of numerous scientific domains and need to combine new technology and life science to solve medical issues, commonly called cross-fertilization.

This is where the NIS is expected to play a key role in boosting or connecting some specific sectors where the ground is fertile, in order to enable entrepreneurship in innovation, with a focused strategy of Technology Transfer that contributes to the foundation of a KBE.

2.2. Research findings & knowledge commercialization

Generally, in the case of University R&D commercialization, four main ways to transfer research findings co-exist, namely:

- Assignment of rights through licensing
- Collaborative research projects
- Through spin-out (or spin-off)
- By technological integration (or spin-in)
How to harness the National Innovation System
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To assess the State of the Art in Technology Transfer, we refer to the R&D commercialization cycle represented by the four stakes model, along with the IP value stream milestones. See the following chart-

![Figure 4: Commercialization cycle](image)

In regard to the long term cycle of the knowledge commercialization, various types of grants have been created in Tunisia, as described in the NIS mapping, but with a mitigated impact and almost no IP Valuation through an entrepreneurial approach.

Observations in the ground and discussion with researchers and key players raised several findings concerning the commercialization of knowledge, and of which we will mention those that affect technology transfer, in particular:

1. Innovation Policy is not clear / readable for all stakeholders and it’s not involving freedom to operate strategy
2. A sectorial dichotomy and a cutting between Hard Science, Soft Science, ICT & Agriculture detrimental to the formulation of a comprehensive innovation strategy for the country.
3. A weak governance and overlapping scopes of works by certain entities in the NIS
4. A first experience launched Technology Transfer Office almost in parallel by the ANPR and INNORPI. Both did not produce the expected outcomes and failed to boost Technology Transfer.
5. Difficulty to import technology at the R&D stage even for companies leading engineering innovation projects in Tunisia
6. Low capacity and lack of resources for applied research
7. Under operation and poor maintenance of heavy scientific equipment in public research laboratories due to the status and conditions of public procurement.
8. STI observatory & market intelligence still in the rudimentary stage with fragmented R&D databases
9- Dominance of compliance over efficiency to adhere to government innovation support programs with red tape in the processing of files
10- Non accounting for R&D costs and investment grants thereunder by companies
11- Difficulty for University labs to capitalize on IP value, and to transfer it as equity in the RBSO
12- The patenting processes and IP rights protection process is not mastered.

To determine the causes of the failure of the technology transfer process, which manifests through the weak protection of IP and very low investment flows in technology, we will use the FMEA tool\(^\text{17}\). By feeding this tool by all the collected observations, cf. table below, the Effects were separated from the Root Causes, through a breakdown articulated around 5 modes, namely:

- Methodology & process
- Material & Tool Box
- Marker Data & Environment
- Management & Governance
- Motivation & competencies

The FMEA tool applied to the deficiencies of the Technology Transfer process returns in the following table:

<table>
<thead>
<tr>
<th>Process</th>
<th>deficiency</th>
<th>Failure Modes</th>
<th>Effects</th>
<th>Root causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methodology &amp; process</td>
<td>very few cases of knowledge commercialization and licensing</td>
<td>No clear strategy with an inadequate process of IP protection and valorization</td>
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<tr>
<td>Material &amp; Tool Box</td>
<td>weak commitment and no result orientation</td>
<td>unreadable Innovation policy and confusing financial incentives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Data &amp; environment</td>
<td>scarce interaction between University and entreprise</td>
<td>No understanding of the IP value stream</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management &amp; governance</td>
<td>low Business intelligence &amp; strategy planning</td>
<td>No dedicated resources and well trained staff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market Data &amp; environment</td>
<td>local companies trapped in low added value and weak competitiveness</td>
<td>No market orientation and no consideration of the value of information (cultural mind set)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management &amp; governance</td>
<td>no alignment around specific objectives and no shared innovation scorecard</td>
<td>inadequate organization with a fragmented governance and no clear criteria for decision-makers</td>
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<td></td>
</tr>
<tr>
<td>Motivation &amp; competencies</td>
<td>no return in investment for academic research sector</td>
<td>No intermediary business and no gratification for inventors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management &amp; governance</td>
<td>weak entrepreneurial dynamic and scarce RBSO generation</td>
<td>Rigidity of rules and confusing regulation on researchers mobility</td>
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</tr>
</tbody>
</table>

**Table 2**

Finally, the FMEA analysis shows that promoting the Technology Transfer from university labs calls for a formal Innovation policy, and a more readable IP strategy, with dedicated resources and means, with a structured governance on the NIS, and a more favorable legal frame for researcher’s mobility and innovation financing.

\(^{17}\)Failure Mode and Effect Analysis tool
2.3. How University could promote Innovation

In a competitive and globalized world, the ability to create innovative products and companies is crucial for promoting rapid structural changes. Universities and other public research institutions are the main source of innovation backed by soft-infrastructure and enabling global environment.

Research Based Spin-Off (RBSO) generation is the result of the process of creating a Startup which seeks to commercially exploit a patent, technology or a scientific finding from a University or Research Institution, which usually requires the involvement of the Researcher(s) for the IP value stream.

Spin-offs are one measurable metrics of tech transfer b/t public and private sectors. Spin-offs are an important indicator of the ability of countries to monetize the knowledge developed by the public R&D.

According to OECD, Research Based Spin-Off –also called Research Based Business- is an innovative Start Up company that has at least one of the five following characteristics:

- Founder(s) include public sector employees
- Key technology is licensed from public sector institution
- Founder(s) include public sector students or alumni
- Physically located in public-sector incubator or science park
- Equity investments were made by public sector

2.4. University Technology Transfer as KPI of the NIS

Most universities and research institutes subscribe to the definition of transfer of technology given by the Association of University Technology Managers (AUTM) in the US, namely that is the "transfer of scientific findings by an organization to another, for purposes of development and commercialization."

This transfer is generally effected by means of a contract under which the university or research institute grants a private company or a public agency marketing a license over intellectual property rights.

The last survey of the AUTM on Licensing Activity (2014) highlights the following achievements in the USA:

- 549 executed licenses containing equity (up 17%)
- 914 startup companies formed (up 11.7%)
- 4,688 startups still operating as of the end of 2014 (up 11.4%)
- 965 new commercial products created (up 34.2%)
In Tunisia, several factors are "repellents" for innovators, particularly the chaotic financing chain and the hostility of the business climate. We will see in the following section, a particular form of knowledge dissemination and technology transfer that deserves to be promoted in Tunisia. It brings the possibility to not only orient graduates toward entrepreneurial trajectory where that can address social and economic challenges by a valuable asset of knowledge and Technology, but to also valorize the public investments on R&D, namely the Research Based Spin-Off. As the entrepreneurial ecosystem is being enforced with the implementation of specific incubation programs such as Univenture.org -a pioneering RBSO generator who is now at his 4th edition- there is a true opportunity to make a consistent strategy for the Research Based businesses.

**2.5. The RBSO generation events**

An RBSO is primarily an opportunity for innovation that has been identified and structured around a vision and a mission by one or more researchers. Its survival depends on the realism of the idea and perseverance of the project team. The good understanding of risks and the adequacy of the promoters with the project features are among the prime factors of success. The human capital, ethics and committed characters are considered as the main asset for this kind of enterprises. Inventing can be a professional work, whereas entrepreneurship is a vocation that requires a broad spectrum of technical and human skills. An entrepreneur needs training, mentoring and specific workouts to manage the complexity of an innovation project, predict and anticipate risks, be equipped with suitable means to understand and meet dynamic market needs. Learning about the risk and constraints, the number effect as well as the people effect is decisive for the project success.

Experience shows that innovation success is awarded to the teams that have been able to control the entire IP value stream and adapt their innovation strategy to the market reality to build up a sound business model.

**a. Proof of feasibility**

In the case of innovative project where the expected competitive advantage relies on an "invention", we often have to go through a preliminary phase called feasibility or "Proof of Relevance".

During this phase, the project team should bring together all the elements to validate the technical and economic benefits of innovation and anticipate the real market competition. Techniques are utilized to assess the potential impact of the invention and its "sustainability" in a competitive and dynamic environment. After confirming feasibility, IP strategy will be formalized at this stage, knowing that IP constitute in the vast majority of cases, the capital of the researcher, co-owned with the original research laboratory.
b. **Proof of concept**

Preliminary analyses validated by professionals are tilted from the laboratory to the company, developing a "model", a "prototype" or a "Beta" version of the product or service that may be exposed to the market. The more valuable will choose to go through an incubator, which will help him to mobilize adequate funding. The proof of concept also produces a first tangible result that refines IP strategy and value based on the market potential.

c. **Proof of market positioning**

It is imperative at this stage, to develop a business strategy, and to check that the new product or service has a competitive advantage in the targeted market, with a well-protected IP. We must prove that the market is scalable and we will be sure to sell what they will produce. The valuation of IP depends on expected cash flows generation. The technological validation of the product or the service can be proved from the first market tests. We can therefore derive the greatest visibility by soliciting the help of networks of experts and professionals for advice on business strategies for a sustainable expansion of the project.

d. **Proof of scaling up**

The first contact with the market is an invaluable source of useful information for the viability of start-ups. Before moving to industrial production, it is necessary to raise the needed capital for the business plan execution and to operate policy adjustments on the investment plan.

2.6. **The tough and dissuasive procedure of Spin-Off formation in Tunisia**

A specific attention has been dedicated to establishment of conditions for horizontal mobility of researchers, public agent and workers, between the sector of research and higher education on one side and the business sector on the other.

By collecting the regulations, all issued before the Revolution, we could reconstruct the administrative procedure governing the scientific spin-off formation in Tunisia. The various links that make up the course of the researcher who wants to create his start-up from his research findings are described in figure 5.
### 2.7. A no probative initial experience of BuTT (University TTO)

In Tunisia, the management of the IP value stream process was supposed to be entrusted to BuTT\(^\text{18}\). This experience launched by ANPR / PASRI started in 2012 and is still in its infancy. The early failures certainly came from the market disconnection, but mostly from the weakness of the mobilized resources to create this industry.

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\(^{18}\)Bureau de Transfert de Technologies (University TTO)
Here is the range of services expected to be provided by the BuTT managers, often reduced to an inexperienced person facing alone dozens of researchers and R&D themes.

- Supporting the voluntary patent filing
- Enabling the access to information (no Patents & Patents)
- Facilitate administrative procedures and access to authorities
- Strengthen IP protection strategy of the University
- Assisting Lab to contract with Enterprises
- Non-Disclosure policy management
- Managing the relationship with the TT and IP protection stakeholders
- Monitoring traceability deposits / recordings
- Managing IP claims, patents and licensing contracts portfolio
- Market analysis and business analysis
- Reporting and publishing key facts and achievements

2.8. A burning need for an IP rights protection policy in Tunisian Universities

There is not a formal IP policy in the Tunisian universities and no referential for IP value stream management process, despite attempts initiated by Butt to standardize certain steps. The IP value stream management process from the qualification of the opportunity to post patenting remains uncontrolled and inefficient, with the exception of IPT (Institut Pasteur de Tunis) that relies on an international network of Instituts Pasteur, headquartered in Paris, and contributes to a more effective way to master IP value stream in the field of vaccines.

2.9. The Institut Pasteur de Tunis case

The Institut Pasteur de Tunis (IPT) is a public health organization and scientific research center. It also produces some vaccines and is considered as a leading innovative institution as it has an effective Tech Transfer Office (named C2VT2) that manages a PCT patents portfolio, filled with the support of the international network of the Institut Pasteur.

The Tech Transfer Office of IPT is named C2VT2 which is the acronym for “Cellule de Communication, de Veille et de Transfert de Technologies”. This means that IPT Tech Transfer Office is dealing with communication and business & technology intelligence in addition to the Tech Transfer process itself. The staff is formed by three highly qualified people in Tunis, backed by a staff based in different branches of Institut Pasteur in the World, and in particular the IP office in Paris, who is partnering with IPT and providing his support in the following areas:

- Evaluation of potential inventions
- IP patenting
- Publication and marketing of the new technology
- Technology valuation and research funding
- Monitoring patent application and licensing deal
- Administration of the IP portfolio

2.10. A referential for IP Value Stream management process to be adopted

Before going any further in the evaluation of practices in the IPP management, we present a generic model that covers all activities of a value stream IP management processes, based on a model in use by an active US firm in the field of IP valuation\(^\text{19}\). This measure allows gaps identification in each stage of the process from the perspective of IP users.

![Figure 6](http://www.ipcg.com/?file=IAM_Process#Processes)

**a) Planning and Motivating**

This stage involves the identification of potentially recoverable IP deposit by industry or by a working R & D, both through technology transfer. It involves working with structured technological and strategic intelligence.

**b) Creating and Acquiring**

IP is an asset to value through a competitive advantage development strategy based on technology. To target the correct IP required for new product or service, it is necessary to map the perimeters Patent and Patent No, to acquire the right IP in a risk management and ROI logic.

**c) Documenting**

The information support (patentable and non-patentable information) is critical in preparing an IPP folder. The choice of fields of investigation and anticipation of strategic information required for a decision of acquiring or protecting a right over an IP is based on the timeliness, completeness and relevance of technology watch.

**d) Reviewing**

The review of the IP portfolio and its impact on the areas/topics of strategic interest for the beneficiary ensures the alignment of the innovation strategy with IP strategy. A particular interest on start-ups operating in the field of predilection may be included in this review.

e) Protecting
There are several possibilities for IP protection, in addition to the patent, there is also the trade secrets and defensive publications. How to optimize the IP protection is a recurring issue that must be addressed with the help of specialists and most of the time with external experts.

f) Extracting Value and Measuring
The value increases if the related IP has a concrete application in new product or service that generates cash flows. Capitalizing on IP also increases its value and incorporates as asset in the company's capital. In order to measure the value of this asset, several methods exist, and must be apprehended with care before opposing them to potential funders.

2.11. Protecting IP rights and mastering the IP Value Stream

The IP law in Tunisia is quite comparable to that applicable in the world. Laboratories have incentives to patent their IP, and are likely to obtain financing, especially for the territorial extension through a patent application by way of a PCT filing. The inventor-researcher can receive compensation of between 25-50% on the exploitation of the patent after deduction of related expenses (Tunisian Decree No. 2001 to 2750 of 26 November 2001).

Tunisian agency INNORPI is responsible of the examination of IP protection applications but its services are limited to industrial sector and to the applicants having already a preliminary examination report delivered by the European patent office (EPO). In practice, they deliver only a basic form of examination, with no substantive investigation on novelty or inventive step or patentability, as they are not issuing any research report.

Despite some effective attempts, such as IPT who is at the same time an R&D institution and a vaccine manufacturer, the experience showed that there were a very few interactions between the Public R&D institution and industry, which explains the weakness of IP protection claims and low Technology investment flows. Thus, we can list the following impediments to IP value stream:

- Absence of high-quality research results suitable for patent protection,
- Low awareness of both research workers and whole institutions with their management of the intellectual property protection purpose;
- No adapted or trained staff / actors
- No coherent and formal referential procedure
- No management of the IP portfolio in relationship with industrial beneficiary
- No technological & business intelligence data base
- No adapted Financing vehicles
- No practice of IP valuation by the Labs with a lack of experts for searching and identifying the commercial potential of R&D results and leading new technologies based projects
- No budget to manage an IP Value Stream accordingly

2.12. **In-Depth work required to set up IP Strategy within companies**

Technological capability of an organization is composed of a variety of sources of knowledge and experiences. Some are subtle and intangible, such as inventions. Others are embodied in equipment, machinery or infrastructure, while others are carried by human skills. The role of TTO should be consolidated by intermediate businesses able to address the IP demand through an assessment of Technological capability and to identify and formally qualify innovation opportunities, in a specific sector, in order to provide solutions based on either collaborative project or IP licensing from R&D institutions.

Finally, the implementation and success in this area remains dependent on the ability of Technology Transfer, which is an industry that requires mastering three businesses: finance and venture capital, engineering innovation projects, valuation and protection of intellectual property.

However, very few companies in Tunisia have an IP strategy with a formal IPP management process in place, and even less are assessing their technological capability in order to plan their investments. These usually orient their efforts on ad hoc IP patenting and licensing operations, with no overarching IP strategy guidance. Supporting the benefits of developing an IP strategy will affect positively the NIS global performance, and this will require a more deliberate and methodical process.

A national program to help companies to formulate an IP strategy and establish formal IP protection processes based on patent and non-patent information search that will lead to a sustainable innovation capacity and will upgrade competitiveness level is required. This service does not yet exist in Tunisia and could enter in the prerogative of the ANPR with the help of the TTO network.
3. Main gaps and deficiencies

Coordination between all National Innovation System actors and the linkages for technology and knowledge flow between them is key for the country innovation performance.

To master the NIS performance based on a systemic approach, it is necessary to reinforce two capabilities.

- **the intrinsic capability**, where actions should focus on solving the identified root causes of the Tech Transfer deficiencies seen in a previous chapter, through
  - the cognitive capacity
  - market data collection and business intelligence
  - setting up an IP Value Stream framework in parallel with the IP rights protection procedure

- **An extrinsic capability**, where actions should focus on the triptic formed by the Strategy, the Actors and the Environment (see matrix analysis in the next chapter) which should lead to enhancing the following elements:
  - Innovation Policy formulation and assessment
  - R&D absorption rate of the ecosystem
  - Industrializing Technology Transfer through RBSO and Collaborative Projects

Concerning the intrinsic capacity, the usual KPI are mainly related with R&D production dimension (expenditures, number of scientists, publications, patents ....), in both public and private organizations. This is to be completed by other dimensions, such as the IP inventory (patents and no-patents) and value, the R&D Data Base, the IP portfolio and its valorization.

As for extrinsic capability, it mainly covers the NIS’s ability to create an environment in which it can progress. It contains qualitative and quantitative dimensions, such as strategic alignment with the broad guidelines of the country strategy, or the absorption capacity of R&D by the ecosystem, the total investment in Technology transfer...etc. This supposes a National Balanced Scorecard for the NIS.

Research and innovation systems in the world are experiencing profound changes, and it turns out that the most effective systems are those that deploy cross-sectoral processes operated by networks of institutions, public agencies and private sector. The expectations are now very high for an Innovation strategy, supported and implemented by the whole stakeholders’ representatives. These latter must send in a clear way the following non-exhaustive principles:

- The major policy directions of the future development model are based on innovation, with exposure of general strategies focusing on key sectors and couples of Technologies / market segments to be promoted as a priority.

- Characterization of the scope of State intervention, and fields of general Interest in innovation, in order to stimulate synergies between stakeholders.

- Identification and development of crucial sources of information for use in monitoring of projects and programs that will come from strategic planning, but also of science and technology foresight to anticipate the trends and needs of the future.
- The Innovation Policy assessment will be entrusted to a specific entity, responsible for strategic planning and steering through a transparent and inclusive governance model.

- The instruments of incentives to R&D, and more generally those who are affecting the IP value stream in all forms, from acquisition, disposal of licenses, spin-off formation, will take into account the responsibility of the State in promoting standards in the industry of technology transfer, to sustain competitiveness in local and international markets.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Actors</th>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information is key for innovative businesses. Crafting the Innovation strategy for the next decade and launching a Big Data Bank for each strategic value chain.</td>
<td>Staffing high level competencies to be able to provide world class services and investing on a National IT system to manage the NIS processes.</td>
<td>A National Innovation Policy with a friendly regulatory frame for innovators, entrepreneurs and investors.</td>
</tr>
<tr>
<td>An ambitious national program that involves all incubators and accelerators to induce a large dynamic of innovation in partnership with all stakeholders of the NIS.</td>
<td>Hiring a high level team to design and implement the national program and to set up a Competencies Center to train all the stakeholders of the NIS.</td>
<td>Setting up a global governance on the National Innovation System and a specific governance for the National Program under the hat of PPP.</td>
</tr>
<tr>
<td>A referential for the IP Value Stream with a framework to enable IPP process management and tech transfer.</td>
<td>Re-focusing the scope of work of BuTT on IP and partnership with local and international organization to share resources and experience in different fields such as Engineering, IP Valuation, patent writing....</td>
<td>Developing Technology Transfer offices, Incubators, Innovation Centers, Prototyping Labs under the hat of PPP.</td>
</tr>
</tbody>
</table>

Finally, it is necessary to communicate the choices and motivations that led to public innovation policy, and disclose the criteria of its evaluation, to ensure stakeholders appropriation, and mobilize them in the implementation. To shift into the Innovation based competitiveness, some decisions, articulated around the trypptic Strategy / Actors / Environment will help to bridge the encountered first gaps.
3.1. Proposed solutions and recommendations

It’s clear that Tunisian NIS needs a deep reengineering of its architecture and Governance to play a key role in setting up a knowledge-based Economy, in concordance with the challenges the country is facing in its long and critical economic and social transition induced by the Revolution.

As mentioned earlier, Tunisia needs a formal Innovation policy, and a more readable R&D strategy, that could increase the Technology absorptive capacity of the entrepreneurial ecosystem, with structured governance on NIS organization and programs, with a more favorable legal frame for researchers’ mobility and innovation financing. This could be implemented through the following framework:

Global Governance with a formal Innovation Policy

One global Governance structure in charge of Policy formulation on STI, with a theory of actions based on the four impact chains, namely:

- Interactions among enterprises, primarily joint research activities and other technical collaborations;
- Interactions among enterprises, universities and public research institutes, including joint research, co-patenting, co-publications and more informal linkages;
- Diffusion of knowledge and technology to enterprises, including industry adoption rates for new technologies and diffusion through machinery and equipment;
- Personnel mobility, focusing on the movement and the training of technical personnel within and between the public and private sectors.

A readable STI strategy

- Clarifying IP policies within Universities and R&D institutions, with formal rules of ownership on research findings
- Encouraging the knowledge commercialization, in particular through RBSO.
- Incentive systems for researchers at universities to include IP commercialization activities.
- Prospecting outputs and developing strong linkage with industry through Tech Transfer consultants and experts.

Adapting the regulatory framework for a more efficient and effective Governance

- Reviewing the Governance structures to withdraw the fragmentation of the NIS;
- Integrating IP as a class of asset to be managed by each University and consolidated within a National Tech Transfer Office;
- Introducing incentives to encourage Researchers’ mobility and RBSO

Placing the IP Value Stream in the core process of the NIS

- Setting up a referential for IP value stream process
- Increasing the IP awareness in the country.
- Developing Business intermediaries to deal with IP protection services.
- Improving the general awareness level of IP in Tunisia;

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- Incentives to boost the Tech Transfer as Industry which should produces market data and Science & technology intelligence
- Managing the IP as a class of asset to be commercialized through an Intellectual Venture System (IT and Big Data system)
- Allocating a portion of the R&D budget to Applied Research

**Easing the access to R&D funds and Innovation financing**

- Establishing institutionalized ways of technology transfer funding via incubators, innovation centers, clusters or techno parks;
- Grouping public funds in a global Innovation Fund aligned with the IP value stream;
- Promoting private equity industry and business angels funding;

4. **In conclusion**

We come to the conclusion that the components of the Tunisian NIS are not truly interdependent and interconnected to formulate or execute an innovation policy at national level. Moreover, the IP Value stream process is not mastered and consequently, it does not enable the valorization of the R&D and Technology Transfer.

To overcome these impediments, there is a room for ANPR, as the STI promoter, to undertake the Innovation Policy formulation, and to translate it into a formal and readable strategy for all stakeholders. This should be accompanied by a review of BuTT competencies and mission, in order to re-focus on their primary role on IP protection process management, under the supervision of the future National Tech Transfer Office.

As for the Technology Transfer as Industry, there is a clear opportunity for Tunisia to promote its R&D capacity, and to develop an expertise in Tech Transfer engineering projects with local and international partners. This could be done with the private sector, but should rely on a mastered IP asset management system.

The last but not the least, reconciling the different sciences, as well as the integration of ICT in the value chain of STI, notably through open data and eGov, represent an incredible opportunity for enhancing the innovation capacity of Tunisia. Information on IP is itself a new discipline that deserves a place in the NIS. Breaking down sectorial walls and building up bridges through the NIS would make the economy much more performant and innovative, once the strategic orientations of the country in terms of development model are clarified.
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6. ANNEX

1. Tunisian NIS mapping and directory (Excel File in attachment)

2. Loi d'orientation n°96-6 du 31/01/1996, (Law related to STI).

Chapitre Premier : des objectifs et principes

Article premier. - La recherche scientifique et le développement technologique constituent un enjeu civilisationnel et un choix stratégique fondamental pour le développement intégral. L'Etat veille à la mobilisation de tous les moyens humains, scientifiques, techniques et matériels nécessaires à la recherche scientifique et au développement technologique dans le cadre des principales priorités nationales ainsi qu’à la mise en place du cadre nécessaire à la participation des particuliers, des institutions et des entreprises publiques et privées aux activités de recherche scientifique et de développement technologique et à leur encouragement.

Art. 2. - La politique nationale de recherche scientifique et de développement technologique vise, notamment, à :

- orienter la recherche scientifique et le développement technologique en vue de stimuler le développement de l'économie nationale et lui permettre de s'adapter aux mutations mondiales.

- assurer la diffusion de la culture scientifique et la promotion de la création et de l'innovation au sein de la société et contribuer à l'enrichissement des connaissances dans le domaine des sciences humaines, sociales et exactes.

- renforcer la formation des chercheurs dans tous les domaines de la connaissance au sein des établissements d'enseignement supérieur et de recherche et des établissements publics de recherche.

- établir un cadre approprié favorable à l'innovation et au développement au sein des divers secteurs et organismes.

- stimuler les activités de coopération et de partenariat entre les établissements publics de recherche scientifique, les établissements d'enseignement supérieur et de recherche et les entreprises économiques et encourager leur ouverture sur l'environnement économique, social et culturel.

- assurer la valorisation des résultats de la recherche et leur application en vue de satisfaire les besoins économiques, sociaux et culturels conformément aux priorités nationales.

- veiller à assurer l'adéquation entre les défis du progrès de la connaissance scientifique et le respect de l'éthique et des valeurs humaines.

- impulser la coopération internationale en matière de recherche scientifique et de développement technologique dans les domaines d'intérêt commun, conformément aux priorités nationales.

Chapitre II

De la coordination, du suivi et de l'évaluation

Art. 3. - La politique de recherche scientifique et de développement technologique est arrêtée dans le cadre des choix essentiels du pays et compte tenu des besoins nationaux. Elle fait l'objet d'un suivi au niveau de son exécution, d'une évaluation des activités de recherche ainsi que d'une coordination entre les divers programmes publics, de recherche et de développement technologique. La coordination des activités de recherche, leur suivi et leur évaluation sont effectués sur la base du principe de la globalité dans la conception et de la complémentarité dans l'exécution.

Art. 4. - II est créé auprès du Premier ministre un conseil supérieur de la recherche scientifique et de la technologie chargé, notamment de :

- suivre l'évolution du secteur et donner son avis sur les orientations générales de la politique nationale de recherche scientifique et de développement technologique en fonction des besoins du pays.
- proposer les mesures tendant à la promotion de la recherche scientifique et du développement technologique.

La composition du conseil supérieur de la recherche scientifique et du développement technologique et les modalités de son fonctionnement sont fixées par décret.

Art. 5. - Il est créé un comité national d’évaluation chargé de l’évaluation des activités de recherche scientifique quant aux programmes, aux projets et aux résultats. Il procède également à l’évaluation des établissements publics de recherche ainsi que des programmes de recherche des entreprises privées qui bénéficient d’avantages et d’aides de l’État en vue de leur encouragement à promouvoir la recherche scientifique et le développement technologique. A cette fin ledit comité national procède, dans le cadre des évaluations sectorielles, à la création de commissions spécialisées.

Le comité national d’évaluation de l’activité de recherche est rattaché au ministère chargé de la recherche scientifique et de la technologie. Sa composition et les modalités de son fonctionnement sont fixées par décret.

Chapitre III

Des établissements de recherche et du personnel de recherche

Art. 6. - Les activités de recherche scientifique et de développement technologique sont entreprises par les établissements publics de recherche scientifique ainsi que les établissements d’enseignement supérieur et de recherche visés par la loi n°89/70 du 28 Juillet 1989 relative à l’enseignement supérieur et à la recherche scientifique. En outre, l’État encourage les établissements et entreprises publics et privés ainsi que les associations à caractère scientifique et les particuliers à participer à la recherche scientifique et au développement technologique.

Art. 7 - Les établissements publics de recherche scientifique sont des établissements publics à caractère administratif dotés de la personnalité civile et de l’autonomie financière. Leur budget est rattaché pour ordre au budget de l’État. Ils peuvent également être des établissements publics à caractère industriel et commercial soumis à la législation commerciale à l’exception des dispositions de leur loi de création. La tutelle de l’État sur les établissements publics visés à l’alinéa précédent du présent article est exercée conformément à leur loi de création et à la législation en vigueur. L’organisation scientifique, administrative et financière des établissements publics de recherche scientifique est fixée par décret.

Art. 8. - Les activités de recherche scientifique sont organisées au sein de laboratoires de recherche et d’unités de recherche dont l’organisation et les modalités de fonctionnement sont fixées par décret.

Art. 9. - Les établissements publics de recherche scientifique à caractère administratif comportent un conseil d’administration comprenant, notamment, des représentants des ministères concernés, des chercheurs et des organismes économiques, sociaux et culturels intéressés. Ils comprennent en outre un conseil scientifique comprenant, notamment, les chefs de laboratoire et des représentants des chercheurs ainsi que des experts.

Art. 10. - Ont pour charge de réaliser les activités de recherche au sein des établissements publics de recherche, les personnels permanents de recherche, les personnels contractuels et les personnels détachés soumis à la législation en vigueur. Lesdits établissements œuvrent pour encourager les opérations de recrutement par contrat et par détachement dans le cadre des projets de recherche qu’ils réalisent.

Les contrats de recrutement fixent la durée et les tâches ainsi que la rémunération des chercheurs. Les contrats sont soumis au ministère de tutelle pour approbation et deviennent exécutoires dès leur approbation. Le détachement est opéré conformément à la législation en vigueur.

Art. 11. - Les grands équipements de recherche sont mis à la disposition de tous les chercheurs dans les conditions fixées par des conventions passées à cette fin avec les établissements concernés et soumises à l’autorité de tutelle pour approbation.

Chapitre IV

Des résultats de la recherche

Art. 12. - Il est créé au sein des établissements publics de recherche scientifique des unités spécialisées chargées des relations avec les organismes économiques, sociaux et culturels, de la valorisation des résultats de la recherche et de l’institution d’un partenariat scientifique et technologique avec les établissements d’enseignement.
supérieur et de recherche et avec les entreprises économiques. L’organisation et les modalités de fonctionnement desdites unités sont fixées par décret.

Art. 13. - Il est créé au sein des établissements publics de recherche des unités d’information et de documentation scientifique chargées de la diffusion de l'information scientifique et technique et de la documentation. L’organisation des unités est fixée par le décret prévu à l’article 7 de la présente loi.


Art. 15. - Au cas où l’État participe au financement de recherches conjointement avec un établissement public ou privé tunisien ou étranger ou avec des organisations nationales ou internationales ou pour leur compte, les modalités d'attribution de la propriété de l'invention ainsi que les avantages qui découlent de l'exploitation de ladite découverte, sont préalablement fixées en vertu d’une convention conformément aux principes visés à l’article 14 de la présente loi.

Chapitre V

Des incitations et encouragements

Art. 16. - L’État peut accorder des encouragements financiers aux établissements et entreprises publics et privés ainsi qu’aux associations à caractère scientifique qui procèdent à la réalisation de projets de recherche et de développement technologique conformément à des conditions fixées par décret. Les dispositions de l’article 42 de la loi n° 93/120 relative au code d’encouragement aux investissements sont étendues aux établissements, aux entreprises et aux associations visés à l’alinéa précédent.

Art. 17. - L’État peut octroyer des encouragements financiers aux auteurs de publications et aux créateurs dans le domaine de la recherche scientifique et du développement technologique dans les conditions fixées par décret.

Art. 18. - L’État, les établissements publics de recherche scientifique ou les établissements d’enseignement supérieur et de recherche procèdent à l’octroi d’avantages aux personnels de recherche imputés sur les produits de l’exploitation industrielle et commerciales de leurs inventions dans les conditions fixées par décret.

Le chercheur peut exploiter son invention ou sa découverte pour son propre compte lorsque l’État renonce à ses droits relatifs à l’invention ou à la découverte. La déclaration de renonciation est prononcée par arrêté motivé du ministre concerné et du ministre chargé des finances.

Art. 19. - Les contrats passés conformément à l’article 10 de la présente loi avec des chercheurs tunisiens résidant à l’étranger peuvent comporter des avantages lorsqu’ils sont invités à assurer l’encadrement de recherches ou à participer à des projets de recherche entrant dans le cadre des priorités nationales.

Chapitre VI

De la coopération internationale

Art. 20. - Les établissements publics de recherche scientifique et les établissements d’enseignement supérieur et de recherche visés à l’article 6 de la présente loi agissent en vue de renforcer leurs relations scientifiques avec les établissements de recherche des pays étrangers et des organisations internationales en vue de tirer un profit mutuel des résultats des recherches scientifiques. Ils encouragent l’invitation des chercheurs tunisiens ou non tunisiens travaillant à l’étranger ainsi que l’envoi des chercheurs tunisiens à l’étranger à l’effet de mettre au point ou de réaliser des projets de recherche communs.

Art. 21. - Les établissements publics de recherche scientifique et les établissements d’enseignement supérieur et de recherche visés à l’article 6 de la présente loi agissent en vue de participer aux programmes de recherche internationaux et notamment, ceux parmi eux qui entrent dans le cadre des principales priorités nationales de recherche.
3. Business Case: Tech Transfer opportunities in the Tunisian Olive Oil Value Chain

With an average annual production of 120,000 tones, Tunisia is the largest producer of olive oil outside of the European Union and one of the five best producer countries (with Spain, Italy, Portugal and Greece). It is estimated that more than 65 million is the number of olive trees which cover 1.68 million hectares representing 30% of the arable area in Tunisia. This surface has placed Tunisia\(^{20}\) in the second rank after Spain which covers almost 19% of the world's surface dedicated to the culture of the olive tree. The culture of olives plays an essential role in the social and economic life of Tunisia and represents almost 15% of the total value of the final agricultural production. The international trade in olive oil represents 50% of the total agricultural exports and 5.5 per cent of global exports, making it the fifth largest source of foreign exchange earnings for the country.

The olive sector (culture of olives, industry of olive oil) represents the livelihood directly or indirectly for more than 1 million people (including 269,000 direct jobs) and generated 34 million working days per year, equivalent to more than 20% of the employment in the agriculture sector.

\(^{20}\) Source [www.Tunisia-oliveoil.com](http://www.Tunisia-oliveoil.com)
How to harness the National Innovation System
to enable Technology Transfer and strengthen the Innovation capability in Tunisia.

In 2014/2015, the production of olive oil has experienced a historic record by exceeding 280,000 tones, thanks to an exceptional rainfall. The production is assured by 1517 mills, having a capacity of press of 28,000 tons per day. In spite of the change toward the modernization of the processing, the traditional mills (52 %) always exceed slightly the equipment of modern treatment (48 %). Modernizations of the sector, coupled with the improvement of cultural practices have led to a better product and a larger quantity.

The transformation also includes 14 refineries; however, only a small part of their activity is devoted to the olive oil, due to the low demand for the refined olive oil. There are also 14 plants of extraction of olive pomace which operate below their capacity and 35 factories of modern packaging, which have been consolidated in recent years and which have provided major efforts to amplify the expansion of the sector.

The culture of olives has also been involved in the development of the regional balance because it remains the only crop possible in the less favored regions. This helps to keep people in rural areas who, otherwise, would feel the negative shock of the depopulation.

Going back to the Carthaginians empire, the tradition in this sector has created an old know-how and infrastructure well suited. The competitive advantages associated to the olive oil sector Tunisian are:

The capacity of production: an olive tree can take more than twenty years to produce at full capacity. With more than 65 million olive trees producers, Tunisia is in a situation of domination by capacity. But the dependency to climatic factors makes this domination very fragile. In fact, the rainfall may vary the harvest of more than 50 %. In addition, the atomization / the size of farms does not allow economies of scales.

Moreover, only 75000 ha on 1.69 million are certified Bio. It is less than 5% of the agricultural area.

The variety of the product: Mainly associated to the quality of the soil and to the variety of olive trees. Tunisia has several varieties of olives which are one of the richest in the world. This fact is recognized by the main competitors, such as Spain and Italy, who choose the Tunisian varieties to mix with their local oils and sell under their own brands. There are not a lot of consumers of olive oil "made in Italy" who know that a large part is in fact Tunisian. Similarly, this sensory richness is not valued on the local market, which is content to buy a standard product, Olive Oil, without reference of the “terroir” or the variety.

Setting the selling price for the Tunisian consumer added to the weakness of the supply circuits and traceability deteriorated the quality of the product at local market.

Processing Capacity: The installed capacity far exceeds the annual production. In theory, the total production of olives can be pressed in 7 days by the mills in service in the country. Clearly the Olive Oil activity is seasonal; this obliged the extraction factories to dispose of excessive capacity. In fact, the bottleneck lies in the supply chain. The farms are small sizes, the farmers do not have the means to harvest and store. Moreover, the logistic costs in the pipeline olive oil are of the order of 24% (or half of the value added).
In exports, the steps of product design, distribution and international marketing are not very developed in Tunisia. This is supported by the fact that more than half of the production of olive oil is sold as “convenience” via the National oil office.

Despite the strong position of Tunisia, the international olive oil market goes through significant changes, which may constitute a threat to the Tunisian pipeline. Among the factors of change induced by the heavy trends of the market we find ourselves:

**Evolution of the modes of consumption:** consumers of olive oil are more and more conscious of these beneficial properties for the health and the style of Mediterranean cuisine is more and more popular in the world.

**The introduction of “improved” varieties**, which is inserted into a logic of productivity via an intensive agriculture.

**Reconfiguration of distribution channels:** The distribution is controlled by large supermarket chains, which have the power to choose the marks spread in their linear. They have also invested heavily in the promotion of their brands of distributors (MDD). For example, the Australian supermarkets control 50% of the total volume of imports of olive oil, and show a clear preference for the Italian and Spanish oil.

**Innovation opportunities to increase the added value added in Olive Oil industry**

If we consider the international value chain of the olive oil, we remark that the activities that provide a large added value\(^{21}\) are in production and in marketing stages. Then, activities with the highest impact on expenditure can be found in the distribution and logistics steps. The development of new competitive advantages is therefore linked to the acquisition of new skills and competencies in the last three steps, but also in developing new derivatives, new applications and new opportunities for the sector. The following paragraphs analyze the crucial components in the olive oil industry where Tunisia could create competitive advantages based on innovation and intellectual property.

**The management of trademarks and the AOC**

A crucial component of the olive oil sector in Tunisia would be to strengthen the presence of the Tunisian trademarks in the international markets. This includes the development of a Tunisian Quality Label leaned on the AOC. Creating a trademark becomes critical in international markets because of the increasing weight that consumers give to the marketing elements of the product. The know-how necessary to the management of brands is located in the international agencies of communication. They possess knowledge and experience required for the positioning of the products in various international markets.

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\(^{21}\)The added value of an activity measured by its contribution to the price paid by the consumer.
**The development of new applications.**

Thanks to its beneficial characteristics, the alternative use of olive oil in the medical products, para-pharmaceutical and cosmetics would provide new niches and opportunities for exportation. The development of these niche markets are resulting in the production of new products based on olive oil, such as essential oils and concentrates. As in several other sectors, the Tunisian strategy is based on partnerships with international firms to benefit from "ready-to-use solutions" in different areas. This doesn’t encourage the development of new products due to the disconnection to the market. The possibility of developing new products is linked by the development of an access to international markets capacity, the services of big consulting firms and manufacturers of specialized materials in the olive oil sector.

**Expertise in supply chains traceability**

The challenge would be for Tunisian distributors to control the entire supply chain of the olive oil. A distributor has a capacity to deliver a finished product, conforming to the quality, in good quantity, with the right information associated. For example, the arrangements for supply of a brand of products intended for a large chain of supermarkets include the certificate of origin since the farm up to the packaging and delivery to warehouses. This requires a capacity to control, of the whole supply chain, and a capacity of management of information on the packaging. However, the Tunisian logistics infrastructures are very expensive compared to other countries. A study done by the World Bank has shown that the cost associated to logistics is 24% of the export value of olive oil.  

What is lacking today is the availability of know-how in managing the whole Supply Chain and traceability which remain very underdeveloped in Tunisia.

The implementation of these competitive advantages requires R&D activities in areas such as biotechnology, genomics, environment, energy, IT... associated to innovation strategies based on the actors of the Tunisian Olive Oil, notably via the scientific spin-offs.