

WATER-ENERGY-FOOD NEXUS INNOVATION TO ADDRESS SUSTAINABILITY AND FOOD SECURITY IN AFRICA

Tunisia Case Study Report

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Acronyms

ACET	African Center for Economic Transformation
AFD	Agence Française de Développement
AfDB	African Development Bank
ANETI	Agence Nationale de l'Emploi et du Travail Indépendant
APIA	Agence de Promotion de l'Investissement Agricole
APII	Agence de Promotion de l'Industrie et de l'Innovation
CBT	Central Bank of Tunisia
CSR	Corporate Social Responsibility
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
IoT	Internet of Things
PPP	Public Private Partnership
R&D	Research & Development
RDI	Research, Development & Innovation
TABC	Tunisia Africa Business Council
TND	Tunisian Dinar
TTO	Technology Transfer Office
UNIDO	United Nations Industrial Innovation Organization

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Executive summary

Industrial Innovation based on the Water Energy Food (WEF) Nexus has the potential to significantly contribute to the food security and sustainable development in a context of climate change Africa. By introducing new technologies, industrial practices and approaches WEF nexus innovation can enhance agricultural productivity, ensure resource efficiency, and promote social progress and economic growth while minimizing environmental impacts.

In the specific case of Tunisia, where the challenges of a climate transition are forcefully imposed, WEF Nexus innovation could be induced by a dynamic and diversified economic fabric, along with an advanced public research. This already showed pioneering success cases of advanced agricultural technologies, such as precision farming, vertical farming, hydroponics and bio pesticides local production. These methods optimize land and water use, increase crop yields, and reduce environmental impact, while contributing to higher food production and enhanced food security. It also enables efficient use of water, energy, and other resources in agricultural production. Precision irrigation systems, for example, can deliver the right amount of water directly to plant roots, minimizing wastage. Energy-efficient machinery and renewable energy sources can also reduce the environmental footprint of agriculture.

In parallel, digital transformation in agribusiness can improve various stages of the food value chain, including post-harvest handling, processing, storage, and distribution. This reduces food losses, ensures better quality, and enhances access to markets, contributing to improved livelihoods for farmers and other stakeholders. Application of digital technologies, such as remote sensing, data analytics, and mobile apps, can provide farmers with real-time information on weather conditions, market prices, and best practices. This empowers farmers to make informed decisions and optimize their operations.

The Tunisia case illustrates the relevance of the WEF Nexus innovation, and also the need for a stronger collaboration between governments, the private sector, research institutions, and local communities, to harness its full potential.

In conclusion, WEF Nexus Innovation is crucial to address climate change challenges. It's not only about technology but also about favorable policy support to take the most of it. In this paper, we'll demonstrate that building a performing ecosystem between research institutions, governments, public and the private sectors can lead to the development of a conducive environment for innovation to thrive and drive positive impacts on food security and sustainable development.

1. Introduction

Tunisia is among the African countries that have a respectable innovation potential. The country is ranked 73rd out of 132 countries in the Global Innovation Index 2022, with a score of 27.9 Tunisia ranks 4th in Africa and 7th in the Arab world. Based on its industrial background, Tunisia has the potential to accelerate its industrial transformation in the Agribusiness to face the challenges imposed by climate change and its devastating effects on the food supply chain. As part of its regional integration with EU, climate transition is part of the Tunisian government agenda, with all what it involves in terms of needs to reduce greenhouse gas emissions, sustainable practices adoption.

More specifically, this report investigates ways in which innovation can accelerate the green transition in Tunisia by integrating Water Energy Food Ecosystems nexus approach. The potential is very high as many efforts are needed at the following levels:

- Ensuring Energy Efficiency: WEFE Nexus innovation can lead to advances in the design and implementation of more energy-efficient technologies in the industrial and residential sectors. This can include advanced technologies for energy management, LED lighting, thermal insulation, etc.
- expanding the use Clean and Renewable Energy: WEFE Nexus innovation can drive the development and implementation of clean and renewable energy sources, such as solar, wind and hydropower.
- Harmonizing Agriculture and Resources management to help modernize agriculture using sustainable farming techniques, efficient irrigation systems and natural resource management methods. This can help build resilience to the effects of climate change.
- Waste management and circular economy: WEFE Nexus innovation can encourage the establishment of more efficient waste management systems and promote a circular economy by promoting recycling, reuse and waste reduction.
- Technologies for monitoring and adaptation: Innovation can also play a crucial role in the development of technologies for monitoring and adapting to climate change. This could include weather monitoring systems, accurate climate forecasts and adaptation strategies for vulnerable sectors.
- Education and awareness: Innovation can be used to raise awareness and educate citizens and businesses about the challenges of climate change and the actions they can take to reduce their carbon footprint.

Importantly, climate transition requires a holistic and coordinated approach, involving government, business, civil society and citizens. WEFE Nexus innovation can play a vital role in providing technological solutions, but it must be accompanied by favorable policies, financial incentives and a collective will to contribute to the fight against climate change consequences.

2. The manufacturing industry in Tunisia

An export-oriented manufacturing industry has been the spearhead of Tunisia's development strategy since the 1970s. A model based on an on-shore / off-shore dichotomy succeeded to attract foreign direct investments (FDI) and made Tunisia a pioneering country in Africa in terms of exportation of manufactured products, particularly in the textile and automobile components sectors which remain labour intensive. On the other hand, the local on-shore industry has become denser and more diversified, but without taking off, given that it depends on a small local market and suffers from exorbitant logistics costs. However, an exception is visible in the agri-food and construction sectors where there are large competitive companies that export internationally.

During the last decade, the added value of the manufacturing industry in Tunisia has increased slightly in dinars (see table 1), but its share in the GDP has decreased from 30.54,% in 2011 to 21.68 % in 2020¹. Going deeper, we note, apart from the agri-food sector and to some extent for the electromechanical components sectors (mainly for the automotive and aerospace industries), a drop in the added value of all the other sectors, including the textile, wearing and leather industry, the manufacture of chemicals or again the construction industry.

	2015	2016	2017	2018	2019	2020
Agriculture, forestry and fishing	8267.1	8123.6	9166.8	11172.6	11819.5	12179.8
Extraction of crude petroleum and natural gas	3049.9	2623.2	2778.9	3503.7	3445.6	2454.9
Mining	504.4	521.5	520.2	492.3	630.3	470.7
Manufacture of food products, beverages and tobacco products	2981.4	3063.8	3315.3	3720.9	4094.3	4276.8
Manufacture of textiles, wearing apparel and leather	2419.9	2581.1	2886.4	3311.0	3511.1	3011.0
Manufacture of refined petroleum products	148.7	62.5	32.3	37.9	30.3	86.4
Manufacture of chemicals	903.2	1009.9	1107.9	1205.1	1324.6	1216.5
Manufacture of other non-metallic mineral products	988.3	1004.9	989.9	1142.8	1192.6	1108.4
Manufacture of electrical equipment, machinery and equipment	3536.4	3758.4	4330.4	4892.9	5225.5	4737.1
Other manufacturing	1603.9	1677.7	1824.5	2091.4	2232.7	2013.0
Electricity and gas supply	948.0	1158.0	792.0	447.4	547.9	1122.1
Water supply; sewerage and waste management	497.2	528.2	576.4	607.2	640.3	652.4
Construction	4776.8	4886.9	4945.1	5309.4	5700.3	4718.9
Wholesale, retail trade and repair	10342.4	11005.9	11907.0	12957.6	14012.9	13705.8
Transportation and storage	5310.2	5490.0	5660.9	6311.6	6691.0	4612.3
Accommodation and food service activities	3167.0	3246.9	3672.0	4304.8	4927.6	3389.5
Information and communication	2554.7	2713.4	2822.2	3261.6	3483.6	3368.2
Financial and insurance activities	3048.3	3238.3	3855.6	4378.8	4912.5	4951.9
Public administration and defence	9016.8	9844.4	10677.8	11371.1	12539.7	14072.3
Education	5424.2	6162.1	6851.1	7009.8	7644.7	8567.3
Human health and social work activities	2824.4	3164.6	3388.5	3707.9	4158.8	4446.0
Other market service activities	5258.7	5530.4	5885.8	6476.7	7130.3	6522.3
Activities of households	5763.2	6253.9	6504.1	7121.9	7790.7	7901.4
Activities of membership organizations	224.7	238.5	255.2	278.4	301.2	288.8
Sub-total. Market service activities	67541.5	70168.8	75425.5	84932.2	91881.1	84981.9
Sub-total. Non-Market service activities	16018.1	17719.0	19320.6	20182.3	22107.1	24892.0
Total of Value Added	83559.5	87887.8	94746.0	105114.6	113988.1	109873.9
Taxes net of subsidies on products	6242.6	7399.1	7265.5	7870.9	8590.3	9652.4
Gross Domestic Product (GDP)	89802.2	95286.9	102011.5	112985.5	122578.4	119526.4

Table 1: Added value by activity sector current prices (in million TND). Source National Statistics Institute

¹ <https://donnees.banquemondiale.org/indicateur/NV.IND.TOTL.ZS?locations=TN>

After having played a role of economic and social locomotive for several decades, the Tunisian manufacturing industry is today confronted with the threat of de-industrialization. This is due to exogenous factors like the Covid-19, but also endogenous ones due to a certain inaction during the last two decades. Stagnant productivity, weak job creation and fragile positioning in the global value chains are attesting the inconsistency of the industrial policy.

The off-shore regime, which has benefited from tax and customs privileges and has been a major asset in attracting FDI and consolidating the Tunisian economy by boosting employment and foreign trades, did not succeeded to entail a dynamic of technology transfer to local industry which has remained trapped in the model of subcontracting with low added value, showing over time a loss of competitiveness.

3. Overview on the agriculture sector

The agriculture and fisheries sector is of central importance to Tunisia given its contribution to income generation, food security, job creation and regional balance.

According to the National Institute of Statistics (INS), the added value of the agriculture and fishing sector represented 11% of GDP in 2019. This added value rises to 14.5% if we add the Agri-business industry. The evolution of value added by sector reveals that agriculture is among the most resilient sectors given that its contribution varied between 9% and 12% over the period 2011-2019. The Agri-business industry also proved to be resilient and stable, recording a contribution of around 3% over the entire period. According to the World Bank, the agricultural sector represents 13.80% of jobs in 2019, and arable land represents 16.8% of the Tunisian territory in 2018.

APIA's indicators show that Tunisia recorded US\$ 178 million (TND 475 million) of private agricultural investment during the first eleven months of 2021, an increase of 26.5% compared to the same period of 2020. These investments are reflecting a positive reaction for the incentives dedicated to agriculture in the new Investment law of 2016.

The food balance displays a positive balance of 13.3% in 2021 against a positive balance of 5.8% in 2020. Food exports represent 9.3% of total exports in 2021 while food imports represent 10.3% of total imports of the same year². Main exportations are Olive Oil representing 36.6 % of food Exportations in 2021, followed by dates which represent 15.3% and sea products representing 13.3% in the same year. Main importations are represented by cereals which reached 52% of food importations in 2021 and vegetable oils representing 9.8% of food importations. Despite the encouragement dedicated to agriculture in the new investment law, the new agricultural policy is slow to stand out from the old policy and to release the potential of this sector.

² Source: ONAGRI Dashboard, December 2021

The World Bank report “The Unfinished Revolution” published in 2014 argues that Tunisia does not have an agricultural policy but a food security policy, which goes against the potential of its agricultural sector.

Indeed, the agricultural sector support policy aims to guarantee sufficient and stable incomes for farmers, protection against fluctuations in international prices, self-sufficiency for certain products and affordable consumer prices for first necessity products. This policy is based on a set of public measures and interventions on the internal market (direct administration of production prices and control of inputs prices used by the agricultural branch; constitution of public stocks; subsidies and tax incentives for private investment, processing premiums, etc.) and border measures (import or export authorisations; export subsidies; customs duties, etc.)³.

Financial instruments are compartmentalized in silos and attributed to technical supervisory ministries which cooperate very little together. However, the agricultural sector benefits indirectly from the incentives for industrial innovation mentioned above, either through the extension of markets and investments attracted by agribusiness along the value chain, or through the development of a supply by start-ups (cf. example of biopesticides or the robotization of farming and harvesting). Agriculture has of course its own innovation incentives, mainly fiscal and largely marked by State intervention both upstream and downstream of several sub-sectors. This has maintained a sector dependent on subsidies and concealing the conditions and factors of competitiveness. This interventionism has also obscured the country's limits in terms of water resources and arable land.

4. Development policies and food security in Tunisia

In Tunisia, public policies are not formally transcribed and are generally encrypted in laws and decrees issued by different ministries, which makes their understanding and interpretation a difficult exercise. As a result, development policies are dispersed among different administrative departments and agencies that are not accountable for overall impact and performance.

Considering the incentives provided by the new law on investments (see summary below) and those offered by the customs' code as well as the transversal law for improving business climate⁴, Tunisian economy has opened up to greater liberalization and tends towards greater integration into the world economy. Nevertheless, It seems that the economic sphere has still not reacted positively to the various reforms undertaken. This is because investment is very sensitive to political stability and the business environment. Some areas in sharp decline in Tunisia since the so-called unfinished Revolution⁵, which has even worsened with the pandemic.

³H.E. Chebbi, J.-P. Pellissier, W. Khechimi, J.-P. Rolland. Rapport de synthèse sur l'agriculture en Tunisie. [Rapport de recherche] CIHEAM-IAMM. 2019, pp.99. hal-02137636

⁴ The transversal law to improve business climate was promulgated on May, 29, 2019

⁵ <https://www.worldbank.org/en/country/tunisia/publication/unfinished-revolution>

Tunisia has succeeded in integrating many good resolutions into its legal literature but it blatantly failed to implement them. During the period of dictatorship, the school of power functioned well, at least for a minority of economic players. Today, the wavering of governance considerably affects decision-making circuits, and consequently encourages corruption.

It's clear that Tunisia needs a radical change in its public administration to be able to implement a new development policy. Restoring investor confidence will also give hope for the youth, so that they stop leaving the country each year, in search of a better world.

Abstract of the incentives offered by the new Investment Law promulgated in 2016:

- Total freedom of foreign equity participation for offshore companies,
- reduction in the number of authorisations and review of the relevant specifications,
- freedom of access to land ownership for the realization of the investment,
- guarantees to the investor in compliance with international standards for equitable treatment and for the protection of industrial and intellectual property,
- freedom to transfer funds (profits, dividends and assets) abroad,
- possibility to hire 30 % of foreign executives during the first 3 years by simple declaration and 10 % thereafter with 4 executives guaranteed in all cases

All the conditions enacted in this 2016 law are linked to regulatory criteria where the role of the administration remains central to guide the management of privileges and exceptional treatment. However, the true law of attraction of investments is that of the market. Many opportunities are found in advantageous local value chains, which are just waiting to be exploited, notably through technology transfer and industrial transformation. Thus, innovation deserves a greater place in the formulation of development policies in Tunisia, in order to increase its attractiveness and initiate a new entrepreneurial dynamic open to both international and national investors, including the youngest.

a. Main challenges

Since independence, governments have been obsessed with exercising national sovereignty over agricultural land (it is still forbidden for a foreigner to own agricultural land in Tunisia), guaranteeing food security while ensuring employment to a large section of unskilled labor to be retained in the inland regions rich in arable land. Making agriculture competitive has always been relegated to the background ahead of social imperatives. The agricultural yield was rather done on the basis of bulk export and the capture of the price differential between local varieties and international ones.

This has led to a situation where Tunisia exports the best it has in terms of olive oil and in return imports much cheaper palm oil for its local market. In addition, it is not uncommon to see the price of olive oil sold in Tunisia more expensive than the price observed on international markets. The olive oil value chain remains under-industrialized. More than 90% of the total production of olive oil is sold in bulk, the rest in bottles under a commercial brand. There are several reasons for this, but the main one remains the imposition by the State of a fixed price on the local market, the ban on imports and the monopoly of the Office de l'Huile in the export of bulk olive oil. Promoting the industrialization of the sector, from farming, irrigation, harvesting to pressing, packaging and distribution would boost WEFE Nexus innovation and give more added value to a strategic sector for the country.

Despite an awareness of the urgency of adopting a renewed vision of the agricultural policy, it is having difficulty in being materialized. This increases the complexity of the challenges to be met, as the new agricultural policy must face a major challenge, i.e industrialization and digitization, in addition to the ones constantly raised in different reports and studies, such as:

- i. adaptation to climate change, in particular the scarcity of water resources
- ii. improving productivity and quality
- iii. consolidating competitiveness
- iv. meeting growing food safety requirements (certification, traceability, etc.)
- v. increasing attractiveness of the sector for youth employment
- vi. Improving governance and public agencies effectiveness

With the health crisis and more recently the war in Ukraine, these challenges along with food self-sufficiency concerns have become even more pressing. Tunisia would benefit from implementing a new agricultural policy as soon as possible. These challenges require a mid and long-term development policy focused on the productive transformation of the sector through the improvement of know-how and technological integration through WEFE Nexus innovation. In fact, those challenges could be met under a systemic and innovative approach only.

b. Productivity and technology linkages

Admittedly, initiatives such as Bureau de Transfert de Technologies (BuTT)⁶ or MOBIDOC⁷ on the public side, and spin-off generation programs such as UNIVENTURE⁸ on the private side, have made it possible to break down some barriers, but they remain quite modest in terms of scale up because of budget limitations.

Extending the analysis to the innovation process proved that the relationship between productivity and technology is not factually established in Tunisia. It is even the opposite. Integrating the technology often justifies a price increase, to amortize the investment more quickly. The reasons for this are multiple, but the main one remains the difficulty in accessing financing, and if so, with prohibitive rates, making depreciation times longer. There is also the phenomenon of market competition distortion. Government is imposing its control on sensitive businesses and maintaining quasi-monopoly situations where operator greed trumps customer satisfaction. An anecdote to illustrate this point, the uberization of the urban mobility value chain. Technology integration here is supposed to improve supply-side (driver) performance, while reducing demand-side (passenger) costs. Exactly the opposite is happening, at least on the transport cost side. The BOLT company, for example, which operates in Tunisia with a business model similar to UBER, displays fares up to 50% more expensive than a taxi stopped on the fly. In addition, this service is only open to taxi drivers, private drivers still do not have status in Tunisia, and therefore cannot enter the competition.

In the field of agriculture, the situation is even more confusing. Most of the agriculture based value chain is under government tariff control. All harvests of fresh produce must pass through the central wholesale market, which sets the distribution prices. The margins are so low that farmers, the vast majority of whom have farms of less than 10 hectares, are unable to make any savings, and still less investment. and make it profitable. Moreover, the digital divide often affects rural areas more acutely which makes technology integration out of reach. In the field of agriculture, the situation is even more confusing. Most agricultural production is subject to government tariff control. All harvests of fresh produce must pass through the central wholesale market, which sets distribution prices. Margins are so low that farmers, the vast majority of whom own farms of less than 10 hectares, are unable to reap the benefits and invest in improving quality and productivity.

However, technological innovations are beginning to spread, and offer solutions within the reach of smallholders thanks to innovative economic models, as is the case of Smart Irrigation proposed by Ezzayra Solutions, presented later in the case study. But as the digital divide still affects rural areas in a significant way, this still makes technological integration beyond the reach of a large part of the farmers.

⁶ Bureau de Transfert de Technologie / Tech Transfer Offices

⁷ Researchers mobility program funded by the EU

⁸ Incubation program dedicated to Research Based Spin-Offs operated by Wiki Start Up in PPP with the Government

With weak agricultural sectors, it is difficult to imagine a competitive agrifood industry. The Poulina Group, a leader in the food industry for more than 50 years, owes its success to vertical integration of the entire value chain. This group masters the entire production, processing and distribution industry of the poultry sector. It also produces the animal feed necessary for its activity, by-products such as ice cream, packaging and even equipment to ensure the cold chain. Diversification and technology transfer have been the ingredients for the success of this group, whose WEF Nexus innovations have made it possible to strengthen its competitiveness and its internationalization (it is currently present in Libya, Morocco, China, etc.).

5. About Water Energy Food (WEF) Nexus concept

The concept of "Water-Energy-Food Nexus" refers to the interconnection and interdependence between water, energy and food in the context of sustainable development. WEF Nexus innovation can play a crucial role by offering integrated solutions that optimize the use of resources while minimizing environmental impacts. Here is how WEF Nexus innovation can contribute in each of these areas:

Water: innovation can offer advanced technologies and systems for sustainable water management. This can include more effective water purification and desalination methods, rainwater harvesting and storage systems, precise and efficient irrigation techniques (such as drip irrigation), as well as intelligent water management systems for a more rational and reduced use of water resources.

Energy: innovation can support the transition to clean and renewable energy sources, such as solar, wind and hydro power. It can also contribute to the development of more advanced energy storage systems, such as high-performance batteries, which better balance energy supply and demand. The energy efficiency of industrial processes can be improved through innovative technologies and the implementation of energy saving practices.

Food: innovation can drive advances in agricultural and food production. Innovative cultivation methods, such as vertical farming and aquaponics, can optimize the use of water and energy resources while increasing yields. Supply chain and distribution technologies can be improved to reduce food loss and ensure a sustainable food supply.

6. WEF Nexus approach to boost industrial innovation potential

Tunisia has several assets that can be exploited to meet the challenges of the Water-Energy-Food nexus and to address the climate transition more generally. Here are some of these advantages:

Abundant solar resources: Tunisia enjoys significant sunshine throughout the year, which makes it a favorable place to develop solar energy projects. Harnessing solar energy can help meet the country's energy needs while reducing greenhouse gas emissions.

Wind potential: The coastal regions of Tunisia have considerable wind potential. Wind energy can be an important source of renewable energy, complementary to solar energy, to meet the growing demand for electricity.

Water resources management: Tunisia has developed skills in water management, particularly in the area of efficient irrigation. Modern irrigation techniques, such as drip irrigation, can be implemented to optimize water use in agriculture.

Diversified Agriculture: Tunisia has a variety of climatic and agricultural zones, allowing it to grow a range of food products. This diversity can foster a sustainable and resilient agricultural approach to climate change.

Strategic geographical location: As a Mediterranean country, Tunisia is well placed to take advantage of regional cooperation initiatives in terms of sustainable development and innovation. It can benefit from knowledge and technology transfers from neighboring countries.

Skilled workforce: Tunisia has a skilled workforce in technical and scientific fields, which can facilitate the implementation of innovative projects related to climate transition and the Water-Energy-Food nexus .

Commitment to Sustainable Development: Tunisia expressed its commitment to the Sustainable Development Goals and the Paris Climate Agreement. This commitment can foster the implementation of policies and projects aimed at reducing greenhouse gas emissions and promoting sustainable practices.

However, it is important to note that despite these strengths, Tunisia also faces challenges such as water management in a context of water stress, the need for investments for the implementation of innovative technologies and the integration of different policies and sectors to ensure a successful transition to a more sustainable future. A collaborative approach between governmental, industrial, academic and civil society actors will be essential to fully exploit Tunisia's assets in the field of climate transition and the Water-Energy-Food nexus.

Furthermore, WEF Nexus innovation can also promote integrated approaches that address the interactions between these three areas in a synergistic way. For example :

Co-generation and energy recovery: Waste-water treatment plants can use co-generation processes to produce both energy and heat from waste, while treating waste-water.

Smart and sustainable farming: Smart farming systems can combine water and energy management with food production to optimize yields while minimizing environmental impact.

Reuse of by-products: Agricultural and industrial waste can be transformed into energy sources or ingredients for animal feed, thus contributing to the reduction of waste and the creation of a circular economy.

Industrial innovation in the Water-Energy-Food nexus requires a multidisciplinary approach involving collaboration between the public and private sectors, scientific research, technology and expertise in sustainable development. This can not only help solve the complex challenges related to these vital resources, but also build the resilience of systems in the face of increasing pressures from climate change and population growth.

Information gathering and policy perception have been made through focused group discussions and direct exchanges with key stakeholders. The analysis was synthesized by the authors and reflects the feedback and testimonials collected during the period of February and March 2022 in Tunisia.

7. Consolidating WEF Nexus innovation ecosystem by clustering strategies

Tunisia is still in the early stage in the formation of WEF Nexus Innovation clusters. The emergence of clusters formally started by the beginning of the 2000s with first groups under the form of export consortia. After the release of the industrial strategy study Tunisia 2016, initially released by the Government in 2008, 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 in three sectors deemed strategic, namely textiles and clothing, agribusiness, renewable energy. The information and communication technology sector is considered as the fourth pillar of the clustering strategy. The mobilization caused by the strategic study was not accompanied by the means which would have enabled the emergence of Innovation-oriented clusters.

An IPEMED⁹ study shows that the 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) and UNIDO (Creative Industry Cluster) massively supported some pilot projects.

⁹ Institut de Prospective Economique du Monde Méditerranéen

The interest of clustering resides in the capacity to facilitate the interaction within the innovation ecosystem, and providing a collaboration framework in nascent sectors driven by technology (biotechnology, artificial intelligence, machine learning, etc.).

Within the framework of the Support Program for the Research and Innovation System (PASRI)¹⁰ The National Agency for the Promotion of Scientific Research (ANPR), in collaboration with the General Directorate for Industrial and Technological Infrastructure of the Ministry of Industry, have supported the formation of productive clusters in six so-called priority regions.

The objective of this action was to support interfacing structures in the assembly and integrated management of Productive and Innovation Clusters in local value chains. Agro-industry is one of them and significant funding from different grantors (AFD, GIZ, ...) has been mobilized to prove the concept and increase interaction and cooperation between companies belonging to the same sector, R&D organizations, support agencies, local administration, etc.

It's a major cultural shift. For a long time, agriculture was seen as the sector of losers or people who failed in their education. Today, there is renewed interest in agriculture by a generation of investors who have gone through the industry and who arrive with means that predispose them to innovate.

The first cluster's model that was adopted is the commercial one. It aims to syndicate commercial efforts and expand the market reach. In that category, some initiatives can be cited, such as Réseau AgroTech (Pôle de Compétitivité de Bizerte)¹¹, Agritech Tunisie-Sénégal (GIZ) and the Cluster Huile d'Olive Nord-Ouest¹².

A second model based on innovation, whose objective is to industrialize and promote new products and services on the market has been experienced, with the support of institutional grantors. The example of Agripreneurs 3.0 (APIA-ANETI)¹³ or IPM4CITRUS that will be presented in chapter 7.

Furthermore, reflections on methods of supporting clusters have been conducted under the PASRI¹⁴ program and forecasted the emergence of 10-15 clusters in the coming years, in high potential sectors that will include the territorial dimension. However, these initiatives raised the question of the lack of a regulatory framework that defines clusters and the need for dedicated public support policies to sustain their development.

¹⁰ PASRI produced a very wide and useful corpus of knowledge to enable the establishment of an Innovation policy in Tunisia

¹¹ http://www.pole-competitivite-bizerte.com.tn/lien_utilite.php?code_menu=44

¹² http://www.tunisia-oliveoil.com/Fr/conditionneurs_110_25_DC40

¹³ <http://www.apia.com.tn/medias/files/projet-cooperation/AGRIPRENEUR-3.0-21.pdf>

¹⁴ PASRI produced a very wide and useful corpus of knowledge to enable the establishment of an Innovation policy in Tunisia

a. The example of the GRDA Sidi Amor

The GRDA (Gestion Ressources en Eau et Développement Agricole) project in Sidi Amor, Tunisia is a major initiative that aims to solve the interconnected challenges of water, energy and food security in the region. The innovative approach that has been developed by the project promoters is known as "Water Energy Food" (Eau Énergie Alimentation in French, abbreviated as WEFE).

The WEFE approach takes into account the fact that water, energy and food are closely linked and interdependent. Rather than treating these resources in isolation, the GRDA project takes an integrated approach that considers the whole system and aims to optimize the use of these resources while minimizing environmental impacts and improving the livelihoods of local communities. .

As part of the GRDA project in Sidi Amor, here is how the WEFE approach was implemented in an innovative way:

Sustainable water management: The project aims to use water efficiently by implementing smart irrigation systems, promoting rainwater harvesting and storage, and promoting water-efficient agricultural practices.

Renewable energy production: The WEFE approach also incorporates the production of energy from renewable sources, such as solar and wind energy. These clean energy sources not only contribute to the reduction of carbon emissions, but they also provide energy for agricultural and community needs.

Food security: The project aims to improve food security by encouraging sustainable agricultural practices and introducing crops adapted to the region. The availability of reliable water and energy supports agricultural production and guarantees a stable food supply.

Building local capacities: An important component of the WEFE approach is building the skills and knowledge of local actors. This enables communities to better manage their resources and make informed decisions about water, energy and land use.

By integrating these three key areas – water, energy and food – the GRDA project in Sidi Amor in Tunisia offers a holistic and innovative approach to addressing the sustainable development challenges facing the region. By adopting the WEFE approach, project proponents recognize the importance of viewing these resources as an interconnected system and work collaboratively with local stakeholders to create a more sustainable and resilient future.

8. Perception of industrial innovation policy

For a better understanding of the functioning of the innovation ecosystem and the influence of public policies, Around 30 key actors in the Agri-business have been identified and reached out to take part in this research work (see participants list in appendix 5).

Agri-business covers a wide spectrum of economic activities, from agriculture, to agri-food and agri-health. It represents an important asset for the redeployment of Tunisia's development model. Traditionally, this sector has served the objectives of social inclusion and poverty reduction, rather than competitiveness. During the COVID-19 crisis, only the agribusiness related sectors showed resilience and succeeded to ensure a notable increase in terms of production and investments, showing an increase of 26% despite a global decline of total industrial investments by 25.8% in 2021, as declared by the APII¹⁵. An explanation for this phenomenon, which deserves further study, could come from the fact that the closure of borders during the pandemic has prompted the exploitation of more local sources of supply, and consequently contributed to redirect investment flows to agri-business. Especially since the agricultural sector has continued to benefit from tax incentives, unlike the other sectors.

Important environmental, economic and social issues in the agri-business sector, combined with under-exploited renewable energy sources, can find answers in the public R&D capacity. With several dedicated laboratories and more than 6000 thousands researchers, the agribusiness sector can produce a high level innovation dynamic¹⁶.

a. Focused Group discussion outcomes

Tunisia has traditionally based its competitiveness strategies on costs and rarely on differentiation. This has been widely adopted by all sectors. In the agriculture, it has shown its limits as reported by H.E Chebbi¹⁷, so, “support measures are not always as effective as expected despite the significant costs incurred for the State budget”. Most of the support given to agricultural producers comes from commodity production support policies and in particular market price support policies. Resources devoted to the long-term development of the agricultural sector as a whole remain limited.

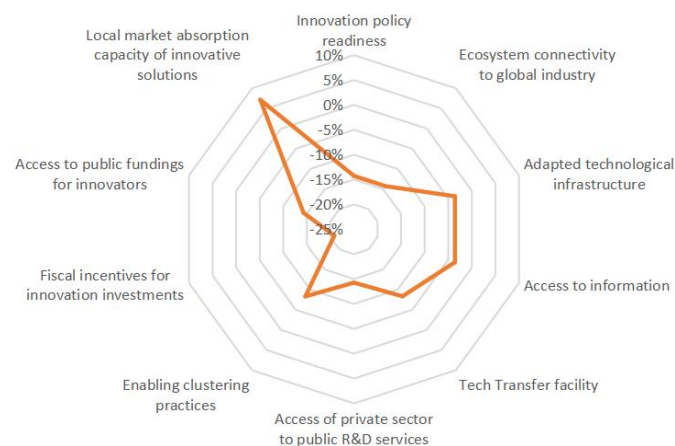
¹⁵ Promotion Agency for Industry and Innovation (APII)

¹⁶ <https://www.phemac.eu/tunisia-in-search-of-its-agricultural-vocation/>

¹⁷ H.E. Chebbi, J.-P. Pellissier, W. Khechimi, J.-P. Rolland (2019) .Rapport de synthèse sur l’agriculture en Tunisie.[Rapport de recherche]CIHEAM-IAMM.2019,pp.99. hal-02137636

Tunisia dedicated on average only US\$ 160 millions (TND 350 million) of public funds per year over the 2013/15 period to services of general interest. This is far from enough to create favorable conditions for the agricultural sector as a whole. Knowing that the funding is mainly intended for infrastructure, to the detriment of education and agricultural research.

A survey addressed to key stakeholders of the Tunisian innovation ecosystem (see appendix 5) revealed a globally negative perception of industrial innovation policies impact in Tunisia. With the exception of the local market's ability to absorb innovative solutions, all the other dimensions of the expected impact are negative, as shown in the graph below:



Graph 5: Industrial innovation policy dimensions and perception by local actors

The public policies readiness, the private sector access to public R&D, the access to public fundings and incentives for investment in innovation are the least well off in terms of scoring.

It's worth highlighting that the favorable environment for clustering is developing in agro-industry, but remains in the rather negative perception ranking. This proves the scepticism of the local stakeholders who are, most of the time, implementing programs that have been designed by foreign grantors.

a) WEF nexus innovation examples

In order to contextualize the key findings of the study entitled "Accelerated Investment and Industrial Innovation" commissioned by GIZ and carried out by the ACET, three examples of industrial innovation, i.e three startups and one research based spin-out from a public laboratory, have been selected and served as business cases to discuss industrial innovation policy¹⁸ with their promoters in presence of key actors of the local ecosystem (see appendix 7).

¹⁸ https://www.youtube.com/watch?v=KcYMr0Thfps&t=18s&ab_channel=MondherKhanfir

The first example concerns Vitalight Lab (see datasheet in appendix 8), a startup in the cosmetics business based on microalgae that values biotechnology research results developed by the two founders when they were working in France. They have chosen to return to Tunisia to launch their startup after winning a grant dedicated to the diaspora researchers. Thus, they benefited from support mechanisms from France, the country of residence, to return to their country of origin. Paradoxically, Tunisia has been less generous in terms of support and even guidance. This almost derailed their project, which took, due to administrative obstacles, much longer time than expected to start.

The second example concerns IPM4CITRUS project (see data sheet in appendix 9) a Research Based Spin-Off in the Biopesticide domain. It illustrates an exceptional case of technology transfer from a public laboratory to a private pharma company, namely MEDIS¹⁹. This took place via public funding from the European RDI program (H2020). The project is held by a consortium of Academia, Technical Centers, Technoparks and Business Incubator with the recipient pharma company under the lead of the Tunisian Center of Biotechnologies in Sfax (CBS)²⁰ and the french Institut National des Sciences Appliquées de Toulouse (INSAT)²¹. As pointed out by Dr. Souad Rouis²², director at the CBS laboratory, the project would never have been possible without the funding of 800 k€ to complete the development work in the field with a high level partnership (a kind of innovation cluster) which connected the team with the international Bio innovation ecosystem.

The third example is about Ezzayra Solutions (see data sheet in appendix 10), a technology company that developed some software solutions for Agriculture, such as the smart irrigation application. More recently, it developed a robot for harvesting. This example shows the interest of new business models, driven by technology able to boost productivity in the agri-business sector. This startup offers software solutions on the "pay as you go" basis, which is very well adapted to the local market with almost no investment capacity of local farmers. This example revealed a major obstacle to innovation, namely the access to information. The government does not collect strategic and microeconomic data that are needed for a global performance. As expressed by Yasser Bouaoud, the founder of Ezzayra, the State does not know how many farms are in operation, what they produce each year, how much they consume in water, energy, fertilizers and pesticides, etc. This makes our marketing investment heavier and much more time consuming. In addition, Ezzayra is embarking on robotization and has already produced a prototype capable of assisting farmers in their harvest monitoring thanks to computer vision and artificial intelligence technologies, which not only improves the yield of their farm but and saves them the search for qualified personnel, less and less available it must be said in Tunisia.

The fourth example is METHANIA, a startup which designs, builds and installs bio-digester systems and implements turnkey biogas production plants that allow farmers, industries and cities to transform biological waste into fertilizer and methane that could be transformed into energy.

¹⁹<https://medis.com.tn>

²⁰ <http://www.cbs.rnrt.tn/fra/home>

²¹ <https://cordis.europa.eu/project/id/734921>

²² See testimonials in the Focused Group Discussion video report

b. Analysis of public actions in favour of Industrial Innovation

The main lessons learned from these experiences have been broken down into two categories, namely obstacles and levers for industrial innovation. The obstacles were in turn declined around the axes of the PESTEL²³ analysis tool and the levers around the axes Governance, Regulation, RDI, Clustering and Financing (see details in appendix 12).

The various testimonies converge on a position of mistrust among entrepreneurs via current public policies, which go so far as to content themselves with the lifting of the obstacles identified rather than the formulation of new additional incentives by the government.

The causes of public policy failure are bureaucracy and governance in silos, as denounced by the ecosystem stakeholders. Beyond that, industrial innovation failures are the result of a lack of common vision, making any policy direction irrelevant.

However, a strong demand concerns the liberalization of the agribusiness sector and the modernization of the administration, and beyond that, a greater contribution of the private sector in development initiatives.

Public action materializes at different levels and through various instruments that are not always consistent with each other. This is even truer when it comes to innovation policy. This emerged from the focus group discussion, which pointed to a tendency for policy-makers to push with far more supply-side measures than demand-side.

By bringing together the different points of view, we obtain a matrix describing the current situation as represented in the Table 2.

Most of the actions cited in the table relies on the administration capability to appropriate and execute public policy instruments. As long as it's not directly concerned by the potential of the innovation ecosystem, which, let us recall, is quite modest in Tunisia compared to countries in the region, performance will remain limited.

²³ An impact analysis matrix with the following axes: Political, Economic, Social Technological, Environmental and Legal.

Public action instruments	Current situation in the supply side	Current situation in the demand side
Legal and regulatory	Complexity and scattering of legal texts Inadequate interfacing between public agencies Limited application of environmental protection rules	No support for technology / innovation users Low awareness of climate and environmental issue
Fiscal incentives and procurement	Modest measures compared to the stakes Weak collaboration within innovation ecosystems Blockage in the implementation of PPPs	The State does not buy local innovation Low valuation of local search results
Finance	Derisory budgets for both R&D and innovative companies Access to public financing very difficult	Modest private sector contribution to increased demand-side requirements
Organizational and sectoral	Weak institutions and governance No sector strategy formulation process Disorganized market with a lot of distortion fragmented value chain with several guardianships weak cross sectoral collaboration Public sector collusion in the market	Domination of the informal Weak demand marked by “cost driven” Lack of know-how and skills
Information et communication	Delay in the National digital transformation project The Open Gov initiative is still inoperative	Weak consumer protection culture

Table 2: Analysis of public actions in favour of industrial innovation

9. Conclusion and recommendations

After several decades of encouragement and incentives for industrial investment, the Tunisian national innovation system has remained below expectations. The long-term modernization program initiated in 1995 to prepare industrial companies for free trade with the European Union has shown its limits. The thousands of beneficiary companies have essentially focused their investment efforts on their industrial subcontracting capacity, their organization and to a certain extent on their information system, rather than on the integration of R&D activities and grouping of innovations. This heavily penalized Tunisia, which ended up losing its place as an industrial flagship in North Africa. Thanks to the prospects offered by WEF Nexus innovation, start-ups and SMEs will have an important role to play in stimulating the local and international market. The ecosystem is there and its potential just needs more attention from public policies to be fully exploitable.

Indeed, the R&D capacity that has been developed so far in Tunisia could be used for cross-fertilization between sectors, and induce a broad dynamic of industrial innovation, thanks to research-based spin-offs and start-ups. The examples presented in this report show the interest of betting on the fields of Biotechnology and ICT to boost industrial innovation, in particular in the agriculture based value chains. But this requires the development of a high-performance and business-friendly innovation ecosystem.

Knowing Tunisia's industrialization needs in all sectors, including in the agriculture as demonstrated in this case study, and while waiting for a new governance of the innovation ecosystem to move from the current directive mode (primacy of legal compliance) to a steering mode (primacy of performance), Tunisia can begin to stimulate industrial innovation by implementing a WEF nexus approach with the following short-term actionable recommendations:

- Multiplying and scaling up the experience of the GDA Sidi Amor by giving the chance to young entrepreneurs to duplicate the model and attract innovative startups
- Provide innovators with Intellectual Property Protection support. This could be through the BuTTs, already in place, with the help of certified patent writers.
- And finally, launch living labs programs in crucial areas in the local economy, in particular through open innovation initiatives and with the establishment of technology transfer programs focusing on national priorities.

In the long run, Tunisia should simplify the regulatory framework encouraging WEF Nexus innovation. This definitely requires promoting collaborative approaches through PPP.

Ultimately, in order to consolidate the shift towards a new development model powered by WEF Nexus innovation, Tunisia will need to set up an adequate institutional governance on its innovation policy. The latter must become a formal process with the involvement of the public and private sectors. For this purpose, four building blocks will have to be laid, namely:

- 1) a national cross-sector innovation vision/strategy with an ambitious budget
- 2) an overall governance on the innovation ecosystem involving the public and the private sector
- 3) an effective OpenGov agenda with a world class digital services rules
- 4) a friendly business environment and with judicial efficiency enshrining the rule of law

Setting up these four building blocks will make the formulation of an industrial innovation policy more percussive and will engage policy makers in a new paradigm of accountability and performance orientation.

Given the cross-cutting nature of these recommendations, which affect or interfere with several areas and jurisdictions, it would be appropriate to consider an appropriate governance mechanism that can ensure effective and sustainable implementation. The authors therefore suggest a three levels structure with well defined roles and responsibilities as following:

- 1) A high inter-ministerial committee in charge of validating and adopting public policies for development through innovation. This body meets once or twice a year and validates the work of the National Council.
- 2) A National Council for Innovation, bringing together the public and private sectors for the formulation of public policies and mobilizing resources to implement priority strategic projects.
- 3) And finally, an executive structure to implement public policies and strategic projects, composed of an observatory and an independent think tank to measure the impact.

Of course, this model of governance requires a formal and adapted institutional framework. The experience that has been achieved in Tunisia in the field of Logistics and Supply Chain Management can be a source of inspiration and an indication of the amount of effort and means to be deployed in order to succeed in establishing sound cross sectoral governance.

Appendix

Appendix 1: Startup Act measures

(The english version of Startup Act displays the advantages of this law)

www.startup.gov.tn/en/startup_act/discover

Mesures		Cadre
1	Une Startup est une société de droit Tunisien au sens du Code des Sociétés Commerciales récemment créée telle que : (i) son modèle économique est à forte dimension innovante notamment technologique; et (ii) son activité est à fort potentiel de croissance. Ce Label est octroyé par le « Collège des Startups » sur la base de critères méritocratiques et transparents fixés par Arrêté Ministériel.	Loi + Arrêté
2	Le Collège des Startups est une instance nationale sous la tutelle du Ministre en Charge de l'Economie Numérique. Il s'occupe de la labélisation, des avantages aux Startups, du Portail des Startups et des demandes de Garantie. Il bénéficie d'une totale indépendance dans l'exercice de ses fonctions. Il est composé d'un Directoire et d'une Equipe Exécutive. Le Directoire compte le Président du Collège + 2 Représentants du Secteur Public + 5 Représentants des Organismes d'investissement collectif dédiés aux Startups + 2 Experts reconnus.	Loi + Décret
3	Congé pour Création de Startup: d'un an renouvelable une fois - c'est un droit accordé à tout employé lançant une Startup et qui a plus de 3 ans d'ancienneté. Pour les entreprises employant moins de 100 salariés, l'accord du représentant légal de l'entreprise est requis.	Loi + Décret
4	Bourse de Startup: Instauration d'une Bourse de Vie accordée aux fondateurs d'une Startup durant la 1 ^{ère} année suivant sa création. Le montant de la Bourse est calculé sur la base du revenu moyen antérieur pour les salariés et une allocation standard pour les autres.	Loi + Décret
5	SIVP: Le SIVP est maintenu pour le Jeune Diplômé qui lance sa Startup ou qui en rejoint une en tant que salarié.	Loi
6	Brevets: Le Collège des Startups prend en charge l'enregistrement et dépôts à l'INNORPI et à l'international des brevets des Startups.	Loi
7	Portail des Startups: Interlocuteur Unique des Startups relevant du Collège auquel l'entrepreneur s'adresse, une fois le label obtenu. Il y effectue les formalités administratives liées à la création, au développement et le cas échéant à la liquidation amiable de sa Startup.	Loi + Décret
8	La SAS et les Instruments Financiers: Réforme du Code des Sociétés Commerciales pour intégrer la Société par Actions Simplifiée (SAS), les Actions de Préférence, les Actions Gratuites et les Bons de Souscription d'Actions (BSA)	Réforme CSC
9	Exonération de l'Impôt sur les Sociétés: Les Startups sont exonérées de l'IS durant la période de labélisation.	Loi
10	Exonération des charges salariales & patronales: notamment les charges de la CNSS pour les Startups durant la période de labélisation.	Loi

11	Abattement fiscal aux Personnes Physiques: Les investissements des personnes physiques dans les Startups sont déduits de leurs revenus imposables à hauteur de 50 kDT/an.	Loi
12	Entreprise Innovante: Une Startup est, de fait, Entreprise Innovante au sens de la Loi n° 2017-8 sur le dispositif des avantages fiscaux.	Loi
13	Impôt sur la plus-value: Les investisseurs dans les Startups sont exonérés de l'impôt sur la plus-value.	Loi
14	Utilisation des OCA: Les Startups sont autorisées à procéder à plusieurs émissions d'Obligations Convertibles en Actions.	Loi
15	Valorisation des Apports: Les Apports en nature réalisés pour les Startups sont exemptés du recours à un Commissaire aux Apports.	Loi
16	Fonds de Garantie pour les Startups: Les participations des organismes d'investissement Collectifs dans les Startups peuvent être garanties par le Fonds de Garantie pour les Startups à hauteur de 30%. Ce fonds géré par la SOTUGAR intervient uniquement en cas de Liquidation amiable et n'est pas cumulable avec le Fonds National de Garantie.	Loi + Convention
17	Marchés Publics: Les Startups sont considérées, de fait, des « Petites Entreprises » au sens de l'Article 20 du décret 2014-1039 pour lesquels tout acheteur public doit réserver 20% du montant annuel des marchés de travaux, fourniture de biens et services et d'études.	Décret 1039
18	Augmentation du plafond de la Carte Technologique: à 100 kDT/an pour les Startups.	Circulaire BCT
19	Compte en devise: Toute Startup ouvrant librement un compte professionnel en devises en Tunisie peut l'alimenter librement par des apports en capital en devises auprès de Non-Résidents ou d'Organismes d'Investissement Collectif.	Circulaire BCT
20	Investissement en devise: La Startup investit librement ses avoirs en devises pour acquérir des biens matériels ou immatériels, créer des filiales et prendre des participations dans des sociétés à l'étranger.	Circulaire BCT
21	Homologation: Les Startups sont exemptées des procédures d'homologation et de contrôle technique CERT & ANCE à l'importation.	Note 2015-50
22	Procédures douanières: Les Startups sont considérés, de fait, des « Opérateurs Economiques Agréés » au sens du Code des Douanes.	Loi



Appendix 2: Global Innovation Index (African countries ranking 2021)

Classement des économies africaines les plus innovantes en 2021  					
RANG AFRIQUE	PAYS	RANG MONDIAL	RANG AFRIQUE	PAYS	RANG MONDIAL
1	MAURICE	52	17	CÔTE D'IVOIRE	114
2	AFRIQUE DU SUD	61	18	BURKINA-FASO	115
3	TUNISIE	71	19	NIGÉRIA	118
4	MAROC	77	20	OUGANDA	119
5	KENYA	85	21	ALGÉRIA	120
6	CAP-VERT	89	22	ZAMBIE	121
7	TANZANIE	90	23	MOZAMBIQUE	122
8	EGYPTE	94	24	CAMEROUN	123
9	NAMIBIE	100	25	MALI	124
10	RWANDA	102	26	TOGO	125
11	SÉNÉGAL	105	27	ETHIOPIE	126
12	BOTSWANA	106	28	BÉNIN	128
13	MALAWI	107	29	NIGER	129
14	MADAGASCAR	110	30	GUINÉE	130
15	GHANA	112	31	ANGOLA	132
16	ZIMBABWE	113			

SOURCE : GLOBAL INNOVATION INDEX 2021

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Appendix 3: Network readiness Index (African countries ranking 2020)





Classement des pays africains avec la meilleure qualité de réseaux télécoms - (Network Readiness Index 2020)

PAYS	RANG AFRICAIN	RANG MONDIAL (SUR 130 PAYS)	NOTE SUR 100	PAYS	RANG AFRICAIN	RANG MONDIAL (SUR 130 PAYS)	NOTE SUR 100
MAURICE	1	61	49.83	CÔTE D'IVOIRE	17	115	31.23
AFRIQUE DU SUD	2	76	45.26	ZAMBIE	18	116	30.54
KENYA	3	82	43.22	NIGERIA	19	117	30.44
EGYPTE	4	84	42.56	CAMEROUN	20	118	29.86
CAP-VERT	5	86	42.01	GAMBIE	21	119	29.40
TUNISIE	6	91	41.30	GUINÉE	22	120	28.42
MAROC	7	93	39.71	LESOTHO	23	121	27.72
RWANDA	8	96	37.24	ESWATINI	24	122	27.21
GHANA	9	98	36.97	MALI	25	123	27.00
BOTSWANA	10	99	36.94	MADAGASCAR	26	124	25.84
SÉNÉGAL	11	100	36.90	BURKINA FASO	27	125	25.79
NAMIBIE	12	103	36.11	ZIMBABWE	28	126	25.78
ALGÉRIE	13	107	35.15	MALAWI	29	127	25.23
TANZANIE	14	110	33.92	MOZAMBIQUE	30	128	24.18
BÉNIN	15	112	32.25	ETHIOPIE	31	129	23.49
OUGANDA	16	114	31.40	BURUNDI	32	130	22.62

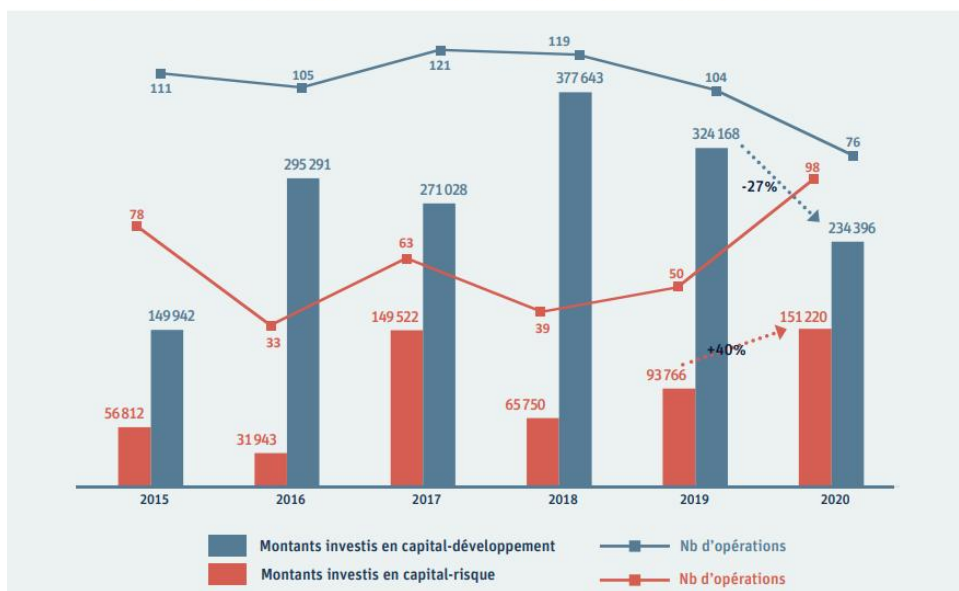
SOURCE : PORTULANS INSTITUTE / STERLITE TECHNOLOGIES

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Appendix 4: Venture Capital deals flows evolution (2015-2020)

EVOLUTION DU CAPITAL-RISQUE ET DU CAPITAL-DÉVELOPPEMENT ENTRE 2015 ET 2020



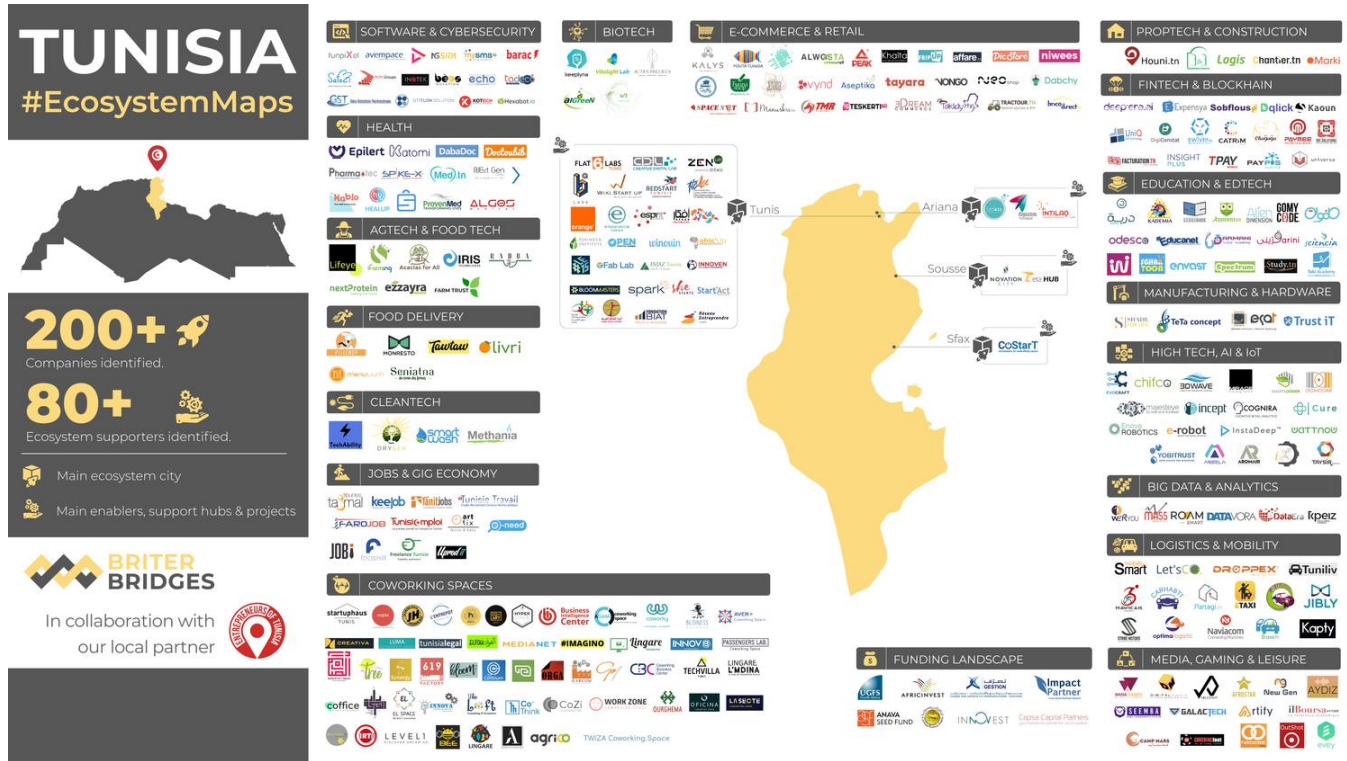
-> Forte progression des investissements en Capital-Risque: aussi bien en montants (+40% en 2020) à 151 Mio DT qu'en nombre d'entreprises financées.
 98 opérations de financement en 2020 (+96% par rapport à 2019).
 -> Baisse de 27% des investissements en capital-développement en valeur et en nombre d'entreprises accompagnées.

Appendix 5: AgriBusiness key ecosystem stakeholders list

Catégorie	Entité/structure	Prénom & Nom	Position/qualité
Regulation/Policy	Ministère Agriculture	Mahmoud Elyes Hamza	Président du programme 05 depuis 2017, Président de l'établissement pour la recherche agricole et l'enseignement supérieur
	Ministère de l'Industrie	Kais Mejri	DG
	Ministère de la Santé	Anis Klouz	DG
Public Interface Agencies	Agence de promotion des investissements agricoles (APIA)	Dalhouni Dalila	Coordinatrice du projet "Innovation..."
	Agence de promotion de l'Industrie et de l'Innovation (APII)	Amor Bouzouada	DG
		Kamel Ouerfelli	D Central
	Agence nationale de la promotion de la recherche scientifique (ANPR)	Chedly Abdelly	DG
	Observatoire national de l'agriculture (ONAGRI)	Hamed DALI	DG
	Observatoire national de l'agriculture (ONAGRI)	Kaouthar Challouf	
	Agence de Vulgarisation et de la Formation & Agricole (AVFA)	Khemaïes ZAYANI	DG
Academia	Centre de Biotechnologies de Sfax	Dr Souad Rouis	Chef de Laboratoire
	Ecole Supérieure des Industries Alimentaires de Tunis (ESIAT)	Wided MHAMDI	Responsable pépinière
	INAT	Faycel Ben Jeddi	DG
	IRESA (Institution de la Recherche et de l'Enseignement Supérieur Agricoles)	Hichem Ben Salem	Directeur
	IRESA (Institution de la Recherche et de l'Enseignement Supérieur Agricoles)	Jamel Benrebah	Directeur de la Diffusion des Innovations et de la Liaison entre la Recherche et la Vulgarisation

	INRAT: Institut National de la Recherche Agronomique de Tunisie	Mondher Ben Salem	DG
	Institut Supérieur de Biotechnologie de Sidi Thabet (ISBST)	Rim Darouich	Directrice
	Ecole Supérieure des Ingénieurs de Medjez el Bab	Hassen Kharoubi	Directeur
	Ecole supérieures des sciences économiques et commerciales de Tunis (ESSECT)	Houssem Eddine Chebbi	Professeur
Support	INNORPI	Riadh Soussi	DG
	Centre technique agroalimentaire tunisien (CTAAT)	Narjess Moshel Hammar	DG
	Délégation UE	Rajeh KHEMIRI	Chargé de projet
	GIZ	Meta Oechtering	Chargée de projet
	GIZ	Ons Obba	Chargée de mission
	GIZ	Rim Bejaoui	
Funding	Caisse de dépôts et de consignations	Nejia Gharbi	DGA
	Association Tunisienne des Investisseurs en Capital	Mohamed Salah Frad	Président
Private Sector	MEDIS	Lassaad Boujbel	CEO & Founder
	VITALIGHT Lab	Ilyes Gouja	CEO & Founder
	Ezzayra	Yasser Bououd	CEO & Founder
	Policy Advisor	Mustapha Boubaya	Expert
	Novation City / Technopark	Anas ROCHDI	
	STECIA	Walid Gaddes	Expert

Appendix 6: The Tunisian startups' universe



Appendix 7: Focused group participants list

- Attendance list of FGD 1 : February, 10, 2022

Catégorie	Entité/structure	Nom & prénom	Position/qualité
Regulation/Policy	Ministère de l'Industrie	Kais Mejri	Innovation and technological development Manager
	SIPHAT (Société des industries pharmaceutiques de Tunisie)	Anis Klouz	General Manager
Public Interface Agencies	Agence de promotion des investissements agricoles (APIA)	Dalhoumi Dalila	Project Coordinator of "Innovation: Agriculture and Agri Food" GIZ/APIA
	Agence de promotion de l'Industrie et de l'Innovation (APII)	Omar Bouzouada	General Manager
	Observatoire national de l'agriculture (ONAGRI)	Kaouthar Challouf	Manager
	Agence de Vulgarisation et de la Formation & Agricole (AVFA)	Khemaïes ZAYANI	General Manager
Academia	Centre de Biotechnologies de Sfax (CBS)	Souad Rouis	Head of the Biopesticides Laboratory
Support	Centre technique agroalimentaire tunisien (CTAA)	Narjess Maslah El Hammar	General Manager
	GIZ	Meta Oechtering	Project manager
Funding	Association Tunisienne des Investisseurs en capital (ATIC)	Mohamed Salah Frad	CEO at UGFS and President at ATIC
Private Sector	Ezzayra	Yasser Bououd	CEO & Founder
		Mustapha Boubaya	Senior Advisor and Innovation Policy Expert to the Tunisian Government

- Attendance list of FGD 2 : February, 24, 2022

Catégorie	Entité/structure	Nom & prénom	Position/qualité
Public Interface Agencies	Agence de promotion des investissements agricoles (APIA)	Dalhourni Dalila	Project Coordinator of "Innovation: Agriculture and Agri Food" GIZ/APIA
	Agence de promotion de l'Industrie et de l'Innovation (APII)	Omar Bouzouada	General Manager
	Observatoire national de l'agriculture (ONAGRI)	Kaouthar Chellouf	Manager
Academia	Centre de Biotechnologies de Sfax (CBS)	Souad Rouis	Head of the Biopesticides Laboratory
	Institut National Agronomique de Tunisie (INAT)	Hanan Ben Ismail	Manager
	Institut National de la Recherche Agronomique de Tunisie (INRAT)	Mondher Ben Salem	General Manager
	Institution de la Recherche et de l'Enseignement Supérieur Agricoles (IRESA)	Jamel Ben Rebah	Dissemination of innovations and liaison between research and extension Manager
	Ecole Supérieure des Sciences Economiques et Sociales de Tunis (ESSECT)	Houssein Eddine Chebbi	Professor
Support	Centre technique agroalimentaire tunisien (CTAA)	Narjess Maslah El Hammar	General Manager
Funding	CDC	Karim Bououni	Manager
Private Sector	Cluster Agri-Tech/ Stacia	Walid Gueddas	Clustering Expert/CEO STECIA
	Vitalight Lab	Ilyes Gouja	Founder & CEO

Appendix 8: Vitalight Lab example



Startup in Biotechnology

Presentation: Founded in 2016, Vitalight Lab is a dermo-cosmetic laboratory which is one of the few in the region to combine the extraction of active ingredients from seaweed and the formulation of refined 100% natural care products.

Products :

- dietary supplement
- 100% natural cosmetics

Innovation Object : Vitalight Lab has developed an innovative industrial process for the extraction and stabilization of active ingredients from seaweed.

Social Capital (2021)	70 000 DT
Turnover (2021)	1 575 000 DT
Nbre of employees	20

Inhibitors	<ul style="list-style-type: none"> - Financial Access - frequent changes in regulations (release on the market, Customs) - Smallness of the market and difficulty in penetrating foreign markets
Catalysts	Start up Act Social and tax exemptions, technology card, etc.

Appendix 9: IPM4CITRUS example



Biopesticide: IPM4CITRUS Spin-Out in PPP

Innovation Object : Biopesticide from a strain of Tunisian bacteria

Innovation framework : A valorization case of research work started in the CBS Biopesticide Lab, with a Tech Transfer process, at the key, for production in an industrial unit from the end of 2022.

Technology Transfer Process: carried out thanks to a consortium bringing together 11 partners (4 Tunisians and 7 foreigners) within the framework of the H2020 program

The main stages of the spin-out innovation process

- Patent No. 18913 filed on December, 29, 2004
- Lab-industrial meeting: 2009
- Commitment of the consortium: 2016
- Entry into production (prev): 2022

IPM-4-CITRUS project funding	801 000 Euros
Investment in equipment and infrastructure for the industrial unit	1 515 151 Euros

Inhibitors	<ul style="list-style-type: none"> -IP Transfer from public to private - long time for Industrialization and market access
Catalysts	- Tunisia joins the H2020 R&D program

Appendix 10: Ezzayra Solutions example



Presentation: Founded in 2011, Ezzayra is a publisher of innovative solutions serving agriculture. It is positioned as a regional leader in the sector of technological services for farmers.

Products :

- **IGS (Intelligent Growing System):** an irrigation supervision and control application
- **AgriManager:** integrated and user-friendly solution for simple, precise and efficient agricultural management
- **Smart tractor : Prototyping stage**

Innovation Object : robotization and digitalization of farm management processes

Startup in Agritech

Social Capital (2021)	1 500 000 DT
Turnover (2021)	600 000 DT
Nbre of employees	13

Inhibitors	-Data availability - Procedures with Customs - Level of farmer awareness
Catalysts	Start up Act Social and tax exemptions, technology card, etc.

Appendix 11: METHANIA example

Methania: Renewable Energy startup



METHANIA, a Tunisia-based startup, specializes in biogas and combined power solutions. They recently entered the market with their innovative product: the Containerized Micro Biogas Cogenerator. The startup is committed to delivering effective, high-quality, and reliable solutions that meet international quality standards.

Products:

- Biogas production technology
- Co-generation technology

Innovation:

The Containerized Micro Biogas Cogenerator by METHANIA is a unique and timely entry into the renewable energy market, offering a compelling blend of innovation and practicality.

Social Capital (2022)	5 M.DT
Annual revenue	-
Number of employees	50
Inhibitors	- Growth Funding - Cost of Capital
Catalyst	Startup Act, Mobidoc, Green Transition incentives Vocational training

Appendix 12: Obstacles and levers for innovators in Agribusiness

Innovation is usually at the frontier of what is possible. Innovation policy can be thwarted by obstacles of different kinds, namely political, economic, social, technological, environmental and legal.

The wrap up of the focused group discussions outcomes are split into the following tables:

Obstacles	Statements collected
Political	Lack of a national innovation vision/strategy National priorities are not fixed Excessive sectorization of public policies Dispersion of innovation policy instruments under several supervisions Pricing policy in agricultural value chains
Economic	Insufficient resources allocated to innovation (derisory amount) combined with the shelving of several programs promoting innovation (e.g.: funds for the Valorization of Research Results, R&D Investment Bonus, etc.) Inadequate public instruments supporting innovation Low use of Blended Finance and CSR financing
Social	Problem of skills at the level of the Administration Weak inter-sectoral cooperation Insufficient level of collaboration and coordination between the structures/organizations involved in agriculture Farmers' know-how not updated to take into account environmental, technological and social developments Regional disparities in support and technical assistance
Technological	Weakness in Data collection and valuation Delay in the implementation of regional smart specialization No cross-sector collaboration platform Uncontrolled technology transfer process No bridges between the world of research and industry
Environmental	Failure to adapt territorial approaches in public policies The research issues do not emanate from the reality on the ground.

Obstacles	Statements collected
	Climate change is not taken into account in the agricultural development strategy
Legal	Consolidate the means and budgets allocated to innovation but also accountability Imagine new forms of PPP based on RDI and built in bottom up mode and not top down

Lever	Statements collected
Governance	Institutionalize the governance of the innovation ecosystem by promoting inter sectorality Organize and allow access to data (Open data in agriculture: improve input and allow access) Integrating innovation into the regional specialization strategy Integrating interdisciplinarity into public policies and developing cross-sectoral cooperation platforms Moving from a policy of administration of the agricultural sector to a policy of upgrading and strengthening the competitiveness of the sector (Innovation emerges in a “real Market competition”
Regulatory	Introduce innovation within the administration for better efficiency and performance Facilitate and professionalize the process of technology transfer from the public sector to the private sector
RDI	Establish a process for promoting research results with professionals from industry Innovate in approaches to the development and organization of value chains Facilitate access to public research infrastructure Partnerships with foreign/international programs A new generation of PPPs based on RDI and which strongly involves farmers and peasants
Clustering	Betting on Agri-tech and green-tech Focus research and innovation on issues emanating from the field Promote exports to meet international standards
Funding	Delegate the management of incentive instruments Involve the private sector in financing innovation Ensure funding mechanisms throughout the innovation process

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