

STATUS OF
**AGRICULTURAL INNOVATIONS,
INNOVATION PLATFORMS AND
INNOVATIONS INVESTMENT**

Tunisia



PARI

Program of Accompanying Research
for Agricultural Innovation

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University of Bonn

Status of
**Agricultural Innovations,
Innovation Platforms
and Innovations Investment
in Tunisia**

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ACRONYMS

AFESD	Arab Fund for Economic and Social Development
AGDP	Agricultural gross domestic product
ASTI	AGRICULTURAL SCIENCE AND TECHNOLOGY INDICATORS
AVFA	Extension and the Agricultural Training Agency
CGIAR	Consultative Group on International Agricultural Research
FAO	Food and Agriculture Organization
FEMISE	Euro-Mediterranean Forum of Institutes of Economic Sciences
FTE(s)	Full-time equivalent (researchers)
GDP	Gross domestic product
GIL	Inter-Professional Grouping of Vegetables
GIPAC	Inter-Professional Grouping of Poultry and Rabbit
GIPP	Inter-professional Grouping of the Fishery Products
GIVLAIT	Inter-professional Grouping of Red Meats and Milk
GIZ	Gesellschaft für Internationale Zusammenarbeit
IFAD	International Fund for Agricultural Development
INAT	Tunisian National Institute for Agronomy
INRAT	National Agricultural Research Institute of Tunisia
INRGREF	National Research Institute for Water Management, Forestry, and Agricultural Engineering
INSTM	National Institute for Aquatic Science and Technology
IO	Olive Tree Institute
IRA	Institute for Arid Regions
IRESA	Institute for Agricultural Research and Higher Education
IRVT	Tunisian Institute of Veterinary Research
MARH	Ministry of Agriculture, Hydraulic Resources and Fishing
MESRS	Ministry of Higher Education and Scientific Research
MD	Million de dinars
NEPAD	New Partnership for Africa's Development
OEP	Office of Livestock and Pasture
ONAGRI	National Observatory of Agriculture
PECAR	Programming and Evaluation Commission for Agricultural Research
PPP	Purchasing Power Parity (exchange rates)
PRF	Project Federated Research
PRSAA	Agricultural Support Services Strengthening Project
RDFP	Research and Development Framework Program
SDC	Swiss Agency for Development and Cooperation
USDA-FAS	United States Department of Agriculture, Foreign Affairs Services

STUDY BACKGROUND

Science and technology remains the fulcrum for development over the ages. There is hardly any national development in contemporary history that is not based on consistent efforts from the science and technology sector. The spate of development in agriculture follow suit; the state of efficiency in science and technology generation correlates highly with the development of agriculture. In Africa, agriculture is considered as the sector with the best potential to lead the socioeconomic development of countries on the continent. However, the sector is bedevilled with many constraints that could be categorized as technological, socio-cultural, institutional, infrastructural, and economical. The poor productivity of the enterprise stream in the sector is clearly seen from its contribution to a country's GDP versus the number of active workers engaged in the sector. Africa's agriculture currently engages about 65% of the working population and its average contribution to GDP still stands at 22.9%.

The crave to develop Africa has received good attention in recent years, starting with the political will of the heads of states, under the auspices of the Africa Union Commission, to develop and implement the Comprehensive Africa Agricultural Development Programme (CAADP), the Science Technology and Innovation Strategy (STISA). The Forum for Agricultural Research in Africa (FARA) also came up with a handful of continental initiatives, such as the Sub-Saharan Africa Challenge Programme (SSA CP), *Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA)*, Dissemination of New Agricultural Technologies in Africa (DONATA) and several others. The different initiatives aim to foster change by addressing specific issues that constitute constraints in the path of progress in Africa agriculture. The notion that African agricultural research system has generated a lot of technologies with great potentials, but which are not realized due to different institutional and organizational constraints—more specifically, the way agricultural research and development systems is organized and operated—is prevalent among stakeholders in the sector. Indeed, this notion appeals to reasoning. However, there is no known cataloguing or documentation of existing technologies and their veracity in delivering broad-based outcomes. The possibility of finding some documentation in annual reports of research institutes, journal articles and thesis in the universities is known, but this will not meet an urgent need.

Thus, the Programme of Accompanying Research for Agricultural Innovation (PARI) commissioned the three studies reported in this volume to provide a compressive analysis of the state of agricultural technology generation, innovation, and investment in innovations in the last 20 years in selected countries in Africa.

Study 1 is the “situation analysis of agricultural innovations in the country” and provides succinct background on the state of agricultural innovation in the last 30 years. It provides useable data on the different government, international and private sector agricultural research and development interventions and collates information on commodities of interest and technologies generated over the years. It also conducted an assessment of the different interventions so as to highlight lessons learnt from such interventions, with regard to brilliant successes and failures.

Study 2 concerns a “scoping studies of existing agricultural innovation platforms in the country”. It carried out an identification of all the existing Innovation Platforms (IP) in the country, including identification of commodity focus, system configuration, and partnership model. The study provides an innovation summary for each IP for use in the electronic IP monitor platform. It further synthesises the lessons learnt from the agricultural IPs established through different initiatives in the country in the last ten years.

Study 3 was an “Assessment of the national and international investment in agricultural innovation”. It is an exhaustive assessment of investments in innovation for agricultural development, food and nutrition security in the country. It collates updated data on investment levels in the past and present, including a projection for the next decade requirement to assure food and nutritional security in the country.

The three studies form the comprehensive collation on the state of agricultural innovation in the 12 countries where the PARI project is being implemented. It is expected that these studies will benefit all stakeholders in Africa’s agricultural research and development, including the users of technologies, research stakeholders, extension system actors and, more importantly, the policymakers.

STUDY 01

Inventory of Agricultural Technological Innovations (1995 to 2015)

INTRODUCTION

Global liberalization has put the world productive potential in a double challenge: economic opening and upgrading in order to maintain and improve the competitiveness of products. In Tunisia, an upgrade plan of its industrial enterprises, which was started in 1995, contained a series of measures and innovation incentives. For the agricultural sector, this is less valid. In fact, farming is not yet accepted as a business, particularly for smallholder farmers which represent 80% of farmers in the country. Nevertheless, certain measures have been beneficial to farmers through the support of research structures and vectors of innovation.

An innovation can be defined as the adoption, at the scale of industrial firm or agricultural farm, of the results or technologies acquired from research activities, in order to achieve a competitive advantage or reduce a gap in production. In this respect, innovation may be: a product or a service, process, organizational aspect, or social aspect. This study refers to the support structures and describes the incentive procedures and measures for innovations at the national level, with a focus on agriculture, in general, and the cereals sector, in particular.

In Tunisia, the industry sector is characterized by three stages:

1. In 1972, the birth of the first generation of private industrial firms, in the framework of Law No. 72-38, which related to export industries and foreign investment,
2. The industrial sector crisis in the 1980s, and
3. The implementation, from the plan of structural layout (PAS), to lift the country out of economic stagnation. This period was characterized by trade liberalization, accession to WTO, and finalisation of the association agreement with EU, which established the free trade area (FTA) for the industrial sector. This was the period of the main measures to upgrade and evolve industrial innovations.

Agency for the Promotion of Industry and Innovation (APII)

This is a public establishment under the supervision of the Industry Ministry. It was created in 1972 to implement the policy related to the promotion of the industrial sector and innovations as a support structure for companies and promoters. To this effect, **APII** provides benefits and products in the form of information, accompaniment, assistance, partnership and studies. It is organized in 5 interventions centres and provides benefits from one headquarters and 24 regional branches:

- a. CFGA - Centre de Facilitations et de Gestion des Avantages
- b. CEPI - Centre d'Etudes et de Prospective Industrielles
- c. CIDT - Le Centre d'Innovation et de Développement Technologique
- d. CDII - Centre de Documentation et d'Information Industrielle
- e. CSCE - Centre de Soutien à la Création d'Entreprise

The CIDT is a new support structure created within APII with the aim of assisting companies in their innovative approaches and improving performance, using relevant advice and services of high value. CIDT has 3 structures and a network:

- a. A partnership structure and technological development
- b. A structure for the promotion and dissemination of the culture of innovation
- c. A 'task force' of innovation enterprise accompaniment
- d. The Enterprise Europe Network (EEN-Tunisia)

APII has, however, increased its prerogatives to the coaching and assistance of economic enterprises in order to identify their needs in term of innovation and work to the valorisation of the research results and technology transfer.

National Agency for the Promotion of Scientific Research (ANPR)

Created in July 2010, this body's mission is to assist public research structures to valorise their research results and promote the emergence of a national innovation system (SNI) through: support for research programmes and projects; support for the interfacing structures; and services to facilitate the technology transfer in the framework of public-private partnership (PPP). In addition, ANPR:

- contributes to the implementation of national research programmes,
- supports the creation and follow-up of the universities offices of the valorisation and transfer of technology,
- assists the public research structures in the areas of intellectual property, the valorisation of the results and the transfer of technology,
- contributes to the creation and animation of research consortia,
- supports the implementation of financial management of research projects,
- provides services of mediator between the research structures, economic enterprises and foreign partners in the framework of international cooperation,
- broadcasts programmes and mechanisms related to the exploitation of research results, transfer of technologies and promotion of a technological innovation culture,
- contributes to the exploitation of results of scientific and technological reviews, and

- gives opinions on the acquisition, maintenance and use of high-tech scientific equipment.

National Institute for Standardization and Industrial Property (INNORPI)

This is a non-administrative public establishment with the mission of ‘undertaking all actions concerning the standardization, production of quality products and services and protection of industrial property.’ In this regard, INNORPI:

- Centralises and coordinates all works, studies and surveys in various areas; it provides the necessary information and training
- Defines, in collaboration with the concerned agencies, the general programme for the development of standards. It creates the technical standardization committee, organizes their work within it and provides the secretariat.
- Certifies compliance of products, services and management systems to the necessary standards and manages the national brands of conformity to standards.
- Grants invention certificates. It keeps an inventory of and protects trademarks, trade and services and industrial designs.
- Receives and records all acts affecting the rights of industrial property.
- Holds the central register of commerce.
- Represents Tunisia at the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC) and World Intellectual Property Organization (WIPO).

Research structures

Universities: In addition to teaching and knowledge transmission activities, Tunisian universities help create knowledge through scientific research. The university system is a key element of the national research system, using basic and applied research. In addition to a virtual university, the academic map includes more than 198 structures within 13 public universities and 25 higher institutes of technological studies (ISET) covering all specialties and territories.

Research Centres: These are 33 public establishments attached to the various ministries with partial or full research activities. Among the 33 research centres, 12 have technological orientation in relation to different industrial activities, namely:

1. Centre for Water Research and Technology, Borj-Cédria
2. Centre for Research and Technologies in Energy, Borj-Cédria
3. Centre of Biotechnology, Borj-Cédria
4. National Centre for Research in Materials Science, Borj-Cédria
5. National Centre for Nuclear Science and Technology

6. National Institute of Research and Physicochemical Analysis
7. Biotechnology Centre, Sfax
8. National Institute of Nutrition and Food Technology
9. Institute Pasteur, Tunis
10. International Centre for Environmental Technologies, Tunis
11. Centre for Telecommunications Studies and Research
12. National Centre for Cartography and Remote Sensing

Organization of research (LR/UR)

The law for research orientation (2003) has organized research in laboratories and research units. The membership of teacher-researchers to these structures offers the possibility to develop a scientific cooperation at national and international scale in the framework of various projects. Therefore, university research was organized in 241 laboratories and 174 units.

- **Research unit (UR):** The research unit is a structure formed by a group of researchers working on a specific theme. It comprises of a minimum of 6 persons, including two teacher-researchers (a professor of level A and an assistant professor HDR). The other members should, at least, be 4 PhD students.
- **Research laboratory (LR):** This is the basic structure for scientific research and technological development activities in all fields of knowledge, in accordance with the general guidelines of the Higher Council of Scientific Research and Technology. It comprises at least 12 people, including 8 teacher-researchers (with 4 professors of Level A or assistant professors HDR). The remaining four members must be PhD students.
- **Specialized units:** To ensure the opening of university to its socioeconomic environment, the research orientation law planned, in addition to LR and UR, the establishment of two specialized units for each research institution. These are:
 - The unit of valorisation of research results
 - The unit of documentation and scientific edition

Scientific associations

The voluntary sector is highly developed in Tunisia and actively contributes to economic development and the promotion of innovation. The main associations are:

- Association of Tunisian Economists
- Society of Natural Sciences of Tunisia
- Tunisian Association of Marketing
- Mathematical Society of Tunisia
- Chemical Society of Tunisia
- Tunisian Society of Physics

- Tunisian Association of Sociology
- Tunisian Association of Nutritional Sciences
- ASEnit
- Tunisian Association of Administrative Law
- Association of Mediterranean Studies
- Arab Association of Sociology
- Association Jeunes-Sciences of Tunis
- Tunisian Association of Biological Sciences

Technopoles (cyber park)

The Act No. 2001-50 of 3 May 2001 (amended and supplemented by Act No. 2006-37 of 12 June 2006) defines technological poles (or technopoles) as a space or set of integrated spaces and landscapes to host activities in the field of training and scientific and technological research, on the one hand, and the areas of production and technological development, on the other, in a given specialty or range of specialities. The goal is to promote the competitive capacity of the economy and develop its technological components through the encouragement of technological innovations and support of its complementing and integrative activities. The objectives of technopoles are:

- Develop high-level skills
- Promote scientific research in the fields related to national priorities
- Promote technological innovations and innovative projects
- Promote the incubation and creation of innovative firms by valorising research results
- Help economic enterprises whose activities are based on research and development and technological innovations
- Stimulate the jobs creation, particularly for graduates
- Improve the competitive capacity of Tunisian companies
- Promote public-private partnership
- Promote foreign direct investment.

Business Incubators

In the framework of the agreement between Higher Education Ministry and Industry Ministry, Tunisia has been engaged, since 1999, in a national programme for the establishment of business incubators (or nurseries) within educational institutes. Since 2001, a network of 26 incubators were established all over the country. These incubators are located in Higher Institutes of Technological Studies (ISET), engineering schools, research centres and technopoles and are managed in

collaboration with APII. Within an incubator, a young promoter benefits from the following services of expertise:

- Two permanent staff in each nursery to inform and help
- A financial expert, a technical expert and an accounting expert to train and assist the promoter in project establishment,
- A representative of an investment company to risk capital 'SICAR' to help the promoter in the market and financial study of a project,
- A bank representative to assist the promoter in the financial part of a project,
- An expert from a local company to advice the promoters on their projects,
- International experts.

Business centres

Their role is to facilitate the achievement of a project and provide the necessary services to promoters for the launch or development of a projects. In this regard, the business centres cover activities in different economic sectors, namely, industry, services, agriculture, trade, crafts, tourism and small trades. The role of business centres is to provide orientating information towards appropriate structures in relation to the objectives of potential promoters.

Programmes and procedures in support of innovation

Programme of upgrade (PMN): This was launched in 1995 to support the competitiveness of businesses. Several objectives were assigned to the programme, including:

- Improve the competitive positioning of businesses structures (enterprise) and their capacity to adapt.
- Provide enterprises with the means of allowing them to resist competition at the target markets level.
- Contribute to the export efforts of companies.
- Allow companies to modernize their production means, to adapt to new technologies and develop their human resources.

Technological investments Priority (ITP)

It is of subsidy of encouragement to the hardware investment (50% of the cost of investments in hardware with priority character) or bodiless (70% of the cost of the bodiless investment with priority character) reserved for services enterprises connected to the industry sector which are in business for at least two years and not presenting of economic difficulties.

Premium for investment in research and development (PIRD, Decree No. 2010-656 of 5 April 2010)

PIRD is a subsidy which offers to public and private firms as well as to scientific associations access to technologies and innovations. It has the following objectives:

- Enhance and strengthen the technological levels of companies,
- Support R&D effort in all its components (applied research, experimental development: prototypes, pilot installations, etc),
- The design of new products,
- Improve existing products,
- Establish new processes,
- Develop new formulation,
- Perform tests in laboratories,
- Develop new technologies

Programmes in support of the competitiveness of enterprises and the facilitation of market access (PCAM)

This programme cost about 23 million euros and fits in the framework of the economic cooperation between Tunisia and the European Union, in the perspective of establishing a free trade zone. It aims to support the competitiveness of Tunisian enterprises and facilitate access to their products and services in the international market through technical assistance and support for infrastructure quality.

Programme to support the research and innovation system (PASRI)

This was a programme funded by the European Union, at about 12 million euros, from 2011 to 2014. It was establish to help solve the major challenges encountered by actors in the innovation chain (industrial enterprises and services, LR, researchers, ANPR, APII, financial institutions, technical centres, schools, INNORPI, technopoles, and business centres). Its objectives also included contributing to research and innovation activities in socioeconomic development.

Researchers Mobility

Decree No. 2002-1573 of 1 July 2002 stated that the regulatory framework for the conditions and modalities of public researchers is delegated to companies (public or private) or to be mobilized in full-time for the purpose of launching innovative projects with technopoles or nurseries (start-ups).

Programme of Research Results Valorisation (VRR)

Initiated by the Ministry of Higher Education and Scientific Research (MESRS) in 1992, VRR is a benefit to the public research structures (research Centres, research

laboratories, research units) with the possibility of partnership with economic enterprises. It is a programme which aims to promote research results and their transfer toward the productive system. To this goal and in the case where there is an economic enterprise partner, VRR is involved in the financing of projects to at least 10% (human resources, equipment, raw material, etc).

National Programme of Research and Innovation (PNRI)

It is a programme that finances activities and projects in the areas of research, development, innovation, improvement of industrial products, and development of competitiveness and modernization mechanisms, through the consolidation of partnership between industrial enterprises, research structures and technical centres. The programme participates in the financing of up to 80% of the cost of research and technological innovation projects. PNRI covers all industrial sectors, including industry, agriculture and services.

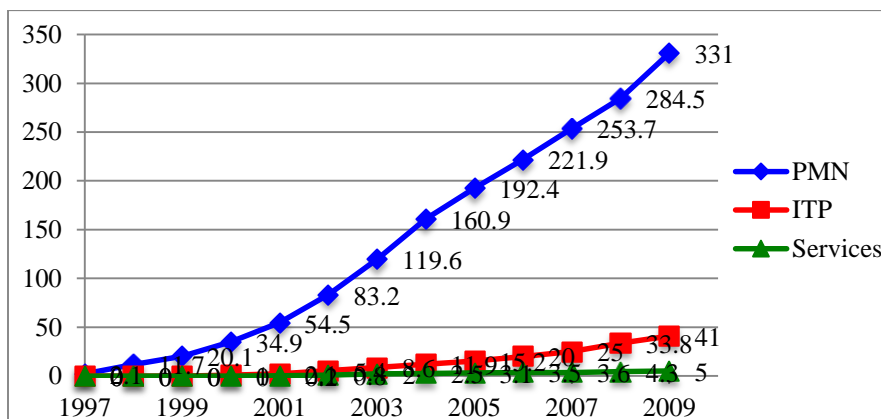


Figure 4. Amount of subsidies for PMN, ITP and services (MTDN)

Tunisia covers an area of 163,600 square km for a population of about 11 million. The agricultural land averages 10 million hectares, from which 4.2 million hectares are cultivated, with 92% under rain-fed regime and 8% irrigated. This area is split into: 1.7 million ha for crops (cereal + forages + grain legumes), 2.2 million ha for fruit trees (with 1.7 million ha alone for olive). The agricultural sector plays a key role in Tunisian economy; it has a growth rate of 6%, which is greater than that of the population (1%), although its contribution to GDP (averaging 10%) has shown relative decline since 2009.

Agriculture is the main activity in several regions of the country. It provides employment to about 22% of the active population, ensures fifth of the jobs and provides permanent income to 470,000 farmers and 60,000 fishermen. Moreover, this

sector occupies the second place in terms of production and added value. Since 2004, it shows an increase rate of 25%. Its contribution to the equilibrium of payment balance through exports (mainly of olive oil, dates and oranges) reached an average of 14%. The main imported products are cereals, vegetable oils and sugar. During the three decades preceding Tunisian revolution of 2011, the country's agricultural policy was characterized by pronounced state interventionism through:

- preservation of consumer purchasing power by giving priority to the internal market,
- mobilization of natural resources for the benefit of the sector
- rural development and supporting of smallholder (family) agriculture
- promoting export of agricultural products with comparative advantage.

Two successive shocks have led policymaker to reflect on a real strategy. These are:

- i. The 2008 food crisis, which led several vulnerable countries, including Tunisia, to revise their concept of food security
- ii. The Tunisian Revolution of January 14th 2011, which revealed the fragility of the development model practised and which induced a multidimensional disequilibrium between different regions of the country.

These led to a redefinition of the concept of food security and to a refocusing of major social concerns around employment and regional development. For the agricultural sector, refocusing was translated to better consideration of smallholder farming systems of underprivileged regions. In such a context, innovation cannot be reduced to a simple technical invention or technology transfer process as for industrial enterprises. It should be translated to a social process, by which a social group appropriates an invention or new technology.

Innovation-supporting structures in the agriculture sector

a. The Ministry of Agriculture

The policy of agricultural development has always been implemented by government through successive quinquennial plans. The government has put in place or helped to implement different supporting structures and organizations. The Ministry of Agriculture includes several technical directorates, covering the whole agriculture sectors. These are: General Directorate of Agricultural Production (DGPA); General Directorate of the Protection and Quality Control of Agricultural products (DGPCQA); General Directorate of Veterinary Services (LSB); General Directorate for Fisheries and Aquaculture (DGPA); General Directorate of Forests (DGF); General Directorate of Development and the Conservation of Agricultural Lands (DGAFTA); Directorate of Resources (DGSE); General Directorate of Water Resources (DGRE); General Directorate of Rural Engineering and Water Management (DGGREE);

General Directorate of Dams and Major Hydraulic Works (DGBGTH); and Agency of Extension and Agricultural Trainings (AVFA). Added to these structures are the regional representations of the ministry in 24 governorates, named regional commiserates of agricultural development (CRDAs).

b. Promoting Agency of Agricultural Investments (APIA)

APIA is a non-administrative public institution, whose main mission is to promote private investments in agriculture, fishing and associated services, as well as in transformation activities integrated into agricultural and fishing projects.

c. Offices

These are a kind of state agencies mandated by the Ministry of Agriculture and enjoying a certain degree of autonomy to supervise certain vital sectors. They include:

- Office of Animal Breeding and Pastures (OEP) is currently the main operator in the sector of livestock and feeds resource development; it plays the role of advisor and technical repository for public authorities.
- Office of State-owned Lands (OTD): It ensures the management and development of state-owned farms covering 156,000 ha.
- The Cereals Office (OC) holds the monopoly on cereals marketing (supply, collection, purchase, importation, storage, sale, etc), and the constitution of strategic grain stocks and management; and provides support to the whole cereals chains.
- Office of Sylvo-Pastoral Development of Northwest Region (ODESYPANO) is specifically responsible for the sylvo-pastoral development of mountainous and forest areas of northwest Tunisia.
- National Office of Olive Oil (ONH) gives coaching and support to olive growers to improve productivity, promotes the quality and exports of Tunisian olive oil and regulates internal market.

d. Technical Centres

These are mainly the National Institute of Field Crops (INGC), which has replaced the Technical Centre of Cereals Crops (CTC); Technical Centre for Organic Agriculture (CTAB); Technical Centre of Potatoes and Artichoke (CTPTA); Technical Centre of Citrus Fruits (CTA); Technical Centre of Aquaculture (CTAq)

Professional Organizations

The professional organizations operate at regional or national level.

a. Central cooperatives

These are created at the central level and are functioning as para-state bodies involved in collecting and marketing of certain agricultural products. The following are partners in seed multiplication of major crops: Central Cooperative of Seeds and Selected Plants (CCSPS), Central Cooperative of Field Crops (CCGC) and Seeds Cooperative (COSEM).

b. Tunisian Union of Agriculture and Fishing (UTAP)

This is the main trade organization for producers in agriculture and fisheries. After the Revolution, multi-trade unionism emerged, with the establishment of the Farmers Union (SYNAGRI).

c. Professional Organizations per Chain

These are inter-profession groups (GIP) exceeding the framework of agricultural producers and aiming to bring together the chain stakeholders (producers, exporters, processors, etc) to create an inter-professional consultation framework and to enable the state to reconcile conflicting ones. Their main mission is to: constitute the databases relative to the concerned chains; contribute to improving productivity through farmers coaching and research; and regulate the market for certain products through the constitution of stocks. Six inter-professional groups are currently active:

1. Inter-professional group of fruit producers (GIFruits):
2. Mandatory group of wine and fruits producers (GOVPF)
3. Inter-professional group of poultry and rabbit producers (GIPAC)
4. Inter-professional group of fishery products (GIPP)
5. Inter-professional group of red meat and milk (GIVLAIT)
6. Inter-professional group of vegetable producers (GIL)

d. Other structures

- National Society of Water Supply and Distribution (SONEDE)
- Agency of Ports and Fisheries Facilities (APIP)
- Promotion Agency of Agricultural Investments (Apia)
- Tunisian Society of Aviculture (SOTAVI)
- Operating Company of Water Canals and Adductions of the North (SECADENORD)
- Agricultural Property Agency (AFA)
- National Society of Plants Protection (SONAPROV)
- Society of Races
- National Foundation for the Improvement of Horse Race (FNARC)
- National Centre of Agricultural Studies (CNEA)

Moreover, two of the technopoles cited earlier are agriculture-related and are thus directly managed by the Ministry of Agriculture, Water Resources and Fisheries. These are technological pole of Jandouba, with diversified agricultural characteristics (multi-satellites); and technological pole of the south (Medenine), dedicated to the valorisation of products of the Sahara. Its main research achievement is the establishment of the Arid Regions Institute of Médenine (which is an element of NARS). In addition, NARS maintains a close collaboration with two other technological poles: Borg Sédria (for energy, water, environment and biotechnology plant) and Bizerte (on agro-feedstuff industry).

e. Agricultural advisers: (Act No. 98-34 of May 23rd 1998)

The agricultural advisor does the following tasks:

- Give general agricultural consultation: consisting of circumstantial advice to assist farmers in the development and monitoring of production support programme.
- Provide specialized agricultural consultation especially in production management,
- Provide consultation in agricultural and rural development: usually at the request of organizations and professional structures, while executing rural agricultural development programmes at national or regional level.

Agricultural Research

The structures involved

While Tunisian university is created after independence in 1956, some institutes of higher education and/or agricultural research (such as INRAT, IRVT, INSTM) have more than a century of existence. These research institutes are therefore the anchor agricultural research and development in the country. Since independence, the national agricultural research system (NARS) has achieved the following:

- Multiplication of higher agricultural education establishments in the 1970s in order to train the needed managers and engineers for promoting and expanding Tunisian agriculture.
- A restructuring of the research component has been undertaken,
- Establishment of the Institution of Agricultural Research and Higher Education (IRESA), which coordinates the whole of the national system, higher education and research and confused.
- Implementation of seven regional representations of IRESA (the PRRDAs: regional Poles of Agricultural Research and Development), structuring the interface to coordinate all research and extension activities at the regional level and identify regional needs in term of research within the framework of objective

programming. Four of these PRRDAs have evolved to Regional Research Centres with full autonomy. These are: Regional Centre of Research in Oasis Agriculture of Dégouèche, Tozeur (CRRAO), Regional Centre for Research in Organic Agriculture of Chott Mariem, Sousse (CRRAB), Regional Centre of Field Crops Research of Beja (CRRGC), and Regional Centre for Agricultural Research in the Centre West (CRRACO).

- Creation of business incubators in higher education institutions and research institutes. Under a management agreement between IRESA and APIA.
- Following the promulgation of the Research Orientation Law of 2003, NARS was aligned to the national approach through the creation of: 29 research laboratories, 10 research units, and 10 specialized support units (some of them intended for valorising research results, while other are specialized in documentation and editing).

Currently, NARS comprises 11 establishments of higher education, 6 national research institutions, 4 regional research centres, 2 regional poles of agricultural R&D, 29 research laboratories, 10 research units, 15 business incubators, 10 specialized units, 300 full-time researchers, and 400 teachers-researchers (130 EFA). During the 2011/2012 academic calendar, there were 6,162 students, among which were 471 doctoral student and 763 master's students.

Research institutions

- National Institute of Agronomic Research of Tunisia (INRAT)
- National Institute of Research in Rural Engineering and Water and Forestry (INRGREF)
- Olive Tree Institute (IO, Sfax)
- Institute of Veterinary Research of Tunisia (IRVT)
- Institute of Arid Regions (IRA, Mednine)
- National Institute of Sciences and Technologies of the Seas (INSTM)
- Regional Centre of Oasis Agricultural Research (CRRAO, Tozeur)
- Regional Centre of Horticulture and Organic Agriculture Research of Sousse (CRRHAB, Sousse)
- Regional Centre of Research of the Western Centre (RRC Co, Sidi Bouzid)
- Regional Centre of Field Crops Research (CRRGC, Beja)

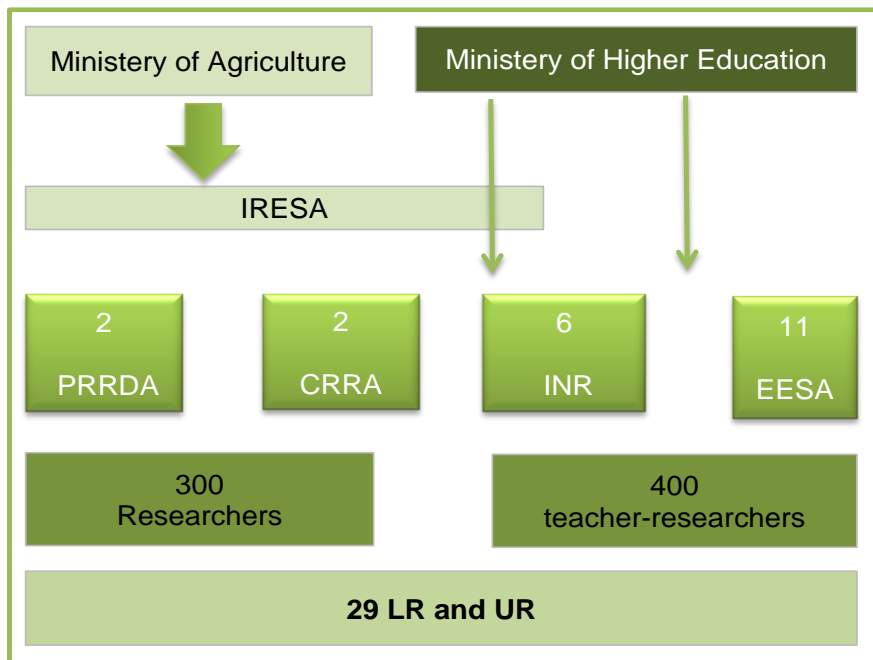


Figure 5. National System of Agricultural Research (NARS, Tunisie)

Institutes and schools of higher education

- National Agronomy Institute of Tunisia (INAT)
- Higher School of Foodstuff Industries of Tunisia (ESIAT)
- Higher Institute of Agronomy, Chott Meriem (ISA, Chott Meriem)
- Higher School of Agriculture of Mograne (ESA, Mograne)
- Higher School of Agriculture of Mateur (ESA, Mateur)
- Higher School of Agriculture of Kef (ESA, Kef)
- Higher School of Engineering in Rural Equipment of Medjez el Bab (ESIER, Medjez el Bab)
- Sylvo- Pastoral Institute Tabarka (ISP, Tabarka)
- National School of Veterinary Medicine (ENMV, SidiThabet)
- Higher Institute of Fisheries and Aquaculture (ISPA, Bizerte)
- High Institute of Preparatory Studies in Biology and Geology (ISEPBG of Soukra).

Operation/Programming

Federating projects

The creation of IRESA in 1990 was followed by that of AVFA (Agency for Agricultural Extension and Training) in replacement of DGFRA (General Directorate of Extension and Agricultural Training). It was a strategic reform for alleviating the

burdens of previous coordination agencies while ensuring complementarities between the new structures through organic links and facilitating the flow of research results and their valorisation. At the level of IRESA and in the framework of the project for ‘strengthening agricultural support services’ which was co-financed by the World Bank, the first national strategy for agricultural research (1999-2008) was developed and implemented in conjunction with development partners and a few organized professionals. The aim of this strategy is summarized as follows:

- Identification of 10 priority areas of agricultural research: a marathon of meetings with development (CRDA, technical directorates, offices, etc) and support structures (technical centres, inter-professional groups, trade unions, professionals, etc) were organized and completed with surveys and allowed to group research needs in ten priority areas.
- Constitution of a joint commission for research areas (Commission for Programming and Evaluation of Agricultural Research, CPERA), which comprised researchers, teachers-researchers, administrative staff and professionals. CPERA is in charge of prioritizing research needs according to a number of criteria (including the adequacy of development needs and concerns) and monitoring and evaluation of results outcomes. This way, 150 research actions, grouped in 37 federative projects, were identified, financed and executed (Table 2). At the end of each action, a workshop of assessment identified the results and put them in Research Results Sheets (FRR) and updated ongoing actions. The deliverables (reports, articles, FRR, etc) provided a virtual library within the same strategy.
- Signature of research-development-valorisation contracts between IRESA, presidents of CPERAs and development agencies, stipulating the contribution of the latter to the funding of certain priority actions. It is a symbolic contribution but serves to initiate a partnership process of R&D and innovation.
- In the aim of strengthening the R&D partnership, a series of themes proposed by Inter-professional groups and related to agricultural and fishery product quality were made subjects of six (6) R&D agreements between IRESA, GIVRLait, OEP, GIPP, GIL, GIFRUIT and GIPAC. The 6 themes related to the following chains: red meat, milk, fishery products, poultry, vegetables, and fruits.

These results have been presented in a kind of restitution workshop in order to validate the conclusions that are likely to help clarify the guidelines for upcoming development plans of each chain. Updates to the research programmes, as well as adjustments to the procedures are made regularly, such as:

- a. Appointing a member (from development sector) at each CPERA to be in charge of synthesizing and promoting transmissible research results.

b. Revising priority domains at the end of the first strategy in anticipation of a second one to increase them to 13 thematic and provide them an official character through publishing in the Tunisian Official Journal (JORT). The themes are related to the following chains:

- Filed crops,
- Natural resources (water forests and soil) and climate change,
- production and animal nutrition,
- Animal health,
- Fisheries and aquaculture,
- Horticulture and protected crops,
- Fruit tree growing,
- Dry-land farming and oasis agriculture,
- Organic agriculture,
- Crops protection of and quality of agricultural products,
- Processing and Industrialization of agricultural products,
- agricultural machinery,
- Rural economy and agricultural policies.

Federated project

The 2008 financial crisis manifested itself in Tunisia through the soaring prices of major cereals and this has been a main driver of federated projects (Projets fédérés, PRF) which focused mainly on field crops and for a 4-year period (2009-2013). IRESA was launched in an emergency tender process to execute projects that could help meet national food security. The review of these proposals has been done by CPERA (Commission for Programming and Evaluation of Agronomic Research) in field crops. Twenty research laboratories from NARS and other partners took part of the selected federated projects. The projects are:

- a. Creation of new varieties of cereals and forage crops adapted to climate change and disease-resistant
- b. Cultivation of rain-fed barley and irrigated durum wheat in central Tunisia
- c. Improvement of barley productivity in southern Tunisian
- d. Cultivation and use of faba bean and other pulse crops in animal feeding in the aim of limiting soybean meal import.
- e. Nutritional value and economic interest of faba bean and other pulse crops in ruminant feeding

There were a total of 47 research activities (table 1).

Table 1. Field of Research priority and federated projects (PRF)

Field	Title of the PRF	Number of Activities
Field crops	1. Durum wheat 2. barley 3. forage crops 4. grain legumes 5. Production systems and chain analysis	22
Water	6. Water management, transporting and distribution 7. Irrigation techniques 8. Management of saline irrigation water 9. Use of wastewater in agriculture	13
Animal breeding	10. Cattle 11. Sheep and goats 12. Poultry and rabbit 13. Feeding resources	18
Fruit tree growing	14. Olive tree growing 15. Citrus 16. Date 17. Viticulture 18. Others	22
Hort Crops	19. Potato 20. Tomato 21. Protected crops 22. the Cucurbitaceae 23. Pepper	21
Natural Resources	24. Ecology, selection of species and reforestation 25. Improvement of the agro-sylvo-pastoral systems 26. Silviculture, protection and valorization of natural resources 27. Research on Soil and water conservations techniques and their impacts 28. Aromatic and Medicinal Plants	24
Aridoculture	Programme Research Laboratory of IRA Médenine attached to the Ministry of Higher Education and Scientific Research	
Agricultural Machinery	29. Cultivation techniques in cereal crop rotations 30. adapting specific mechanization to small and medium-sized farms 31. Harvesting and postharvest techniques	9
Fishing and aquaculture	32. Continental Aquaculture 33. Marine Living Resources	17
Animal health	34. Animal Pathology 35. Food safety, Infectious pathology, zoonoses and Organic Products	2
horizontal Projects	36. Agricultural Policy 37. Organic agriculture	2
Total	37	150

R4D projects

In the frame of the project for ‘strengthening support services to agriculture’ financed by the World Bank, several research themes related to the quality of agricultural and fisheries products have been proposed by Inter-Professional Groups (GIP). Five ad hoc committees within IRESA, involving researchers, teachers-researchers, administration staff, concerned GIP and APIA, were formed. These committees in the areas of animal breeding, fishing, horticulture, poultry and fruit trees were in charge of selecting the projects proposed by research groups through tender launched by IRESA and to monitor the implementation of the selected ones. The projects covered the themes proposed by GIVRLait, GIPP, GIL, GIPAC and GIFruits. The research topics covered by the different projects focused on the value chains of: red meat, milk, fishing industry, poultry industry, vegetables, and fruit trees. Five R&D framework conventions established between IRESA, GIVLait, OEP, Gipp, GIL and GIPAC were developed. It is noteworthy that the innovation platform APIA/GIZ in agriculture and agri-food (IAAA) capitalized on these R4D projects.

A credit line has been created by the Ministry of Higher Education and Scientific Research, and it is intended to finance adaptive research for some results judged to be of high economic interest and potentially transferable and easily adopted. Among 92 the projects granted, 26 were related to agriculture and fisheries (table 2)

Table 2. Projects of research results valorisation

Area	Number
Agriculture and Fishing	26
Industry and Energy	19
Health and Pharmacy	14
Water and Environment	12
ICT and	11
biotechnology services	09
Social Sciences and Humanities	01
Total Cost : 10 million DT (1 DT = US\$0.5)	

Companion Research of PDARI

Integrated Agricultural Development Projects (PDARI), funded by IFAD, have in general research components that are executed in the framework of a convention between NARS and regional CRDA. Examples of these are: ESA Kef and CRDAs of Kef and Siliana; ESA Mograne and CRDA of Zaghouan; IAPH ChottMariem and CRDAs of Mahdia and SidiBouزيد; the IRA Médenine and CRDAs of Médenine and Tataouine.

Table 3 Varieties released

<i>Crop</i>	<i>Number of varieties</i>
<i>Crop production</i>	
Durumwheat	64
Breadwheat	41
Barley	18
Triticale	04
<i>Leguminous plants</i>	
Chick pea	7
Small fababean	3
Fababean	2
Lentil	4
Bean	2
<i>Forage and Pasture Crops</i>	
Loat	5
Perenial grasses	6
Legumes	15
<i>Industrial crops</i>	
Safflower	1
Flax	1
<i>Vegetables</i>	
Fakkous	2
Pepper	3
<i>Fruit trees</i>	
Almond	6
Apricot	6
Pistachia	3
Citrus	5

In agricultural research, the most concrete result consists of plant varieties released (table 3). They are often subject to a seed multiplication contract between breeders and seed cooperatives or companies. Moreover, the scientific and technical results are listed in the virtual library and serve as a reference for the edition of extension documents at the request of AVFA and other extension bodies.

Innovations/Technologies in the Cereals Sector

Cereal production, mainly durum wheat, bread wheat and barley, is an important agricultural activity in Tunisia both in terms of the area grown annually to the crops and their importance as staple and, hence, to the food security of the country. Indeed, 1.5 million hectares, representing one-third of cultivated land, are grown to these three cereal varieties. This important agriculture activity is carried out by more than 240,000 farmers, employs approximately 17% of the labour force and contributes 15% of the agriculture's gross domestic product. With an average annual per capita consumption of 180kg, mainly in the form of bread and pasta, Tunisia is among the countries with

high cereal consumption. On average, cereals provide 60% of calories and 70% of protein daily requirements of the population (Bachta, 2011).

From independence in 1956, Tunisia has seen its population increased from 3.5 million to 6.4 million in 1980 and nearly 11 million in 2014 (National Institute of Statistics, 2014). Tunisia's cereal needs followed the same trend as population growth, urbanization, increase in consumers purchase capacity, and consumption diversification. Despite the slowdown in population growth, the country cereal needs are increasing, mainly because of increased urbanization (68% in 2014, as against the 50% of 1975) and livestock development (National Institute of Statistics, 2014). In order to ensure maximum coverage of the needs through local production, the government designed and implemented a set of production improvement policies and regulation in the cereal sector. These policies led to changes in the different stages in cereal value chain (research, production, collection and marketing). Below is a quick review of the different actions and policy measures with a focus on remarkable innovations in that sector.

Given the limited opportunities for expansion in the area for cereal cultivation, increased production per unit area was chosen as the only mean of increasing grain production. The introduction of the Green Revolution was the most important technological innovation that characterized the cereals subsector in the last four decades (1970-2010). The package was based on the development and cultivation on a larger scale of semi-dwarf wheat and barley varieties, the use of fertilizers, especially nitrogen, and chemical weed control; there was also more mechanized tillage, sowing, application of inputs and harvesting operations.

The cereal breeding programme conducted at the National Institute of Agronomic Research of Tunisia (INRAT) is among of the oldest programmes in the region and the world. This research programme, which dates back to 1893, started testing the first semi-dwarf varieties developed by CIMMYT (International Wheat Improvement Centre, based in Mexico) in 1965. This resulted in a spectacular increase in wheat yield in many countries, known as the Green Revolution. These early semi dwarf durum wheat varieties (Cocorit, Maghrebi and Amel) and bread wheat varieties (Jaral, Inia 66 and Tobari) tested and grown in Tunisia gave 40% yield increases, compared to local varieties then in use. However these first durum and bread wheat varieties were highly susceptible to septoria leaf blotch, leaf rust and stipe rust. These diseases were the cause of significant yield losses particularly during wet years. Some of these semi-dwarf varieties were too short, less than 70cm (such as the durum wheat variety Maghrebi), which exposed them to competition from weeds, whose control was not quite a common agricultural practice at that time. These short varieties did not give

enough straw which was used to sustain the sheep and cattle herds during the long period after harvest and before the first rains of the following season. These defects were quickly considered in breeding programmes. The varieties developed and put in use by farmers over the next two decades (1980-2000) (table 4) gave more yield, were more resistant to diseases and had straw height approximately 90cm without a concomitant susceptibility to lodging.

Table 4. Semi-dwarf high yielding wheat varieties developed between 1980 and 2000

<i>Species</i>	<i>Variety</i>	<i>Year registered in the variety catalogue</i>	<i>Main characteristics</i>
Durum wheat	Karim	1980	High yield potential, resistant to lodging but susceptible to septoria leaf blotch and leaf rust.
	Razzak	1987	High yield potential, resistant to lodging but susceptible to septoria leaf blotch and leaf rust.
	Khiar	1992	High yield potential, resistant to lodging but susceptible to septoria leaf blotch and leaf rust.
	Oum Rabiaa	1996	High yield potential, resistant to lodging but susceptible to septoria leaf blotch and leaf rust.
Bread wheat	Salammbô	1980	High yield potential, resistant to lodging, resistant to septoria leaf blotch and leaf rust but susceptible to yellow rust.
	Byrsa	1987	High yield potential, resistant to lodging, resistant to septoria leaf blotch and leaf rust but susceptible to yellow rust.
	Utique	1996	High yield potential, resistant to lodging, resistant to septoria leaf blotch, leaf rust and yellow rust.

Subsequent innovations brought by the breeding programme focused on a simultaneous improvement of yield potential and disease resistance. Field experiments have shown that septoria leaf blotch incurs yield reduction as high as 40% under favourable conditions. Efforts at improving the level of genetic resistance to diseases and tolerance to water stress starting in 2004 led to the registration of durum wheat varieties Nasr, Maali and Salim, all with good level of resistance to septoria and/or leaf and stipe rust. The bread wheat varieties Haidra and Tahent have also good level of resistance to septoria leaf rust and yellow rust (table 5). Moreover, Maali is the most drought-tolerant of the currently grown wheat varieties. The area covered by this variety is around 60% of the area under durum wheat, making it the most widely cultivated. Salim variety has resistance to septoria leaf rust and stipe rust. Multiple resistance of Salim variety to all three diseases will save farmers using expensive and polluting chemicals to control these diseases.

Table 5. Wheat varieties with good level of disease resistance

<i>Species</i>	<i>Variety</i>	<i>Year registered in the catalogue</i>	<i>Main characteristics</i>
Durum wheat	Nasr	2004	High yield potential, resistant to septoria leaf blotch.
	Maali	2007	High yield potential, resistant to septoria leaf blotch and drought tolerant.
	Salim	2009	High yield potential, resistant to septoria leaf blotch, leaf rust and yellow rust.
Bread wheat	Haidra	2004	High yield potential, resistant to septoria leaf blotch and yellow rust.
	Tahent	2009	High yield potential, resistant to septoria leaf blotch and yellow rust.

Owing to the higher yield potential of recently released varieties and their improved resistance to diseases, attainable yields, taken as those obtained in research stations, continued to rise. These varieties are contributing to further improvements in yields and overall wheat production both at farm and national level. The data in figure 4 show that the attainable yield of durum wheat continued to increase at the rate of 45kg / ha / year.

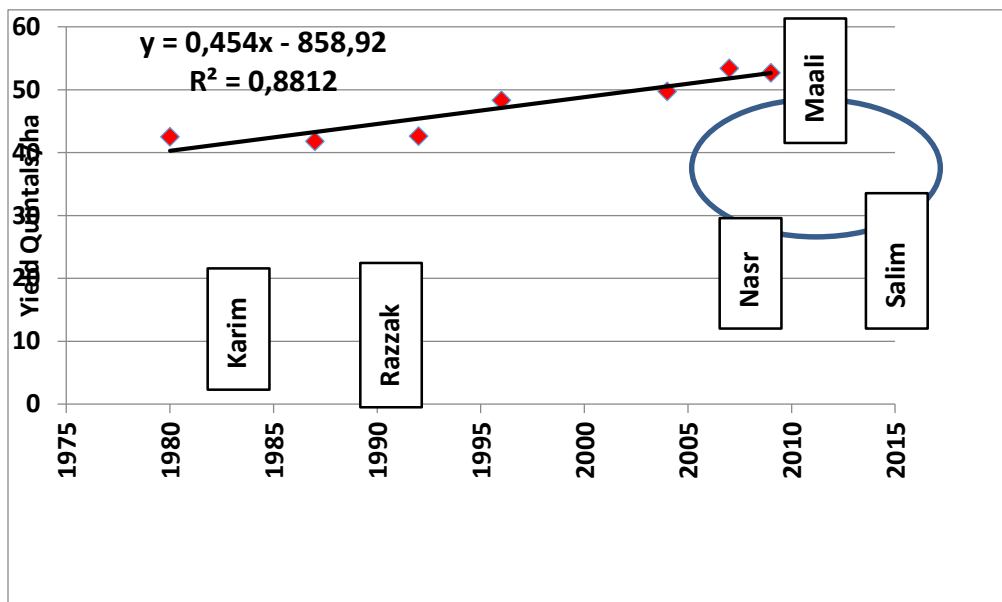


Figure 6. Trend in attainable yield of commercial durum wheat varieties (X axis is year of variety release).

Impact of Technological Innovations

The expanding area devoted to the cultivation of new varieties resulted in yield and gross production increases at national level. Almost stagnating until the 1970s, wheat yields doubled over the next two decades (1970-1990) (Ammar and al., 2011). This upward trend was maintained with an average yield during the following two decades (1991-2010), which tripled the achievement during the period preceding the cultivation of such varieties. Domestic wheat production experienced a similar increase and it was proportional to that of the average yield (figure 7) (Gharbi and Felah, 2013).

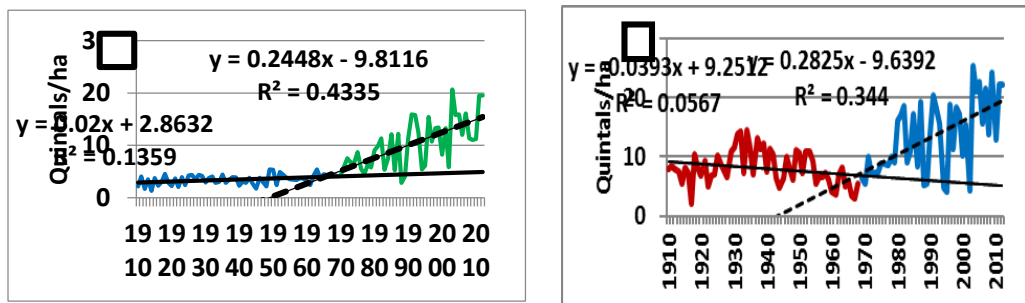


Figure 7. Evolution of durum wheat (A) and bread wheat (B) national yields from 1910 to 2012

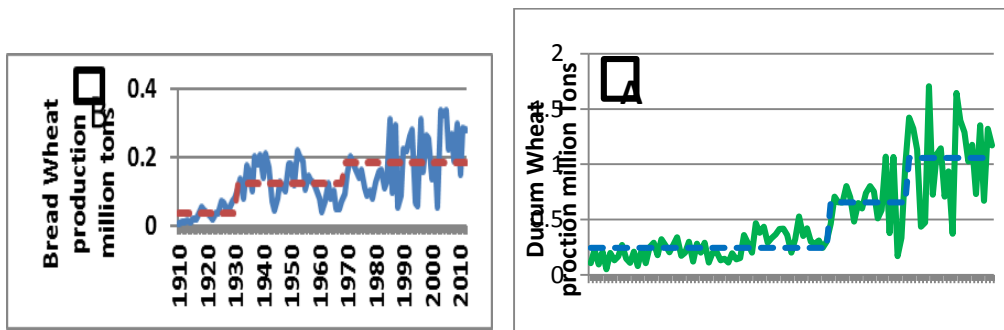


Figure 8. Evolution of durum wheat (A) and bread wheat (B) production from 1910 to 2012

‘Office des Céréales’ (Office of Cereals, OC) was engaged in promoting wheat production through extension activities and dissemination of modern technologies to cereal growers. A technical division within OC was responsible for implementing new variety demonstration plots and other agronomic practices, such as chemical weed control and application of phosphate and nitrogen fertilizers. Thematic information days were organized for the benefit of producers and extension staff and services. These demonstrations helped popularize the different technologies to a large number of cereal growers. Starting from 1996, these tasks were handed out to ‘Centre Technique des Céréales’ (Cereals Technical Centre) (CTC) which carried out broader

actions on cereals, food legume and forage crops. CTC was replaced by the ‘Institut National des Grandes Cultures’ (INGC) (National Institute of Field Crops) in 2009. The latter is currently engaged in improving the performance of the sector through the adaptation of research results and their demonstration within innovation platforms (IPs), where new technologies recommended to specific environments are validated and then disseminated.

The above results were taken in recent years in two technology transfer projects which were implemented in grain producing regions. Both projects followed new technology transfer methodologies and had significant impact on yields and farmers’ incomes. The first project ‘Food Security in Arab Countries,’ coordinated by the International Centre for Agricultural Research in the Dry Areas (ICARDA), was executed by INGC in the irrigated perimeter of Chbika in central Tunisia and in Fernana district, located in northwest Tunisia. There was the full support of researchers from INRAT and INRGREF (National Institute for Research in Rural Engineering Water and Forestry). The new approach of technology transfer followed by this project was that of the ‘lead farmer’ where the new technology was introduced in a first step and neighbouring farmers (satellite farmers) (ten lead farmers) are invited to participate in field visits where the technologies were presented and discussed. The lead farmer was chosen among the most receptive ones on the site and on the basis of its commitment to join the action and his communication skills and acceptance by neighbouring farmers. In a second step, the lead farmer supervised the satellite farmers and acted as link between them and project services. For instance, the introduction of Maali durum wheat variety resulted in average yield increases of 22% and 28% respectively in Chbika and Fernana, compared to farmers’ varieties.

The same approach was used on the project ‘Enhanced smallholder wheat-legume cropping systems to improve food security under changing climate in the drylands of West Asia and North Africa’ implemented by INRAT in rainfed cereal-producing districts in northern Tunisia. Disseminated technologies within this project included new food legumes (faba bean and chickpea) and wheat varieties. The area planted to durum wheat variety Salim and bread wheat Tahent and food legume varieties, as well, have increased rapidly due to seed sales by lead farmers to their neighbours.

OC engaged extension activities for the promotion and modernization of the cereal sector, facilitated the supply of inputs (seeds, fertilizers, herbicides, etc) and apply the pricing policy. OC’s engagement has been through its central, regional and local representations, and through other structures, such as the ‘Cooperative Centrale du Blé’ (COCEBLE) (Wheat Central Cooperative) and ‘Cooperative Centrale des Grandes

Cultures' (CCGC) (Central Cooperative of Field Crops). These structures were mostly very active in seed sales, input supply and collection of grain operations.

By the 1990s, the government began to encourage competitive activities through a privatization policy. These concern grain collection operations and input supply. The goal was the gradual withdrawal of OC and encouragement of private investment in these activities. As a consequence, the amount of grains collected by private operators rose from 25% in 2008 to 50% in 2015. The collected and stored grains were then reassigned to processors at subsidized prices. The difference between prices paid to farmers and sale prices to processors was funded through OC budget item, called 'support to grain market' supported by the 'Caisse Générale de Compensation' (General Compensation Fund). These subsidy prices were reflected in the low consumer prices for cereal products.

Although new high yielding and disease-resistant varieties were the technologies that contributed most to increased cereal yields and production in Tunisia, the use of chemical fertilizers, herbicides and mechanization significantly contributed to a better expression of yield potential of improved varieties. The average amount of chemical fertilizers (phosphates and ammonium nitrate) applied to cereals have risen from 58kg/ha in 1980 to 80kg/ha in 1990, then to 185kg/ha in 2010. Hence, the amount of fertilizers used on cereals tripled between 1980 and 2010. With regard to mechanization, the number of tractors more than tripled between 1960 and 1994 and continued to increase. It went from 10,000 in 1960 to 35,000 in 1994 and 47,000 in 2010. The number of combined harvesters increased from 2,840 units in 1994 to 3,551 units in 2012.

Conclusion

Despite the various efforts in developing and deploying agricultural innovations, this inventory study showed that there is low valorisation rate. The main reasons are as follows:

- Centralized decision-making and research: there is concentration of human and material resources at the central level; and there is inadequate regulations to research needs
- Scarcity of recoverable results, as there is dominance of academic research and inadequate evaluation and transfer procedures
- Low performance of R&D linkage structures; this also shows insufficient coordination between stakeholders; lack of simplification procedures of deliverables

- Limited contribution of professional entities to research mechanisms; this also stresses inadequate professional structures; and the dominance of small and medium-sized farms

This assessment thus remains totally subjective in the absence of tangible indicators to measure the degree of adoption of research results, particularly in agriculture.

STUDY 02

Inventory and Characterization of Innovation Platforms

INTRODUCTION

In general, agricultural research (AR) has not realized its potentials in improving the livelihoods of people, especially the smallholder farmers in Tunisia. In the developing world, ARD has had numerous successes; however, the impact of the technologies did not match their potentials. Many reasons were leading to this situation, mainly i) an Institutional setting of the research system which cannot support scaling up of the technologies, ii) also approaches to R&D are not all encompassing and iii) inadequate human and financial resources. In most cases, technologies were being hindered by institutional barriers. The requirement for change, was to alter the landscape to take place and working under a new dispensation.

The ARD system has moved from the traditional linear model for research and extension, the Farming systems perspective, the participatory research methods to the IAR4D (Integrated Agricultural Research for Development) recently used. The IAR4D is a new approach to help research contribute more effectively and efficiently to poverty reduction and sustainable use of natural resources. To mainstream a new way of doing business that ensures that research does not only lead to knowledge and publications, but also contributes to change and innovation for the betterment of people, while also preserving the natural resource base for future generations.

IAR4D operation principles were i) IAR4D proposes to carry out research in a demand driven mode and the impact of such endeavours will be measured in terms of meeting the demand, ii) IAR4D is a multi-stakeholder - approach; as such, it accommodates and gives adequate recognition to the complexities of the situations that affect sustainable production, marketing and utilization of each commodity in designing a solution, iii) IAR4D will engage stakeholders beyond the rural communities to ensure their intellectual contribution to innovation and also secure their sense of ownership of the research products, iv) IAR4D will involve the policy makers at different levels of governance in research, to diagnose problems, innovate solutions, facilitate implementation and appreciate the need for policy and infrastructural development, v) IAR4D will adopt the innovation systems approach and create innovation platforms on which stakeholders will interact to jointly identify problems, device solutions, implement solutions and evaluate the cycle and vi) IAR4D integrates research with development along the value chain with emphasis on productivity, market, natural resource management, policy, product development and gender.

Concept of Innovation Platform

All stakeholders on an IP have a contribution and benefits which sustain their interest and continued participation. Innovation generated using IAR4D will benefit all stakeholders on the platform. IAR4D engages the policy makers at different levels all along the process of R&D till innovation is generated. IAR4D demands investment by partners, which is followed by returns on the investment. IAR4D ensures a smooth public-private partnership in ARD. IAR4D easily achieves a change in mindsets of the stakeholders.

An Innovation Platform is a physical and or virtual forum established to facilitate interactions, and learning among stakeholders selected from a commodity/system chain analysis. Their interaction leads to participatory diagnosis of problems; joint exploration of opportunities and investigation of solutions leading to the generation of agricultural innovation along the targeted commodity chain or system. Two functional types of Innovation Platforms were identified: (i) *Strategic Innovation Platforms*: These are platforms that are set up at higher level of governance and management hierarchies. At this level, strategies are developed for the development of agriculture in the domain of coverage and (ii) *Operational Innovation platforms*: These are platforms set up at the grassroots level to respond to target commodity or system of production need for specific market. The operational IP do respond to the strategies developed by the strategic innovation platform. Innovation platform can be set up in different ways, but to be effective, it must have the following steps.

- *Step 1: Establish the location of IP activities*
- *Step 2: Identification of commodity or system of focus and analysis of market chain*: The commodity needs to be identified; this could be influenced by the strategic innovation platform operated by the government or the government research institute. The value chain analysis needs to be conducted to identify i) chain of actors, ii) Challenges and opportunities for innovation and iii) Productivity, NRM, policies, market, product development, gender and nutrition etc
- *Step 3: Identification and validation of stakeholders*: Partners' engagement should start from an identified and quantified output market.
- *Step 4: The engagement of researchers*: Researchers are important to the generation of technologies along the commodity value chain. The research should be represented by core research partners making direct contribution to the research agenda. The representation of researchers should change as the prioritization of research topic changes on the platform.

- *Step 5: Development of governance and management guidelines:* IP varies in the degree of formality. Informal IPs may have loose regulation guiding the operations, formal IPs will develop a set of well-articulated guidelines. The orientation of IP in-terms of formality
- *Step 6: Facilitation of stakeholders' interactions:* It is anticipated that the facilitation of the IP should be devolved to the extension system; however any of the stakeholders could initiate an IP and facilitate the process.
- *Step 7: Develop and implement business plan:* The stakeholders all have equal right to decision on the platform; as such the business plan should be agreed upon by all. The implementation is undertaken by all partners and specified in the agreed business plan.
- *Step 8: The establishment of PM&E measures to draw lessons:* This is very vital to generation of innovation. Most times, the platform could experience iterative learning along the pathway of generating innovation.
- *Step 9: Review of implementation and lesson learning:* This may include the review of business plan in response to lessons and re-assessment of priorities. At this stage, the platform may assess other issues on the platform that require intervention along the commodity productivity chain.

Approaches to linking producers (*Farmers*) to markets: Purchases at village level can often be extremely inefficient and this can contribute to the high marketing costs that often lead to allegations of exploitation. Such costs can be reduced if farmers can work together to assemble all their products at one location, for purchase by one or more traders. IP could be the catalyst for this

Innovations in Tunisian agricultural system

One has to admit that Innovation in Tunisian Agriculture is a colonial legacy. In fact, after having occupied the best land of Tunisia, the French have created the oldest supporting agricultural institutions of Tunisia: INAT: Institut National Agronomique of Tunisia/National Institute of Agronomy of Tunisia (training of technicians and engineers) created in 1898; INRAT: National Institute of Agronomic Research of Tunisia, creates in 1913. For this latter, Agronomic Research was initially confined to cereals and then undergone a first phase of diversification after the Second World War and a more broad diversification after independence in 1956.

It is to say that the INRAT was since its creation the main development partner in terms of variety creation (particularly in cereals). There had collaboration and sharing of the tasks between the research institution, seed multiplication cooperatives and the extension system (Chapter III, Part I).

It was a first form of "platform of innovation". Between this classic mechanism and the current form of IP, several scenarios have been tempted, some are still in use to bring together research and development in order to create the innovation just as for "the end justified the means". We present below a few examples of itineraries for transfer of the results of the research which is similar to what is currently qualified as innovation platform".

Research/development programmes

a. The regional development programmes

At the eve of independence, Tunisia has implemented an agricultural development program which has passed through several steps:

- The project for combatting under-development in the 1960s,
- The regional development programs and rural Animation (PDR) in the 1970S
- Integrated Rural development programs (PDRI) since the middle of the 1980s

While for the PDR the transfer of research results passes through the extension system, the second category (PDRI), benefiting from a budget line of R&D, has experienced an opening on the research through the establishment of R&D memorandum of agreement (as shown in the table below) involving researchers in the development effort. In this framework, many results of research have been transferred to the development sector. As an example, the R&D agreement with the PDRI of Siliana (in the framework of PDRI Siliana) has enabled the transfer of interesting results in fruit trees growing, conservation agriculture and livestock feeds diversification.

b. FAO projects

For most development projects granted to the development in Tunisia, FAO combines the research (studies, development of technological packages, transfer of results of research, training, etc). Regarding to the large number of projects (table 2), this route contributed significantly to the creation of the innovation.

Table 2a. Examples of major IRDP

No.	Project title	Period	Total cost	Research partner	Comments
1	Project for the development of rainfed agriculture of Sidi Bouzid	1985-1993	13.3 Million US\$ Including 5.5 IFAD		
2	Project for the development of agriculture and fishing in the plateau of Sidi M'Hadheb	1991-1999	37.2 Million US\$ Including 11.9 IFAD		
3	Integrated Agricultural Development Project in the governorate of Kairouan	1993-2002	28.3 Million US\$ Including 12.5 IFAD		
4	Integrated Agricultural Development Project in the governorate of Siliana	1995-2004	41.7 Million US\$ Including 11.3 IFAD and 17 AFD	ESA of Kef	In collaboration with national research institutes, research and development have helped to identify interesting results in the areas of the arboriculture, conservation agriculture and the livestock feeds diversification
5	The integrated rural development project and Management of Natural Resources (DRI-GRN)	1998-2006	75 million euros of which 50 of the European Union	INRFGRE F	targeted the Governorates of Bizerte, Jendouba, Nabeul, Kasserine, Kairouan, Zaghouan and the KEF
5	Integrated Agricultural Development Project in the governorate of Zaghouan	1998-2007	33.4 Million US\$ Including 16.1 IFAD	ESA Mograne	
6	Project of production improvement around small hydraulic structures and around catchment lakes	2001-2008	20.8 million euros, of which 14.5 of the European Union		The Governorates of Kairouan, Kasserine, Siliana, Zaghouan and the KEF

Table 2b: FAO Cooperation Project in Tunisia

<i>Field</i>	<i>Number of Projects</i>	<i>Tst</i>	<i>Pag</i>	<i>UTF</i>	<i>TFD</i>	<i>Undp</i>	<i>Total</i>
<i>Support for the policies and capacity building</i>	24	1391	66	-	-	1903	3360
<i>Crop production and protection</i>	24	3828	729	-	-	11	4569
<i>Production and Animal Health</i>	12	527	18	-	28	227	801
<i>Natural resources and biodiversity</i>	12	264	12480	1089	-	2064	15897
<i>The Forest</i>	7	400	-	2860	-	-	3260
<i>Fishing Industry</i>	13	873	955	-	-	1473	3301
<i>Food quality and safety</i>	3	114	-	-	-	-	314
<i>Rural development, gender and disparity</i>	12	1196	678	155	-	241	2271
Total	107	8795	14927	4105	28	5919	33775

c. GIZ projects

The GIZ is active in Tunisia since the 60s on behalf of German cooperation. It has always proceeded through participatory approach involving various stakeholders (populations, associations, administrations, organizations, socio-professional, dialog frameworks of local and regional level, private sectors...). The research was always a privileged partner in the development approach since the development plans participatory community (PDCP) in the action sites of the ODESYPANO up to the initiative "one world without hunger" which included the platform "IAAA" and the project "PARI".

NARS projects

The restructuring of National System of Agricultural Research (NARS) made in 1990 aimed to strengthen the R&D partnership. In fact, the first for agricultural research strategy 1999-2008 has been based on a objective oriented programming. This strategy has also known:

- The signature of a dozen or so of research-development-valorization agreements
- Implementation and execution of 14R&D projects as shown in Table 3.

Table 3: R&D projects between NARS and GIP and/or Offices

				Period
1	Contribution to the establishment of a Label of AOC for the meat of lamb of Sidi Bouzid	INAT	GIVRLait /OEP	2006/2010
2	Parameters assessment of the different fattened cattle breeds in Tunisia	INAT/ISA Chott Mariem	GIVRLait /OEP	2006/2011
3	carcasses classification of, reference cutting, meat quality and identification of possible origin-linked product according to production system small ruminants in Tunisia	INRAT	GIVRLait /OEP	2006/2012
4	Assessment of productive parameters of fattened Camelidae in Tunisia	ESA Mateur	GIVRLait /OEP	2006/2011
5	Determinants of milk quality in Tunisia	ISA Chott Mariem, ENMV, ESA Mateur,	GIVRLait /OEP	2006/2012
6	Mastitis Epidemiology of effect of milking conditions on cows health, milk quality and farm performances.	ENMV, ISA Chott Mariem	GIVRLait /OEP	2007/2013
7	Studying nutritional value of sardine and sardinella for their valorization	INAT	GIPP	2006/2013
8	The eel <i>Anguilla anguilla</i> : Smoking and study of the Nutritional variation biochemical and	ISPA Bizerte	GIPP	2006/2010
9	Study of the conservation of post-mortem quality of Royal and white shrimp	INSTM	GIPP	2006/2012
10	Study of the detoxification of the coastal clam	IRVT, INAT	GIPP	2008/2013
11	Prevalence of major bacterial pathogens in poultry and their antibiotics resistance monitoring	IRVT	GIPAC	2006/2013
12	Study of Tunisian consumers preferences as regard to meat and sea products	INAT	GIVLait /OEP /Gipp	2006/2008
13	Determination of conditioning cost of major fresh vegetables and its effect on the consumer	INRAT	GIL	2006/2008
14	Refrigerated storage of fruit, quality control of fruits stored for a long period	INAT	GIFruit	2007/2012

ENPI projects/CBCMed

The cross-border program ENPI/CBCMed is dedicated to networking at the benefit of the of technology and innovation transfer. Such a project is equivalent to an innovation platform. As an exemple, PROCAMED project, is a support to the valorization of results research on the dromedary obtained by IRA Médenine and that are already initiated at its business nursery and are part of the mission of South technological pole.

Table 4. Projects ENPI CBC Med where Tunisia is a partner

Acronym	Project Name	Period	Budget €	EU funding €
PROCA MED	Promotion of innovative camelins systems and of local chains for a sustainable management of Sahelian territories	2007- 2013	190694 0	1716246
QUALI MED	The label of quality and food safety of food products from the Mediterranean Basin	2007- 2013	799033	719129
AGRO- med Quality	Mediterranean platform for quality in agriculture et agri-business	2007- 2013	800000	720000
C.Q.	Creation of a platform for exchanging experience and establishing systems for diversification of agricultural production and certification of quality products	2007- 2013	702153	631938
SERVA GRI	Italo-Tunisian Observatory for Quality Sustainable Agriculture	2007- 2013	799700	719730
AGRIPO NIC	Promotion and dissemination of aeroponic technology in agriculture	2007- 2013	740250	666000
VEDER	Energetic Recovery of waste	2007- 2013	187809 1	1686773
Divine	Development of innovative interventions there indigenous grape varieties - Vines for the Italian-Tunisian Integration	2007- 2013	674107	606240
HIL.F.T RAD	Hilâl Sicilian-Tunisian dairy chain - traditional cheeses through new technologies	2007- 2013	753941	678547
ACCBA T	Adaptation to climate change through improved water demand management in irrigated agriculture by introduction of new technologies and best agricultural practices	2007- 2013	499895 2	4498152
ILE	Local Initiatives in the environment in the Mediterranean	2007- 2013	119466 5	1032611
LANDC ARE Med	LANDCARE Mediterranean cross-border network for local rural governance improvement to enhance rural waste management	2007- 2013	200000 0	1800000
MedDiet	MedDiet - Mediterranean diet and enhancement of traditional foodstuff	2007- 2013	499688 5	4497197
SIDIG- MED	Social and intercultural dialog through governance for local development: Mediterranean Urban and Peri-urban agriculture (UPA)	2007- 2013	199864 6	1798781

ENR projects

NARS has benefited from 26 projects (Table 5), equivalent to "Innovation Platforms". funded on the credit line planned by the Ministry of Higher Education and Scientific Research (MERST) for the Valorization of Results Research (VRR). They are presented in table 5.

Table 5: Projects of Research Results Valorization (VRR) in agriculture

<i>Year</i>	<i>Nbr</i>	<i>Institution</i>	<i>Project</i>
1992	2	INRST	Large scale production of vitro-plants
		IPT	Production of vaccine against enterotoxemy
1994	1	INRST	Cleansing and production of healthy plants and quality of vine
		INRAT	
1995	4	IO	Study of the evolution of the stability and the quality, during storage, of the olive oils obtained by various systems of extraction.
		INTAT	Valorization of the the results of research on certified and powerful plants an plant protection
		FST	Fodder and and pastoral leguminous multiplication, evaluation and valorization
		FST	Useful plants in Tunisia: multiplication, evaluation and valorization
1996	2	INRAT	Production of basic seedlings of understocks of fruittrees with inscathed cores virus
		INRGRE F	Development of caper plant culture in the Northen-West of Tunisia
1997	1	INSTM	Valorization of the the results of research in aquaculture in ofdrillings an geothermal water in Southern Tunisia.
2000	1	INAT	Biological protection against the Beemoth of dates by the technique of sterile males
2002	2	INSTM	Installation of a zoo-medical inspection network of the bivalves in Tunisia
		CNSTN	Controle of Mediterranean fly using the technique of sterile males
2004	1	INRST	Ochratoxine A and the quality of grapes in Tunisia
2005	1	INAT	Volorization of waste of handling fattened blue fin tuna
2006	4	INRAT	Development of a organic-fungicide against Botrytis cinerea, agent of the gray rot of vegetales and fruits.
		INSTM	Valorization of the results of researchh on the clam Ruditapes Decussatus breeding.
		INSTM	Development of the breeding of the Mulletts ingeothermal water
		INSTM	Development of of an ultrasoc repulsive prototype to move away the dolphins far from the fishings nets.
2008	2	CBBC	Strategy of vine organic production
		ISB Monaseir	The valorization of the zooplanc tonic resources to feed fishes.

2009	1	CBS	Overproduction, formulation and evaluation of the effectiveness of a thermostable new phytase in poultry feeding.
2011	1	IO	Development of organic pesticide to protect olive and fruit trees.
2013	4	INRAT	Biological protection of citrus fruits against the "mal secco" by the use of endophyte bacteria.
		FST	Organic- suppression of fruit moulds in post harvest conditions
		INRAT	Valorization of the results of research on drought tolerance of barley to produce a good quality forage.
		CBBC	Insecticidal and paesticidal potential of essential oils of some local aromatic and medicinal plants in Tunisia.
2014	1	CBBC	Hydroponic culture of local barley a solar panel to produce good quality green fodder.
2015	1	ENIS	Risk management and detection of toxic microalgues in marine environment
Total projects : 29		Total allocated amount : 2 929 080 TND	

PNRI projects

As accompanying measures to upgrade industrial sector, the NARS has been able to register 7 projects involving research institutes, technical centers and industrial of the programme (Table 6).

Table 6: Projects in agriculture and agri-food, within the framework of the program National Search innovation (PNRI)

Year	The title of the project	Carrier structure	Industrial Partner	Research partner	Total cost (DT)	Amount of the grant
2016	Design and implementation of a pilot unit of production of Artemia cysts	CTA (aquaculture)	BIBENE Artemia	Unexpected ENIT	200,000	160,000
2015	Production of a new local blue fish based-food smoked and fermented of high added value and rich in omega3 and Omega 6".	CTAA	Tunipponia	INSAT	250,000	200,000
2015	The Spirulina: Optimizing the conditions of production, extraction and purification of the phycocyanin and testing of applications in food products "healthy food".	CTAA	- BioAlgae Society -Sté Zahra Nature	Higher Institute of Biotechnology of Monastir (Lab BIOVAL)	250,000	200,000

2014	Elaboration of composites of bio based material-sources for the valorisation of olive cake and the almond hull	CETIBA	SAMET furniture	ENIS	250,000	200,000
2012	Optimization of the techniques of extraction and purification of the β -carotene from a Micro-alga 'Dunaliella salina'	CTAA	BIOALGUES Society New Society of soft drinks SNBG	UR "genome, Immune Diagnosis and Recovery" Higher Institute of Biotechnology of Monastir	251,000	200,000
2011	Recovery of wood waste of for the manufacture of composite wood polymer.	CETIBA	SIFF STIBOIS	ENIT Unexpecte d	250,000	200,000
2011	Optimization of leather processing operations to turn rabbits skin to fur	Ccnc	SARTEX	Ccnc Unexpecte d FSM/UR-CAE	247,300	197,300

Inventory of innovation platforms of the last 10 years in Tunisia

No	IP name/name of the PI	Rental/region of intervention	Facilitators/contacts/web site	CV concerned /commodity of interest	Beneficiaries/beneficiaries	Funders /funders	Starting year/year of start-up	Statue/Satus
1	Allouch Sidi Bouzid	Sidi Bouzid, Central Tunisia.	Sonia Bedhiaf: Bedhniaf.sonia@gmail.Com	Meat Quality of the local breed barbarine	Community of Zoghmar	ICARD A/CGI AR	2013	Over 2016
2	Lactimed	Beja and Bizerte	Paper Mahjoub Zaiter: Zmahjouba@voila.fr Web: www.pole-competitivite-bizerte.com.tn	Value chain for the milk and its derivatives of sheep and dairy cattle	Dairy Breeders of Beja and Bizerte	European Union/ APIA	2007	Over 2015
3	Harissa	Tunis, Capbon and Kairouan	Noureddine Agrebi agrebiagrebi.noureddine@gmail.com Nuria Ackermann (UNIDO). n.ackermann@unido.org	Pepper puree	-Eight manufactures of transformation -2000 producers of hot peppers -100 women engaged in artisanal transformation of the pepper	Unido/S ECO	2014	In Progress
4	Figs from Djebba	Beja, Djebba village	Abdelfattah Ben Said: saidabd@voila.fr Nuria Ackermann (UNIDO). n.ackermann@unido.org	Figs from the region of Djebba	Producers of figs from the region of Djebba, 1 SMSA representing 200 Farmers	Unido/S ECO	2015	Startup
5	Fig of barbarism	Kasserine	Samia Maamer (DGAB); dgab@iresa.agrinet.tn Nuria Ackermann (UNIDO). N.ackermann@unido.org	Organic local Cactus fruits	-2 groupings of farmers representing 870 farmers - 1 refrigerated warehouse in Kasserine - 5 Tunisian businesses of transformation of the cactus/	Unido/S ECO	2012	Mid-period
6	CANA	Fernana	Hatem Ben Cheikh M'hamed: Hatemcheikh@yahoo.fr	Conservation agriculture among small farmers: Design	5000 farmers of the region targeted.	ACIAR /ICAR DA	2011	Completed (2015)

				of direct planter for holdings of small size	A workshop to manufacture small machines for the design of the direct smoir Tunisian			
7	Enhancing Food Security in Arab Countries	Fernana (north-west) and Kairouan (Central Tunisia sous irrigation)	Mohamed Salah Gharbi: Gharbi.wheatpro@gmail.com Tark Jrrahi (INGC)	Technical package adapted to maximize the performance of wheat in dry and in irrigated	1000 farmers in the two regions Targets	Koetienne bank	2011	In Progress
8	EU-IFAD:	Northern Tunisia	Hamadi Ben Salah: Bensalah.hamadi@iresa.agrinet.tn	Intensification of the production of cereals with the integration of pulses to seeds	5000 farmers in the target regions	Ifad	2013	In Progress
9	The analysis of the value chain The Aleppo pine "zgougou"	The Governorates of Kasserine, Kef and Siliana	Gisa Marggraff	Seeds of the Aleppo pine	5000 Operators of the drill bit and 300 artisanal Transformers	GIZ GmbH	2014	Completed
10	Essential oil of myrtle	The Governorates of Jendouba, Bizerte	Gisa Marggraff	Extraction of essential oil in prtir of the fruit of the myrtle	2500 Operators of the drill 300 transformers, + 5 companies			
11	Fixed oil of Lentisque	Benzart and Beja	Gisa Marggraff	Extraction of the fixed oil of fruit of lentisque	300 operators/habitants of the Foret+50 Transformers			

12	Rosemary essential oil	Kef, Siliiana, Kasserine and Kairouan and Zaghouan	Mongi Ben Mohamed (DGF)	Extraction of fixed oil of rosemary	1500 Operators/forest inhabitants+ 50 processors		2014	
13	Pinion pin	Benzart, Beja, Jandouba and Nabeul	Gisa Marggraff	Fruit of the pinion pin	3000 collectors among the inhabitants of the forest+ 11 micro firms		2012	Finished
15	Olive oil Zarrazzi	Medenine	Mongi Sghaier Email : sghaier.mon@gmail.com	Olive oil coming from the local olive variety Zarrazi/ olive oil from the local variety of Olivier Zarrazi	310 000 farmers	ICARD A/CGI AR	2013	Finished 2016

Case studies of innovation platforms in Tunisia

a. Value chain analysis of the zgougou and myrtle

Adapted from GIZ, 2014. Value chain analysis of non-timber forest products in Tunisia: "Zgougou, lentisk and myrthe ". Katy Schröder (GFA Consulting Group GmbH), Abdelmonaem Labidi (National Consultant) and Faten Mezni (INRGREF).

The analysis of value chain of Non-woody forest products (PFNL) has been carried out in the framework of the project "Adapting to climate change in forest policies in the MENA region" of GIZ GmbH, and aiming to assist Tunisian forest administration to improve conditions for the sustainable management of forest ecosystems so that they keep their ability to provide goods and services under a context of climate change.

In Tunisia the PFNL include a wide range of products of the forest that have different sources, characteristics and uses. They can provide significant revenue to forest households and create a significant economic value as well as "green" jobs. Right today, analyzes of the added value chain (CVA) according to the Methodology "Value Links" of GIZ for pine nuts (Directorate General of the forestry bit and GIZ), seeds of Aleppo pine (zgougou), of the lentil and of the essential oil of myrtle have already been carried out. The objective of these analyses is to get an overview and better understanding of the economic reality of these value chains in Tunisia. The analyses of CVA of zgougou and essential oil of myrtle, from the report GIZ 2014 (analysis of value chains of non-timber forest products in Tunisia: Zgougou lentisque and Myrtle) will be detailed below.

The methodology "ValueLinks" of the GIZ GmbH, relative to the promotion of value-added chains (CVA) has been used. After compilation of secondary data and the analysis of the existing literature, the study on the two CVA started with a first workshop in which the objectives and the methodology were presented to central regional Directorate of forestry (DGF) representatives. It was planned to follow a participatory approach in identifying the actors to meet and in establishing a timetable. As a result went out the major concern of the representatives of the various divisions of the DGF, the REF (Régie of forest exploitation) and districts to take into account the access to the resources which should be set up before going into the value chains analysis.

The analysis of the two CVA needs first to study the market at national and international level, to identify chain links - the flow between final consumer up to raw material and interviews with formal or informal operators throughout the chains. Interviews with identified institutions offering support services potentially relevant to the CVA and with concerned administration have been conducted to discuss the framework conditions and options for a better exploitation of the potential of these

products. The results of the semi-structured interviews were presented in actors workshop. The results have been discussed, chains maps have been updated and the actions to carry up for upgrading the CVA have been identified.

Analysis of the 'zgougou' value chain

Among the studies launched in the framework of the TCP/TUN/3304, seeds of Aleppo pine ('zgougou' in Tunisian jargon) are cited as forest product of a great importance. The analysis of "zgougou" value chain in Tunisia highlights the diversity of Aleppo pine seeds-based products in the market (Assida, cream dessert, vegetable oil, etc).

The "zgougou" is a product of strategic importance for the Tunisia. At national level, the size of the market is estimated to at least 500 T of seeds per year. The products "zgougou" represent a growth market. The "Assida zgougou" a sort of pine seeds-based mash is part of the culinary heritage. Consumption peak of zgougou is at its maximum level during the feast of Mouled (birth of Mohamed) and at lower extent during Ramadan. However, a big change is being underway in the market consisting of the consumption of different zgougou-based products throughout the year: the cream dessert offered in large stores and ice cream as well as the Assida in pastry.

Another recent trend is the sale of "zgougou" in raw state: a kind of pasta composed of zgougou (50% of bulk zgougou) which enters in the transformation of zgougou. The demand for this product seems to increase as consumers of urban centers are keen on utilizing ready to use dough. These product is proposed for selling in large stores in dried fruit retailers. The seeds calibre, the rate of empty seeds and of impurity determine the purchase price of the zgougou seeds in bulk. Moisture content between 14-15% should be respected during seeds drying and storage phases. In addition, the Ministry of Commerce, including the direction of the quality and protection of the consumer, is concerned about the quality of marketed f zgougou. The price of the zgougou is free, it is dependent on supply and demand. Nevertheless the price of zgougou in bulk is in constant yearly increasing: 5 DT (2005) to 20 DT/kg (2013).

The mapping of a value chain is the major component of analysis. This exercise goes through the following stages: specify zgougou-based products of and their market segment; establish the various links of the CVA; establish the main sequence of actors and the flow of the product; differentiate the chain depending on the Channels and quantify the number of actors by link. The mapping showed the complexity of the CVA zgougou which integrates for some products seven different links with three levels of processing (Figure 1). Following the steps of the mapping, the categories of actors and the specific functions of each link of the CVA have been identified (figure 2).

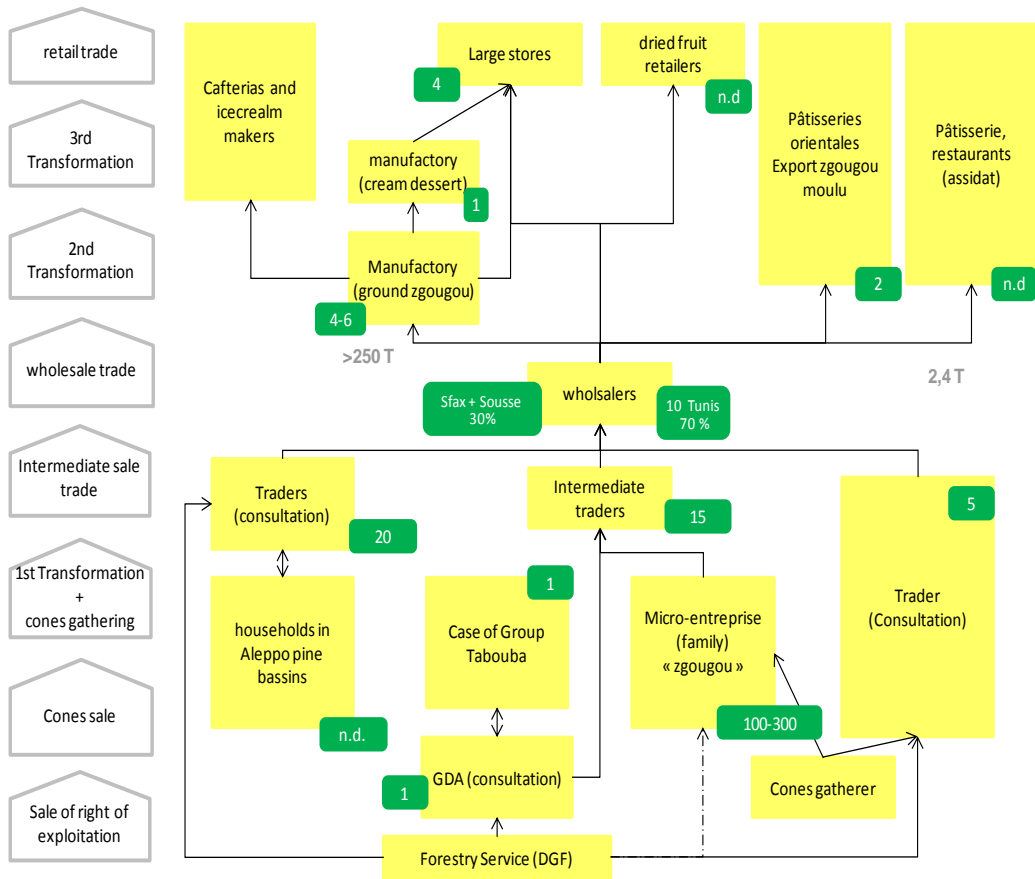


Figure 1: Mapping of the CVA zougou

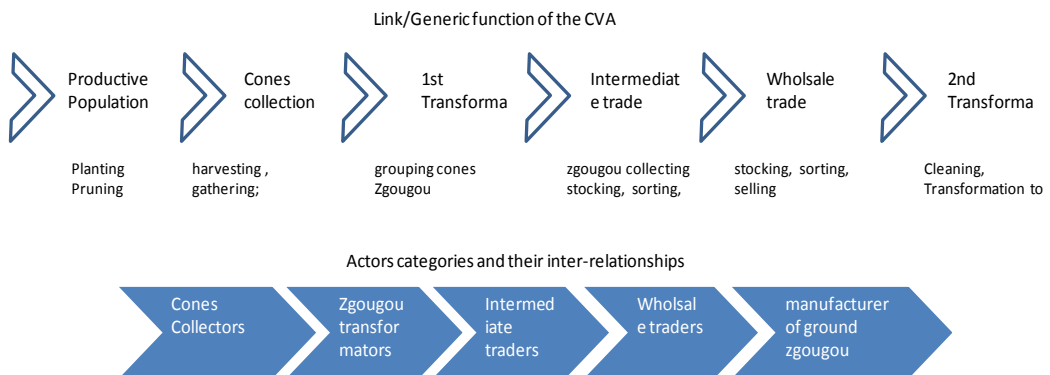


Figure 2: Categories of actors and their functions (example of the zougou group)

PRODUCTION LINK

The surface area of Aleppo pine-based forests is estimated to about 296.000 ha which are distributed between the governorates of Kasserine, Kef and Siliana (covering

together 77% of area). As fruitful production was not the first objective of the forest Services, planting densities were high and not compatible with abundant fruiting. The plantations of Aleppo pine aimed primarily to protect the dunes. Thinning and pruning treatment were rarely undertaken under those plantations.

In 2012, FAO has estimated that the quantity of marketed cones per year is around 10.000 Tons. However, productivity of Aleppo pine stands varies from one year to another (Table 7) as a consequence of soil and climatic conditions, stand density, height, age, etc. The quantities of cones offered for sale and those sold during the last years of the consultations reflect that only 4% of the seeds are marketed in official circuits. Thus a parallel circuit not controlled by the Ministry of the commerce always existed. For example, Siliana 176 t of zgougou seeds have been marketed with a peddlers licence (2014). Knowing that it is the hub of zgougou which supplies almost all of the country, this number represents only 35% of the quantities actually marketed.

Table 7: Results of the 5 last consultations to sell the right of exploitation of pine cones of Aleppo conducted by the DGF-REF

Campaign	Offered for sale Qty (T)	Qty Sold (T)	Average price (DT/T)
2009/10	6 422	1 468	90
2010/11	6 617	2 177	112
2011/12	9 353	1 051	65
2012/13	11 806	1 308	77
2013/14	5 786	821	72

The harvest of fruits from cones of Aleppo pine begins after sale closure of the lots offered for exploitation by November 15th each year and ends by late April. Some families settle nearby the lot of Aleppo pines to ease collection and storage of the largest number of cones they can do. The collection capacity per day and per person is estimated at 50 kg of cones. Families who are not specialised in the extraction of seeds sell the cones to processors. The sale price of the cones turns around 0.070 DT / kg.

The activity of seeds extraction is based on two types of actors: first the rural families who work for traders who have purchased lots of Aleppo pine from forest services and second, the "zgougoumicro-enterprises" who have received themselves some lots for exploitation. The first type of families who live in the areas of the stand purchase the licence to harvest the cones from the merchant with 15 DT/month per person. A trader may employ up to 100 families. This is tantamount to an immediate write-off of the consultation cost, or even for beneficiary margin. The families organize themselves for harvesting operation, the collection and transport of the cones until the domicile where

the cones are dried during a month. The seeds extraction is made using a traditional oven. At heat contact, the cones swell, burst and release the seeds of zgougou. The empty cones are reused as fuel for the oven. After cooling, seeds of zgougou are screened to eliminate small ailerons attached to the seed. The quantity of seeds per kilogram of cone is variable according to the year, the age of the Planting etc.... With the traders who come to collect the seeds the purchase prices vary between 7 and 15 DT/kg. The sale of the zgougou generates significant benefits for the family which are considered as a second source of income after the agricultural activities.

The second model said "zgougou micro-firms ": the main difference with the first type consists of degree of specialization. For these actors, the zgougou is the main activity which occupies at least five months of work in full-time. The micro entrepreneurs consider themselves to be professionals who participate in the consultations, purchase the lots of Aleppo pine stands and mobilize their specific equipment to put in the forest camps. The harvest and the extraction occurs the year-around. 100 to 200 firms of this type belonging to five large families concentrated in the area of Kessra which traditionally dominates the sector. According to the information obtained during the interview of several interlocutors, operating costs mobilized for the collection of the cones amounted to 9.000 DT and the costs related to the extraction of the seeds to 600 DT per micro-firm. The seed production capacity is around 880 kg per year. The annual turnover is of 12400 DT with a gross margin of 2.700 DT.

The Processing Link

The transformation link includes the steps of cones harvesting at the level of production basin and the extraction of the seeds of the Aleppo pine. Different systems are distinguished according to the level of specialization of actors who operate in this link. The first level of transformation: the manufacturers of the milled zgougou are six, among them are two major operators. The first manufacture started in 1999. The annual production capacity of the two first operators is 200T of the milled zgougou in pot of 500 g each. The important factors for the manufacture of pulp is the good quality of seeds and the rate and nature of the additives used. The Purity depends on the use of the oil from the seeds zgougou for conservation.

Another type of actor - the bakery specialized in Assida which can transform 2.4 T of zgougou bulk per year: It sells its product throughout the year. The third level of transformation: A manufacture of cream dessert that uses the "Paste" of the zgougou and a manufacture of zgougou-based ice cream. 5555

Marketing Link

The system of intermediate trade: Despite the fact that the zgougou is not a staple product and with irrelevant importance in international market, the supply of domestic market transits through very specialized circuits. Siliana is considered as the "hub" of gathering, storing and redistribution of this product. About forty semi-wholesalers are installed there. They enjoyed peddling licence for zgougou seeds coming from Algeria and granted by the Ministry of Commerce for not less than 20 T per year and per importer. The annual volume of commercial operations related to zgougou varies between 50 and 100 t by half-wholesaler. Their profit margin to the kg of the zgougou sold varies between 1.5 DT outside Mouled to 3.5 DT to Mouled. Generally, the functions are limited to the grouping of seeds, to the storage and to the routing.

The system of wholesale trade: about fourteen wholesaler traders sell the zgougou seed in bulk among other dried fruits. Their cross margin per kg of the zgougou ranges between 0.5 and 2.5 DT according to the period. The customers are manufacturers of the milled zgougou, pastries specialized in making Assida (mash), large stores and retailers of dried fruit.

Retail trade system: only two large stores sell 137 T (as zgougou milled), 10 T (Z. in bulk), 0.65 T (as in dessert cream) per year. After extrapolating this market segment, large stores can sell up to 500 T of ground zgougou, 50 T of zgougou in bulk), 3 T (cream dessert zgougou) per year. The retail trade through dried fruits merchants is extrapolable, because their number is difficult to estimate. As an example: a retailer may sell 200 kg of zgougou bulk and 50 kg z. ground per day during the Mouled.

ECONOMIC ANALYSIS OF THE VALUE CHAIN

The economic analysis of the value chain consists in an assessment of the performance of the chain in terms of economic efficiency. The sale price is influenced by the advent of Mouled feast in the case of the CVA of bulk zgougou seeds. In this case there is two scenarios. The first reflects the month of October 2014 where the price to the final consumer was 14 DT and the second scenario reflects the price during the feast of the Mouled (25 DT/kg). The gross margin is an indicator that allows you to measure if the activity of a company can make a profit or not: it is the difference between the selling price and the price of returns. The gross margins for the two scenarios are presented in figures 3 and 4. Cones collection is a dangerous job and painful. The gross margin per kilo remains less than one dinar in the two scenarios. Indeed, the activity only generates an additional income. With the system of micro-firms, the business of zgougou becomes more profitable.

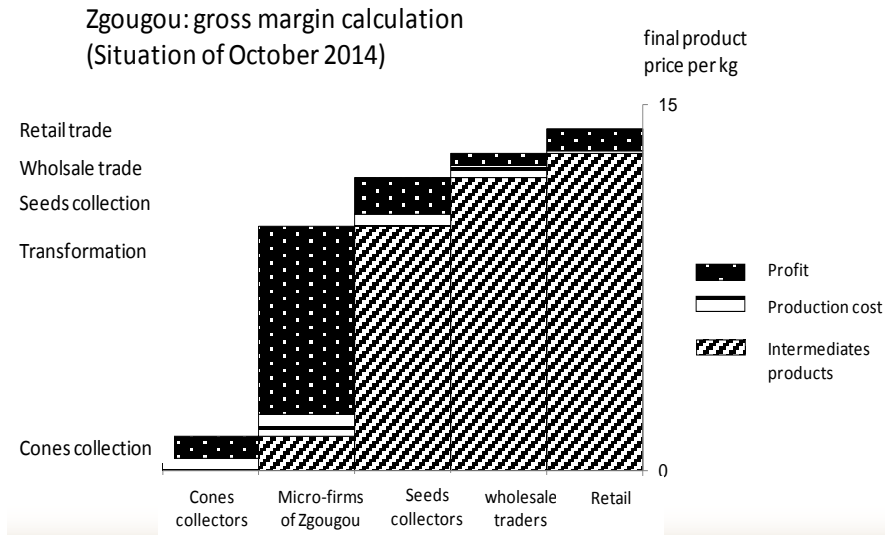


Figure 1: Calculation of the gross margin with each operator representing a link

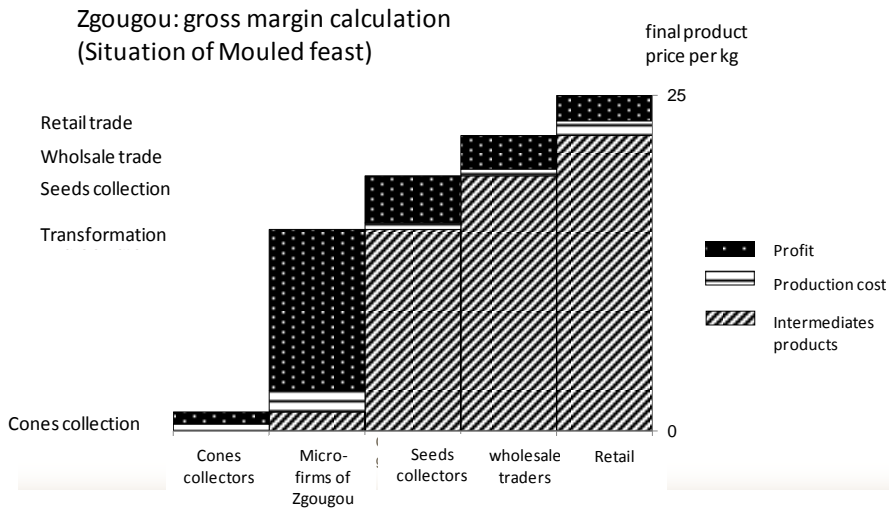


Figure 4: Calculation of the gross margin for each operator representing a link

The second element of economic analysis is the added value. It represents the difference between sale price and the total value of expenses incurred to get goods and services. In the case of the bulk zgougou seeds, to the price of October 2014 added value per link is given in figure 5. In reference to the second scenario the price to the consumer at 25 DT during the mouled January 2015, the parts of the value added by the link is given in figure 6.

Calculation of Added value- zgougou (situation of October 2014)

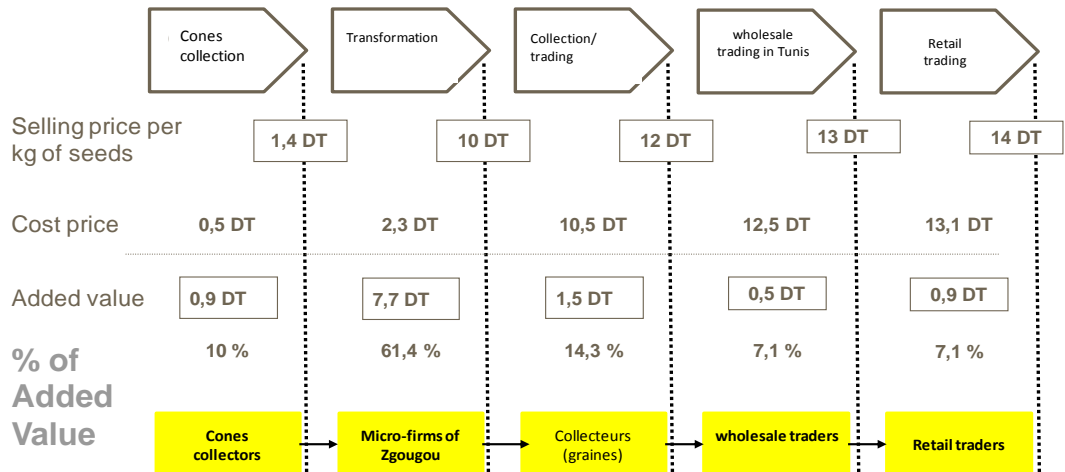


Figure 5: Calculation of the value added - zgougou bulk seeds

Calculation of Added value- zgougou (situation of mouled feast)

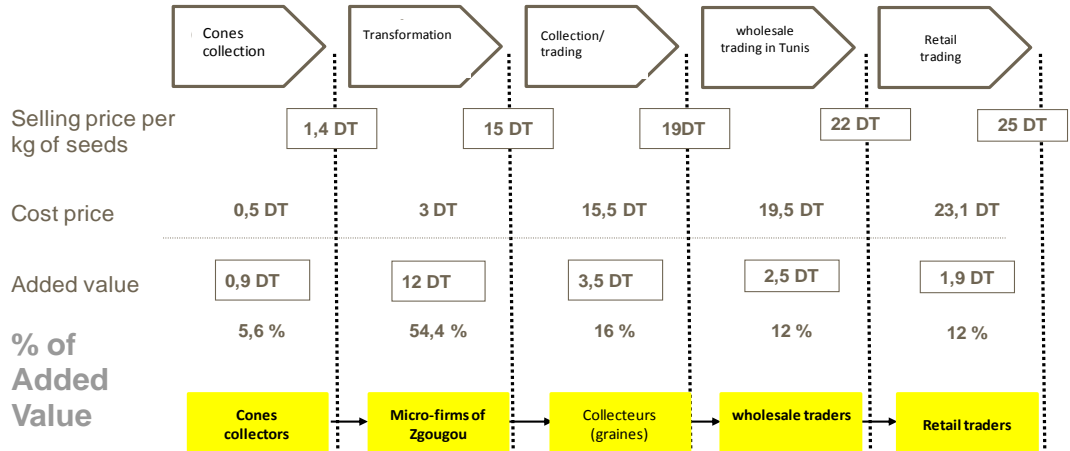


Figure 6: Calculation of the value added - zgougou seed bulk (mouled situation, January 2015)

The transformation link captures the greatest part of added value. This reflects the many functions that are integrated up to the sale of the seeds bulk. However the links downstream share 40% of the added value. Their functions include especially shipment, storage, screening and bagging.

SUPPORTING SERVICES OF CVA

Apart from silvicultural operations carried out by Forest Service and the National Institute of Research in Rural Engineering, Water and Forestry (INRGREF) through some research projects on Aleppo pine, no institution offers a targeted support to the actors of the CVA zgougou. The needs in several areas are not covered e.g.:

- technologies: new technologies for seeds extraction, equipment for the harvest of the cones, technologies for triage and calibration;
- control of transformation process: good practices in processing and hygiene;
- control of good practices of storage, knowledge of national references of quality and detection methods.

STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS OF THE CVA

The factors that affect CVA zgougou in Tunisia are given in table 8.

Table 8: Matrix "SWOT" of the CVA zgougou

<p>Strengths</p> <ul style="list-style-type: none"> • Source of Income • Creation of employment • Importance for local economy in Aleppo pine basins • Good image of products " zgougou" on the national market • Market not saturated 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Forests characteristics not appropriate for fruitful production • Interest of DGF for preponderant wood • Insufficient control (Forest Service and trade regional directorate) • absence of a mechanism for monitoring and Evaluation and lack of sound statistics on harvested, processed and marketed quantities • System of consultation of the REF does not take into account the type of actor: rural family –Intermediate trader
<p>Opportunities</p> <ul style="list-style-type: none"> • Creation of new zgougou-based products for national: (juice) and for international market (zgougou vegetable oil...) • Upgrading extraction processes • Profitability of seeds production plantations (state and private owned) • Reform of current forestry code 	<p>Threats</p> <ul style="list-style-type: none"> • Overexploitation of the cones • Deforestation, fires

As regard to potential increase of income and creation of additional employment, PFNLcensus (DGF, 1999) counted 2.334 farms on zgougou and 53 merchants (intermediate traders). Added to them the jobs created downstream of the CVA: 15 wholesalers and their employees, 6 factories of milled zgougou, a factory of zgougou cream as well as the specialized pastries on Assida and their corresponding employees.

The potential of the CVA is based on greater integration at chain upstream toward a professionalized transformation extraction (not more than one unit of extraction per zone) and greater diversification downstream of the chain (more jobs in the sector of food industry related to zougou).

The potential for improving the product and innovation: is based on the integration of zougou case in the food sector through mechanization of seeds extraction processes and creation of new zougou-based products, such as juice and candies; and at medium term, the exploitation of its cosmetic virtues using zougou vegetable oil for manufacturing sunscreens.

PROPOSED ACTIONS

The work group led to the proposition of several actions to set up in the aim of finding adequate solutions to the current situation of this added value chain. All proposals revolve around the following points:

- to improve slumps in sales of proposed lots by forest service, it was proposed to develop a guide for the evaluation of PFNL; to train experts on the techniques of estimation and to assess a commission of evaluation;
- To reduce damages during cones collection operations: sensitize the collectors on the identification of mature cones and on the use of adapted tools for harvesting;
- To benefit rural families, it has been proposed to come back to the sale of portions of Aleppo pine stands.
- Support and advice to micro-firms: simplified accounting etc.;
- Structuring of the CVA: dialogue between operators and administration; ensure more organization of collection campaigns

b. Analysis of the value chain" essential oil of myrtle" in Tunisia

The Myrtle (*Myrtus communis*) is an aromatic plants deemed for these medicinal virtues. The bulk of the tablecloths of exploitable Myrtle in Tunisia is concentrated in the governorates of Bizerte, Beja and Jendouba (Figure 8) (ODESYPTANO, 2007). The Myrtle is considered by the DGF as a "strategic product", because it is subject to tendering procedures (Article 18 of the Forestry Code) and an imperative for the preservation of resources. It is among the plants the most significant in terms of the production of essential oils at the national level. Several products of myrtle or with a basis of Myrtle exist, the most requested: essential oils, Floral Waters, soaps, herbal teas, berries, buds, creams, etc.

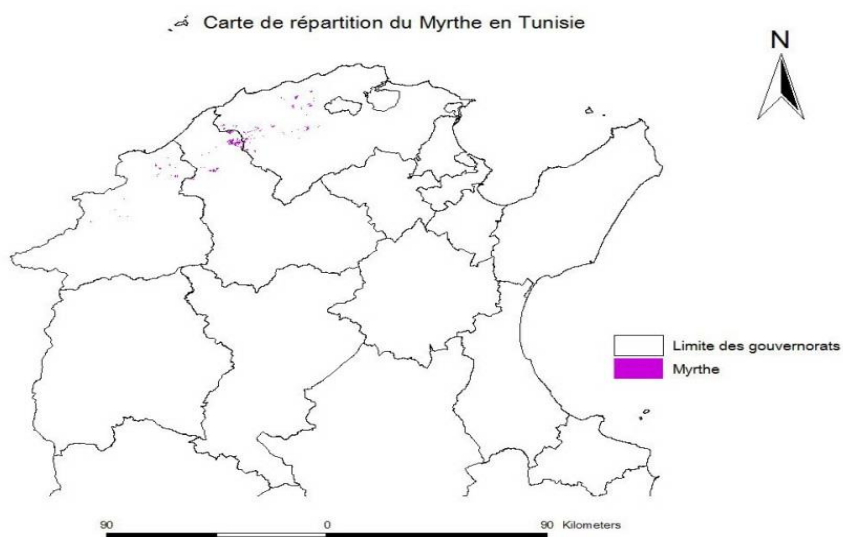


Figure 8: Map of Tunisia showing myrtle production (FINP, 2010)

The essential oil of myrtle remains a niche product both on the national and the international level. The production of the myrtle in Tunisia is stable. It is the exploitation of the same tablecloths. The same lots of myrtle are put in the invitation to tender each year. The consumption of myrtle in Tunisia is done at the local level in rural areas. The size of the market is estimated to be 400 to 500 kg. The plant and its virtues are not yet very well-known at the national level. The entire production is practically destined for export. France, Spain, the United Kingdom, Switzerland, Germany and the United States absorb 95% of Tunisian exports (Table 9).

The price of the sale for export of the essential oil of myrtle observes a growth: 115 DT/kg in 2011 to 194 DT/kg in 2014 (INS, Apia). The price is determined as a function of the quality of the product, flowering period, costs of labour, performance. The value of exports of essential oils has reached 632.654 DT in 2012 (INS). The segment of the market of cosmetics and perfumery is not seeking of bio. This is more prevalent in the agro-food. Consequently, the size of the market for the essential oil of myrtle certified "bio" is estimated at 100 kg. Even if the price of sale for organic products is 10% higher than the conventional, this does not represent a margin beneficiary but covers the costs of certification.

Generally, the prices on the national market are higher than those for the export: between 10 and 20 DT for a bottle of 10 ml. But given the limited size of the domestic

market, the societies of the WFP (aromatic and medicinal plants) are geared exclusively to the export.

Table 9: Evolution of the exported quantities and prices of the essential oil of myrtle Between 2008 and 2012

Years		2008	2009	2010	2011	2012
France	Qty (kg)	1.474	1.395	4.595	3.743	3.462
	Price (DT)	156.036	154.707	488.627	410.831	554.554
Germany	Qty (kg)	150	250		228	5
	Price (DT)	18.368	32.565		38.912	879
Italy	Qty (kg)	50	50	50	100	
	Price (DT)	4.467	5.074	6.550	14.580	
United Kingdom	Qty (kg)			20		
	Price (DT)			2.458		
Spain	Qty (kg)		25	25		
	Price (DT)		2.957	3.159		
Switzerland	Qty (kg)	598	200	289		200
	Price (DT)	51.601	18.129	32.866		29.831
Canada	Qty (kg)				25	
	Price (DT)				5.084	
United States	Qty (kg)	100				100
	Price (DT)	12.303				16.833 Ritchie Point
Countries not determined	Qty (kg)				50	170
	Price (DT)				8.180	28.545
Total	Qty (kg)	2.372	1.920	4.979	4.146	3.937
	Price (DT)	242.775	213.432	533.660	477.587	632.654
	DT Price/kg	102	111	107	115	161

The Tunisia presents several competitive advantages at the level of the production of the essential oil of myrtle: healthy environment and non-polluted environment favourable to the collection of myrtle; provision of a capacity of industry capable of ensuring the integrity of the methods of production or gathering according to the specifications well formulated; response to the needs of the markets more and more demanding in terms of quality; conventional myrtle and "bio" exist; proximity to the market outside.

The Myrtle Tunisian Green presents the specificities requested characteristics in comparison to the red myrtle of Morocco. Indeed, the difference lies in the rates of 3 molecules in the majority to know the α -pinene, 1,8-cineole and acetate of myrtényle (Table 10).

Table 10: Comparison of the chromatographic analysis Myrtle green and red myrtle

Green Myrtle of Tunisia (<i>Myrtus communis L. cinéoliferum</i>)	Red Myrtle of Morocco (<i>Myrtus communis L. myrtenylacetatifera</i>)
- α -pinene: 47.0 to 57.0%	- α -pinene: 20.0 to 28.0%
- limonene: 6.0 to 11.0%	- limonene: 8.0 to 15.0%
- 1,8-cineole: 15.0 to 25.0%	- 1,8-cineole: 23.0 to 36.0%
- linalol: 2.0 to 4.0%	- linalol: 1.5 to 5.0%
- terpineol: 1.0 to 3.0%	- terpineol: 2.0 to 5.0%
- myrténol: maximum 0.5%	- myrténol: at least 0.3%
- acetate of myrtényle: at max 0.5%	- acetate of myrtényle: 13.0 to 25.0%
- acetate of géranyle: 1.5 to 3.0%	- acetate of géranyle: 1.5 to 3.0%,
- Methyl eugenol: maximum 1.0%	- Methyl eugenol: maximum 1.5%

MAPPING OF THE MYRTLE VALUE CHAIN

The mapping of the value chain presents all of the steps in the production of the essential oil of the production up to the final consumer. It shows the multitude of products from the myrtle showing 2 levels of processing and 3 types/ business models involved in the production (Figure 9).

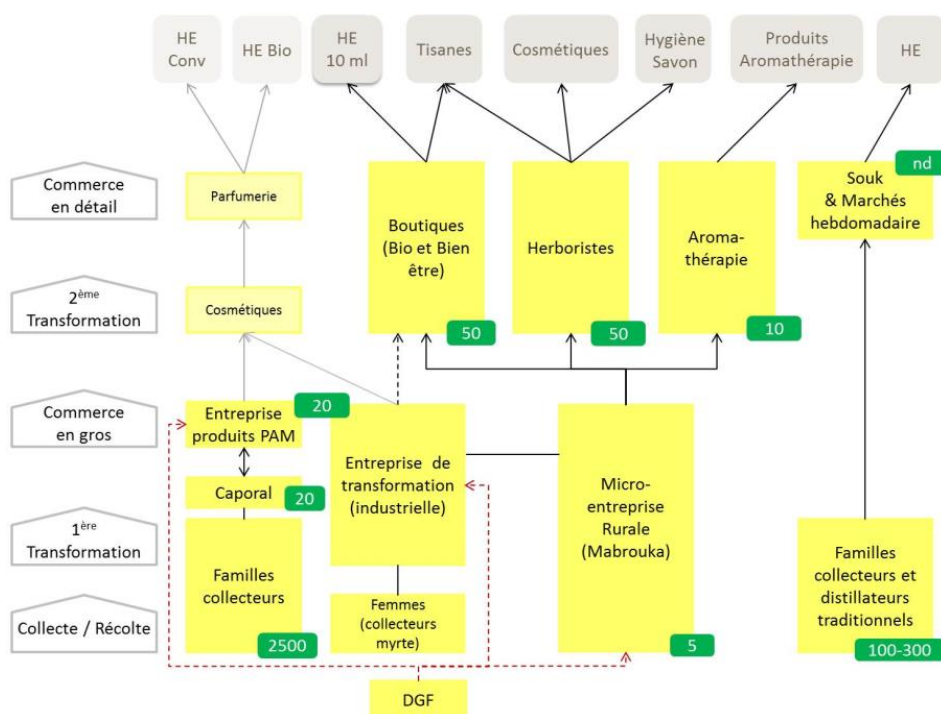


Figure 9: Mapping of the CVA the essential oil of myrtle

The area usable, estimée has 35.000 ha, is localized in the region of Kroumirie-Mogods. The surface exploited is estimated at 26,000 ha located essentially to Jendouba (55%), Beja (43%) and Bizerte (2%) (2nd Forest Inventory and National Pastoral, 2010). The sale of the lots of myrtle in forests is subject to the procedure of the invitation to tender. Each participant withdraws a book of specifications containing all the information on the Myrtle in the proposed lots and is present on the day of the tender. An auction was held in the REF and more saying grants the lot in question. The average area proposed to the exploitation, is an average of 24,800 ha per year during the period 2010 to 2014, against 16,500 ha in 1998 (Table 11). This area has increased, due to a resumption of interesting regrowth of myrtle in areas of Nefza and Sejenane. The operators of the chain confirm that each year the mêmes lots are exploited. This demonstrates the limitations of the model management and mobilization of the resource to which the DGF/REF is facing. A system of rotation which allows a regeneration of the water of the myrtle does not exist.

Table 11: Recent data on myrtle production in Tunisia

<i>Year</i>	<i>S proposed (ha)</i>	<i>S sold (ha)</i>	<i>Price (DT)</i>
2010	24.165	7.261	95.350
2011	23.652	13,800	157.300
2012	22.269	5.474	55.400
2013	26.215	8.724	230.800
2014	27.758	7.452	110.970

Model 1: Families collectors and distillers traditional craft

Women are predominantly present in the crop of the myrtle (as labor) and in the distillation. The activity of harvesting and distillation of the myrtle generally constitutes an additional source of income for women.

- The system of harvest of the raw material: The collection of myrtle is done during the season that begins in the month of June and ends in the month of September of each year. The women use of appropriate pruning shears and fulfill the raw material in bags of 50 kg. The capacity for the collection is 200 kg per person and per day. The sale price of the leaves plucked is 0,120 DT/ kg. The men are involved to facilitate some upstream stages of the value chain (transport).
- Families collectors and distillers traditional craft: it identifies an average of 200 actors in this model. The extraction of the essential oil is done in a manner craft through a still of limited capacity (15 liters) that makes an annual production of 50 ml/year. The women benefit to sell the floral water, a by-product of the distillation. The market is exclusively local. The sale is done by word of mouth and/ or through the weekly markets. The annual turnover of 200 DT for the

essential oil of Myrtle (including the floral water) demonstrated the marginality of the product "essential oil of myrtle" for these craft distillers and on the local market.

Model 2: Micro-Rural Enterprises

It is a model of integrated case where the microenterprise Performs all operations of production up to the marketing. This model has benefited from the support of development projects (technical trainings, grant from the hardware). It has a hardware semi-industrial with a capacity of 750 kg with a production capacity of 100 kg per year. It presents a turnover of 36,000 DT by year and creates four positions of the direct employment and indirect ten for the collection and the distillation of the myrtle. A part of the production is done in command after the contracts carried out with larger enterprises. Currently, this model of a production contractualese is facing the non-reliability of the essential oil due to the lack of total control of the production. The problem of the quality remains a topical issue given the lack of mastery of the hygiene and the production environment. The products are not analyzed and the production process is not optimized.

Supported by development projects, micro-enterprises have a know-how for the distillation, but often the marketing aspects are neglected. The sale is made at the local level (close environment), regional (trade fairs and events) and at the national level (shopping well-being, herbalists, aromatherapy). However, the remoteness of the units of the market creates the low capacity of these micro-enterprises to adapt to changes on the market.

Model 3: Companies of transformation of aromatic and medicinal plants

The processing companies have a character "industrial" because they have the capacity to participate in auctions for the exploitation of large lots. They are the number of 10 who also work the essential oil of myrtle. The production is contractualese (framework contract of soutraintance determined by the specifications of the client) through a corporal who ensures the quality of product (essential oil and have been botanically and biochemically defined conventional or Bio) and other aspects of the production. The collection performed by the local population (450 people by Corporal). The purchase price of the raw material is 0,120 DT/kg. The collection capacity is 200 kg/day/per person. On the picking season (4 months), the income per person can go to 2.000 dt. The company performs periodic checks with the corporals. They use distillers with a capacity of 1.000-3.000 KG in employing three persons for the loading, the evaporation and the unloading. These are paid to 35 DT/day. The corporal is paid pro rata of the production (8-10 DT/kg).

The marketing links

The system of micro-businesses: the sale is done at the local level (close environment, family), at the regional level (trade fairs and events) and at the national level (shopping well-being, herbalists, aromatherapy) by reason of 360 DT/kg.a price which is high compared to the price of the sale for export. This is due to the growing interest in natural products and the limited number of micro-enterprises operating in the sector.

The systems of trade in detail: the essential oil of myrtle is sold at the level of the boutiques "well be" and "bio" mainly on Tunis, as well as among the herbalists using it as ingredient in the manufacture of creams and infusion, and also by aromatherapy. The price is usually 10-20 DT for a bottle of 10 ml.

The system of the exporters of essential oils: The product is intended for export to the large firms of perfumery and cosmetics. The margin of Corporal contracted by the company is 9%. After a second transformation (settling, filtering) the Society are made a margin of 36% and sells the product to reason of 194 DT/kg (course of the kg of the HEB in 2014). This model presents an annual turnover of 300.000 DT. Some companies are beginning to invest in the development of new products and new markets (SQO instruction (sign of quality related to the origin), Products of Terroir, fair trade, bio).

Economic analysis of the value chain

A limit of the application of the approach ValueLinks on the Myrtle is the fact that the distillers of PAM transform a large range of products among them the myrtle only occupies a niche. It is therefore difficult to assign exactly the costs of production associated with the transformation of the myrtle. In determining the importance of the product in the assortment, a percentage for the depreciation of the equipment has been granted to the myrtle. Also the absence of the holding of an accounting from the traditional distillers or micro-enterprises constitutes an obstacle.

The gross margin is an indicator that allows you to measure if the activity of a company can make a profit or not: it is the difference between the selling price and the price of returns. The price to the final consumer is 10 DT/ bottle of 10 ml.

The gross margin per bottle is very low and is of the order of 0.140 dt (Figure 10). At the level of the link of the collection, the value added is estimated at 4.2% (Figure 11). The transformers have font Wholesale Marketing and have a gross margin 15 times greater than height of 2.09 DT/bottle of 10 ml corresponding to a value-added of the order of 31.8%. The value added and gross margin the most important are recorded at

the level of trade in detail. This is mainly due to the bottling and the sales environment. The added value is 64% and the gross margin is estimated at 5.45 DT/bottle of 10 ml.

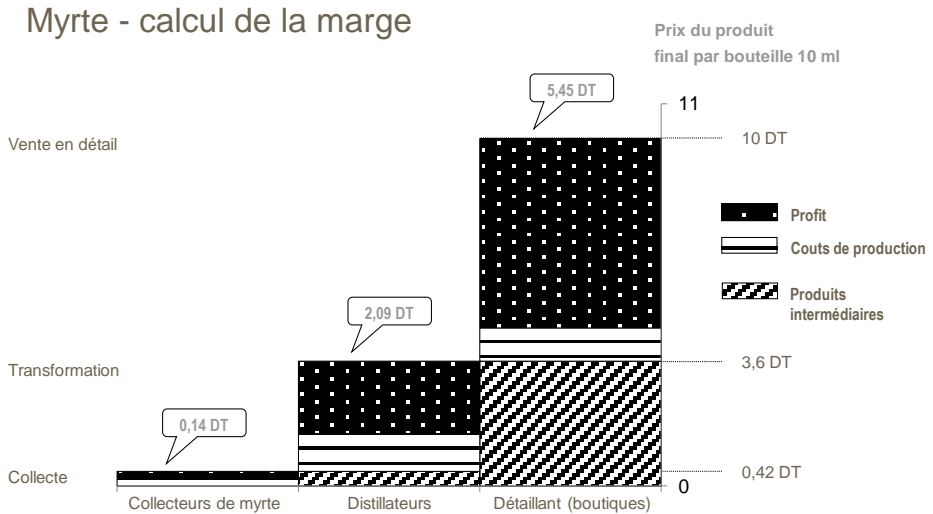


Figure 1: Calculation of the gross margin level of a micro business in rural

Calcul de la valeur ajoutée – Myrte (HE)

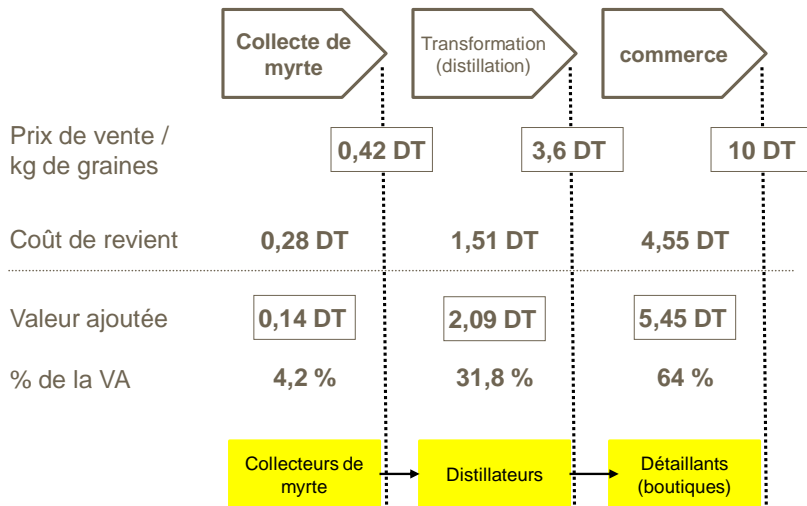


Figure 11: calculation of the value added to the essential oil of myrtle

Support services to the CVA

As regards the support services to distillers of myrtle, two levels are to distinguish (Figure 12): The first represents the companies of PAM supported by the House of association to the Utica. This House facilitates the dialog with the institutions at the macro level, such that the DGF and in a general way constitutes a platform for discussing the problems of the sector e.g. on the transport, export. The companies of PAM can benefit from the support of the APII for investment projects to upgrade and improve their competitiveness. In addition, the whole range of support of the CEPEX on the facilitation of the export is made available to them.

The second level represents the micro-enterprises of distillation supported by NGOs and of some projects. E.g. the project TCP/FAO has funded training and the development of business plans. Nevertheless, some services, such as analysis at the level of the central laboratory and certification are not affordable for these actors. The informal character makes the access to financing difficult. Even for the purchase of appropriate packaging they need a patent. In addition, the access to the resource is a problem. The DGF does not have appropriate services to this type of actors.

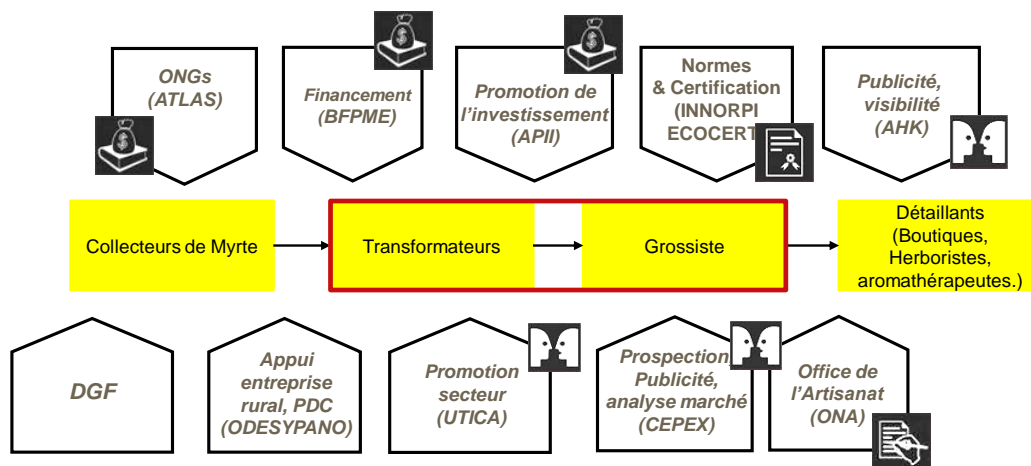


Figure 2: support services to the CVA

The strengths, weaknesses, opportunities and threats of the CVA

The matrix "SWOT" is an instrument of analysis the factors that affect the CVA essential oil of myrtle in Tunisia (Table). The latter influence on the future actions for the promotion of this NTFPS especially from the point of view of the DGF.

<p>Strengths</p> <ul style="list-style-type: none"> • Know-how • Knowledge of the distribution of the water • <i>Mastery</i> of gathering techniques • Price to export • Prices at the national market 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Lack of equipment of good performance • Mastery of the occupational health and the working environment • Tend to be present in all the links of the chain • Scientific ignorance of the benefits of the plant. • Labelling and Packaging • Production of non-stable (rural micro-enterprises) • Access to the myrtle Resource • Lack of knowledge of the market
<p>Opportunities</p> <ul style="list-style-type: none"> • Labelling of the product of the Kroumirie • Optimization of the process of distillation • Marketing at the national level • Reform of the Forestry Code in favor of rural micro-enterprises • Development Plan for more exploitable surfaces 	<p>Threats</p> <ul style="list-style-type: none"> • Overexploitation tablecloths of myrtle Limited • Deforestation, fire

Table 12: matrix "SWOT" of the CVA essential oil of myrtle.

Proposed actions

The work of group have enabled to propose several actions to carry out to find adequate solutions to the current situation of this chain of value added. These proposals revolve around the following points:

- To improve the quality of he, a laboratory can take the load the analysis for the rural micoentreprises.
- Reserve 20 per cent of proposed surfaces in the invitation to tender to rural families at symbolic prices.
- Communicate on NTFPS and natural products to the general public in order to stimulate the local market.
- The successful tenderers do not exploit all the surface of the water purchased from the REF. A proposal to allow price very symbolic and 10% of the surface for the surrounding population.
- A label of products from the Tunisian forests to create.
- Draft BIO certification of forests to follow.

Analysis of the Cactus Value Chain (based on gender)

Under the general supervision of the FAO Representative Tunisia, and under the supervision direct technique of the responsible for the production of plants and the protection of plants and gender focal point (FAO-SNE) and the technical officer responsible for the production and animal health (FAO- SNE), the coordination of the CRP1.1- ICARDA and INRAT.

- Technical Diagnosis of the feasibility to promote niche products in the area of Zoghmar.
- Analysis of cactus value chain sensitive to gender,
- Analysis of the actors and identification of partners for the development and the promotion of local products,
- Workshops organization for raising awareness and planning programs and plan of action for the valorization and the promotion of the cactus and the sheep in Zoghmar community according to a value chain sensitive to gender.
- Projects proposals elaborated with youth promoters (girls and boys) and women for exploitation and marketing of the niche Products (Cactus and sheep)

In the first step, it is important to mention that the diagnosis of the sector took place, in its different stages, in accordance with the traditional format of the diagnostics oriented toward the development of clusters:

- A documentary synthesis linked to the sector in Sidi-Bouzyd, in general, and to Zoghmar, in particular;
- A workshop of assumptions: allowing to increase the awareness of the members of the team to the main concepts and tools of the methodology and to formulate a number of assumptions as to the competitiveness of the sector to Cactus Zoghmar.
- A launch workshop: participation of actors concerned by the chain, from Zoghmar but also of the Governorate of Sidi Bouzid. Presentation of the methodology of diagnosis, to inform the participants of the realization of the diagnosis and its different stages;
- Mini-workshops: field work and individual interviews related to the various links in the chain;
- An internal workshop of results: Analysis of the results of the field work by the team of the diagnosis and the proposal of concrete actions to develop the sector;
- Restitution of the results to Zoghmar and proposal of concrete actions to implement.

For the field work, the team of diagnosis has made use of the main tools of the methodology required during the workshop of hypotheses to know:

- Mapping of chain,
- Analysis of the Five Forces,
- Matrix interaction,
- Guidelines for the individual interviews with businesses and the support structures,
- Gender aspect in the diagnosis and identification of concrete actions.

In accordance with the chosen option at the meeting for the presentation of results, the diagnosis of the chain cactus is presented here following the main tools of the methodology of diagnosis.

A preliminary mapping of the sector cactus Dan to Zoghmar had been developed by the diagnostic team at the workshop of assumptions. This tool has thus helped to identify the functional activities of the sector, the main actors that comprise, as well as support structures and facilitators of the sector, without, however, claim to be exhaustive. It has also helped to identify the obstacles to the proper functioning of the market and identify opportunities for investment, which are mentioned in the present report. Enriched during the workshop for the launching of the diagnosis and the field work, the mapping of the sector cactus has served as a frame for the team to structure its diagnosis. The final version, presented at the meeting of restitution of the results, figure below.

Analysis of the five forces of wear

The analysis of the five forces of Porter aims to better understand the structure of a given industry, to define a competitive position which will be more profitable and less vulnerable and, therefore, to design a strategy adapted. This tool has been used in a systematic manner by the team of the diagnostic When mini-workshops with homogeneous categories of actors in the chain (farmers, rural women, young women graduates of higher) and during individual interviews with the economic operators of the sector. The analysis of the five forces of Porter was performed during the mini-workshop with the farmers. During the mini-workshop with rural women and the one with the young women graduates, the exercise conducted has focused on the identification of socio-economic data related to the target group as well as the potential to upgrade intended to this group.

Mini-workshop Agriculture: The results of the analysis of the five forces of Porter highlight the following key elements:

Rivalry between the companies:

- Majority of farmers has an area of less than 5 hectares
- Cactus Inerme of average area of 0.4 to 0.7 hectares
- Family Farm in the division: Approximately 90% of the lands are in the division
- Absence of agricultural groupings or SMSA
- Old plantations: Thorny cactus
- New plantations: Cactus inerme
- Place of current plantations:
 - ✓ Douar Frayjia
 - ✓ Douar Jouawdia
 - ✓ Douar Mrazguia
 - ✓ Douar Hnezliya
- Three types of Cactus:
 - ✓ Chibouni (very thorny):2% of areas (non-consumable)
 - ✓ - thorny: 65% of the seeded
 - ✓ Inerme: 28% of the areas (fruit / foods of livestock)
- Very fertile soils not exploited in the past
- Culture in dry and without castration requiring irrigation
- Average distance between the traits of cactus: 5 to 6 meters (a line is composed of two parallel lines of remote an average of 08, m to 1.0 meter)
- Thorny Cactus used as piecemeal limit
- Culture of cereals between the lines without fertilisers or pesticides
- Use of manure ovine and caprine animals especially during the planting (Average of 1 kg per plant)
- Use of snowshoes as food of livestock between April and October in a period of drought. This use was extended to the rest of the year in order to reduce the costs of the food of cattle (Hay and plugs) as food complementation
- Absence of a tradition of sale of fruit / Almost all the fruits are not picked up at the exception of small quantities consumed by families
- Period of the harvesting of fruit:
 - From 30 June to 15 July (fruit of before the season / beginning of the crop)
 - From 15 July to 15 August (fruits of season / PIC of the crop)
 - From 15 August to 31 December (fruit of rear-season if good rainfall / otherwise fruit not consumable by the consumer but valid for the transformation and for the supply of the herd)

- Sheep and goat farming in almost all of the families: average of 25 to 50 head
- Strong tradition and know-how in the field of marketing of the lamb

Bargaining power with suppliers:

- Planting
 - ✓ Auto-consumption of the snowshoes for the plantation (low because of the use of the supply of the herd)
 - ✓ Purchase: Camion-Isuzu with approximately 800 to 900 Double snowshoes at the price of 70 dinars (including transport). The purchase is made of the neighbouring areas to Zoghmar
- Manure
 - ✓ Manure: auto-consumption of the family production or local of manure
- Labour
 - ✓ 20 dinars / Hour

Bargaining power with customers:

- Fruit: Zero sale in from the sale of fruits
- Snowshoeing: Zero sale in from the sale of snowshoes

Threat of new competitors:

- Kasserine
- Kairoun

Threat of substitution of culture:

- Culture of olive trees and almond trees (possibly as a replacement of the cactus)

Mini-workshop Rural Women

The socio-economic data collected during the mini-workshop with the rural women has allowed us to identify the following key elements:

- Household tasks
- Food and Hygiene of sheep and goat farming
- Preparation of the snowshoes for the supply of the livestock (grill and cut the snowshoes)
- Agricultural Work
- Weaving (Margoum - Cover in wool - Kachabia - Bornous)
- "The woman does not buy and do not sell " / These functions are provided by the men
- Desire and willingness of women to improve their situation

- Currently, women (70% older women and 30% young women) are working to Hajeb Layoun - Labaiedh - El Hamma -El Hsaynia (Departure for the work to 06h00 - Return to 16h00 / Farm operators Of areas employing these women to agree with a carrier to ensure the movement of women toward the place of work and their return to village) - Compensation to 9 dinars / day
- Work according to the agricultural season:
 - ✓ Summer : Tomato and pepper
 - ✓ November/December: Olives
 - ✓ According to the season: Other cultures maraicheres

Mini-workshop Young Women Graduates:

The socio-economic data collected during the mini-workshop with the young women graduates helped to identify the following key elements:

- November - December: harvesting olives
- Preparation of the food of livestock throughout the year
- Cutting of the snowshoes for the food of cattle
- The snowshoes are roasted by the women who also provide the function of cutting of grilled snowshoes
- Thinking of young people wishing to leave for other places
- Need for information on the benefits of the creation of projects
- Harvesting of the cactus for auto-consumption (90% older women - 10% young women)
- Harvesting of fruit which may constitute a source of income for the young (collection and marketing)
- In the case of profitability from the fruit of the cactus, retention of young people in the locality and return to agricultural activities

Proposed actions

In addition to the improvement of the competitiveness of the sector, one of the priority objectives of the diagnosis was the establishment of a plan of action to strengthen the pipeline through a strengthening of the different factions of the mapping and by providing opportunities for the development of the sector to the benefit of the local population. Concrete actions, taking into account the aspect of gender, have been able to be identified on the occasion of the diagnosis and validated at the time of the restitution sitting of the results:

Action
Creation of a professional grouping Mixed" SMSA" (FAO - DREA)
Strengthening of the capacities of the members of the Steering Committee of the SMSA (FAO - DREA)
Awareness and Training on the community organization - the common interest and the management of conflicts of interest (FAO)
Identification of specific cultivars to Zoghmar (ICARDA - CTV - Farmers)
Identification of areas favourable to the culture of the cactus and of farmers with land available and interested by the planting of cactus in order to ensure a better coordination with the project of planting of 200 hectares programmed for 2015 by the OEP (CTV- ICARDA)
ACTION
Organization of information days and training on the technique cultural in dry and in irrigated (soil preparation - Plantation - Operating - gathering and packaging - Technical of castration ...) (AVFA/DREA-OEP - FAO)
Organization of awareness raising days on the theme: Optimization of the operation to avoid overgrazing and the conservation of plantations in the framework of a sustainable approach (Drea - OEP - AVFA - FAO)
Organization of a day of information on the benefits and subsidies granted on the part of support structures for the benefit of the culture of the cactus (Drea-Apia- OEP-FAO)
Visit organised at the area of Zelfene (Drea - Project PAMPAT)
Organization of visits to units of processing of products derived from the cactus, like the Omega and Nopal Tunisia (SMSA - Project PAMPAT)
Provision of farmers in a didactic guide describing all the steps of the culture up to the valorisation of the cactus (AVFA - FAO)
BIO certification (DGAB - SMSA - FAO)
Action
Establishment of cultivation contracts between the processing companies and the professional grouping to create (SMSA)

Action
Creation of an Association of Women for the development of the Rural Feme of Zoghmar (FAO)
Strengthening of the capacities of the members of the Association (Governance - Management - negotiation - Access to Markets - etc...) (FAO - Other Women's Associations)
Training of the Steering Committee of the Association on the formulation and management of projects in order to better respond to calls for projects by the funders (Association of Women - FAO)
Training/action on the possibilities of use of derivatives of the figs of barbarism (jam - Syrup - soap - chriha - infusion to basis of flowers of Cactus - food of livestock) (FAO - Other Women's Associations)
Provision of the SMSA of small equipment necessary to the collection, cut and to the protection of the persons responsible for these tasks (Association of Women)
Organization of a day of information on the benefits granted for the creation of projects of transformation (SMSA - Association of Women - API - DREA)
Extracting the seeds of figs of barbarism in view of their marketing to processing units (SMSA - Association of Women)
Organization of a day of training/application on the manufacture of food blocks (SMSA - OEP - DREA)
Support for the acquisition of the experimental material for the manufacture of food blocks (FAO - OEP - ICARDA)
Optimization of the use of snowshoes as the power supply for the herd and improvement of the working conditions of women through the acquisition by the SMSA a machine for grilling and cut the snowshoes (FAO - OEP - ICARDA)

- Ownership of the techniques of refrigeration facilities / capacity building of operators of refrigerated warehouses of the region (Drea - Project PAMPAT-techniques in the course of the identification)
- Ownership of the techniques of refrigeration facilities / capacity building of operators of refrigerated warehouses of the region (Drea - Project PAMPAT-techniques in the course of the identification)

Integration of farmers and rural women to marketing channels / better knowledge of markets (SMSA - Association of Women - FAO - PAMPAT Project)

Support for the society OMEGA Tunisia for access to markets (PAMPAT Project)

Prospects for the development of the cultivation contracts between the SMSA and the OMEGA society in the case of access to new markets

Opportunity to marketing of seeds of figs of barbarism to the benefit of the units of transformation (SMSA - Association of Women - omega - professional groupings)

Sheep value chain in Zoghmar community, Governorate of Sidi Bouzid

The Consortium Research Program (CRP) in dryland systems (Known as CRP 1.1) targets poor and vulnerable populations in arid regions in order to improve their food security and livelihoods. It aims to develop the technology, policies and institutional innovations using an integrated systems approach. Dryland systems suffer from limited natural resources more specifically water scarcity and periods of extended droughts which have severe consequences for agricultural production. In these regions, farms are in most cases small farms and have to face resilience. This research program (CRP) has as objective to reduce vulnerability of small holder farmers by developing approaches that simultaneously mitigate risk and increase productivity which aim to improve food security and livelihoods. In this context, one of the activities within the framework of CRP-DS is "Post-harvest and market access" for Sidi Bouzid Sheep conducted by INRAT team with the scientific and financial support of ICARDA. In Tunisia, sheep plays a key role in the development of agriculture in central and Southern regions where environmental conditions can be very harsh due to the scarcity of water. In 2012, the contribution of the sheep production is 57.7% in these areas compared to national production. In Central Tunisia, the governorate of Sidi Bouzid is the most famous place for lamb production. "The lamb of Sidi Bouzid" has a national reputation based, firstly, on the adaptation of the Barbarine breed sheep to the environment largely predominant in this region and secondly for the image that the Tunisian consumer have from animals raised on major rangelands of Central Tunisia. In 2012, sidi bouzid sheep production contributed for 9.2% out of the national production.

The major objective of the study was to characterize the Zoghmar sheep value chain in order to facilitate the development of stakeholder-driven strategies for improving the marketing efficiency, postharvest management and value addition. The specific objectives of the study include:

- The diagnosis and selection of the relevant stakeholders in Zoghmar sheep value chain,
- Mapping the sheep value chain,
- To identify the weaknesses, strengths, opportunities and threats that affect the sheep value chain,
- To suggest key intervention areas for development stakeholders and policy action.

In order to collect information for the sheep value chain analysis, a combination of different techniques were applied:

- Literature review: Relevant literature review through documents and publications were consulted especially from the Mashreq/Maghreb (M&M) Project and Femise/ICARDA project;
- Secondary data: Provided by the regional department for agricultural development of Sidi Bouzid; the territorial cell of extension and the office of livestock and pasture;
- Participatory approaches: Through focus group discussions, main stakeholders workshops and regulatory actors meetings. The focus groups were held with 18 farmers in the region and 10 butchers in the governorate of Sidi Bouzid (Jelma, Lassoueda, Sidi Bouzid market). Age, location and level of education are considered in the identification of participants. The first stakeholder workshop took place in December 2013 with the launching of the innovation platform in Sidi Bouzid site (Zoghmar community). This workshop brought together the main stakeholders in the field of agricultural development. A total of 192 participants attended the workshop (38 women). Group discussions by gender (Women, men and youth) identified social, agricultural, economical and environmental constraints faced by Zoghmar community (see figure3).



Figure 13. Innovation platform, December 23, 2013

The second workshop took place in November 2014 with the launching of the learning alliance in Sbeitla (Zoghmar community) which brought together the main stakeholders in the sheep value chain (see figure 4). The learning alliance is a process of continuous learning, jointly undertaken by research organizations, farmers, marketing agents, donors, Non-governmental Organizations (NGO's), financial service providers, policy makers and relevant civil society actors. The main objective of this learning Alliance workshop is to identify and share good practices in research and development related to sheep value chain. The specific objectives were:

- To describe the sheep value chain in Sidi Bouzid region;
- To identify strengths, weaknesses, opportunities and threats of the sheep value chain;
- To find ways and mechanisms to upgrade the sheep value chain in order to meet the expectations of farmers and to improve their income and their livelihood;
- To increase awareness of the different stakeholders mainly policy makers for the importance of the sheep value chain concept and its impact on regional development.





Figure 14. First Learning Alliance (Sbeitla) November 4-5, 2014

Meetings with regulatory actors were conducted during the year 2014, key informants was collected from the regional department of agricultural development, the territorial cell of extension and the office of livestock and pasture. The core functions of the sheep value chain include: Input supply, production (breeders), intermediaries, processing

(butchers, abattoirs), marketing (market access and channels) and consumption. All these functions are coordinated by regulatory actors.

The input providers in Zoghmar concern the livestock feed suppliers; they are four with an average quota of 425 tons of subsidized barley per provider and per month. Barley is the most requested product by breeders; however, the quantity offered by the suppliers cannot meet the demand of all the farmers in the area. Indeed, breeders in Zoghmar are obliged to buy barley at high prices to cover the needs of the cattle. Breeders always ask for regular controls from the authorities for the animal feed suppliers to punish opportunistic behavior. In the district of Jelma, there are about 250 points of sale of animal feed but they sell the products at higher prices than the subsidized price. For example, soybean packed in 50 kg bags is sold at 13 tunisian dinars (TND¹) by the suppliers while its subsidized price is 10,8 TND. The livestock feed suppliers explain that the demand for animal feed is greater than the supply and they are forced to pay more for transportation and sometimes they also give money for delivery. They reject the idea of opportunism and think that the problem will be solved by a larger supply amount. Veterinary services in Zoghmar count 50 private veterinarians and 10 public doctors; these latter complain from the lack of means of transport and analysis laboratories. CRDA is used in most cases to call on private veterinarians to intervene on time. Health coverage is about 75%.

Sheep breeding is the main economic activity in the area, but the numbers of herds are shrinking because of the degradation of the rangelands and the reduction of the number of the shepherds which affected the reorganization of the farming activity and led to intensification in its conduct. In Zoghmar, the number of sheep (ewes) decreased from 8380 in 1994 to 5970 heads in 2014. In the 1960s, herds took their supply essentially from rangelands. Nowadays, fattening animals is a growing activity due to the degradation of rangelands. Sheep production is constituted by the Barbarine breed and the Algerian thin tail which is becoming more and more important in the farming system of Zoghmar breeders through illegal imports of this breed from Algeria.

The effect of climate change and price rising of raw materials since 2008, have negative effects on sheep production in Zoghmar community. Breeders have seen the number of the cattle reduced by half and sometimes more. According to Bedhief and al (2008), small farmers are facing various constraints:

- ✓ Economical due to a low lamb market prices and high feeding costs
- ✓ Social because of low farmers income

¹1 TND = 0.53 USD (December, 2014)

- ✓ Environmental consequent to rangeland degradation and limited water availability
- ✓ Animal with a genetic erosion of the Barbarine fat-tailed breed

Typology of the breeders in Sidi Bouzid governorate

Several studies have been able to determine a typology of farming systems in the region of Sidi Bouzid and more specifically in Zoghmar Community.

In 2004, Selmi and al identified four types of breeders in Zoghmar community: Fatteners of short period: less than 3 months (19%), Fatteners of long period: More than 3 months (22%), Breeders-fatteners of farm lambs (29%) and Breeders (30%). Purchasing strategies, feeding and sale are not the same for the four types of breeders. The results of the work of Selmi and al, confirm the importance of Eid El Idha for the marketing of sheep farming products in the region of Sidi Bouzid. This period of sale polarizes the activity of livestock in the region at least in communities whose agricultural systems are still in agro-pastoral character, such as Zoghmar. The activity of fattening for the period of Eid is therefore a strategic objective of security of all the households.

In 2005-2006, a survey of 152 farmers was conducted in the governorate of Sidi Bouzid and revealed the presence of three types of breeders: breeders (47%), breeders-fatteners (33%) and 20% of fatteners (Chihi, 2006). There are three types of breeds in Sidi Bouzid: Barbarine breed, the Algerian thin tale and Cross-breeds from these two breeds named "Mezmouz". The Algerian thin tale is attracting more and more interest from breeders with a percentage close to that of Barbarine breed (46% against 49% of the total). Cross-breeds represent only 5% of the total. 58% of the breeders sell their lambs at an age superior to six months. A proportion of 37% sell their lambs between the ages of 3 and 6 months.

In 2008, a survey in the region of Sidi Bouzid, on a representative sample of 42 farmers was achieved within 4 delegations of Sidi Bouzid: Jelma, Ouled Haffouz, Sidi Bouzid East and West. The main results have identified four types of sheep breeding in the region of Sidi Bouzid:

1. Barbarine breed reared on rangelands
2. Algerian thin Tail reared on rangelands
3. Barbarine breed reared on sheepfold
4. Algerian thin Tail reared sheepfold

This study shows that 65% of the breeders conduct their herds in an agro-pastoral system, while 35% are in a semi-intensive system with zero grazing with shepherds

reared in sheepfold. Both breeds: Barbarine breed and the Algerian thin Tail exist in both systems, with a predominance of barbarine breed in the agro-pastoral system. In 2014, a survey was conducted on 129 breeders in the community of Zoghmar and revealed the following conclusions (Gamoudi et al, 2014):

- The traditional sheep system known for a long period in the region has shifted into 50% traditional and 50% intensive;
- The Barbarine breed known as a unique breed reared in the region is now equal with the thin tail breed;
- The Barbarine breed is under a random crossbreeding with the thin tail breed, which represents a threat to the integrity of the breed;
- The best body condition scores were obtained for the Thin tail breed, followed by Crosses then the Barbarine breed;
- Only 20% of sheep owners remain breeders, 40% were at the same time breeders and fatteners and 40% were only fatteners.

The breeders had various criteria for their perception of the breed types (see table 13). The barbarine is a breed of resilience that is resistant to the lack of feed and to the diseases, it requires a highly technical know-how and produce a tasteful meat. In contrast, the thin tail is a breed that produces more meat and is available all the year. Its degree of fertility is higher than the barbarine especially in the case of a suitable feeding. However, this breed is more exposed to diseases because animals are imported from abroad. Cross breed have intermediate quality between Barbarine breed and the thin tail breed.

Table 13. Perception of the breeders

	<i>Barbarine</i>	<i>Thin tail</i>	<i>Cross-breed</i>
Adapted to nature	++		+
Resistant to the lack of feeding	++		+
Resistant to the diseases	++		+
High meat yield		++	+
Need high technical skills	++		
Organoleptic meat quality	++		+
Disseminate diseases		++	
High fertility		++	
Availability during the year		++	

Source: Focus Group with butchers, 2014

(++) Very important (+) important

Intermediaries

Intermediaries are an important player in the value chain to the extent that they can intervene at various links in the chain and capture a significant margin. In 2004, two types of intermediaries were identified:

1. The permanent intermediaries who practice this activity throughout the year and are specialized in the purchase and marketing of sheep products between regional markets and the markets of major cities,
2. Occasional intermediaries who practice this activity only in the period of Eid el Idha and have also other professional activities (agriculture, trade, etc.).

Intermediaries can be breeders, butchers or traders originally from Sidi Bouzid and living in big cities and who take benefit from the period of Eid El Idha to earn money. In 2014, in the framework of the sheep value chain workshop organized in Sidi Bouzid, we met a butcher who buys at around thousand sheep from Algerian borders to fatten them among breeders of Zoghmar community before selling them to markets in the region and in major cities. This intermediary even provides food to farmers and pays them according to the percentage of sale. There are other intermediaries that are specialized in buying lambs one to three months before Eid El Idha to fatten and sell them on the major cities markets where prices are interesting. With the rising prices of lambs and meat, intermediaries are more cautious in their purchasing strategy for several reasons:

- The cost of food is high and the intermediary has no interest in fattening animals during long periods of time ;
- The consumer has showed a lack of willingness to buy lambs in the period of Eid. In 2014, the Eid El Idha was marked by a great reluctance from Tunisians in the purchase of lambs and many intermediaries sold their animals at a loss ;
- The farmers do not want to sell lambs at low prices to intermediaries due to the high cost of food ;
- The prices of sheep on the local, regional and national market became high.

Intermediaries can be classified according to their financial capital. There are in one hand large intermediaries that have the ability to buy large number of head, to practice fattening and sell in the markets of large cities and in the other hand small brokers who are generally farmers that have very close relations with regional and national markets.

Butchers

For sheep production in Sidi Bouzid and especially in the district of Jelma, butchers play a key role in promoting the breed of the animals. Due to the vocation of the region, butchers can be of different types: butchers-traders, breeder-butcher-traders and breeder-butcher-traders- intermediaries.

1. Butchers-traders (type1) are butchers who buy from local markets and practice only their profession as butchers. They are more specifically butchers from Sidi Bouzid market.
2. Breeder-butcher-traders (type 2) are butchers who buy from local markets but also have their own breeding of 100 heads of animals. This type of butchers has an important advantage over the butchers-traders because they can also purchase lambs from farmers in the region and especially the farmers of the family (uncle, cousin, etc.),
3. Breeder-butcher-traders- intermediaries (type 3) are butchers who have great financial capacity and can buy a large number of animals and distribute them among a number of farmers by providing them food. After a fattening period that varies between 2 and 4 months, the animals are sold by the butcher and a share of the profit will be distributed to farmers. This type of butchers supply mainly from the border markets of Tunisia (Algeria and Libya).

Slaughter-houses

Currently in Tunisia there are 201 slaughterhouses divided between North (39%), Central (44%) and South (17%). Clandestine slaughtering represents nearly 50%. In most of the countries, the slaughterhouse is an important source of information on livestock and epidemiology that are interesting for the production of milk and meat. Their management mode is questionable; the hygienic rules are not respected, and the health and livestock control escapes the services of the Ministry of Agriculture. The slaughterhouse of Jelma is small and lack of modern and hygienic equipment.

The causes of clandestine slaughter are multiple; they include:

- The lack of specialization of the activities of the sector, only one person is responsible for slaughtering,
- High fees in some slaughterhouses,
- Problems linked to transport when slaughterhouses are distant from the places of consumption,
- Strict application of the legislation on logging in some slaughterhouses,
- The displayed tolerance of the authorities.

Consumers

Meat consumption in the community of Zoghmar can be analyzed through the perception of market butchers in the district of Jelma or consumers in the region of Sidi Bouzid. In 2004, selmi et al demonstrated that consumers of lamb in the period of Eid El Idha do not give much importance to the breed of the lamb but rather to the presence of fat in the tail. Consumers of the Eid El Idha make their choice based on budget, colour, weight and general appearance.

In 2006, a detailed survey was conducted among 32 consumers while buying meat from butchers. 50% of consumers surveyed were in the area of East-Sidi Bouzid and West-Sidi Bouzid since both delegations represent the majority of the butchers of the municipal markets and specifically "Lahwez" and "Faidh" (Chihi, 2006). The conclusions of this study show that:

- The periods of purchase of meat sheep are three. 59% of consumers buy throughout the year against 25% who exclusively buy during the spring season and 16% buy only in autumn. The purchase price of the kilogram of meat varies from period to period. During the survey, the price was 10 TND / Kg.
- Consumers buy mainly from the market with 94% and 6% only buy from breeders. Regarding the quantities purchased per week, they vary from one consumer to another and depend on the financial conditions.
- For the quality of the meat, consumers prefer more Barbarine breed (59%) rather than the Algerian thin tale (41%). This indicates the growing relevance of the Algerian thin tale in the governorate of Sidi Bouzid which is traditionally known for being the birthplace of the Barbarine breed.
- The Algerian thin tale is preferred for 89 % of the consumers because it is the most available on the market, against 11% for Barbarine Breed. This confirms the fact that the Algerian thin tale is the most sold in the local markets of Sidi Bouzid.

In 2014, the focus groups conducted with the Butchers and consumers in the region of Jelma and particularly in Zoghmar have identified the following conclusions:

- Prices for sheep meat has doubled between 2005 (10 TND/Kg) and 2014 (20 TND/Kg) which pushed the consumers to look for cheapest meat such like poultry products.
- Consumer preferences are different depending on the purchasing conditions. The barbarine breed is mostly preferred at the period of Eid El Idha and wedding parties. The Algerian thin tail is preferred mostly by older people, the inhabitants of large cities and by butchers.
- In absence of signs of quality, Barbarine breed is sold on the same channel as the Algerian thin tail and do not benefit of quality differentiation from the supermarkets.
- Consumers buy sheep meat generally from the butchers of the neighbourhood and rarely directly from farmers. For the period of Eid El Idha, this strategy changes and the consumers try to buy from several channels namely the breeder, the intermediary, the butcher and the local or regional market.
- Market access and channels
- Sheep marketing in Zoghmar community will be analyzed through the study of the market of jelma and the market channels.

The market of Jelma

The weekly market of Jelma is the largest market for breeders in Zoghmar. This market is known for the availability of lamb of good quality and good prices. Market prices vary greatly depending on the season (Ramadan, Eid El Idha, spring) and according to the supply and demand. A field visit made at the market lamb of Jelma four days before Eid El Idha in 2014 revealed the existence of three types of sellers: the breeder, the breeder-fattener of less than three months and the breeder-fattener of more than three months.

The table 6 shows that 70% of Jelma market sellers are breeder-fatteners for a period more than 3 months. These are young breeders with an average age of 44.5 years and the number of head can reach 180. For the three types of vendors, the thin tail is the bestselling breed with a proportion of 75% for breeders to 84% for breeder-fatteners of more than 3 months. The selling prices of the lambs vary according to the type of vendors from 200 TND to 700 TND for breeder-fatteners for more than three months that usually sell animals with a weight that exceeds 50 Kilograms. The profits generated from the sale of a lamb vary according to the type of sellers. The maximum profit generated from the sale of a lamb vary between 40 and 50 TND for the first and second group and 100 TND for the third group. However, lamb sellers can make a small profit (10 TND for breeder-fattener for more than 3 months) or sell at a loss. Jelma market is seasonal and prices may decline significantly after the period of Eid. This average decline is estimated at 75 TND for breeders, 120 TND for breeder-fatteners less than 3 months and 150 TND for breeder-fatteners of more than 3 months. The selling markets are different depending on the seller especially for the third group who extend the marketing channels to Tunis, Gafsa and Sfax.

We can conclude that the fattening activity is an important activity in the region's sheep production. This activity leads to earn more money and is less dependent on climatic fluctuations.

Table 14. Types of sellers in Jelma Market

	Group 1 Breeders	Group 2 Breeders-fatteners Short period	Group 3 Breeders-fatteners Long period
%	10%	20%	70%
Age (average)	62 years	40.5 years	44.5 years
Number of heads			
Maximum	75	123	180
Minimum	40	25	7
Barbarine Breed	20%	25%	16%
Algerian Breed	80%	75%	84%
Selling price (TND)			
Maximum	540	550	700
Minimum	230	250	200
Benefit (TND)			
Maximum	40	50	100
Minimum	Sell at a loss	10	Sell at a loss
Average price decline after Eid (TND)	75	120	150
Main sales market	Jelma, El hajeb, Sidi bouzid, El fayedh	Jelma, El fayedh, Sebbala, El hfay	Jelma, Sebbala, El hfay, Tunis, Sidi bouzid, Sfax, Sbeitla, Gafsa.

Source: Market survey, 2014

The marketing channels for sheep in Zoghmar

The sheep production in Zoghmar has several marketing channels which link production to final consumption through several stakeholders (see figure 5). The number and type of actors vary from one distribution channel to another. There are long channels and short channels, it depends on the selling season and the type of product sold (lamb in the period of Eid or cut meat). The same player in the sector can play different roles. It can be breeder, butcher and intermediary. The calculation of the profit margin is difficult because the product can go through several players before reaching the final consumer. The main marketing channels identified are:

a. Sheep purchased by individual consumers

This marketing channel is the shortest since consumers may buy their sheep at the period of Eid El Idha or festive occasions at the farm. Sheep producers are breeders, breeders-fatteners or fatteners; they can sell their lambs at the time of Eid in the different markets in the region. Breeders from Zoghmar choose in most cases the

market of Jelma for proximity reasons. Zoghmar breeders buy sheep from three suppliers: the farmers of the region, the market mainly Jelma and the imports of the thin tale from Algeria's borders. Prices of sheep are highly variable depending on economic conditions, the season of Eid and the law of supply and demand in different markets.

b. Sheep slaughtered at butcheries

This marketing channel is longer than the first since the butcher sells cut meat. Butchers buy in the majority of carcasses carcass of animals which does not exceed 20kg. The butchers have several options:

- Buy from small farmers, who sell their animals several times a year to earn money,
- Buy from intermediaries sheeps from Algeria to fatten them during two or three months,
- Buy carcasses at the slaughterhouse of Jelma,
- Buy at the market of Jelma sheep from Zoghmar or other markets in the region,
- Buy directly sheep from Algeria's border in collaboration with other butchers.

c. Sheep transported to cities markets

Major cities are supplied with sheep from Sidi Bouzid and Zoghmar community in two ways:

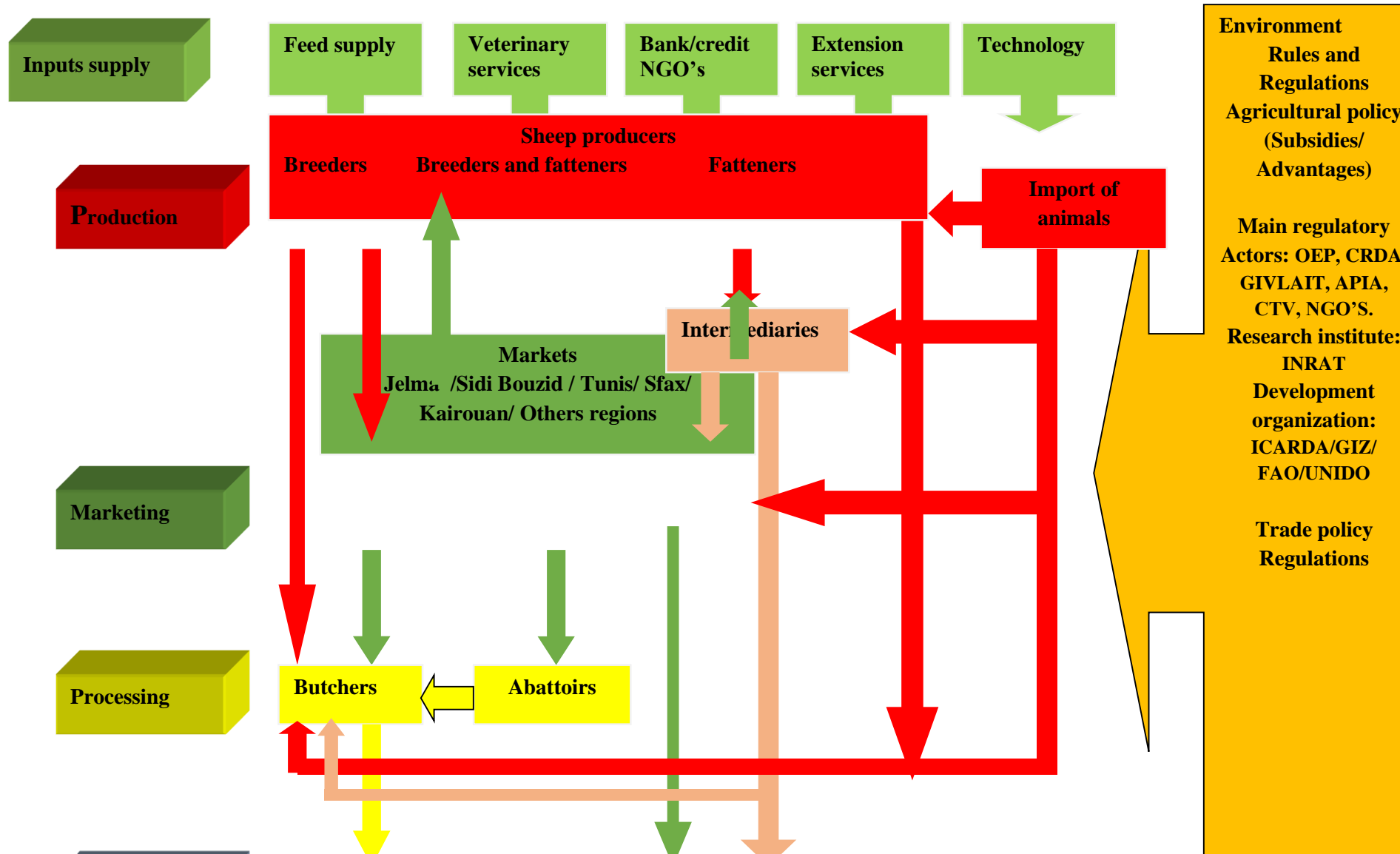
1. At the time of Eid, breeders from the community of Zoghmar sell their lambs in the markets of major cities and their products are highly demanded. The market of Tunis is the most important for breeders from Sidi Bouzid because prices of sheep are very interesting,
2. Outside the period of Eid El Idha, sheep from Jelma are transported to slaughterhouses of big cities and they are also highly demanded.

Butchers can at the time of Eid become intermediaries and sell lambs on the markets of major cities together with their family members. Restaurants and hotels can contract with the butchers in the region for regular delivery in sheep meat.

d. Sheep purchased by other farmers

Farmers buy sheep to increase the number of heads or for replacement. Prices vary depending on sheep breed. In the market of Jelma the Thin tail ewe is more expensive than Barbarine ewe due to higher fertility. Farmers usually buy sheep after harvest crops or after earning money from off-farm activity. Farmers buy sheep from breeders in the region, from the market and sometimes from intermediaries because they sell highly appreciated rams.

Figure 5. Sheep value chain mapping in Zoghmar



SWOT ANALYSIS ALONG THE SHEEP VALUE CHAIN

The SWOT analysis allows highlighting the main Strengths, Weaknesses, Opportunities and Threats along a value chain (see figure 6).

Strengths of the sheep value chain

Sheep value chain has several strengths in Zoghmar community especially for Barbarine breed. The highly technical know-how of the breeders of this area is an important characteristic of this regional asset. Zoghmar inhabitants are attached to the Barbarine breed because of its adaptation to severe environmental conditions and especially to its low production cost. This region has also large range lands that are rehabilitated through the intervention of the office of livestock and pasture by planting spineless cactus. Consumers' preference for Barbarine breed on the occasion of Eid Al Edhha is important, this breed is rooted in the traditions and history of Tunisia.

Weaknesses of the sheep value chain

However, the sheep sector also has several weaknesses. The high costs related to food, the unavailability and a non-diversified fodder affects the activity of livestock in Zoghmar. Rangeland degradation, a small irrigated area and a small forage area make the farmers increasingly dependent on the market of feed products. The introduction of the Algerian thin tail breed can end up with a severe inbreeding problem that can worsen with low health care for animals, this breed is in high demand by butchers who want less fat. Other weaknesses of this sector are also institutional insofar extension service is specifically addressed to irrigated areas, the sector is mostly disorganized in the marketing of fodder and the role of professional organizations in the technical monitoring and supervision are insufficient. This sector also suffers from a lack of funding and investment. The breeders are not organized in a professional structure and do not have access to information.

Opportunities for the sheep value chain

The sheep sector of Zoghmar present real Opportunities mentioned by the different stakeholders. The creation of a production market in Sidi Bouzid will offer to the farmers of Zoghmar a space to buy and sell and to achieve greater sales transactions. In addition, the specification of their product by a sign of quality especially for Barbarine breed will create an added value. The creation of a new modern slaughterhouse allows the production area to ensure a smooth flow and quality levels for these kind of services. The creation of a mutual agricultural services organization is an important opportunity for Zoghmar breeders because of the advantages which may be granted to this organization. The joint purchase of fodder at subsidized prices

solves the problem of the high cost and unavailability of forages. Creating a sign of quality can be achieved only through this organization. Real opportunities in the sector are in the development of agricultural and industrial waste for animal feed and in the valuation of assets of research.

In Zoghmar community, contribution of the rural women in final decisions is not important. Their role can be enhanced when they become members of rural women association. In this context, the first women association was created for Zoghmar community in December 2014 with the help of FAO.

Threats of the sheep value chain

The Threats of the sheep value chain that can at short-term hinder its development are the effect of illegal importation of sheep from Algeria on animal health and on the domestic market, the decline of the Tunisian purchasing power which leads to drop out of purchase of the lamb or to diminish the sheep meat consumption to the profit of poultry products which are much more cheaper, increased production costs and their impacts on the income of the farmer, opportunism of intermediaries who seize opportunities to monopolize the margin of breeders, rangeland degradation through erosion and youth rejection of farming and migration to coastal areas.

Gender in Sheep Value Chain

Roles for men, women and youth are well distributed in the activity of livestock in Zoghmar. The contribution of each player in the family income is still not recognized or valued as it differs from one household to another.

Men's contribution in Zoghmar community

Men are the major actors in the production stage of the sheep value chain. They work as shepherds, they provide food for animals, they provide daily care for animals, they extract the wool, they take care of the sheepfold, they buy and sell forages and animals and they slaughter the animals. The synthesis of the group discussion (adults) with Zoghmar community in the context of the Innovation platform launched on December 23rd, 2014 revealed that the main development problems highlighted by men are related to the lack of drinking water, the lack of irrigation water and adequate facilities, unemployment and the weakness of the financial resources, and insufficient means of investment. These problems, already identified in the participatory development plan (2005), are aggravated by the increasing cost of livestock and the reduction of agricultural income due to successive years of droughts. The participatory research led to the following possible solutions:

In relation to agriculture and valorization of agricultural products:

- Extension of irrigated areas and creation of new ones
- Equipment of hill lakes by pumps
- Creation of hill lakes
- Plantation of spineless cactus
- Cropping of “green barley”
- Creation of a unit of forage blocks
- Production of essential oils
- Organic production
- Labelling (Sidi Bouzid Sheep)
- Stipa “Alfa” Handcraft production
- Aviculture

In addition, the entire group is favourable by the planned activities in the frame of the CRP1.1 program.

In relation to livelihoods improvement

- Distribution of drinking water
- Microcredit / Promotion of investment / Assistance for credit of investment
- Capacity building

Women’s contribution in Zoghmar community

Women in Zoghmar can be shepherdesses if the sheepfold is near the house, they do sheep cleaning, collect the weeds, process the milk into dairy products (butter), make clothes from wool, pick up the cactus and extract milk from the sheep. Zoghmar is a male-dominated society where female perspectives are rarely voiced. It is then extremely important to identify resource-women who can manage an association for development. The women manager must have an academic degree and have desire to be active in the civil society.

Meetings were organized by a lawyer-consultant (recruited by the FAO) and the FAO team. These meetings were conducted to clarify the concept of an association, the objectives and the importance of this organization in Zoghmar. In addition, discussions were made to reach a consensus about the name, the objectives, the head office and the division of labour. The name of this association is 'Women in Development Association in Zoghmar. The activities of this association are:

- Enhancing the development of Zoghmar community (partnership with men, public and private institutions);
- The organization of social and cultural activities;

- Creating projects for women and youth (management, encouragement, organizing trainings, etc.).
- Research projects for the development of Zoghmar community.

Table 1. Challenges and Suggested interventions in sheep value chain

<i>Stages of value chain</i>	<i>Challenges</i>	<i>Suggested interventions</i>	<i>Implementing actors</i>	<i>Time horizon</i>
Input supply	Lack of means for veterinarians from the public service (car, analysis laboratory)	Give veterinarians financial means Agreement with private veterinarian	CRDA OEP	Long term Short term
	High transportation costs	Travel premium	GIVLAIT	Short term
	Lack of credits	Credits up to 20000 TND	NGO's FAO ICARDA CRDA	Short term Medium term
	Opportunism from input suppliers	Creation of a mutual agricultural services organization Regular controls	CRDA Regional office of trade CRDA	Short term
Production	Feed shortage	Planting 100 hectares of spineless cactus, consolidation of acacia plantation / periploca and other fodder shrubs, valuing cultural residues, granting subsidies for irrigation for farmer's fodder, aid for the purchase of straw and enhancers rams.	OEP ICARDA INRAT CRDA	Short term
	Occurrence of diseases due to illegal import of Algerian thin tail	Borders control vaccination campaign	Regional office of trade Local Authorities OEP CRDA	Short term
	Lack of training on improved sheep production and management	Technology transfer and results of research	ICARDA INRAT OEP AVFA	Short term
Marketing	Low bargaining power of farmers	Creation of points of sale	GIVLAIT	Medium term
	Lack of vertical linkage of sheep producers with other actors in the value chain	Production Contract Breeder –Buyer Contract with supermarkets	GIVLAIT CRDA	Short term Medium term
			ICARDA INRAT	Medium term

	Weak horizontal linkages among sheep farmers Non specific Product	Creation of a mutual agricultural services organization Development of signs of quality	OEP CRDA ICARDA INRAT OEP CRDA	Long term
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Source : Learning alliance workshop, 2.014

STUDY 03

Investments in Innovations
for Agricultural
Development and Food and
Nutrition Security

INTRODUCTION

Today, Tunisian agriculture faces considerable challenges: climatic, environmental, socioeconomic, demographic and agronomic. Policymakers must produce more, but sustainably, and with an optimal use of natural resources. The challenge of ensuring the country's food security requires a new strategy for agricultural sector development. In this sense, the development of Tunisian agriculture, built according into the Green Revolution model, enabled a significant increase in agricultural production, which resulted in a better balanced national food equilibrium. However, this model has failed to significantly increase productivity and improve the technicality of farmers. Faced with these agricultural sector challenges, the Institute for Agricultural Research and Higher Education (IRESA) launched a new strategic draft plan of agricultural research and higher education system, considering a new development paradigm -- a new agricultural knowledge allowing to capitalize and sustainably improve the success of the green revolution model in Tunisia on one hand and, on the other hand, adapt this model to build an efficient, sustainable and inclusive long-term new agricultural development model.

Importance of agriculture to Tunisian economy

In Tunisia, the agricultural sector is important to the national economy and plays a strategic role in the country's development process. The importance this sector is reflected by its contribution to the GDP (8.6%) and employment (about 15% of the national workforce, reaching 18% if one considers fishing and other seasonal jobs). The sector provides permanent income to 470 000 farmers. Thus, it plays an essential role in stabilizing the rural population, which represents 35% of the Tunisian population. The average farm size is 10 ha, with 75% below the 10 ha threshold. The added value of agriculture and fisheries has almost doubled over the past decade, registering 7,226 billion dinars in 2014, compared with 3,722 billion dinars in 2005 (figure1).

The agricultural sector contributed about 8.5% to the GDP in 2004 as against 9.9% in 2005. The average contribution of agriculture and fisheries during the period 2005-2014 is about 8.6% (figure 2). Since the 1990s, agricultural production has evolved remarkably, especially in the following productions: olive oil, red meat (sheep and cattle), white meat, dates and milk. These increases took place thanks to the Tunisia's quinquennial development plans, aimed at ensuring the country's food security (table 1).

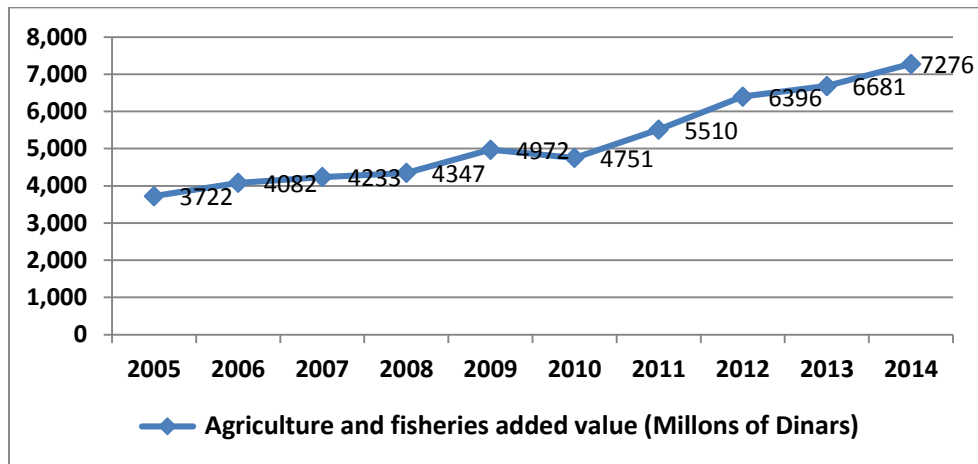


Figure 1. Agriculture and fisheries added value evolution

Source: ONAGRI, 2015

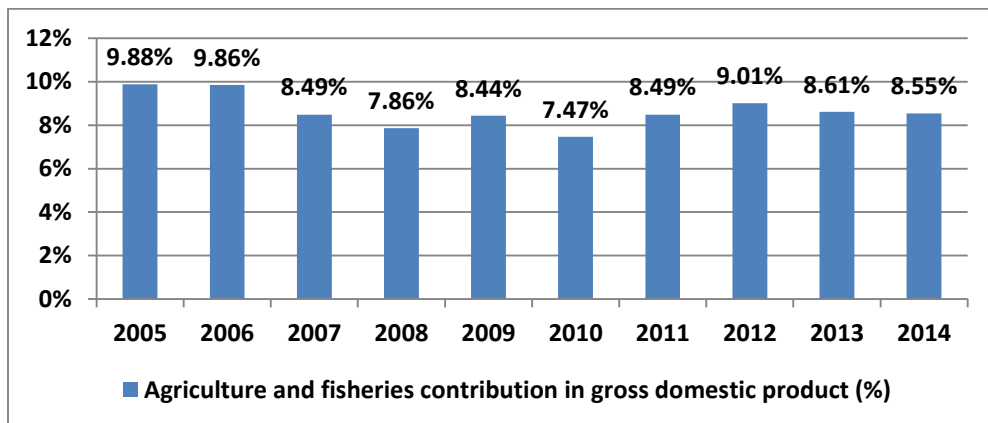


Figure 2. Contribution of agriculture to GDP (%)

Source: ONAGRI (2015)

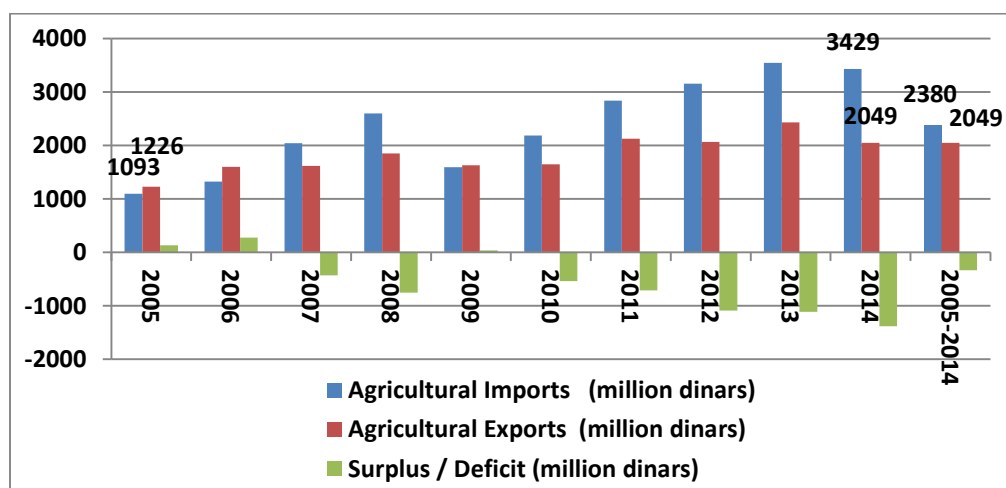
During the last decade (2005-2014), Tunisia's agricultural and food products foreign trade was in an average deficit of 548 million dinars. Imports have more than tripled, while exports have almost doubled. This deficit seems related to a strong increase in domestic demand, along with the increase in grain prices, while the export's growth has been much lower during the same period (figure 3).

The coverage rate of imports by exports recorded a decline during the last decade, especially from 2009, following the global economic crisis and agricultural products' price increase. The coverage rate was 60% in 2014 compared with 121% in 2006, and 112% in 2005. However, the average coverage rate was 86% during the period 2005-14 (figure 4).

Table 1: Main agricultural products' evolution (in thousands of tons)

Product	1990's	2005-2014	Rate of growth (%)
Cereals	1697	1870	10
olive oil	162	815	403
Citrus	219	305	39
Dates	83	163	96
Potato	247	358	45
Tomato	593	1144	93
Mutton	42	102	143
Beef	39	109	179
Poultry	58	157	170
Milk	567	1060	87
Fish	88	110	25

Source: ONAGRI (2015)

**Figure 3.** Agricultural trade (in million dinars)

Source: ONAGRI (2015)

The agricultural sector contributes about 15% to the total exports of Tunisian goods. The government wants to increase this share by diversifying the agricultural products to be exported (figure 5). Tunisia has been planning to develop particularly its olive oil exports. Currently it is mainly exported in bulk, in part through the Community preferential quota. Tunisia's agricultural exports consist mainly of olive oil (490 million dinars), dates (389 million dinars) and seafood (132 million dinars). Italy (22.7% of the market), Libya (13.9%), France (12.3%) and Morocco (8%) are the main customers of Tunisia (figure 6).

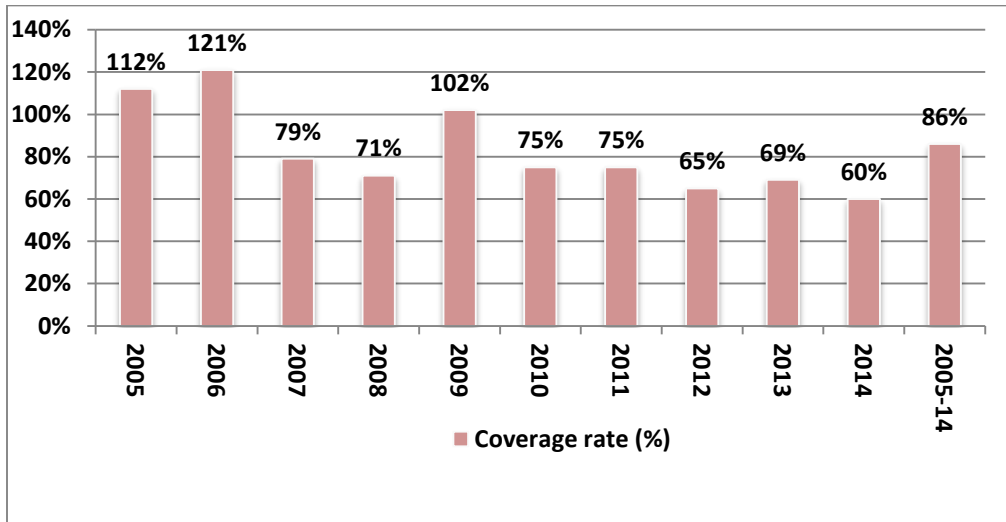


Figure 4. Coverage rate of imports by exports rate in%

Source: ONAGRI (2015)

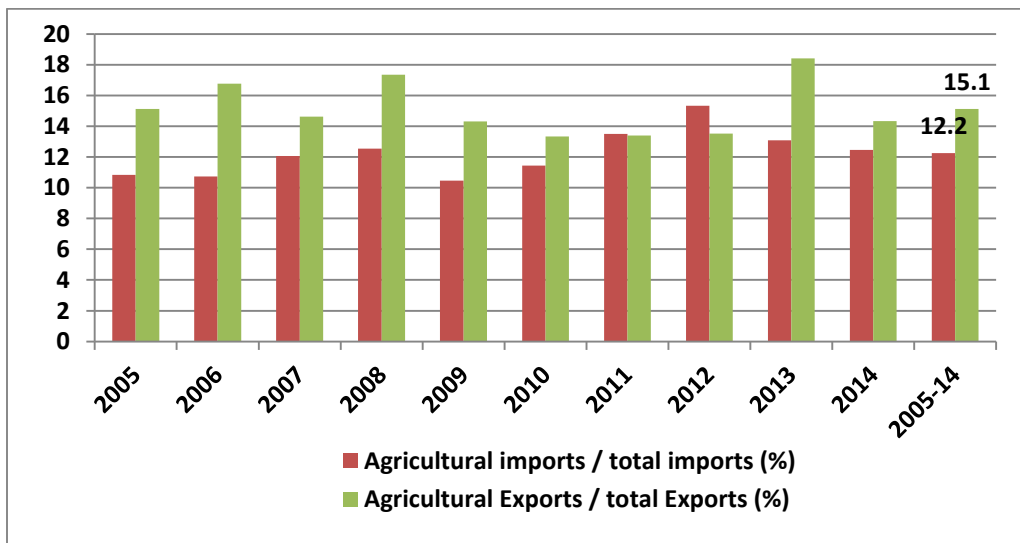


Figure 5. Share of agricultural trade in total trade (%)

Source: ONAGRI, 2015

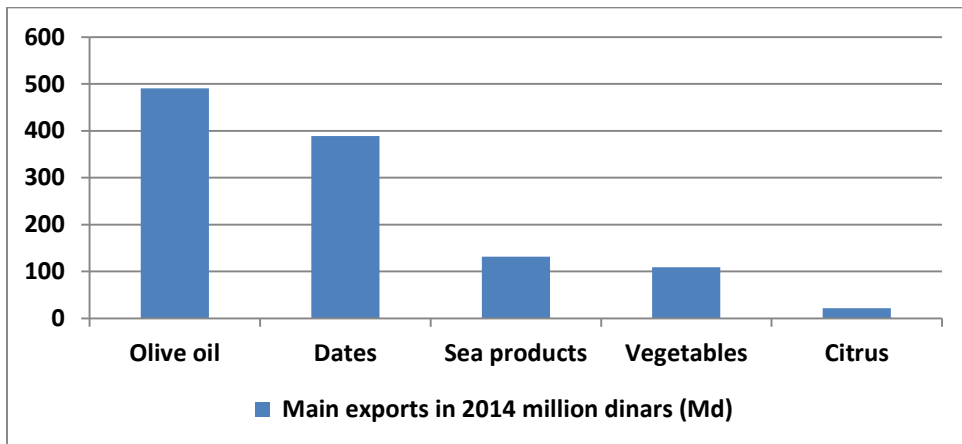


Figure 6. Main exports in 2014 million dinars

Source: ONAGRI (2015)

Tunisia's agricultural imports are mainly grain (1.137 billion dinars), corn (396 billion dinars), seed oils (389 billion dinars) and sugar (323 million dinars). The main suppliers of Tunisia are the United States (14.8%), France (10.7%), Ukraine (8.7%), Brazil (7.7%), Italy (7, 2%) and Argentina (6.5%) (figure7).

Agricultural policy must reconcile the economic and social objectives to ensure the farmers' income and the consumers' purchasing power. The prices of agricultural products do not entirely follow the law of supply and demand. First of all, certain products are subsidized by setting producer prices (cereal, fresh milk); and secondly, the Ministry of Commerce determines ceilings based on a number of parameters. These interventions tend to increase the profitability of grain and cattle production compared to gardening and arboriculture. Regarding the most important agricultural products, the average annual growth rate of producer prices for the period between 2005 and 2014 were 5.5% for potatoes, 4.4% for tomatoes, 6.5% for green pepper, 6.7 for fresh milk, 1.6% for olive oil and 5.2% for durum wheat (figure 8).

Tunisian decision-makers are preparing a revised agricultural policy, taking into account the challenges of Tunisia's agriculture, namely: structural bottlenecks, low productivity, and limited resources in an uncertain environment, both in terms of price (volatility) and climate (climate change). The principles of a bottom-up approach in the decision-making mechanisms and a dialogue between the different stakeholders of agriculture and the rural communities were highlighted.

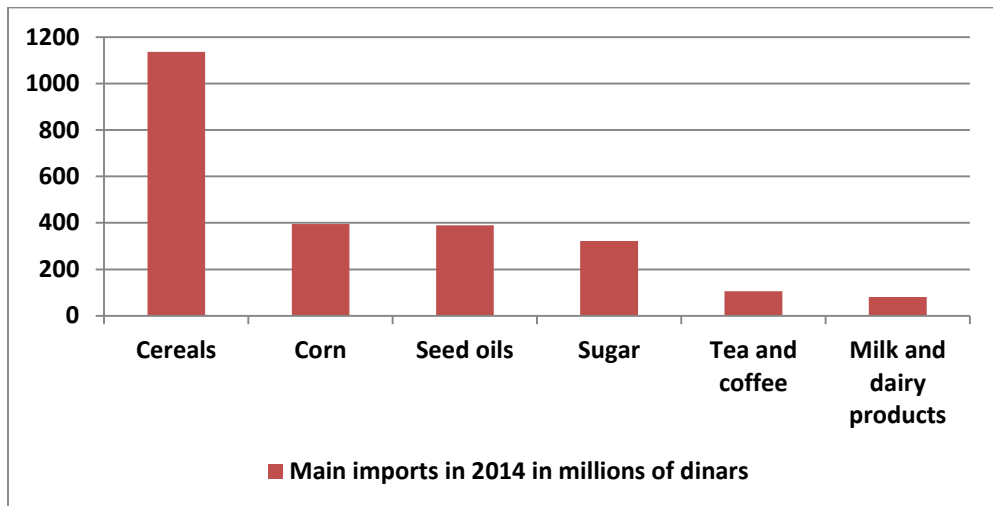


Figure 7. Main imports in 2014 in millions of dinars

Source: ONAGRI (2015)

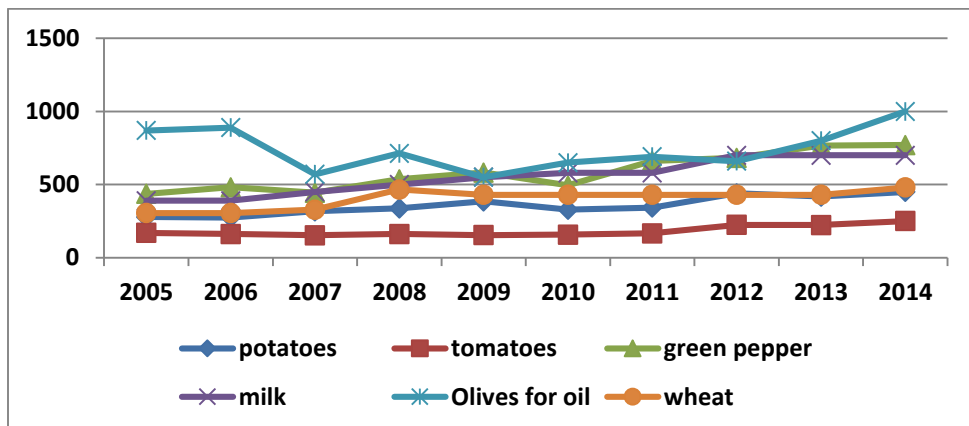


Figure 8. Major agricultural products' price evolution, 2005 and 2014 (dinars / ton)

Source: ONAGRI (2015)

Moreover, the notion of sustainability is integrated with the objective of developing the agricultural sector, through three dimensions with significant effects on agricultural policy:

- a. The economic dimension, by improving the production's competitiveness,
- b. The social dimension, with a better growth benefits' distribution between different categories of farmers, various production sectors and various agricultural regions,
- c. The environmental dimension, with the sustainable management of natural resources.

Tunisian agriculture is facing considerable challenges, and the new agricultural policy should give special importance to innovation either by supporting agricultural research or by its transfer to farmers.

Situation of Tunisian Agricultural Research

Twenty-three agencies carry out agricultural research in Tunisia, all under the umbrella of IRESA, a semi-autonomous institute administered by the Ministry of Agriculture. IRESA has the national mandate to develop research programmes, oversee research budgets, facilitate linkages between its research and education agencies and with extension agencies and producer organizations, and to ensure the relevance of the research conducted according to national agricultural production and development priorities. IRESA comprises 6 research institutes, 4 regional centres, 2 so-called regional poles and 11 higher education agencies. The 6 research institutes under IRESA are INRAT (74 FTE researchers in 2012), INSTM (75 FTEs), IRA (120 FTEs), INRGREF (59 FTEs), IO (35 FTEs) and IRVT (9 FTEs). INRAT is Tunisia's principal crop and livestock research institute. It operates 20 centres, 6 laboratories and 5 experiment stations across the country. INRAT's research focuses predominantly on barley, wheat, pulses, vegetables, livestock and socioeconomics. IRA conducts dry area research, particularly on camels, pastures and forages, barley and pulses. INSTM focuses on fisheries, INRGREF on forestry, water, and agricultural engineering; IO on olive trees, and IRVT on livestock. INAT (35 FTEs) is IRESA's largest higher education institute. Its principal mission is teaching, but crop, livestock, fisheries and natural resources research play a relatively important role as well. The other higher education agencies each employed 13 or fewer full time equivalents (FTEs) in 2012. The private sector plays a negligible role in the conduct of agricultural research in Tunisia (Gert-Jan Stads et al, 2015).

The increase in agricultural research spending is directly correlated to the increase in the number of agricultural researchers. The increase in the number of agricultural researchers in the recent years is explained by the creation of four regional centres under IRESA's aegis. The full-time equivalent of the total number of public sector agricultural researchers increased from 348.1 in 2000 to 541.6 in 2012, registering an increase of 56%. The number of agricultural researchers (FTEs) increased from 45.6% in 2000 to 66.1% in 2012 (figure 9).

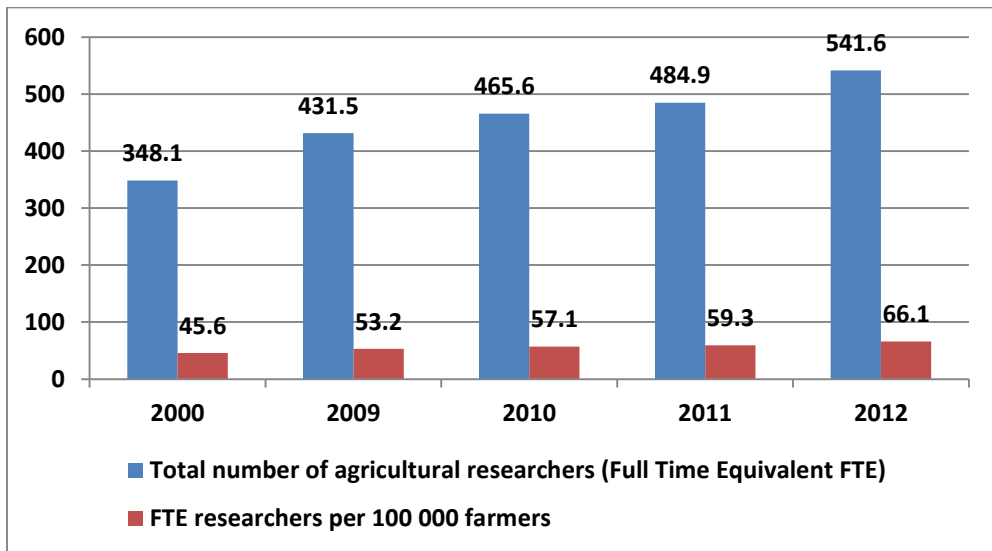


Figure 9. Total number of agricultural researchers (FTE) of the public sector

Source: ASTI database, 2005

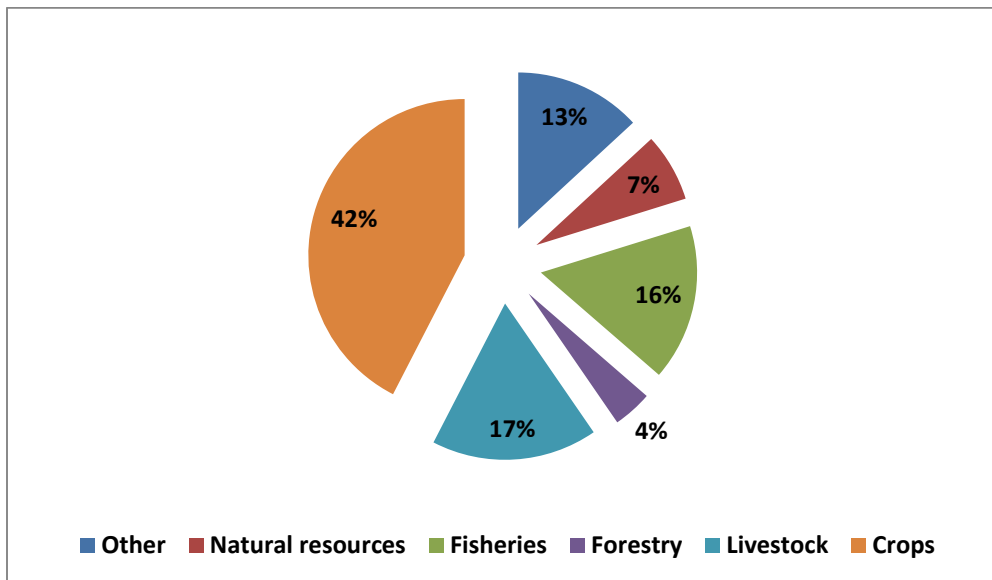


Figure 10. Distribution of research focus in 2012

Source: ASTI database, 2005

Crops, livestock and fisheries were the most targeted areas of research by agricultural scientists, representing 75% of the research direction (figure.10). Natural resources and forests only represent 7% and 4% of the research direction. This distribution of research areas depends closely on the strategic directions of the government, especially in the field of cereal crops. The main crops studied by researchers are olives (20%),

vegetables (14%), fruit (12%), barley (10%), pulses (10%) and wheat (9%). Gender balance in agricultural research is important, because women researchers propose different ideas and perspectives that may help research organizations to more effectively address the unique and pressing challenges of women farmers. In 2012, 33% of Tunisian researchers were women, and this percentage will increase in the coming years due to the high number of female PhD students (figure 11). With this percentage, Tunisia precedes Oman (31%) and Morocco (23%), but lags behind Egypt (36%), Lebanon (48%) and Algeria (51%).

Imbalances in the distribution of the age of the research staff should be minimized. Having too many senior researchers approaching retirement age can be an obstacle for the future research continuity. Additionally, a preponderance of young, inexperienced researchers can affect the quality of research over time. In 2012, approximately 50% of agricultural researchers were over fifty, and was noted that within certain organizations (including INRGREF and INAT) almost two-thirds of the researchers were more than 51 years (figure 12). As the official retirement age is set at 65 years, it is important to ensure that young researchers can, in the medium term, improve their level of qualification, to counter the imminent threat of a large-scale loss of senior researchers (Gert-Jan Stads et al, 2015).

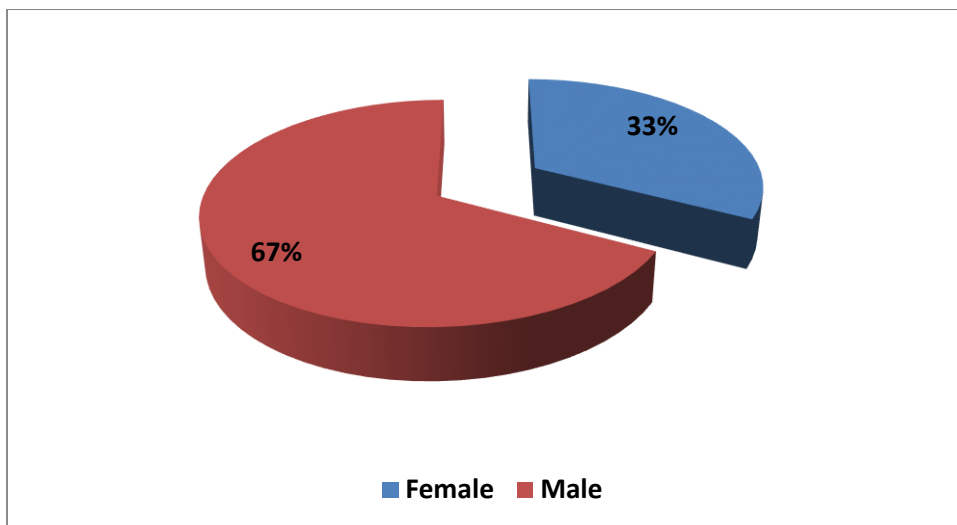


Figure 11. Distribution of agricultural researchers by gender in 2012

Source: ASTI database, 2005

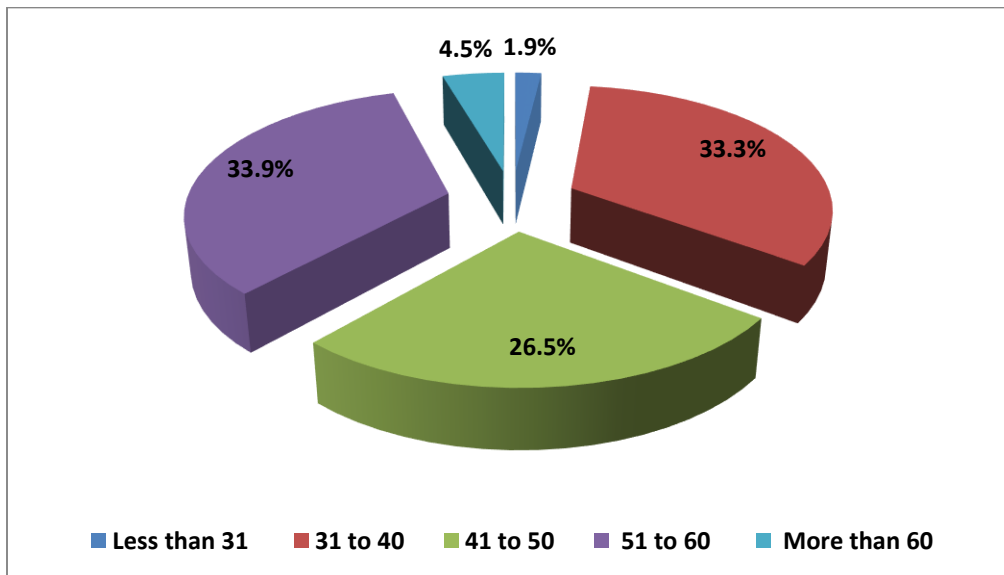


Figure 12. Age distribution of agricultural researchers in 2012

Source: ASTI database, 2005

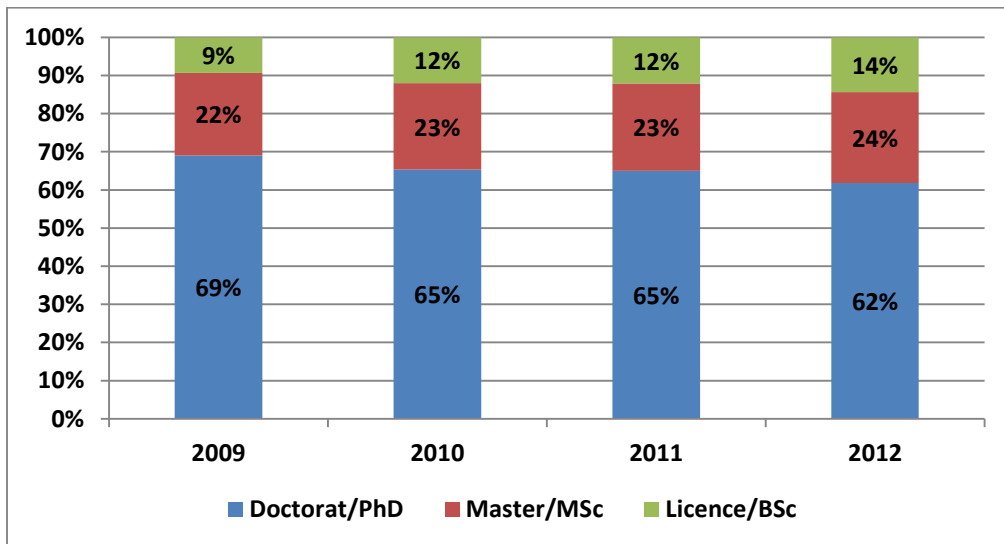


Figure 13. Distribution of agricultural researchers by academic degree in 2012

Source: Calculations from ASTI database 2005

The share of Tunisian researchers with PhDs decreases from 69% to 62% between 2009 and 2012, at the expense of researchers holding a license or a master (figure 13). Nevertheless, the share of researchers with PhDs in 2012 is high compared to other countries like Morocco (45%), Jordan (35%) and Algeria (23%).

Expenditure on Agricultural Research

Agricultural research funding comes from several sources such as the government, donors, development banks, levies on products and organizations of producers and sales of products and services. Nevertheless, the government remains the main actor financing agricultural research, with a share of 97.4% in 2012 (figure 14).

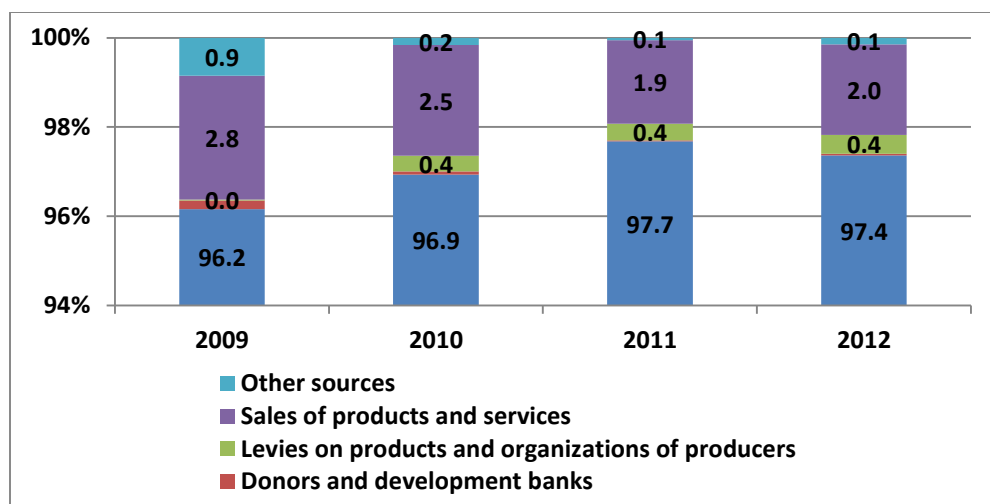


Figure 14: Sources of funding for agricultural research distribution (%)

Source: ASTI database, 2005

Agricultural research's expenditure are distributed into salaries, operating and programme costs, and capital investments. The salaries paid by the government represented the largest share of total expenditure, with 69% in 2012 (figure 15). Total spending on agricultural research experienced two different periods between 2002 and 2012 (figure 16). The first period is between 2002 and 2009, and is characterized by a decline in total expenditure by about 28.6%. The second period is between 2009 and 2012, in which the total expenditure increased by around 13%. However, despite the rise of the second period, total spending on agricultural research in 2012 (37.3 million dinars) are lower than those recorded in 2002 (46.3 million dinars).

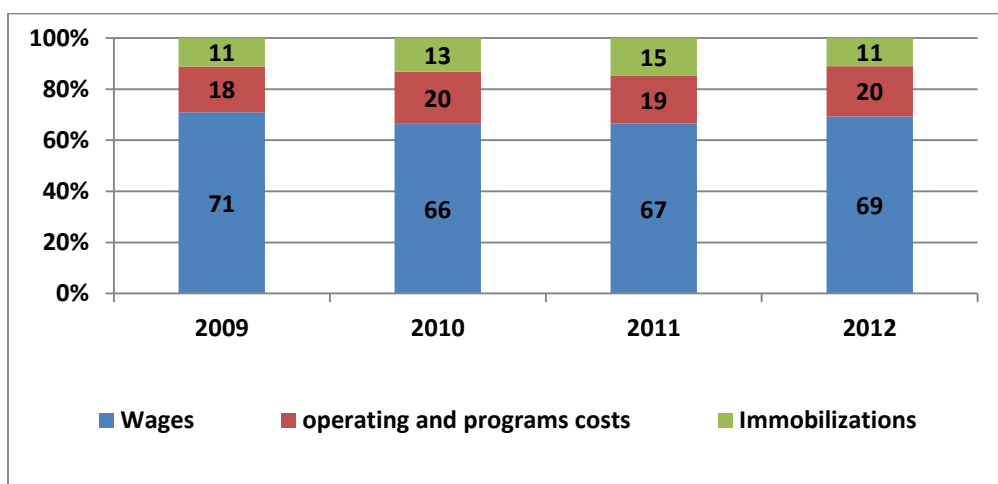


Figure 15. Distribution of total expenditure on agricultural research (%)

Source: ASTI database 2005

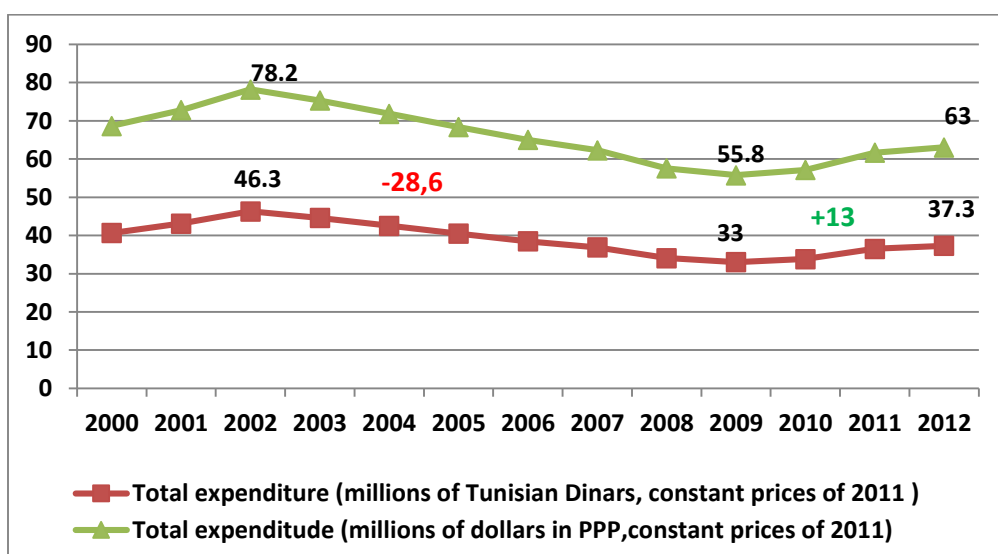


Figure 16. Total expenditure on agricultural research's evolution (millions of dinars)

Source: ASTI database, 2005

Total public spending as a percentage of agricultural gross domestic products (AGDP) is a common indicator of investments made in research that places spending on a country's agricultural research in a comparable context internationally. The current rate of the Tunisian agricultural research has declined substantially by 33% between 2000 and 2012. The total expenditure for agricultural research as a percentage of agricultural GDP are below the target recommended by the United Nations and NEPAD (New Partnership for Africa's Development), which is 1% (figure 17). The

completion of the Reinforcement of Services Supporting the Agriculture Program (PRSSA/PRSAA in French) in 2008, funded by the World Bank seems to explain the decline in research intensity rate.

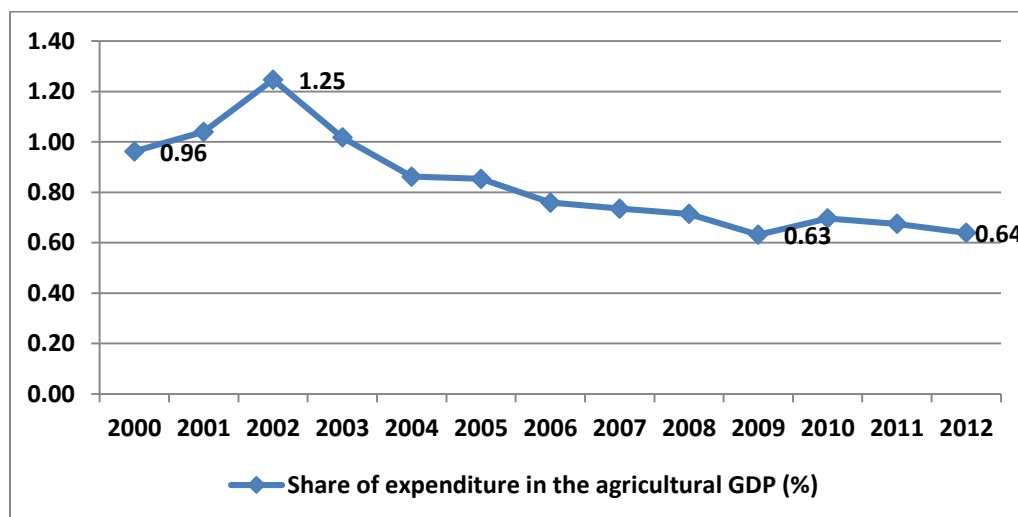


Figure 17. Total expenditure on agricultural research as a percentage of agricultural GDP (%)
Source: ASTI database, 2015

FUNDING FOR AGRICULTURAL RESEARCH

Funding research programmes by IRESA

Research programmes are funded by IRESA (Institute for Agricultural Research and Higher Education) and projects are co-financed by multilateral donors, loans and MESRS grants. IRESA's budget is determined annually by MARH and the Ministry of Finance, and includes the following components (Gert-Jan Stads et al, 2015):

- A comparatively constant (in real terms) annual operating budget for administrative and general research activities that is disbursed directly to IRESA's four research institutes;
- A special operating budget for research programmes that is disbursed by IRESA based on priorities and financial needs;
- A capital budget derived from multilateral donors and World Bank loans that is managed by IRESA in accordance with donor project agreements (this also includes a discretionary component allocated to the research institutes for unplanned capital expenditures);
- A relatively small capital budget is assigned to research agencies for work on infrastructure or the acquisition of unplanned equipment in projects co-financed by donors or loans;

- e. MESRS allocates an annual budget to research laboratories. This budget is transferred directly to the designated research institutes and managed by the laboratories themselves;
- f. An allocation for specific product-related uses funded by public enterprises and professional associations, which jointly agree on its utilization with IRESA and the research agencies;
- g. Operating funds from foreign donors are managed by the research agencies themselves as part of extra-budgetary competitive funds.

Operating budget of IRESA

Between 2010 and 2013, IRESA funded the operating budgets of various research programmes (federated research projects, unifying projects, research and development projects, etc.) for an average annual budget of 2286 million dinars, including a maximum of 2580 million dinars in 2011 and a minimum of 2060 million dinars in 2012 (figure 18).

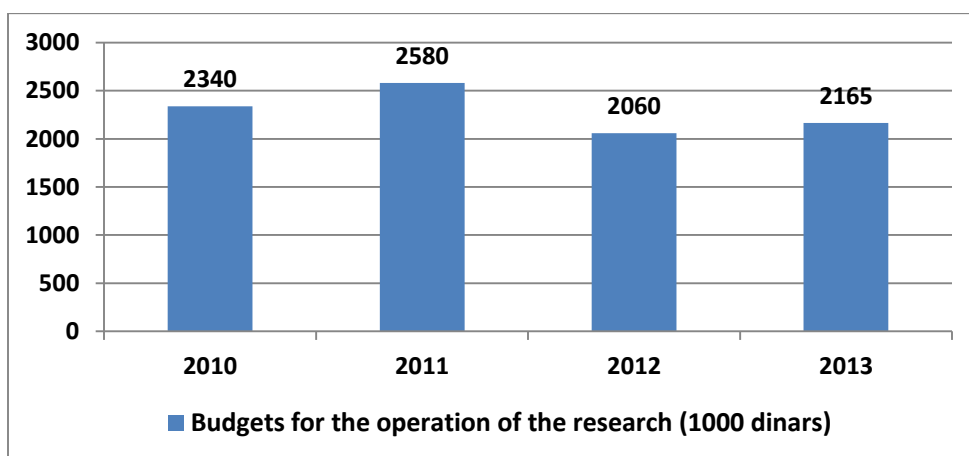


Figure 18. Operating budget of agricultural research between 2010 and 2013

Source: IRESA (2015)

The Project of Operational Research Programs was dedicated to finance 5 types of projects: federal research projects, federative projects, research and development projects, "Tuta Absoluta" project, and the project, Network of Support for Agricultural Research in the Mediterranean Countries. Programme funding is made differently depending on the year and the project's type (figure19).

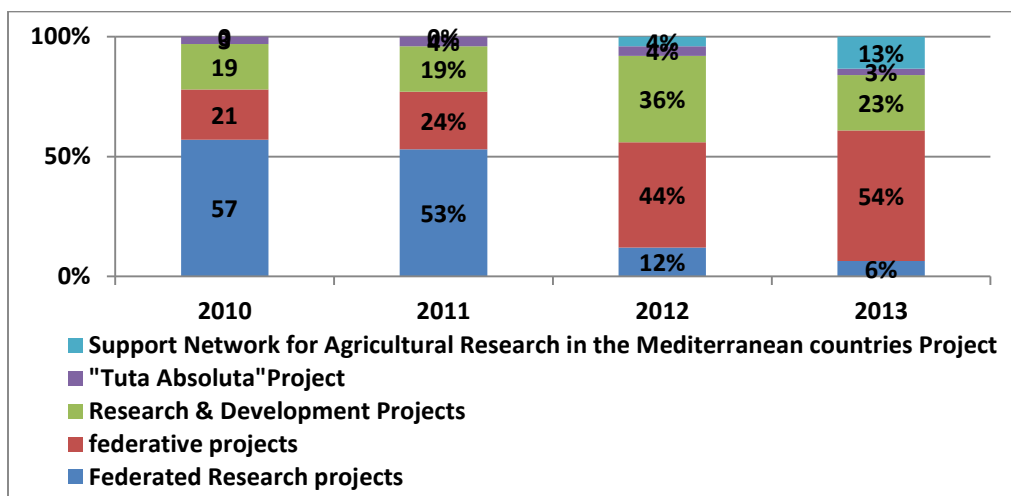


Figure 19. Operating budget for agricultural research by project type (%)

Source: IRESA (2015)

About 74% of the operating budget for research programmes were released to the research and higher education institutes in 2013 (Figure 20). IRESA, the institution that manages this budget, had only 218 million dinars (10%).

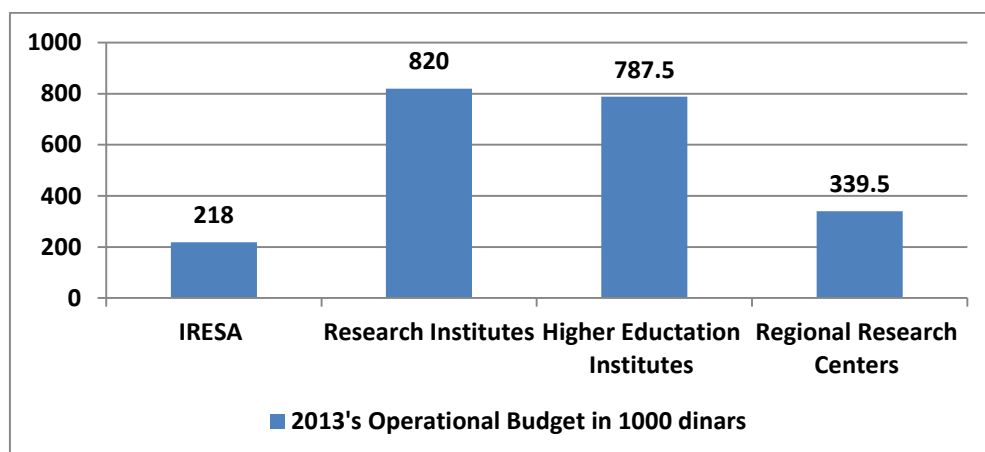


Figure 20. Agricultural research institution's operating budget (1,000 dinars)

Source: IRESA (2015)

Financing federated projects

Project Federated Research (PRF) in the area of cereal crops was initiated by IRESA in 2008 for a period of four years (2009-2013). The IRESA launched a tender to receive project-related proposals. The examination of these proposals was carried out by the Programming and Evaluation Commission for Agricultural Research (PECAR)

in the area of cereal crops. This project involved 20 institutes, 20 laboratories and 300 scientists. The budget of the PRF was 1340 million dinars and 1380 million dinars for the first two years, and declined to 140 million dinars in the last year (figure 21).

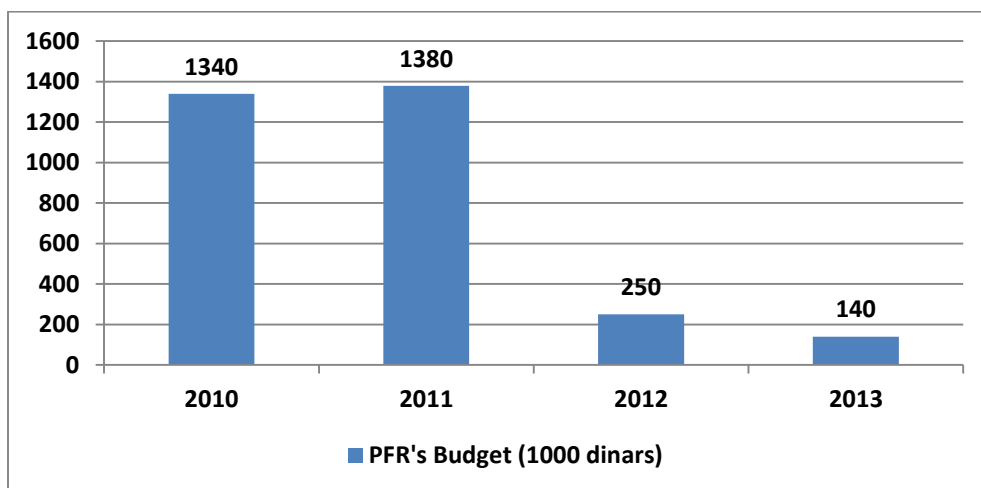


Figure 21. PFR's budget (1000 dinars)

Source: IRESA (2015)

The federative projects are multi-institutional and multi-disciplinary projects evaluated by programming and evaluation commissions of trained agricultural research scientists and representatives of the development of that profession. In total, 42 federative projects, including 150 research projects, have been formulated. The budget for federative projects rose from 497 million dinars in 2010 to 1178 million dinars in 2013, an increase of 137% (figure 22)

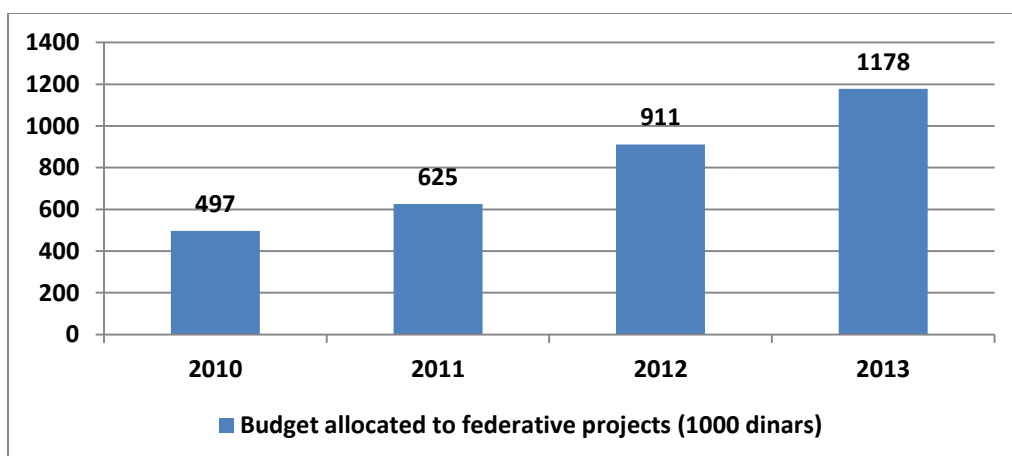


Figure 22. Budget allocated to federative projects (1000 dinars)

Source: IRESA (2015)

Funding for research and development projects

The best-known research and development projects within the scope of the reinforcement of services supporting the agriculture project was destined to improve the quality and competitiveness of agricultural production and market access to small and medium producers. Five "senior" conventions in research and development involving IRESA, and GIVLAIT, OEP, GIPP, GIL and GIPAC were signed. The budget allocated to development projects ranged from 447 million dinars in 2010 to 730 million dinars in 2012. The average budget between 2010 and 2013 was 544 million dinars (figure 23).

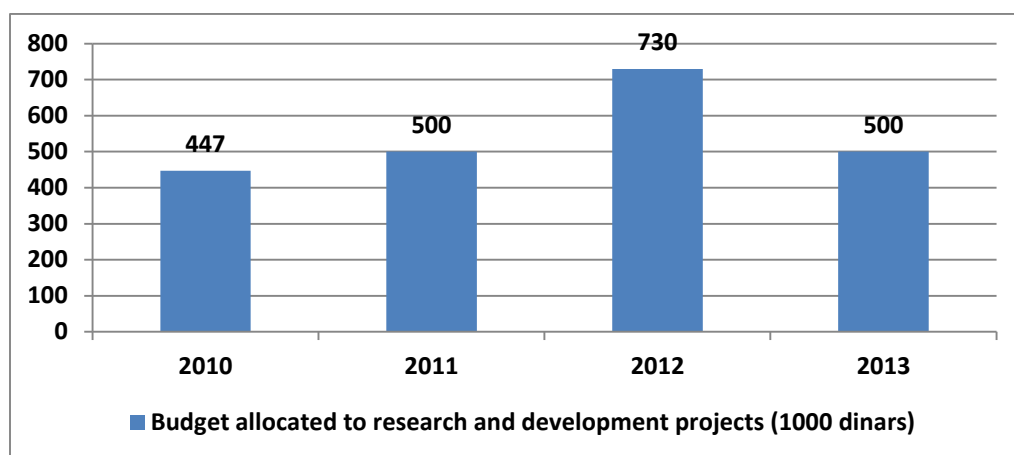


Figure 23. Budget allocated to research and development projects (1000 dinars)

Source: IRESA (2015)

Financing MESRS in laboratory research institutes

The MESRS finances the research programmes of research institutes within the laboratories and research units. The laboratory programme lasts four years. Laboratory assessments are made at the beginning, during set course and at the end. Between 2011 and 2014, the budget allocated by the MESRS was 2900 million dinars for IRA Medenine, 2400 million dinars for INRAT, 2300 million dinars for INSTM, 2000 million dinars for INGREF and 900 million dinars for The Olive Institute (figure 24).

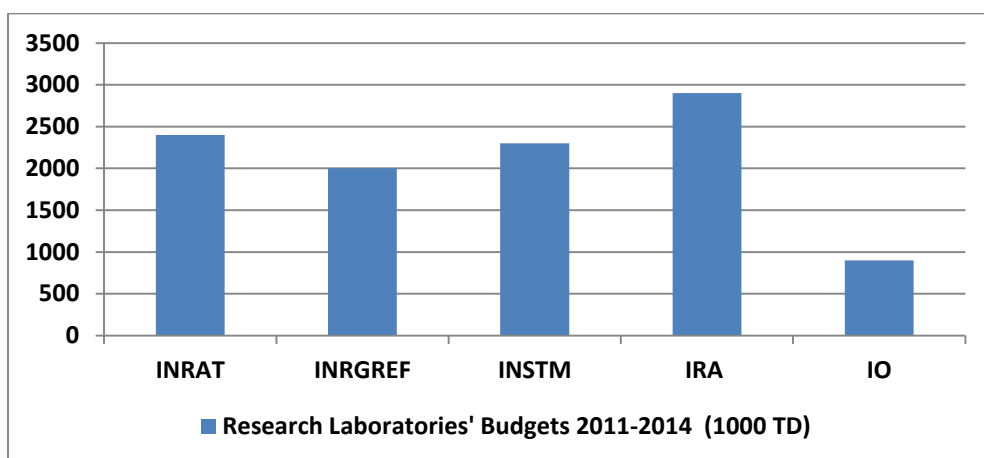


Figure 24. Budget allocated by the MESRS to research institutes' laboratories between 2011 and 2014

Source: IRESA (2015)

The laboratories of the research institutes were budgeted according to the adopted research programme means based on the number of research activities and permanent researchers and/or associates of the laboratory. Between 2011 and 2014, INRAT had 6 laboratories despite the dissolution of the Rural Economy Laboratory in 2011. In terms of budgetary importance, the "animal and feed production" laboratory holds the largest share (23%), followed by the "agricultural science and technology" laboratory, "agricultural applied biotechnology" laboratory (18%), "cereal crop" laboratory (17%) and "horticulture" and "plant protection" laboratory with 13 % of the total budget. In 2015, a new rural economy laboratory proposal was submitted to MESRS (figure 25).

There are 4 INRGREF laboratories. The "agricultural engineering" laboratory's share of the total budget from MESRS was 33%, followed by the "rural ecology" laboratory (28%), they "management and development of natural resources" laboratory (23%), and the "environmental risk management in irrigated agriculture" laboratory, with a share of 18% of the budget (figure 26).

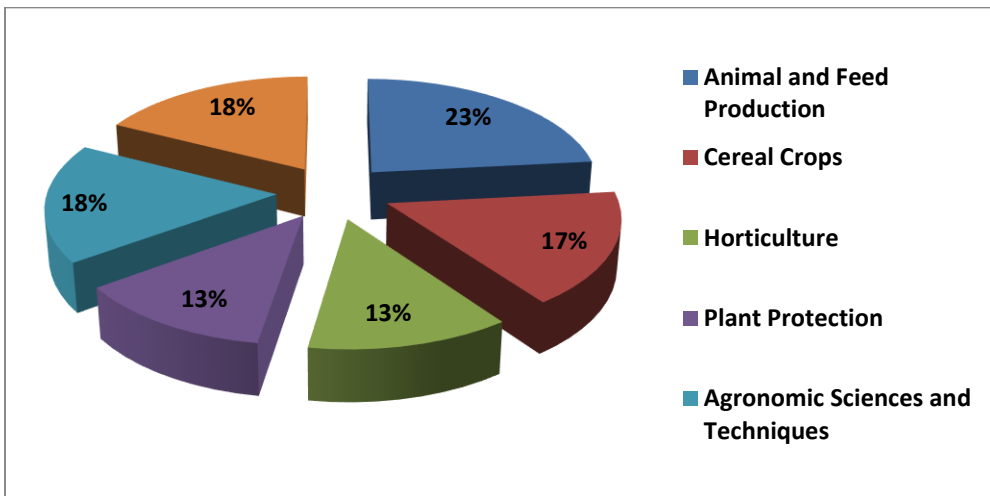


Figure 25. Distribution of budgets by research laboratory during the period 2011-14 (INRAT)
Source: IRESA (2015)

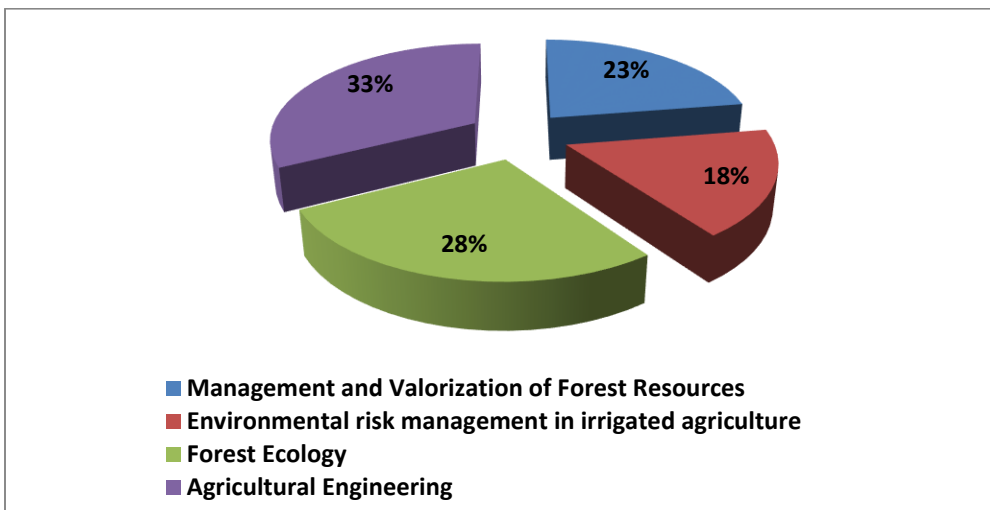


Figure 26. Budgets' distribution by research laboratory type during the period, 2011-14 (INRGREF)
Source: IRESA (2005)

There are 4 INSTM laboratories. The "biodiversity and marine biotechnology" laboratory's share of the total budget from MESRS was 33%, followed by the "fisheries science" and "marine environment" laboratories (24%) and "aquaculture" laboratory (20%) (figure 27).

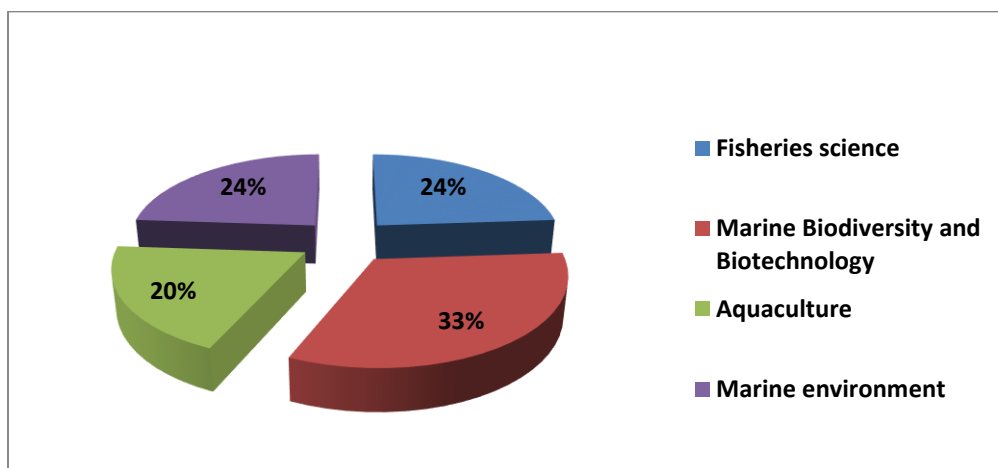


Figure 27. Budget's distribution by research laboratory type during the period 2011-14 (INSTM)

Source: IRESA (2015)

There are 5 IRA Medenine's laboratories. The "dryland farming and oasis crops" laboratory holds the largest share of the budget (25%), followed by the "animal husbandry and wildlife" laboratory (21%), "combat against desertification" laboratory (19%), the "pastoral ecology in arid and desert areas" laboratory (18%) and the "economy and rural societies " laboratory (17%) (figure 28).

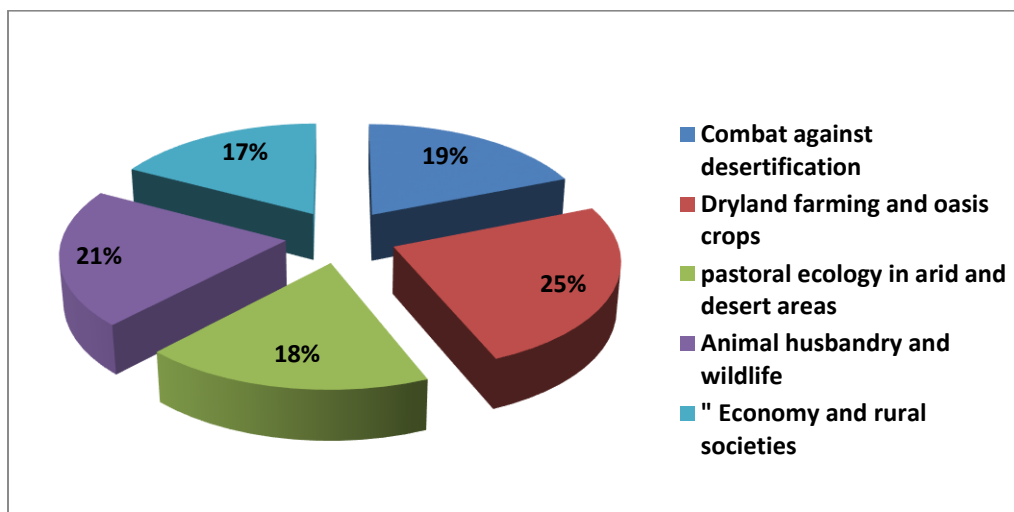


Figure 28. Budgets' distribution by type of research laboratory during the 2011-14 period (IRA)

Source: IRESA (2015)

There are 2 laboratories in the Institute of Olive Trees (IO). The "olive trees improving and genetic resources protecting" laboratory holds 56% of the total

budget from MESRS and 44% for the "improving productivity of olive trees " laboratory (figure 29).

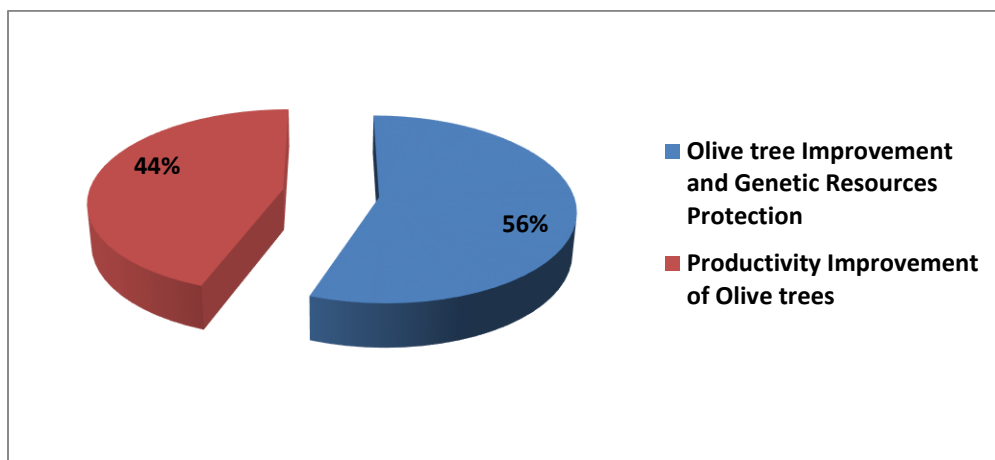


Figure 29. Budgets' distribution by research laboratory type during the period 2011-14 (IO)
Source: IRESA, 2005

Funding from the European Union

The Seventh Research and Development Framework Program (7th RDFP) is the main instrument for funding research from Europe for the period 2007-2013. The IRESA and its guardianship institutions are involved in 20 research projects (table 2). In addition, the participation of teams within the institutions under the supervision of IRESA is related to the following themes: food, agriculture, fishing, climate change, aquaculture, livestock, animal health, water, forestry, etc. The IRESA as a coordinating organization of research in agricultural programmes participated in three projects aimed at coordinating research in the Mediterranean (Arimnet and Foresterra projects), as well as the development and management of the 7th RDFP projects (ETC Project).

After the 7th RDFP, the EU is planning for a new programme, "Horizon 2020", for the period 2014-2020. The budget would reach up to 80 billion Euros and cover the following themes: food security, sustainable agriculture and economy, research infrastructures, access to financing risks, health, demographic change and the challenge of well-being, innovation in SMEs, resource efficiency and the climate change.

Table 2: Projects funded under the 7th RDFP

<i>Project's name</i>	<i>Date of commencement of project</i>	<i>Completion date</i>	<i>Institution</i>	<i>Project's cost (M. €)</i>	<i>Project Financing (M. €)</i>
INCOMMET	01/01/2012	31/12/2014	INSTM	0.449 962	0.911
COCONET	01/02/2012	31/01/2016	INAT	11.36	9
Foresterra	01/01/2012	31/12/2015	INRGRE F IRESA	2.47	2
CHIBIO	01/11/2011	31/10/2014	INSTM	3.98	2,9
Eau4food	01/07/2011	30/06/2015	INRGRE F	4.94	3.99
CREAM	01/05/2011	30/04/2014	INSTM	1.24	0,999
PARAVAC	01/04/2011	31/03/2015	ENMV	12.47	8.94
AnimalChange	01/03/2011	28/02/2015	INRAT	12.85	9
WAHARA	01/03/2011	29/02/2016	IRA	2.62	2
AQUAMED	01/06/2010	31/05/2013	INSTM	1.11	0,996
PRO-EEL	01/04/2010	31/03/2014	INSTM	5.09	3
SUSTAINMED	01/03/2010	28/02/2013	INAT	2.64	2
FUME	01/01/2010	31/12/2013	INRGRE F	8.23	6.18
WASSERMED	01/01/2010	31/12/2012	INAT	3.67	2.93
AGORA	01/01/2010	31/12/2012	INRGRE F	1.19	0,986
ETC	01/09/2009	31-02- 2013	IRESA	0,56064	0,499
LOWINPUTBREEDS	01/05/2009	30/04/2014	INRAT	8.91	6
BIOBIO	01/03/2009	31/08/2012	INRGRE F	3.92	3
Arimnet	01/10/2008	31/03/2013	IRESA	1.24	0,999
SEADATANET	01/04/2006	31/03/2011	INSTM	10.51	8.75

Source: Ministry of Agriculture (2012)

Funding from the World Bank

The World Bank-supported projects facilitated the positive development of Tunisia's agricultural research sector (Gert-Jan Stads et al, 2015). The first project, PRVA, ran from 1990 to 1997. The World Bank loan provided US\$9.4 million under the research component (of the planned budget of \$17.0 million for both research and extension), and the Tunisian government provided \$17.0 million (World Bank, 1997a). The main goal of PRVA was to reform agricultural research and extension in Tunisia by creating

IRESA and the Extension and the Agricultural Training Agency (AVFA). This project also focused on restructuring existing experiment stations and decentralizing agricultural research programmes to meet regional needs. According to the World Bank, the project's success was only limited (World Bank 2003b). Both IRESA and AVFA were created, national research priorities were set, regional structures were rationalized, budgeting and programmatic mechanisms were established, and infrastructure was developed. Original programme plans, however, went even further to include the establishment of three regional centres. Instead, IRESA and the World Bank project overseers agreed on the establishment of the regional branches. Some of these may eventually be developed as autonomous regional centres. The second World Bank project, PISA Relais, ran from 1998 until 2002. The project's budget was \$67.9 million, comprising \$24.9 million from the Tunisian government. The primary objectives of this second project were to build rural revenues through the sustainable use of hydraulic resources and to improve institutional responses to farmer needs for agricultural research, extension, and training. The project's research component was only \$4.0 million (6% of the total budget). This allocation funded several priority research programmes and the establishment of the regional branches in Chott-Meriem, Tozeur and Sidi Bouzid (World Bank 1997b).

The construction of a biotechnology laboratory as originally planned was not completed because IRESA decided to integrate its biotechnological research activities into the existing research programmes (World Bank 2003b). The PISA Relais project was deemed to have fulfilled all its other objectives. A third World Bank-supported project, the Agricultural Support Services Strengthening Project (PRSA), was launched in 2002, as the first phase of a longer term (10 year) project to improve the quality and competitiveness of agricultural production and market access for small- to medium-sized producers. The total project budget is \$42.5 million, including a World Bank loan of \$21.3 million, \$16.7 million from the Tunisian government and \$4.4 million from foreign sources. The first five years of the project were to focus on strengthening the organizational capacity of producer organizations and professional associations, widening the supply of research, training, and counselling services to producers, supporting animal health, supporting crop protection, and strengthening the provision of public services and the management of projects. The project's agricultural research component has a budget of \$8.3 million and focuses on strengthening regional agricultural research by building linkages with producers, introducing competitive research funding and selection mechanisms, creating a single research institute with regional research centres, and establishing a database of research results and a scientific information system (Gert-Jan Stads et al, 2015).

ICARDA programme in Tunisia

The collaboration agreement between the International Center for Agricultural Research in the Dry Areas (ICARDA) and Tunisia was signed in 1979 and rectified by the National Assembly in 1980. Since signing the agreement, ICARDA led (in collaboration with the Tunisian national research system) a significant number of projects (32 projects until 2005), involving the majority of the country's research institutions with financial support from several donors (IFAD, AFESD, USDA/USA, Germany GIZ, SDC Switzerland, CGIAR, FAO, FEMISE, European Union). These projects involved almost all of the priority areas of research in Tunisia, especially water, sustainable management of natural resources, medicinal and aromatic plants, breeding, plant protection, biotechnology, agricultural policy issues and institutions.

ICARDA and IRESA currently are trying to establish a better coordination of cooperation programmes between the two institutions to strengthen the following:

- The coordination and integration between the teams of the various programmes.
- The capitalization of results by the national research system.
- The development of recycling channels of project deliverables including those gender-sensitive,
- The visibility of deliverables achieved under different programmes.

Conclusion

The development of agricultural research requires specific measures (especially in funding). The agricultural research institutes need to diversify their sources of income. Also, the government should encourage the private sector to become more involved in agricultural research through tax benefits, protection of intellectual property rights and regulatory reforms. Finally, institutional flexibility will enable agricultural researchers to participate more in world-class research initiatives such as the European Union's programme, "Horizon 2020".

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APPENDICES

EXPO Milano 2015

Call

Good Practices for Sustainable Development

On Food Security

(NB: Prof. Mohamed Ben HAMOUDA is the focal point of the Tunisia from project Feeding Knowledge)

Application Form

The history is a simple instrument, immediate and pleasant to better convey the experiences to a broad public and the concepts relating to the ethics, values and cultural differences.

In order to achieve this objective, all the good practices presented will have the characteristic to be stories made of Ideas, People, experiences.

Has **each candidate** it will be asked, therefore, to **describe the various aspects of the experience** with the aid of a **written text**, but also **with the support of significant photos, diagrams visuals, documents and indicators**.

At each stage of the application for admission, the candidate will find useful suggestions to fill all the fields and to choose the images, videos, visual diagrams who better tell the experience.

The initiatives will be evaluated according to the criteria outlined in the international call for the "Good Practices for Sustainable Development on the Food Safety (<https://www.feedingknowledge.net/best-practices>).

Before the compilation

Before completing the fields, we urge you to view the general indications which you will not make mistakes and that the form be sent with success.

Only the initiatives which have the caractéristiquessuivantes will be admitted:

- **Completeness** (Application form not duly completed and/or with missing documents will not be considered).
- **Consistency** (the initiatives of the candidate must be in line with one of the five themes described inthe annex I).

- **Collaboration** (the proposed initiatives must clearly indicate that they have been carried out through a real collaboration between at least 3 partners, which we must give all the necessary information).

Attention:

All the hardware and attached documents must be indicated in the form:

- All multimedia contents (pictures and videos) must be **inserted in the form as the URL** (web address) of the site/platform where they have previously been published online by the candidate. Only the Photos E The videos listed in the form with a URL (web address) accessible will be taken into consideration for the assessment.
- **All attached documents** (brochure, flyers, etc.) must be **indicated in the application form in the field correspondant avec the title of the fichier et they must be attached in the same mail that includes the form, in a compressed file less than 10 MB.**
Only the files specified in the form with the correct name and tied in a single compressed file will be taken into consideration for Evaluation.

Only a mail for each application for admission: for the evaluation will be taken into consideration **only the content present in the same mail that contains the form.** Each subsequent content sent separately in other following mails will not be taken into consideration for evaluation.

If these limits that prevent you from properly present your "Best Practice", we urge you to consider the possibility to use the online request form: <https://www.feedingknowledge.net/best-practices>.

Instructions for the compilation

The application form is composed by 11 sections :

- | | |
|--------------------------------------|--|
| Step 1 - The idea in brief | Step 6 - Human Resources involved in the |
| Step 2 - Main innovation produced | experience |
| Step 3 - Background and Context | Step 7 -Main difficulty or obstacle |
| Step 4 -Main Results Achieved | Step 8 -Impact of the environnement |
| Step 5 -Main beneficiaries and needs | Step 9 - Portability, sustainability and duplicabilité |
| | Step 10 – Divulgation |
| | Step 11 -General Information and Partners |

We urge you to pay attention to "Step 11"

s of the initiative.

In the table below are described the formats of usable files and dimensions admitted.

Text	Illustrate the information requested in always respecting the maximum number of characters specified(1000 characters for the text field)
PHOTOS	<p>Each photo must be loaded on a site/online platform to make available and accessible to the vision.</p> <p>In the form must indicate:</p> <ul style="list-style-type: none"> - Url (address of published resource on the web) - Title (30 characters including spaces) - Description (500 characters including spaces) - Legend (60 characters including spaces) <p>Maximum size : 1 MB</p> <p>Minimum width :180 px.</p>
Slide, documents, Brochure	<p>In the same compressed file that includes the form, can be attached documents, diagrams, material produced for the promotion up to a maximum of 10 MB</p>
VIDEO	<p>Each video must be loaded Vimeo Youtube or online for the Put Available and accessible to the vision.</p> <p>In the form must indicate:</p> <ul style="list-style-type: none"> - Url (address of published resource on the web) - Title (30 characters including spaces) - Description (500 characters including spaces) - Legend (60 characters including spaces) <p>Maximum limit: 3 minutes</p>

Description of the Initiative

Step 1 - The idea in brief

To enable everyone to enter what is the fundamental concept of the Initiative, write a slogan, i.e. a sub-title highlighting the strengths of the initiative.

Suggestions for the compilation: Think about the key words (tags) of the initiative and create a text of 1000 characters maximum in describing the essence in describing as BPDD on food security.

Avoid redundancies with the title: The application must be complementary to this to add useful information .

Text

The diffuser buried is a new technique to ensure food security through sustainable management and efficient use of water resources. The experiments in true greatness helped to show:

- That the diffuser buried, is very effective to combat the droughts of short (seasonal) and long (1 to 3 successive years) thanks to the "early irrigation" (during the fall or the winter) and to the "injection and the storage of water in the deep layers of the soil" of arboreal plantations. This allows to have a production certain regular and even during years of drought.
- A large economy of water. As well to produce the same weight of vegetables, irrigation by buried diffuser uses 60% less water than the drip.

Step2 - Main innovation developed

What is the contribution that the experience described may bring to the program FeedingKnowledge? What has been the main innovation that your initiative has developed?

Suggestions for the compilation: the experience that you are in the process of décrireaura certainly generated more that an innovation at different levels (technical, political, technological, economic, cultural, social). Choose the one that is most important to you and describe the

(1000 characters maximum) with simple words that everyone can understand (Do not use language too specialized). If this is applicable, explain as innovation has been useful for achieving the objectives of the initiative.

Describe the same with images innovation produced, the significant stages or the details that can help those that will read your experience for the better support.

Text	The diffuser buried is a technical innovation in the field of irrigation. It uses the dissemination of water by a large surface porous macro facilitating the infiltration of water in the basement. This innovation drift of a very ancient technique using: irrigation by Jarre (pottery) and another more recent(1990) "the pocket in the buried stone". Thanks to this new way to irrigate, it eliminates any loss of irrigation water by evaporation by the sun and the heat of the atmosphere. This loss by evaporation represents 30 to 80% of the irrigation water. This allows you to use less water (60% less than the drip) and to avoid the accumulation of salts in the soil (salinization of soils). It also eliminates the development of weeds and decrease the number of irrigation. For the arboriculture we arrived to irrigate only 1 times a year.
1-3 pictures (For each photo: url,title,Description, Didascalie)	

Background and Context

A good practice has a specific context with a set of specific conditions. How can we describe the local context from the point of view of geographical, climatic, economic, technological, cultural and social?

Suggestions for the compilation: please focus on all the important aspects related to food security and necessary to understand the context of the initiative and to give a short description(Maximum 1000 characters).

Caution: Make sure that the context does not present redundancies with the description of the needs of the Step 5. Select images and/or videos of the aspects either positive or negative. Make sure that the point of view of the people representative emerges, even through stories of "real life".	
Text	The diffuser buried is the "fruit" of a program of research aimed of technical solutions to the problems of water resources management in arid and semi-arid regions Tunisian women. As well water resources are experiencing a overexploitation. For arid regions this has led to a deterioration of the water quality of the fossil aquifers non-renewable resources (salinization), and the decline in their piezometric levels. For semi-arid areas, the resources in waters of tablecloths have declined as a result of a decline in the recharge of these aquifers by the stormwater. This is the result of the droughts due to climate change. These droughts have also reduced the volume of water stored in the dams.
1-3 photos or video (For each photo, for each video: url,title,Description, Didascalie)	

Step 4 - Main Results Achieved

The results of the Initiative developed have or have had tangible impacts on people and the context. What was the tangible result of the initiative?

Suggestions for the compilation: Please describe (Maximum 1000 characters) all the important results that the initiative has helped you to achieve. Try to be very specific in giving all the facts that you can collect and describe them with visual diagrams if they have already summers products.

Text	Among the tangible results of the diffuser: <ul style="list-style-type: none"> • An economy of water, energy, fertilizers, products phyto sanitary, manpower, at least equal to 50%.
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	<ul style="list-style-type: none"> • A reduction of the number of irrigation: for the arboriculture only once a month to once a year; for the maraichage under greenhouse once per week to once per 15 days. • Almost a total absence of the work of the soil (hoeing, weeding) after each irrigation; either a reduction in the number of days of work, • For the maraichage ,the productivity of the diffuser is much higher than that of the drop by drop: for the same volume of water the diffuser product 3 to 5 times more than the drip. • For the injection and the storage of water in the soil no other technology on the market that responds. A broadcaster has allowed to inject and store 10 m³ of water during 52 days; a true solution to combat the drought of 2 or 3 years.
1-3 slide and/or documents	

Step 5 - Main beneficiaries and besoinsauxquels experience has found the answer

What are the actual beneficiaries of the initiative and what are the needs to which we gave a response?

Suggestions for the compilation:to make the results and the value of the experience more understandable, please describe (Maximum 1000 characters) The different people who can be defined as the beneficiaries of the initiative and the specific needs of persons involved in the experience, always with reference to food security. Try to be very specific and provide the data that have been collected and describe them with tables and diagrams visual. Describe the people who can be considered representative of the various targets of the beneficiaries. Use the photos and videos for introduce the people and write the opinions relating to the activities made.

Text	<p>The direct beneficiaries of the use of the diffuser are the farmers:</p> <ul style="list-style-type: none"> → For the poor countries is successors of the problems of drought, the farmers will be able to adapt to climate change and to ensure a minimum level of production (food safety) thanks to the early irrigation and the injection and the storage of water in the soil of plantations. → For the rich countries, the farmers will produce more with less water. Thanks to the early irrigation and the injection and the storage of water in the soil of plantations, the farmers will be able to avoid the damage caused to the level of the production. This is currently experienced by the farmers of western Americans in particular the California. This has impact on the Food Security on a global scale.
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	<p>The indirect beneficiaries are the national governments and the international organizations to the funding and technical support for their projects and strategies in the fight against desertification and drought and the adaptation to climate change.</p> <p>In addition, this technology has been adopted in an exclusive way for the irrigation of facilities and forest and farm of the large project desert water which aims revegetate the African Sahara by desalination of water of the ocean and the sea by solar energy.</p>
1-3 slide and/or documents	
1-3 photos and/or video (For each photo, for each video: url, Title, Description, Didascalie)	

Step 6 - Human Resources involved in the Experience

Who are the people who have represented the initiative on the ground? Describe the amount and the profile of the resources involved in the initiative.

Suggestions for the compilation : describe who has been actively involved in this experience: how many of the people, with what profile and skills, who are the responsible (Maximum 1000 characters)..Provide a short visual diagram of the staff.

Text	<p>During its phase research and development (20 years) to the IRA Médenine, human resources were: in addition to the leader (Dr ChahbaniBellachheb) A team consisting of 3 researchers is 4 technicians (engineers and assistant engineers) ,</p> <p>At the time of the phase Industrialisation and marketing, the leader is always Dr ChahbaniBellachheb, but the field team became more numerous integrating of researchers and technicians of research institutions (IO, CTA, IRA),as well as the framework of NGOS (Association of Boughrara, Association for Cooperation in Tunisia) and frameworks regional technical (DREA) of the Ministry of the agricultures.</p>
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	A research and development project on the diffuser is in the course of preparation in USA with the financial support of the USDA and a second in Saudi Arabia with the University of Jeddah.
1 slides and/or images	
1-3 pictures E/O video (For each photo, for each video: url, Title, Description, Didascalie)	

Step 7 - Main difficulty or obstacle

What have summers difficulties or obstacles you have faced during the project and the implementation of the initiative and how do you have the exceeded?

Suggestions for the compilation: You have probably \hat{U} Solves the difficulties and problems to achieve good results. Choose the one that has put your initiative the most at risk, prompted you to change your original program, has given a specific input at the trial of innovation. Tell us (Maximum 1000 characters) of the strategy that you have adopted to overcome these difficulties and to achieve positive results. Use photos to describe some significant aspects of the difficulties that you have exceeded or of a person who has helped you to resolve them, illustrating his personal point of view on the obstacle and on the way to solve the problem.

Text	The political change in Tunisia (revolution), has blocked the procedure for the adoption of the broadcaster as a technique of saving water is subsidized by the Ministry of Agriculture of Tunisia. This is a major obstacle for the popularization of this technology with the Tunisian farmers, accustomed to the grants to the State. To overcome this obstacle, it was of the forge links with NGOS and of cooperative services to popularize the diffuser from the Tunisian farmers.
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	At the same time, thanks to the Internet (web site, Linkedin, blogs, it was able to introduce the diffuser, USA , Saudi Arabia, Morocco, Algeria, France and soon in some African countries (Cameroon, Chad, Kenya), India, Iran ...
1-3 pictures (For each photo: url,title,Description, Didascalie)	http://www.desertwater.no/ The project site Desert Water introducing the concept of the project and the state of progress of the project

Step 8 - The Impact of the Environment

What is the impact of the environment of the initiative, in terms of economy of energy, defense of biodiversity, end of the life cycle of materials, etc.)?

Suggestions for the compilation:the experience that you are in the process of describing, to be considered as a BPDD, it must develop a strong attention to the environmental impact. Choose your strong point in terms of the sustainability of the environment, and give a description (maximum 1000 characters), with simple words, so that everyone can understand (please do not use language too specialized).Provide facts on the effectiveness of the initiative developed in terms of environmental impact.

Text	<p>The diffuser buried is a Technology 100% Environmental Pro. In effect it:</p> <ul style="list-style-type: none"> → Allows you to an important energy saving (60 to 90% compared to the drip). If one uses the Solar with the gravity version of the diffuser, it uses 0% energy fossil, this helps to limit the emission of greenhouse gases. → Allows a strong reduction of the use of herbicides, pesticides and other products phyto health and chemical fertilizers. This allows a better protection of biodiversity and the protection of the Environment, → Through the early irrigation and the injection of the water in the soil, the broadcast allows you to contribute to the fight against the adverse environmental effects (droughts, desertification, flooding)
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	resulting from climate change and to the sustainability of agricultural production in arid and semi-arid regions.
1-3 slides or documents	
1-3 pictures (For each photo: url, Title, Description, Didascalie)	

Step 9 -Portability, sustainability and duplicabilité

Your experience has generated results sustainable in the time and later annexd initiatives?

Suggestions for the compilation: Describe (Maximum 1000 characters) as the results of the experience developed are sustainable in the time and what are the initiatives annexs significant, when you focus on the reason for which they may be considered as being related to the initiative that you have developed. Provide, if available, of the material related to the initiative described: links, print material, documentation.

Text	<p>The results of the experimentation of the Diffuser buried in arid and semi-arid regions in Tunisia are transferable to large scales, in other countries as well as rich or poor or in the process of development. It is ready for duplicate and transfer the technology package of the diffuser as well for the small peasantry of poor countries or developing countries (Africa, India, Latin America) that for large farmers in the USA or Australia.</p> <p>It can also help governments and donors as well as the international organizations (UNDP, UNEP, IFAD, FAO etc.) to disseminate this technology in the framework of their projects.</p>
WEB LINKS, brochure, documents	

Step 10 - Dissemination	
<i>Have been implemented methodologies original and innovative to disclose the main innovations and the results achieved by your initiative?</i>	
Suggestions for the compilation: list briefly initiatives for disclosure which you seem significant, original or have yielded important results. Provide all the hardware available to better describe the activities of disclosure made (images, videos, brochures, the legends used in the process of dissemination, the Links and References Internet).	
Text	<p>The initiatives of disclosure and dissemination for the diffuser buried, are:</p> <ul style="list-style-type: none"> → Participation in fairs and exhibitions: In 2011 , Agricultural Fair of Meknes(Morocco), in 2011, the exhibition on the water in Casablanca (Morocco) , in 2012, Avignon Miffel(France), in 2014, GFIA in Abu Dhabi(United Arab Emirates), in 2012, water event in Dubai (United Arab Emirates), → Use of the tools of the Internet: Linkedin account , participation in the discussions of the various groups Linkedin, twitter account , Facebook account, account Viadeo, EspaceAgro account, account, and Youtube Channel , ACCOUNT Slides share, Web site chahtech, participation to blogs on climate change and drought, → Participation in competitions of prizes and distinctions to the international scale: the most recent are: in 2012: Innovatec Price (Salon Miffel Avignon), in 2013: Price Top 20 of 100 innovations for the Africa(French Ministry of Foreign Affairs) , in 2011: Price Top 50 and Top 20 SME awards(World Bank),
BROCHURE AND meaningful documents, links, Videos (For each video: url, Title, Description, Didascalie)	<p>Web site: www.chahtech.com</p> <p>CompteLinkedin: https://www.linkedin.com/company/2642759?trk=NUS_CMPY_TWIT</p> <p>Twitter account: https://twitter.com/ChahbaniT</p> <p>Facebook account,</p> <p>Account and Youtube channel: http://www.youtube.com/user/Chahtech/videos</p> <p>Account Slides share: http://fr.slideshare.net/chahtech</p> <p>Blog account: http://burried-diffuser.blogspot.fr/</p>

Step 11 - General Information and Partners

The last section collects general information on the project and on partners, proponents of the initiative.

Main information

This section asks you to provide all the key information relating to the experience that you are in the process of describing and organizations involved: Note that an initiative is eligible only if carried out through a collaboration between at least three different organizations.

Title of the experience The irrigation per diffuser for the reduction of the effects of climate change on the olive trees, Creation of pilot plots irrigated by broadcasters, Documentation and Information Days on the diffuser. Insert a title in français(max 200 characters)

Title of the experience In English Establishment of pilot farms irrigated using buried diffusers , Drought Mitigation using buried Diffusers Documents and conferences on the buried broadcast, Insert a title in English(max 200 characters)

Acronym or Abbreviation → Draft Public and Private Partnership (PPP) GIZ/Chahtech ITS: Buried diffuser → Gef Project micro-financing TUN/OP5/Y3/...: the reduction of the effects of climate change by the use of the achievements of research in the field of conservation of water and soil (the diffuser buried) for the rehabilitation of the olive groves of the peninsula of Jorf (Tamessent, Elgrine, Ayati, JORF, and Boughrara). Insert the name in brief with which you name the initiative. It may be a simple abbreviation or acronym

	<p>→ ACT Project: reduction of the effects of climate change by the use of the Diffuser buried for the rehabilitation of the olive groves of the region of Matmata .</p>	
Main theme	Management of Natural Resources	Choose the main theme to which we can extend the initiative that you want to describe. If the project has affected differ themes, choose the one that has had the greater impact.
Summary of the main characteristics of the experience conduct	<p>The various projects with ACT JIZ and ASPAEB, have helped to:</p> <p>→ The implementation of 20 pilot plots irrigated by broadcasters buried totalling 800 trees. These parcels are demonstration in true greatness to raise the awareness of farmers as well as policy makers(in Tunisia and abroad) of the role of presenter as " good practice of sustainable development for food security ".</p> <p>→ It is thanks to this experience in Tunisia that was able to convince of the partners in the USA and in Saudi Arabia, to undertake, in a first phase, research projects/development. This phase will be followed by the popularization of the Diffuser in these 2 countries. These 2 projects will begin in 2015.</p>	Insert a brief description of the experience, paying attention in particular to the aspects that make it identifiable as a BSDP (main objective, beneficiaries, results) (1000 characters including spaces)
Summary in English of the main characteristics of the experience conduct	<p>The different projects with ACT, GIZ and ASPAEB, allowed:</p> <p>→ The installations of 20 pilot fields irrigated with buried diffusers. The number of trees in the 20 pilot fields is about 800. This is a real scaledemonstration to make aware the farmers and political deciders (in Tunisia and worldwide) of the role of the Buried disseminate as abest sustainable development practices on food security.</p> <p>→ Using this experience, we arrived to convince our partner in USA and in Saudi Arabia to undertake, in a first phase, a research and development</p>	Reécrivez the translation into English of the summary inserted in the field preceding(max 1000 characters including spaces)

	<p>projects on the buried broadcast. In second phase starts the dissemination of this technology in the 2 countries. The R/D projects start in 2015.</p>	
Key words	New technique of Irrigation and Water Economy, the fight against drought, adaptation to climate change	Think of the words that can describe the best experience (objective, application sector, innovation produced, results obtained...)
Total Budget	60 000	Specify the project budget in euro
Logo (Not mandatory)		Insert URL, title, description, didascalie the logo of the project, not mandatory
Significant photos (Not mandatory)		Insert the URL, title, description, didascalie to a significant image which may represent the heart or some significant aspect of the project, not mandatory
Duration		
Data of the Beginning	2011	
Data of End (If falling within)		2014
		The project may be still in the race, yet the end date may be same to successive The deadline

Geographical area

Main Region (Not mandatory)	Nation	North, center and south of Tunisia	Specify the main place in which the project is developed, in case this has involved several regions. The indication of the province is not mandatory.
City/ Provence	main	Postal code (Not mandatory)	

Partners

For each partner of the project it must compile a table with all the information.

Organization leader(Mandatory)**Official Nome in English**

CHAHBANI Technologies SA Djerba Tunisia

Nome in full in the original language
(Not mandatory)

Chahtech its

Abbreviation**Type of Organization**
(Select one of the following typologies)

- Governments (bilateral agencies included)
- Body/local authorities
- Public agencies and their associated
- Organizations or Agencies inter-governmental organizations
- Organizations of civil societies
- The associations
- Public or Private Foundations
- Smes**

	<input type="checkbox"/> Large enterprises <input type="checkbox"/> Micro social enterprises and their associated <input type="checkbox"/> Research and academic body <input type="checkbox"/> Public-private partnerships <input type="checkbox"/> Other: private company_____
Legalstatus (choose between public or private)	Private sector
Personal code (Not mandatory)	
Main Activities (1000 characters including spaces)	Chahtech SA is a small SME created in 2008 for the industrial exploitation of 2 patents of inventions: the diffuser buried and the float draining gravity. These 2 inventions have been developed and tested by the manager and founder of Chahtech SA. The company is entry into production in 2012. The 2 inventions and their products have received 10 awards and international prices among which: international price of the water of the Unesco, Top 50 and top 20 innovative SME(SMES)awards of the World Bank. Mediterranean Water Prize(Hydrotop),
Key words (which describe your organization)	Materials and innovative equipment for irrigation
Belong to falling within scientific network	
Official Address (nation, locality, street, postal code)	Tunisie-HoumtSoukDjerba- BP 466 -4180
Phone	+21698254383
Homepage	Www.chahtech.com

(Not mandatory)

(Not mandatory)

Legal representative

(Not mandatory)

Bellachheb

Chahbani

First Name

(Not mandatory)

Name

(Not mandatory)

+21698254383

bchahbani@chahtech.com**Phone**

(Not mandatory)

E-mail

(Not mandatory)

Persona responsible for scientific activities

(Not mandatory)

Bellachheb

Chahbani

First Name

(Not mandatory)

Name

(Not mandatory)

+21698254383

bchahbani@chahtech.com**Phone**

(Not mandatory)

E-mail

(Not mandatory)

Referring**First Name****Name****Phone**

(Not mandatory)

E-mail

Remember that an initiative is eligible only if carried out through a collaboration between at least three different organizations.

Organization2(Mandatory)

Association for Cooperation in Tunisia

Official Name in English	ASSOCIATION OF COOPERATION IN TUNISIA
Name in full in the original language (Not mandatory)	
Abbreviation	ACT
Type of Organization (Select one of the following typologies)	<input type="checkbox"/> Governments (bilateral agencies included) <input type="checkbox"/> Body/local authorities <input type="checkbox"/> Public agencies and their associated <input type="checkbox"/> Organizations or Agencies inter-governmental organizations <input type="checkbox"/> Organizations of civil societies <input checked="" type="checkbox"/> The associations <input type="checkbox"/> Public or Private Foundations <input type="checkbox"/> Smes <input type="checkbox"/> Large enterprises <input type="checkbox"/> Micro social enterprises and their associated <input type="checkbox"/> Research and academic body <input type="checkbox"/> Public-private partnerships <input type="checkbox"/> Other: Grouping Interprofessionel
Legal status (choose between public or private)	
Personal code (Not mandatory)	
Main Activities (1000 characters including spaces)	Agricultural development, environment and preservation of natural resources, health
Key words	Sustainable development,

(which describe your organization)

Belong to falling within scientific network

Official Address
(nation, locality, street, postal code)

Tunisia - Tunis -Omrane-3 rue Descartes -1005

Phone
(Not mandatory)

71517500

Homepage
(Not mandatory)

www.actdev.org

Legal representative
(Not mandatory)

First Name
(Not mandatory)

Jones

Name
(Not mandatory)

Howard

Phone
(Not mandatory)

[+216 27 844 831](tel:+21627844831)

E-mail
(Not mandatory)

Howard.Jones@actdev.org

Persona responsible for scientific activities
(Not mandatory)

First Name
(Not mandatory)

Name
(Not mandatory)

Phone
(Not mandatory)

E-mail
(Not mandatory)

Referring

First Name

Name

Phone

E-mail

(Not mandatory)

Organization3(Mandatory)

Official Nome in English

German International Cooperation Agency Tunisia

Nome in full in the original language
(Not mandatory)

Deutsche Gesellschaft für internationale Zusammenarbeit (GIZ) GmbH

Abbreviation

GIZ

Type of Organization
(Select one of the following typologies)

- Governments (bilateral agencies included)
- Body/local authorities
- Public agencies and their associated
- Organizations or Agencies inter-governmental organizations
- Organizations of civil societies
- The associations
- Public or Private Foundations
- Smes
- Large enterprises
- Micro social enterprises and their associated
- Research and academic body
- Public-private partnerships
- Other: _____

Legalstatus (choose between public or private)	Public		
Personal code (Not mandatory)			
Main Activities (1000 characters including spaces)	Various activities of cooperation with the Tunisian Government		
Key words (which describe your organization)			
Belong to falling within scientific network			
Official Address (nation, locality, street, postal code)	Tunisia -Tunis-Rue The Grand Boulevard, the Corniche Building the Grand Boulevard cited the Pines- shores of Lake II of Tunis-2045		
Phone (Not mandatory)	+44 71 967220	Homepage (Not mandatory)	Https://www.giz.de
Legal representative (Not mandatory)			
First Name (Not mandatory)	Rainer	Name (Not mandatory)	Krischel
Phone (Not mandatory)	+44 71 967220	E-mail (Not mandatory)	giz-tunesien@giz.de

Persona responsible for scientific activities
(Not mandatory)

First Name
(Not mandatory)

Name
(Not mandatory)

Phone
(Not mandatory)

E-mail
(Not mandatory)

Referring

First Name

Name

Phone
(Not mandatory)

E-mail

Organization 4

Official Nome in English

Association for the protection of the Archaeological and the Ethnographic Heritage of Boughrara

Nome in full in the original language
(Not mandatory)

Association for Saving of Patrimoine hasrchéologique and Ethnographique of Boughrara-Médenine (ASPAEB)

Abbreviation

ASPAEB

Type of Organization

Governments (bilateral agencies included)

(Select one of the following typologies)

- Body/local authorities
- Public agencies and their associated
- Organizations or Agencies inter-governmental organizations
- Organizations of civil societies
- The associations
- Public or Private Foundations
- Smes
- Large enterprises
- Micro social enterprises and their associated
- Research and academic body
- Public-private partnerships
- Other: _____

Legalstatus
(choose between public or private)

Personal code
(Not mandatory)

Main Activities
(1000 characters including spaces)
Key words

Various cultural activities and development

(which describe your organization)

Belong to falling within scientific network

Tunisie-Medenine-BP 424 -4100

Official Address
(nation, locality, street, postal code)

Phone
(Not mandatory)

Homepage
(Not mandatory)

Legal representative
(Not mandatory)

First Name
(Not mandatory)

Mongi

Name
(Not mandatory)

Chniter

Phone
(Not mandatory)

+21698212056

E-mail

CHNITER_M@YAHOO.FR Aspaeboughrara@yahoo.fr

(Not
mandatory)

Persona responsible for scientific activities
(Not mandatory)

First Name
(Not mandatory)

Name
(Not
mandatory)

Phone
(Not mandatory)

E-mail
(Not
mandatory)

Referring

First Name

Name

Phone
(Not mandatory)

E-mail