Federal Ministry of Education and Research

ANIS

INDICATOR-BASED ANALYSIS OF NATIONAL INNOVATION SYSTEMS

Tunisia

Summarising Report on the Determinants of the Tunisian Innovation System with Special Focus on the Water and Energy Sector

INSTITUTE FOR INNOVATION AND TECHNOLOGY

CRTEn Technopôle de Borj Cédria

CERTE

Lysann Müller (iit)
Nadine May (iit)
Gerd Meier zu Köcker (iit)
Zied Kbaier (Research and Technology Centre of Energy (CRTEn), Science & Technology Park of Borj-Cedria)
Mohamed Kefi (Water Researches and Technologies Centre (CERTE), Science & Technology Park of Borj-Cedria)

Institute for Innovation and Technology (iit) at VDI/VDE Innovation + Technik GmbH, Berlin
Steinplatz 1, 10623 Berlin, Germany
E-Mail: lysann.mueller@vdivde-it.de, nadine.may@vdivde-it.de
www.iit-berlin.de

International Bureau (IB) of the Federal Ministry of Education and Research (BMBF) at the Project Management Agency c/o German Aerospace Centre (DLR)
Heinrich-Konen-Str. 1, 53227 Bonn, Germany
www.internationales-buero.de
www.kooperation-international.de

This study was elaborated by the Institute for Innovation and Technology (iit) starting from January 2013 until June 2013. It has been funded by the Federal German Ministry for Education and Research (BMBF) and actively supported by the local partners - the Tunisian Ministry of Higher Education and Scientific Research (MESRS) and the Science & Technology Park of Borj-Cedria (CRTEn, CERTE). Thanks to the attendance of Tunisian policy-makers and practitioners from the innovation system, the assessment workshop provided all parties involved with interesting insights. We are very grateful to all participants, the MESRS and BMBF, who have strongly supported our work.

Institute for Innovation and Technology - iit

The Institute for Innovation and Technology (iit) offers tailor-made services to interested parties from politics, economy and science, to explore critical interfaces, quantify new innovation-related tools and models, investigate new paradigms for innovation and develop strategies to address the risks associated with investments in the respective fields. The aim of the iit is to leverage the complementary expertise of academia, industry and government by facilitating new systems for innovation and collaborative processes on behalf of our clients. The work of the iit is based on a broader understanding of innovation, which also deals, besides core technological developments themselves, with the economic and social preconditions and impacts of technological innovations. As a consequence, the iit-experts are involved in many cross-disciplinary, cross-cultural and cross-organisational projects at national and international level.

International Bureau (IB) of the Federal Ministry of Education and Research (BMBF) at the Project Management Agency c/o German Aerospace Centre (DLR)

The study at hand has been commissioned by the International Bureau of the BMBF for the BMBF.

Table of Contents

List of Figures

Preface

As a result of accelerated globalisation and the advancement of high-technology, world-wide competition has risen to new heights. Growth – perhaps even survival – depends even more on innovation than ever. Nowadays, innovation is no longer mainly about science and technology. Industry today has to innovate in other ways since innovation is increasingly driven by co-creation, user involvement as well as by environmental and societal challenges. Key enabling technologies open a completely new dimension of functional attribution of products and processes. Collaborative global networking and new public private partnerships are becoming crucial elements in companies' innovation processes.

Existing and well-functioning regional or national innovation systems designed to support science- and technology-based innovation have to be further developed in order to be able to meet new challenges from emerging global markets for technology and new forms of global knowledge-sharing. Across all countries, governments have recently been involved in research and education; hence a need for new knowledge and new business skills will also have to be in the focus of governmental interest. Governments have constantly been called upon to react accordingly and to adopt innovation-friendly framework conditions. New policy tools have been created to be able to better meet this challenge.

The regional dimension has also become of increasing significance. Nowadays, regions have come up with own innovation strategies considering the individual regional strengths instead of spreading public investments thinly across several frontier technology research fields and, as a consequence, not making much of an impact.

Innovation policy has to acknowledge that traditional boundaries between manufacturing and services are increasingly being blurred. The success of manufacturing depends, for instance, very much on innovative services, such as design, marketing and logistics as well as on product related after-sales services, and vice versa. More and more service providers are manufacturing goods that build upon or are related to their service portfolio or distribution channels. But regional and industrial development policies and tools are still not sufficiently taking account of these changes.

Service innovation is in fact a driver for growth and structural change across the entire economy. It helps to make the entire economy more productive and provides fuel for innovation in other industries. It even has the potential to create new growth poles and to lead markets that have a macro-economic impact.

The so called systematic innovation policy approach, which has recently been introduced in many industrialised countries, is based on the assumption that an effective innovation policy has to improve all determinants that influence a given sector-specific innovation system.

The indicator-based Analysis of National Innovation Systems approach (ANIS), developed by the Institute for Innovation and Technology (iit), includes a comprehensive examination and evaluation of the status of national innovation systems. It is mainly intended for emerging and developing countries for which standard innovation benchmarking and monitoring approaches might not be sufficient as statistical data is often missing or outdated. Policy-makers of these countries can benefit from clear advice on how to overcome weaknesses within their national innovation system and to identify determinants of specific relevance.

We are convinced that the ANIS approach will serve as a fact-based platform initiating discussions on how to improve innovation capabilities and competitiveness.

The conduction of this specific ANIS study on Tunisia would not have been possible without the support of the experts **Prof. Slim Choura** (General Director of International Cooperation at the

Ministry of Higher Education and Scientific Research, Tunisia), **Prof. Brahim Bessais** (General Director of CRTEn), **Prof. Mohamed Ben Youssef** (General Director of CERTE), **Prof. Mohamed Ben Amor** (Director of Laboratory of Natural water treatment, CERTE), **Mr. Zied Kbaier** (Principal Engineer at the Research and Technology Centre of Energy og Borj-Cedria (CRTEn)) and **Mr. Mohamed Kefi** (Scientific Researcher at the Water Researches and Technologies Centre of Borj-Cedria (CERTE)). Owing to their proficiency, it was easy to establish trust among the participants of the study. We are therefore very grateful to them for making this project a success.

Berlin, October 2013

Dr. Gerd Meier zu Köcker

Director Institute for Innovation and Technology (iit), Berlin

1 The Concept of National Innovation Systems

Innovation may be considered as one of the main drivers for economic competitiveness, growth and wealth creation. Therefore, innovation policy has become an important part of economic policy. The design of suitable framework conditions for innovation reflected by the maturity level of an innovation system (at national, local or sector level) has been given high priority worldwide.

Looking back in the past, innovation has been generated differently than today. One of the first (conceptual) frameworks developed for understanding the relation of science and technology within an economy has been the linear model of innovation.

This model is based on the assumption that innovation starts with basic research, followed by applied research and development, and ends with production and diffusion. The precise source of the model remains nebulous, having never been documented. This model taken for granted, research activities have completely been disconnected from market demands. Once a new idea has been considered to be promising, additional developing activities were conducted to further develop the idea towards a prototype. In a next step, the prototype has been further developed into a commercial product. Once the product or technology has reached maturity, the inventors started to elaborate a commercialization strategy for the respective product or technology. It was the time of the creation of the term "technology transfer".

Numerous technologies and products have been created by inventors and had then to be launched on the market. The majority of inventions has however never been commercialised, since the functional attribution did not correspond with the market demands, or simply due to a lacking or inadequate market need.

In the emerging new nature of innovation, multi-faceted skills are required for solving complex challenges. They are needed to support the development of partnerships and collaborative networks as well as the creation of symbiotic relationships among transnational companies, micro-companies and public institutions.

External sources have always been prevalent in the ranking of the most significant sources of ideas. Thus, they also included a substantial portion of the overall quantity of ideas and industrial stakeholders have started to react accordingly. Today, companies have become more open, transparent and engaged in a dialogue with their customers, providing them access to more information, sharing risks with them, and involving individual customers in their innovation process. Besides the fact of a closer collaboration with customers and users in entirely new ways, the conditions of business culture and company skills have changed, too.

The following definitions may help to clarify the concept of innovation and innovation systems:

> *Innovation may be defined as new solutions adding value to both, customers and firms (Nordic Innovation Monitor, 2009). One distinguishes between incremental innovations (e.g. further development of existing products and technologies, often realised by SME without involving any R&D institutions) and radical innovations (completely new solutions, technologies or products not yet available on the market, usually involving R&D institutions).*

A national innovation system may be defined as “a network of institutions in public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies” (Freeman in OECD 1997, p. 10). The main elements of innovation systems are education and research institutes, firms, industrial parks, incubators, governmental institutions. The maturity of an innovation system depends on how these actors are coordinated.

Innovation policy may be defined as the creation of framework conditions aiming at supporting innovation capabilities of companies and public entities (OECD, 1997).

Hence, an innovation system describes the relations between the actors of the different levels of an economy. For an effective innovation system, it is crucial that all “parts” of the system, i.e. **policy-makers** (those that set the framework conditions under which innovation can develop), **innovation supporters** (those that support research and development activities, and **innovation producers** (those that invent, build and sell), cooperate, communicate, create, exchange and transfer knowledge, and thus support dissemination and market penetration of new products and services. Hence, the economic and institutional regime, the information and communications infrastructure, and education are the key enablers of the innovation climate (World Bank 2010). A well-functioning innovation system can influence the country’s economy in a positive way (OECD 1997).

The number of theoretical models, reports and analyses of innovation systems has been increasing since the beginning of the 21^{st} century. Due to the various factors impacting national innovation capacities, the assessment of a country’s innovation system remains a challenging exercise.

For years, economists have tried to identify the reasons leading to the nations’ competitiveness and growth, and as a consequence, many reports on innovation systems have been generated. Despite the high quality of these reports which describe the essential features of an innovation system and summarise its main strengths and weaknesses, the benefits in terms of usable results have unfortunately only been limited. This is explained by the fact that the implemented methodologies have not sufficiently considered the way policy-makers think and operate. Recommendations are neither prioritised nor ranked according to their complexity when putting them into practice.

Instead of receiving mere scientific models of innovation systems, policy-makers - especially in emerging and developing countries - look for descriptions of an innovation system and clear recommendations on how to improve the functionality of their concept, including a description of specific measures. The ANIS (Analysis of National Innovations Systems) approach aims at filling this gap.

2 Scope and Methodology of the ANIS Approach

The aim of the following analysis within the ANIS-framework is to provide a screening of the current status of the Tunisian innovation system and its main determinants with special focus on the sector's energy and water technologies. We assume that these sectors are two of the most prevailing that rank high on the Tunisian and European policy agendas.

Besides assessing and benchmarking important determinants of the innovation system, policy-makers are often interested in receiving guidance for action. Therefore, the ANIS report provides comprehensive recommendations for improvement. At the end of the report, after a presentation of the key results, areas for policy interventions are pointed out. These areas may range from those having a high impact on the national innovation system to those that do not require large public investments or political intervention for a successful implementation. In the following, the methodology of the ANIS approach is presented first in order to give an overview of its core elements.

The major objectives of the ANIS studies are:

- Analysis of existing literature regarding the specific innovation system
- Conducting of interviews with experts regarding the specific innovation system
- Evaluation and measuring of the outcomes
- Identification of determinants that have a high impact, but cause only little costs
- Formulation of recommendations on how to improve the prioritised determinants

2.1 The Three-level Hierarchy

The study provides an indicator-based assessment of many different determinants, of which each does reflect an aspect of the complex innovation system. The determinants may be grouped according to a three-level hierarchy which includesthe macro-, meso- and micro-level. Table 1 describes the different dimensions and its actors.

- Macro-level: Innovation Policy Level
- Meso-level:
  - Institutional Innovation Support Level
  - Programmatic Innovation Support Level
- Micro-level: Innovation Capacity Level

Macro-level – Innovation Policy Level

In the macro dimension, national and regional innovation policies influence the framework conditions of an innovation system directly. At that level, laws, decrees and regulations, etc. may often be ground breaking, in a positive but also in a negative way. Public investment in innovations directly relies on decisions made at policy level. However, such political decisions may only influence the framework conditions for innovation and might not lead to a conversion of innovations into marketable products.

Meso-level - Institutional Innovation Support Level

Institutions operating at meso-level are typically technology transfer centres, clusters, innovation service providers and funding agencies. They may be considered as the relevant tools to put any political decision regarding innovation into practice. In emerging countries such institutions are often publicly owned. They mainly aim at fostering the stakeholders' competitiveness and capability to innovate. Rather than setting up programmes to support innovation, those institutions usually provide in-kind contributions such as training, consultation, conducting applied R&D or product improvement. These institutions remain a key instrument for improving and encouraging the innovation capabilities of firms, especially in countries where public investment is limited.

Meso-level: Programmatic Innovation Support Level

Programmatic innovation support includes public funding programmes and initiatives which aim to put innovation policy into practice. This represents the second pillar in improving the innovation capabilities of stakeholders in an innovation system. Such programmes might be managed either by policy-makers or by innovation support institutions. Any measures at this level would require significant public investments.

Micro-level: Innovation Capacity Level

The micro-level provides an umbrella for the main actors and enablers within an innovation system such as SMEs, entrepreneurs, universities, public or private R&D institutions, innovators or financial organisations.

Level		Actors	Functionality within an NIS
Macro	Policy	Public authorities, policy-makers	Governing and setting up framework conditions of an innovation system
Meso	Institutional innovation support Programmatic innovation support	Institutional innovation support organisations or publicly funded initiatives / programmes	Institutions and initiatives are tools to put innovation policies into practice
Micro	Innovation capacity	Firms, academia, educational institutions, etc.	Main beneficiaries of support measures and main producers of knowledge, innovation, technologies, products

Table 1 Levels and actors within a national innovation system

As shown in Figure 1 the ANIS approach is based on the assumption that an innovation system is mainly influenced by 30 determinants[1], each of which reflects an aspect of the complex reality of the innovation system. These determinants are of dedicated interest for our analyses since all of them directly influence the efficiency of an innovation system. They can be influenced and improved by appropriate measures.

[1] We are aware of the fact that an innovation system is also influenced by external determinants from outside the country. However, as these determinants need a different approach of adjustment, they are not regarded in our analysis.

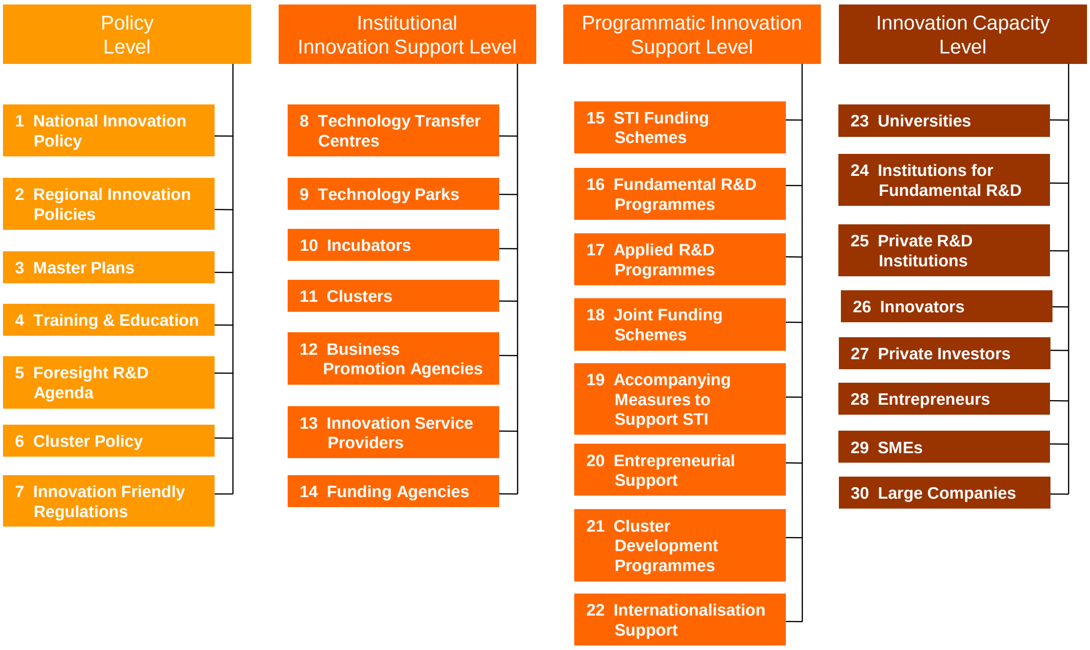

Figure 1 Main determinants of a national innovation system

A comparison between the determinants of these different levels allows the identification of key policy areas requiring a potential intervention to strengthen the innovation system. All determinants within the three different levels can directly be addressed by different measures. Some of them may be addressed in short-term and with low efforts, others may need long periods of time for the implementation of improvements, combined with significant investments. Improving a certain determinant can have manifold positive impacts.

In order to assess the stage of development of all determinants, we have designed questions (Expert Opinion Survey) for characterising the 30 determinants accordingly. The onsite assessments are done by national experts as well as by the expert team of VDI/VDE-IT as explained below.

2.2 Expert Opinion Survey (EOS)

The model used draws on a wide range of data from the Expert Opinion Survey (EOS). The EOS meets the need for up-to-date and far-reaching data, providing valuable qualitative information for which hard data sources are scarce or non-existent. The survey is completed by at least 20 national experts per country. We have asked the experts to provide their opinions on various aspects of innovation and the innovation environment in which they operate. The data gathered thus provide a unique source of insight and a qualitative portrait of each nation’s innovation concept as well as a comparison with the situation in other countries.

The questions in the study follow a structure asking the interviewees to evaluate, on a scale of 1 to 4, the current conditions of their particular innovation environment they are operating in. At one end of the scale, value 1 represents the worst possible operating condition or situation and at the other end of the scale, value 4 represents the best conditions. Thus, the interviews consist of questions describing a situation and environment within a well-established innovation system (positive statement) and a contradicting statement (negative statement). The experts are asked to give their opinion on whether they

- fully agree with the positive statement (4 points),
- partly agree with the positive statement (3 points),
- partly agree with the negative statement (2 points),
- fully agree with the negative statement (1 point), or to give
- a statement that this issue does not exist at all (0 points).

It is also allowed to leave out certain questions if the expert is not able to answer. The experts are classified according to their relationship to and responsibility for the four different levels of the innovation system (macro-, meso-institutional, meso-programmatic, micro-).

In the following, the main findings from the EOS conducted in Tunisia are described, based on the assessed 30 determinants, and analysed in total.

The experts consulted in the context of the present study have been identified by the local partner, the Tunisian Ministry of Higher Education and Scientific Research. The interviews have been carried out on the basis of the Expert Opinion Survey in French language, which had been adapted to suit the two sectors energy and water.

2.3 The Indicator Approach

The ANIS approach fits into the new tradition of indicator-based studies relying on quantitative data generated by the evaluation of expert interviews. Such an approach differs from traditional benchmarking studies on innovation performance. The Global Competitiveness Report, the European Scoreboard and the Nordic Innovation Monitor are excellent approaches for measuring or benchmarking innovation-related performance indicators. However, since the statistical base of emerging and developing countries is often insufficient, the Nordic Innovation Monitor is rather intended for well-matured economies than for developing or emerging countries' issues. The Global Competitiveness Report uses a mix of statistical data and expert interviews. However, since it focuses on the competitiveness of nations, the issue of innovation is not sufficiently targeted. Therefore, the Institute for Innovation and Technology (iit) has developed the ANIS approach.

Based on the findings of the questionnaire and on the evaluation of the questions, we have then calculated the appropriate indicators for the respective determinants (see Figure 1). A scale with the following indicators has been designed:

- Indicator "1" represents the determinant under worst operating conditions or in the worst possible situation, emphasising that it is poorly developed or non-existent.
- Indicator "2" means that a determinant basically exists and has shown first positive impacts. Nevertheless, there is a strong need to improve its efficiency or functionality.
- Indicator "3" means that a determinant is mature and has shown positive impact on the performance of an innovation system over a long period of time. Nevertheless, there is still room for further improvement to reach excellent performance.
- Indicator "4" corresponds to the determinant which under its best operating condition. Although improvements might still be possible, this determinant has proved to be strongly developed and well-performing over a long period of time.

Indicator values above 3 usually apply to well-developed industrial countries where all determinants are well-established and efficient, even though some are performing better than others.

Values between 1.5 and 2.5 indicate that the determinant already exists, but needs to be further developed. Values below 1.5 mean that a specific determinant may exist, but is not yet operational.

2.4 The Comparative Portfolio

The comparative portfolio is an integrated element of the ANIS approach. It consists of the corresponding data of countries having similar comparative economies. According to the Global Competitiveness Report (GCR) of 2010-2011 Tunisia possesses an efficiency-driven economy. The GCR defines three different stages of economies. These are:

- factor-driven economy (stage 1)
- efficiency-driven economy (stage 2)
- innovation-driven economy (stage 3).

According to the GCR, the efficiency-driven countries are characterised through products with better quality, mainly due to more efficient production processes. Economic advancement is achieved through "higher education and training […] efficient goods markets […], well-functioning labour markets […], developed financial markets […], the ability to harness the benefits of existing technologies […], and a large domestic or foreign market […]" (Schwab 2010, p. 9).

In the present study, the determinants of the Tunisian innovation system are benchmarked against the data of Jordan, Namibia, and Indonesia. These countries, just as Tunisia, possess efficiency-driven economies.[2] Although being defined as transition country[3] by the GCR, we have also included Egypt in the comparative portfolio. Even though Tunisia has been considered as efficiency-driven country, it is clear that the revolution and political uncertainties of the last years have led to a consideration as a "moving" country between different stages - similar to Egypt.[4] The countries Jordan, Namibia, Indonesia and Egypt have been analysed with the ANIS tool, and are therefore chosen for the comparative portfolio.

2.5 Data Generation

This report was drawn up based on expert interviews conducted with the help of the Expert Opinion Survey. The data was gathered in April 2013 during a 2-days-workshop with 2 expert groups – one group for the energy sector and one for the

---

[2] Of course, the GCR includes more countries categorised as efficiency-driven economies than those mentioned in this report. However, the countries Jordan, Namibia and Indonesia have already been analysed with the ANIS-tool.

[3] Transition countries are those from factor-driven to transition-driven countries. Countries in between these two stages have developed some of the characteristics of the efficiency-driven economies, but are still struggling with some of the features of the factor-driven economies.

[4] The latest Global Competitiveness Report (2012-2013) did not include an analysis of Tunisia because of the political unrest and the subsequent break in the data. This is why, this ANIS study refers to the data of 2010-2011.

water sector.[5] 21 experts of the 40 workshop participants filled in the Expert Opinion Survey.

The Tunisian Ministry for Higher Education and Scientific Research had invited experts from the policy level, the innovation support level and the innovation capacity level to join the workshop. The event was opened by the Tunisian Minister of Higher Education and Scientific Research.

The workshop started with a general introduction about the situation of the water and energy sector in Tunisia as well as in Germany and Europe Having been provided with input for the group work that followed, the participants were separated into the two groups “energy sector” and “water sector”. In order to familiarise with the scope of the workshop, the participants mapped the institutional structures in Tunisia by listing all stakeholder organisations of their sector at policy, support and innovation level (see Figure 6 and Figure 7).

Concerning the energy sector, the Expert Opinion Survey (see chapter 2.2) was completed by selected key experts (11 experts in total):

- 9 experts from the innovation support level (thus representatives of public and private institutions supporting innovations, funding agencies, multiplicators, e.g. chamber of commerce, public institutions dealing with energy and water technology related issues),
- 2 experts from the innovation capacity level (thus representatives from research and industry, being active in the energy and water technology sectors).

Concerning the water sector, the Expert Opinion Survey was completed by 10 experts:

- 3 experts from the policy level (national and regional policy-makers being active in innovation and/or energy/water technology matters, relevant stakeholders),
- 7 experts from the innovation capacity level.

All key experts have been very much experienced in their respective field of expertise and very much familiar with the Tunisian innovation system (in the sectors energy and water).

The following chapters provide an overview of the Tunisian innovation system with special focus on energy and water, mainly from the point of view of experts from the innovation support level and innovation capacity level.

[5] Please see Figure 6 and Figure 7 for the stakeholders and the appendix for the participants’ lists.

3 Tunisia’s Economic & Innovation Background

Before moving on to the detailed analysis of the sectors energy and water technologies within the Tunisian innovation system, a brief look at the country’s economic situation will be helpful for understanding the status quo.

Since the Arab Revolts in 2011 and its affiliated economic downturn, Tunisia’s newly elected government has been active in ensuring political stability and in elevating the economic and social situation by several political reforms. Tunisia aims at transparent processes, good governance and economic welfare (OECD 2012b). The current Tunisian policy making is therefore characterized by the attempt of reestablishment of trust among the participants of the innovation system in order to increase transparency, enhance the knowledge exchange between the individual stakeholders, and improve the business climate of Tunisia thus leading to a cushioning of the economic downturn. However, Tunisia’s gross domestic product growth declined by 4.2% from 2011 to 2012, mainly due to dropping tourism. As such, Tunisia had a negative growth of around 1% in 2011 (AfDB et al. 2012). Furthermore, investment from abroad has decreased. Another problem is the high unemployment rate among young people, which is currently at 70% in the under 30s age group. For 2013, a GDP of 45.6 billion US-Dollars and a moderate growth rate of 3.7% are expected (AfDB et al. 2012, GTAI 2012).

3.1 The Water Situation in Tunisia

Tunisia covers an area of 163,610 square kilometres and has a population of 10.8 million inhabitants, whereof 68% live in cities. (AfDB et al. 2012).

Tunisia is located in the north of the African continent and has a 1,300 kilometres coast alongside the Mediterranean Sea (Figure 2). While northern areas are influenced by a Mediterranean climate, the middle and southern inland areas are subject to a more continental climate with hot summers and cold winters. Approximately 40% of the Tunisian territory belongs to the desert Sahara. The temperatures range from minimum 7°C in winter time up to 32°C in summer time. Tunisia has only 24 rain days per year. The average volume accounts for 456 mm per square meter and is not evenly distributed in space and time. Droughts and floods pose a severe risk for the regional and national water supply if not minimised by an effective water management system (Louati, M.E.H. & Bucknall, J. 2009).

Figure 2 Tunisia's topographic landscape (Wikimedia Commons, 2009)

More than half of the water supply in Tunisia is provided by the Medjerda basin located in the mountainous northwest of the country (Figure 2). Its valley is the most productive farming area in Tunisia. Since the river has its origin in Algeria, an agreement on the utilisation of this resource has been signed by both states. The northeast of the country is also very fruitful and famous for its olive plantations due to rainy winds from the east. Major groundwater resources in the central and southern arid zones of Tunisia are essential for the existence of 30.000 ha of oases. These oases have to be protected, as the groundwater recharge rate in this area is below 15 mm/y. However, the oases are increasingly used for irrigation purposes. Most of the groundwater resources have to be shared with the neighbouring countries Algeria and Libya on the basis of a political agreement. Nevertheless, the established Tunisian groundwater resources are growing thanks to better monitoring and exploration technologies having been applied in the last years. Using these resources in a sustainable and affordable manner is challenging under the existing circumstances. More than 50% of the available water in Tunisia is affected by a high salinity (Louati, M.E.H. & Bucknall, J. 2009).

Currently, there are 21 dams operating in Tunisia. They ensure the water supply of the constantly growing urban population, especially during droughts. Yet, altogether 80% of the water consumption is caused by irrigation. Despite the scarcity, Tunisia has managed to utilise 95% of its water resources and realises a 100% access to drinking water in cities and an 85% access in rural areas (Hydra Project, 2013). Due to the growing Tunisian population, the changing habitation and lifestyle in cities as well as the poor maintenance of water infrastructures, the water consumption has jumped to a level of 685 litres per day and capita. Without ambitious efforts to change the current development, Tunisia is facing a serious drinking water problem until 2025 (Global Water Partnership Africa, 2011). Technical measures, such as water desalination, wastewater treatment (currently, there are already 98 sewage treatment plants in operation) and artificial groundwater recharge have been applied in Tunisia since the 1970’s and are the only means of choice in the long term. Likewise, initial success is noticeable by subsidised water conservation measures in irrigated areas (World Bank, 2009).

In Tunisia, the water sector is managed and controlled by the Ministry of Agriculture and its general directorate responsible for water used for irrigation purposes. Furthermore, two government agencies are involved in the process. These are SONEDE (Société Nationale d'Exploitation et de Distribution des Eaux) that is responsible for the supply of drinking water and the maintenance of the pipelines as well as ONAS (Office National de l'Assainissement) that is responsible for the waste water management (Pérard 2008). The Tunisian government also supports private investments in desalination projects. Most of them are dealing with the production of drinking water for the tourism sector.

3.2 The Energy Situation in Tunisia

The Tunisian population will grow up to 13 million people until 2050. As a consequence, the energy demand will further increase. Currently, there is an electricity demand of 14 TWh/y (AfDB et al. 2012). The per capita consumption amounted to 1,400 kWh in 2011. According to the Desertec Power 2050 Connected Scenario, the demand will increase up to 38 TWh/y. According to this scenario, Tunisia will be using approximately 75% wind power, 20% solar energy and 5% natural gas contributing to the national energy supply in 2050 (Dii, 2013).

Today, the Tunisian energy supply is still dominated by fossil fuels like oil (35%) and gas (63%), which partly have to be imported. Renewable energies account for only 2% at an installed capacity of 240 MW wind power and 70 MW hydropower (OECD, 2012b; WEC, 2010). According to OECD figures, the renewable energy share of the produced electricity amounted up to 0.6 % in the year 2009 with a tendency to rise (Figure 3).

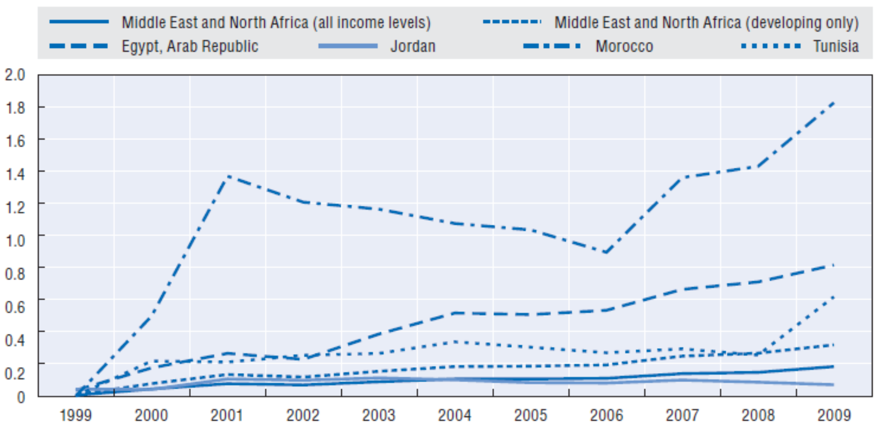

Figure 3 Electricity production from renewable sources (% of total) (copied from OECD 2013b, p. 31)[6]

In order to increase the renewable energy share, the Tunisian government issued a strategic plan (Plan Solaire Tunisien) in 2009, which envisages the installation of 4.7 GW renewable power plant capacities and a 40% renewable share by 2030

[6] Electricity production excludes hydro-electric and includes geothermal, solar, tidal, wind, biomass and bio fuels (OECD 2013b, p. 31)

(Figure 4). The Tunisian Solar Plan comprises a portfolio of 40 complementary projects covering not only solar energy (PV, CSP), but also wind energy, bioenergy, energy efficiency, a power interconnection with Italy and the manufacture of photovoltaic panels. The Tunisian Solar Plan is in line with similar international projects, e.g. the Mediterranean Solar Plan and the Desertec concept (ANME, 2012).

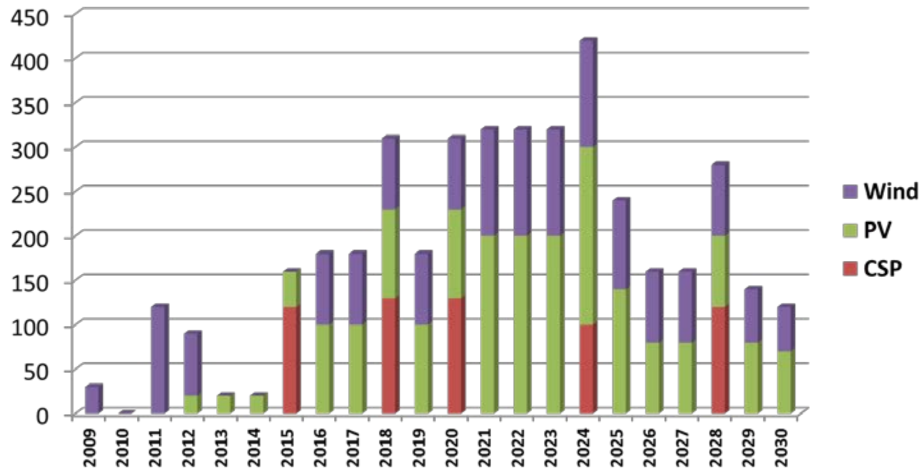

Figure 4 **New planned capacity per year in the scope of the Tunisian Solar Plan (total numbers for Wind: 1.520 MW, PV: 1.930 MW, CSP: 600 MW (ANME, 2012)**

On the short term, Tunisia aims at using "10% of its primary energy from renewable energy sources by 2016" (OECD 2013b, p. 71). As stated by the biggest national energy supplier and only Tunisian network operator STEG (Société Tunisienne de l'Electricité et du Gaz), the erection of 120 MW of wind power plants is already planned. Furthermore, STEG intends to invest 400 million Euro into new gas pipelines and the municipal gas supply (gtai, 2013). From the governmental side, the authority ANME (Agence Nationale pour la Maîtrise de l'Energie) is in charge for the planning and coordination of the renewable energy use in Tunisia.

Figure 5 **Tunisia's electricity network (GENI, 2013)**

The technical solar energy potential of Tunisia's territory exceeds the local energy demand notably. However, large-scale projects require huge investments and Tunisia does not provide feed-in-tariffs. Furthermore, the existing electricity network (Figure 5) needs to be readjusted. Therefore, the right policy framework for the export of solar electricity from the MENA-Region (Middle East and North Africa) to the European Union has been discussed since 2008. At that time, the Mediterranean Solar Plan was initiated by the Union of the Mediterranean (UfM).

Currently, several feasibility studies are ongoing for the development of solar power plants and the export of electricity. A next step will be the erection of the 2 GW solar thermal power plant "Tunur" under the auspices of the private NGO Desertec Foundation. The produced electricity is planned to be exported via a 400 kV submarine cable to Europe (El-Med-Link). Another idea for making the installation of solar power plants more competitive is to combine them with fossil plants in order to save fuels (Dii, 2013).

Investments in green projects are dominated by government-funds. In 2012, Tunisia committed itself to develop an improved framework for private investments in areas such as renewable energy, energy efficiency, water infrastructure and management. This strategy has been named Green Growth Strategy. Moreover, in 2009, the self-generation of electricity using renewable energies was authorised by the energy conservation law. Private investors have since then the right to sell up to 30% of the power generated to STEG at a price equivalent to the STEG selling price excluding tax. Other incentives have been established with regard to tax reduction and bonuses on investment cost (OECD, 2012b).

Research and development is often conducted using co-financing from the European Union. As an example, the Research and Technology Centre of Energy (CRTEn) could successfully acquire funding from the 7th EU Framework Programme for two renewable energy projects (ETRERA[7]; OPEN GAIN[8]). Joint R&D projects with participation of the local industry are still seldom (CRTEn, 2013).

[7] ETRERA = Empowering Tunisian Renewable Energy Research Activities

[8] OPEN GAIN = OPtimal ENgineering Design for Dependable Water and Power Generation in Remote Areas Using Renewable Energies and INtelligent Automation

4 Organisations within the Tunisian Innovation System

The Tunisian innovation system has numerous actors on the different levels (macro-, meso- and micro level[9]) as shown in Figure 6 and Figure 7 on the next pages. These actors have been identified as key actors/stakeholders and classified according to their tasks and activities within the innovation system by the participating experts during the workshop. Thus, the experts in the workshop collected all institutions that play a major role for the Tunisian economy and arranged them according to their function.

It was not intended to have a complete list of stakeholders. It was rather the aim to identify the most relevant ones. The stakeholders were grouped according to the different levels of the innovation system. Figure 6 and Figure 7 visualise that there are numerous relevant stakeholders existing in Tunisia for both sectors. As a consequence, there are also many innovation support initiatives on the Tunisian market. However, during the workshop, it was discussed, whether these innovation support initiatives are actually visible and promotive for the Tunisian economy. The results of this discussion are laid down in chapter 5.

[9] The description of these levels is to be found in chapter 2.

4.1 The Organisations of the Tunisian Innovation System of the Energy Sector

The Innovation System of Tunisia

Sector: Energy

Policy Level

- Ministry of Higher Education and Scientific Research (MESRS):
  - Directorate General of Research Valorisation (DGVR)
  - Directorate General of Scientific Research (DGRS)
  - Directorate General of International Cooperation (DGCI)
- Ministry of Industry and Technology (MIT) :
  - Directorate General of Energy (DGE)
  - Directorate General of Industrial and Technological Infrastructure (DGIIT)
  - Directorate General of Innovation and Technological Development (DGIDT)
- Ministry of Investment and International Cooperation (MICI)
- Tunisian Company of Electricity and Gas (STEG)
- Tunisian Institute for Strategic Studies (ITES)
- Tunisian Union of Industry, Trade and Commerce (UTICA)
- National Centre of Agricultural Studies (CNEA)

Institutional Innovation Support

- Agency for the Promotion of Industry and Innovation (APII)
- National Institute of Standardisation and Industrial Property (INNORPI)
- National Agency for the Promotion of Scientific Research (ANPR)
- National Agency of Energy Conservation (ANME)
- Tunisian Company of Electricity and Gas Renewable Energies (STEG-ER)
- Technology Transfer Office of the Research and Technology Centre Energy (CRTEn-BuTT)
- Science & Technology Park of Borj-Cedria
- International Centre of Environmental Technologies in Tunis (CITET)
- National Agency of Waste Management (ANGed)
- Industrial Innovation Centre (IIC)
- Technology Centres
- Business Centres
- Science and Business (Foundation) Centres

Innovation Capacity Level

- Research and Technology Centre of Energy (CRTEn)
- National Engineering School of Monastir (ENIM)
- National Engineering School of Tunis (ENIT)
- National Engineering School of Sfax (ENIS)
- National Engineering School of Gabes (ENIG)
- National Institue of Applied Science and Technologies (INSAT)
- Faculty of Sciences,Tunis (FST)
- Faculty of Sciences, Monastir (FSM)
- Faculty of Sciences, Bizerte (FSB)
- Institute of Research and Higher Education in Agriculture (IRESA)
- National Research Institute for Rural Engineering, Water and Forestry (INRGREF)

Programmatic Innovation Support

- GiZ Programme to Foster Entrepreneurship and Innovation (PAEI-GIZ)
- EU financed Project for the Support of the Research and Innovation System in Tunisia (PASRI)
- EU financed Project to Support the Competitiveness of Enterprises and to Facilitate Market Access (PCAM)
- EU financed Project: Mediterranean Innovation and Research Coordination Action (MIRA)
- National Research and Innovation Programme (PNRI)
- Investment Incentives for Activities in Research and Development (PIRD)
- Projects in Research Evaluation (VRR)
- Joint Research Projects (PRF)
- Priority Technology investments (ITP)
- Environment and Energy Programme (PEE)
- National Funds for Energy Conservation (FNME)
- Centre of Technology Resources (CRT)
- Network of Experts for Innovation and sustainable Development (IDNET)
- Association for the Development of Research and Innovation (ADRI)

Figure 6 The main players in the Tunisian innovation system relevant to the sector “energy”

4.2 The Organisations of the Tunisian Innovation System of the Water Sector

Policy Level

- Ministry of Agriculture (MA)
- Ministry of Agriculture, General Directorate of Water Resources (MA-DG/RE)
- Ministry of Agriculture, General Directorate of Rural Engineering and Water Use (MA-DG/GREE)
- Ministry of Agriculture, General Directorate of Studies and Hydraulic Works (MA-DG/EGTH)
- Ministry of Agriculture, Directorate General for Development and Conservation of Agricultural Land (MA-DG/ACTA)
- Secretary of State for the Environment
- Ministry of Higher Education and Scientific Research (MHESR)
- Ministry of Industry and Technology

Institutional Innovation Support

- Institution of Research and Higher Agricultural Education (IRESA)
- Agency for the Promotion of Agricultural Investment (APIA)
- National Agricultural Bank (BNA)
- Science & Technology Park of Borj-Cedria
- Water Researches and Technologies Centre of Borj-Cedria (CERTE)
- Centre of Biotechnology in Sfax (CBS)
- National Company for the Exploitation and Distribution of Water (SONEDE)
- National Office of Sanitation (ONAS)
- Tunisian Chemical Group (CGT)
- National Agency for the Promotion of Scientific Research (ANPR)
- National Institute of Meteorology (INM)
- National Institute for Standardisation and Industrial Property (INNORPI)
- Operating Company for Canal and North Water Supply Systems (SECADENORD)

The Innovation System of Tunisia

Sector: Water Technologies

Programmatic Innovation Support

- Ministry of Agriculture (MA)
- Ministry of Higher Education and Scientific Research (MHESR)
- International Organisations
- National Agricultural Bank (BNA)
- Ministry of Industry and Technology

Innovation Capacity Level

- Water Researches and Technologies Centre of Borj-Cedria (CERTE)
- National Research Institute for Rural Engineering, Water and Forestry (INRGREF)
- Centre for Biotechnology in Sfax (CBS)
- National Agronomic Institute of Tunisia (INAT)
- National Engineering School of Sfax (ENIS)
- The Faculties of Sciences
- International Centre for Environmental Technologies of Tunis (CITET)
- Higher Institute of Agronomy of Chott Meriem (ISA - CM)
- Advanced Institute of Science and Technology of Water Gabes (ISSTEG)
- Advanced Institute of Science and Technology of Environment of Borj-Cedria (ISSTE)

Figure 7 The main players of the Tunisian innovation system relevant to the sector "water technologies"

5 Assessment Results for Tunisia

The following chapters present the main outcomes of the assessment of the 30 determinants according to the ANIS approach separately for each sector. This assessment has been conducted based on the Expert Opinion Survey methodology described in chapter 2.2. Selected key experts participated and contributed by providing their expertise in the relevant fields. Although the total number of experts was lower than expected, the experts covered all relevant topics. Since the variety of opinions of the individual experts was comparably low (no extreme values), the assessment resulted in a temporarily consistent picture for the sectors water and energy in Tunisia.

Before reading the results, it is important to know that due to the current political conditions in Tunisia, the risk perception of this country is relatively high. This uncertainty is amplified by sector-specific obstacles, such as little transparency and little public dissemination with regard to national energy policies, innovation support activities and investment incentives (OECD 2013b). Hence, Tunisia suffers from a relatively volatile situation at the moment, which is mirrored by the very critical assessment of the energy sector and the water sector by the experts as demonstrated in the following subchapters.

5.1 Results of the Analysis of the Energy Sector

The following subchapters (chapter 5.1.1 – chapter 5.1.4) show the results of the expert opinion surveys. They are based on the interviews by the experts. Thus, the values reflect the opinion of the interviewed experts who are aware of the strategy plans, master plans and innovation policy agendas relevant for the energy sector in Tunisia.

In order to easily depict the maturity of the determinants within the energy sector at each level of the Tunisian innovation system, the key findings are presented by radar charts and bar charts.

The radar chart figures give an overall impression of the maturity of the individual determinants for each level of the energy sector. Well-matured and weakly developed determinants can thus be depicted easily.

The bar chart figures show the particular average of each level, which has been taken as orientation to identify the determinants being in a very low state and those being at least above the country-specific and level-specific average.

5.1.1 Macro-level: Innovation Policy Level – Energy Sector

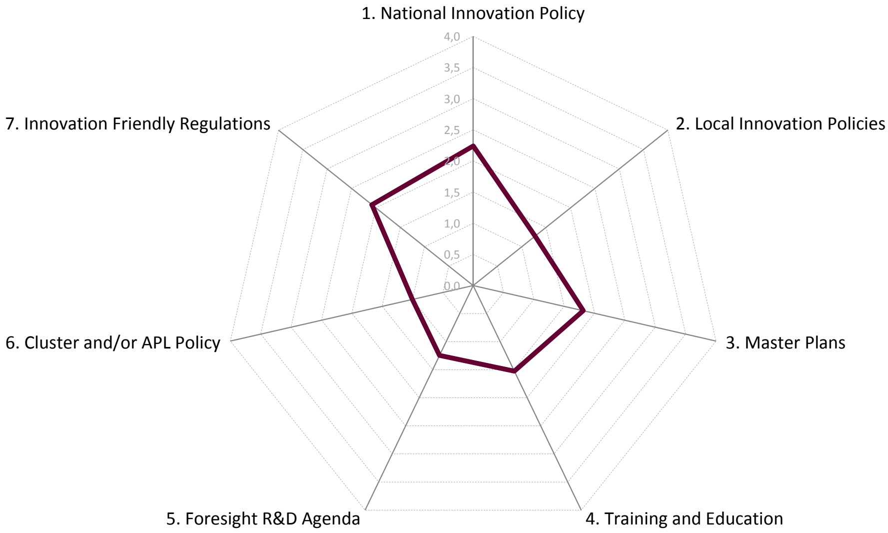

Figure 8 Determinants of the innovation policy level (energy sector)

Figure 8 shows the results of the assessment of the innovation policy level of the Tunisian energy sector. Notably, the determinants *National Innovation Policy*, *Master Plans* and *Innovation-friendly Regulations* are in a comparably good state of maturity. They rank above a value of 2.0, meaning that they basically exist and reveal first positive impacts. However, other determinants *Local Innovation Policies*, *Training and Education*, *Foresight R&D Agenda* and *Cluster Policy* are in a more embryonic status, ranking significantly below the 2.0 value.

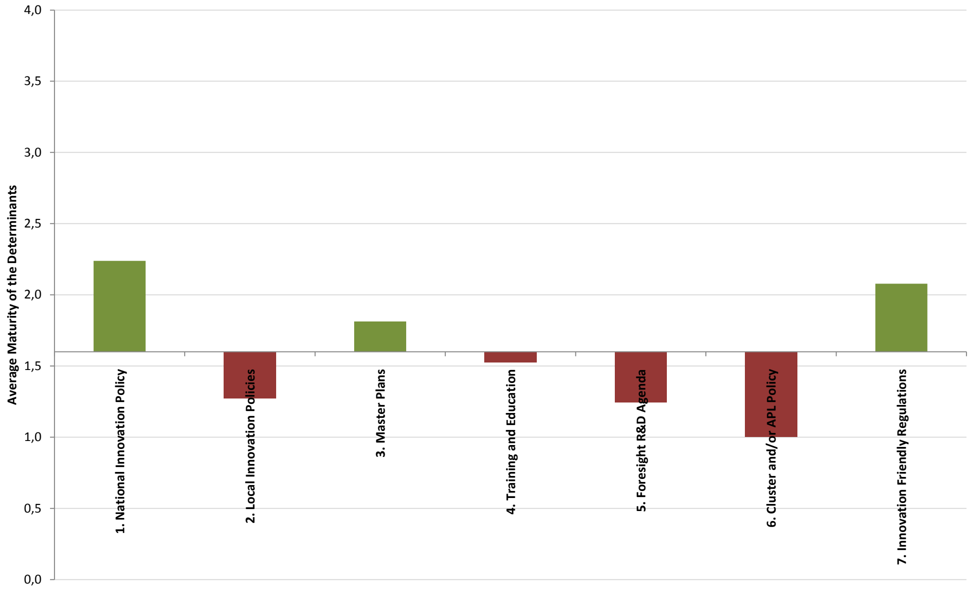

Figure 9 Determinants of the innovation policy level compared to this level's average (energy sector)

Figure 9 shows the values of the individual determinants of the innovation policy level of the Tunisian energy sector and their relation to the average value of all determinants of the innovation policy level of the Tunisian energy sector.

The average value for the seven key determinants of the policy level was calculated at 1.6 on a scale from 0 to 4 (cf. chapter 2.2). The policy level with regard to the sector energy is thus quite weakly developed. This comparably low average is characteristic for an immature innovation policy level. However, the individual determinants which characterise the policy level reveal a different status of maturity. The overall *National Innovation Policy* was ranked comparably high (value 2.3), whereas *Cluster Policy* still has an embryonic status (value of 1.0).

Findings: National Innovation Policy

Tunisia has a *National Innovation Policy* which includes energy-related innovation issues. It is available to all interested parties, sets clear thematic priorities according to the national demand and is turned into practice through significant efforts of public engagement in innovation, science and technology. Relevant stakeholders were actively involved in the design of the innovation policy; the implementation process is relatively well co-ordinated among the actors. Moreover, energy-related innovation projects in Tunisia can benefit from the National Fund for Energy Management (Fonds National de Maîtrise de l'Énergie, FNME) that contains private resources and credit lines in order to support projects within the energy sector (OECD 2013b). However, the energy sector in particular as well as its innovation potential have not been sufficiently considered, yet.

Findings: Local Innovation Policy

Local Innovation Policies exist to some extent, but they rarely contain thematic priorities according to regional needs in the energy sector, and they are not sufficiently linked to or harmonised with the national innovation policy.

Findings: Master Plans

The most important innovation fields and technologies in the energy sector are identified and described by *Master Plans*. Hence, the framework for implementing measures in the energy sector has been established. However, the interfaces between the policy level that sets up the master plans and the innovation capacity level that should benefit from the master plans are not sufficiently developed. Thus, much information concerning innovation projects and innovation strategies does not reach its recipient.

Findings: Training and Education

Education Schemes and *Curricula in Science and Technology* within the energy sector are moderately developed. There are training and education schemes available to improve the knowledge on innovation. However, the quality thereof related to innovation issues has not yet reached a satisfying level.

Findings: Foresight R&D Agenda

With regard to *Forecasting or Foresight Studies*, e.g. long-term visions and detailed projections of technological developments, products or environments in the future, the energy sector in Tunisia has not yet fully embraced these aspects as relevant. Policy measures are rather short-term oriented than long-term.

Findings: National Cluster Policy

A *National Cluster Policy* including aspects of the energy sector has not yet been set into force. Cluster policy needs to acquire a more important role as part of the Tunisian innovation support schemes. The interviewees, who almost exclusively belonged to the innovation support level, emphasised the importance of setting up a cluster policy in Tunisia.

Findings: Innovation-friendly Regulations

The impact of *Innovation-friendly Regulations* for the energy sector has not yet reached a satisfying level. Most of them are not relevant for innovation, but rather hindering as they are causing too much of an administrative burden. However, they are understood by policy-makers as a tool to stimulate innovation.

5.1.2 Meso-level: Institutional Innovation Support – Energy Sector

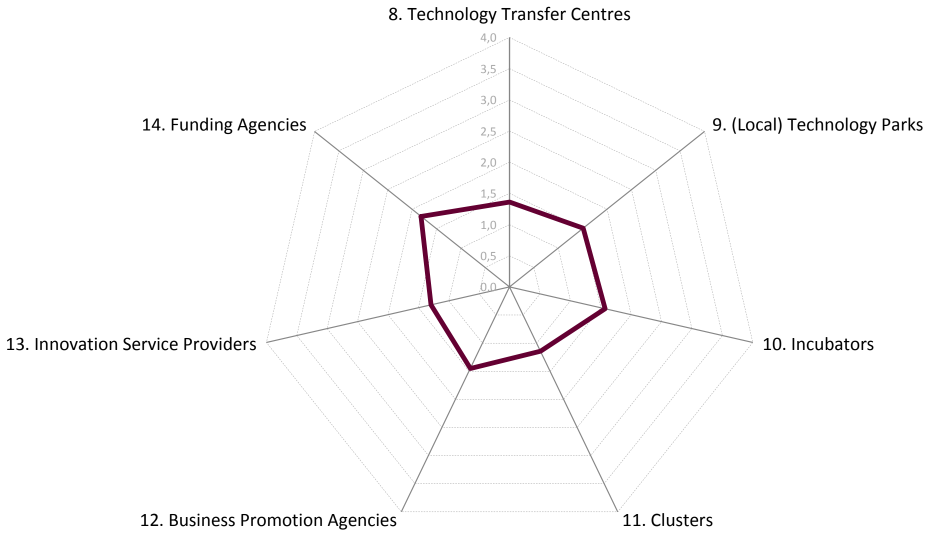

Figure 10 Determinants of the institutional innovation support level (energy sector)

Figure 10 shows that institutional innovation support in the energy sector in Tunisia is not well advanced. All respective determinants are on a similarly low level. The values for *Technology Transfer Centres*, *Local Technology Parks, Incubators, Clusters, Business Promotion Agencies,* and *Innovation Service Providers* are even lower than 1.5. This means that they almost do not exist or are operated at a poor level.

This observation is very much in line with the comparatively weak development of the innovation policy in Tunisia. It seems that innovation support institutions in the energy sector suffer from too little political support by the government or that there are no adequate policy actions for a sustainable implementation.

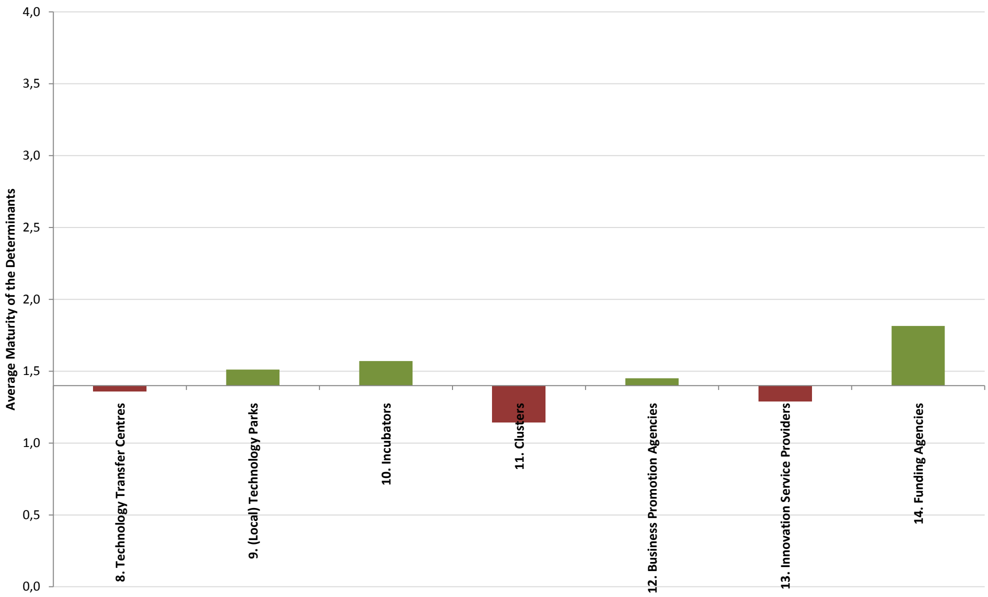

Figure 11 Determinants of the institutional innovation support level compared to this level's average (energy sector)

The average value shown in Figure 11, based on the seven key determinants for the institutional innovation support level was assessed a "1.4", which is even lower than the value defined for the policy level.

The discussion among the experts revealed that basically all institutions providing innovation support, such as *Technology Parks, Incubators, Business Promotion Agencies* or *Funding Agencies,* can be found in the Tunisian innovation system. However, most of them are comparatively low developed as shown in Figure 11. Due to a weakly developed *Cluster Policy* (see relevant determinant in Figure 8), it is not surprising that *Clusters* and *Regional Networks* are ranking worst among the innovation support institutions (value of 1.3). For several years, foreign donors have supported the Tunisian government in promoting cluster and network developments, but with limited success. The lack of trust and openness for mutual cooperation are still the main barriers to unleash the full potential clusters in Tunisia could have.

Findings: Technology Transfer Centres

The implementation of the overall *Technology Transfer Centres* approach has not been very successful so far. Often, neither are the main objectives defined for these institutions, nor are the Technology Transfer Centres adequately equipped.[10]

In Tunisia only one *Technology Transfer Centre* specialised in energy has been established. It is the *Technology Transfer Centre* at the Research and Technology Centre of Energy (CRTE) of the Borj-Cedria Science & Technology Park.

One of the main tasks of this *Technology Transfer Centre* is to develop so-called detection sheets that depict innovative projects. However, many policy-makers do not seem to be aware of this centre and its value. For example, when a researcher publishes two patents he/she will be rewarded by promotion to a higher position (e.g.

[10] Currently, there are several studies and support actions ongoing in Tunisia to identify key success factors for a better implementation of the Technology Transfer Centre approach.

from junior to senior researcher). Yet, after this upgrade, the process is stopped. The patent is rarely used for technology transfer purposes or a validation and commercialisation of products.

Here, the policy level, the innovation support level and the capacity level have not yet found solutions that might help to better interact with each other in order to enhance the knowledge flow between them. This knowledge exchange would lead to an appraisal by the political level of the achievements at capacity level – a valuation which is currently perceived by the actors at capacity level as non-existent.

Findings: Technology Parks

There are several *Technology Parks* in Tunisia. The Borj-Cedria Science & Technology Park is one of them. It includes research facilities for the sectors water and energy. The CRTEn was founded in 2005. It has partnerships with the OME (Mediterranean Observatory of Energy) and CITEF (Conférence Internationale des Formation d'Ingénieurs et Techniciens d'expression Française).

The recognition of the *Technology Parks* in Tunisia is at medium level. They are known as service providers to support innovation. However, they strongly depend on public institutions. As such, often the freedom of science is not given. The impact they have on innovation is still low. The equipment and the number of staff members are not satisfactory.

Generally, it can be said that with regard to *Technology Transfer Centres*, C*lusters*, and *Innovation Service Providers,* the status of maturity has not yet reached a satisfying level.

Findings: Incubators

Incubators exist in the energy sector, for example at the Borj-Cedria Science & Technology Park. However, often they work isolated and do not have the networking capacities that are needed for business start-ups. The connection to universities is relatively minor.

Findings: Clusters

The concept "cluster" is quite new in Tunisia. *Clusters* are considered to be an important determinant to improve the networking between the different stakeholders in the energy sector. However, the status of cluster development is very low, especially in the energy sector. The emergence of some clusters in other sectors has been supported by the GiZ and other donors. However, so far, they have not really contributed to strengthening innovation capabilities among the actors. A lack of trust and a lack of ideas on how to cooperate within these clusters are the main reasons for insufficient innovation capabilities of clusters.

Especially the industry does not see the added value of the cluster approach yet. Some actions just have started to upgrade the competence of the respective cluster managers. Furthermore, the European Foundation for Cluster Excellence is about to implement a training programme for cluster managers. In addition, benchmarking exercises are planned to compare Tunisian clusters with peers from other countries. All these measures aim at strengthening innovation capabilities and competitiveness of the respective industry.

Findings: Business Promotion Agencies

Business Promotion Agencies were appraised as “lagging behind”. The interviewees answered that *Business Promotion Agencies* were often understaffed and did not really represent the interests of the industry.

Findings: Innovation Service Providers

The *Innovation Service Providers* have not been assessed as very successful. Many of the interviewees answered that *Innovation Service Providers* did not exist or many of the interviewees did not know that *Innovation Service Providers* existed, even though there are several functioning *Innovation Service Providers* in Tunisia (e.g. Agency for the Promotion of Industry and Innovation[11]). This gap between reality and perception probably exists because of the different expectations the interviewees are having towards *Innovation Service Providers*.

Findings: Funding Agencies

Tunisia’s *Funding Agencies* in the energy sector are largely well developed. Usually, *Funding Agencies* are responsible for the design and implementation of innovation support measures and are actively involved in transnational innovation support schemes on behalf of the funding ministries. Their work is based on the application of up-to-date tools in day-to-day business, such as impact assessments, evaluations and foresights. Yet, in Tunisia, these services can still be improved in order to make them more useful for the beneficiaries.

5.1.3 Meso-level: Programmatic Innovation Support – Energy Sector

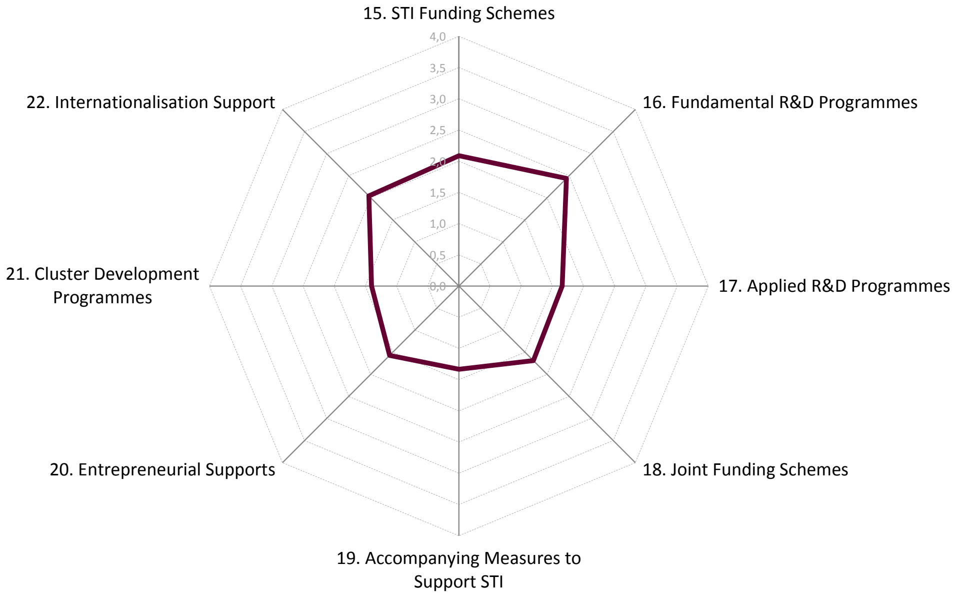

Figure 12 Determinants of the programmatic innovation support level (energy sector)

[11] For more information, see: http://www.tunisianindustry.nat.tn/en/home.asp

When it comes to the programmatic innovation support level (Figure 12), the findings are more promising than those of the previously mentioned levels. With regard to programmatic innovation support, the determinants *STI Funding Schemes*, *Fundamental R&D Programmes* and *Internationalisation Support* are at a quite advanced stage (value 2.0 or above). This is due to a successfully implemented innovation policy.

In practice, there are many relevant programmes, such as PIRD, PNRI, ITP, RICTIC, FOPRODI, IN'TECH that aim at supporting (fundamental) R&D in academia and industry. However, other relevant determinants at programmatic level still have an embryonic status, such as *Applied R&D Programmes*, *Joint Funding Schemes*, *Accompanying Measures to Support STI*, *Entrepreneurial Support*, and *Cluster Development Programmes.* Such programmes and funding schemes are much less developed or do not exist at all, e.g. a national cluster support programme is missing.

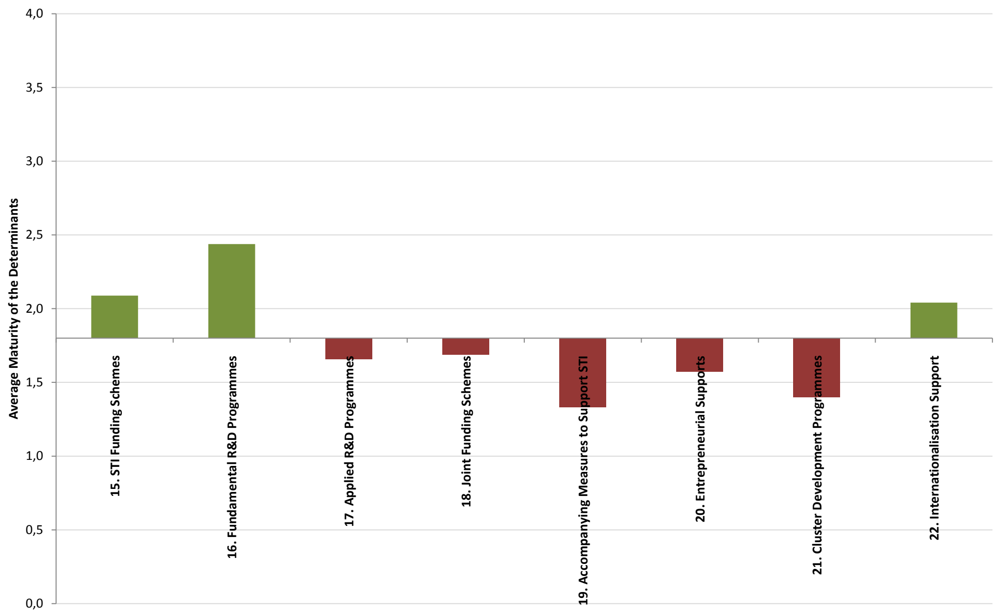

Figure 13 Determinants of the programmatic innovation support level compared to this level's average (energy sector)

The average value shown in Figure 13is based on the eight key determinants (see Figure 1) and was rated at 1.8 on a scale from 0 to 4 (cf. chapter 2.2). Figure 13 further reveals that there is a tremendous gap between the maturity of *Fundamental R&D Programmes* (value 2.4) and *Applied R&D Programmes* (value 1.7). It shows that with regard to fundamental research in the energy sector, Tunisia is quite advanced compared to the maturity of other programmatic support activities. However, when it comes to applied research, where science is turned into innovation for industry, Tunisia is lagging behind.

In some cases, policy-makers are already aware of this gap and first actions are on-going, mostly focussing on how to link fundamental research programmes with applied ones in a better way.

Joint Funding Schemes, Accompanying Measures to Support STI, Entrepreneurial Support and *Cluster Development Programmes* are not well developed, but need to turn knowledge and inventions from fundamental research to applied research. Such programmes are either missing in the energy sector, or, if existent, are not well coordinated with regard to application procedures and grants.

Findings: STI Funding Schemes

STI Funding Schemes for Energy exist and set clear thematic priorities. They are of high relevance and significant efforts are spent to make the results available for the public. Further improvements can be gained when the application procedures become easier and the administrative hurdles are reduced. Currently, Tunisian companies are quite reluctant to apply for respective grants.

Findings: Fundamental R&D Programmes

When it comes to innovation support programmes within the energy sector, Tunisia offers quite well developed measures with regard to *Fundamental R&D Programmes*, e.g. PNRI (Programme National de Promotion de l'Innovation Technologique) administered by the Ministry of Industry and Technology.[12] The aim of this programme is to encourage the cooperation between industry and research in the field of applied research and technological innovation in industrial enterprises. Projects that apply for funding must consist of at least three partners including a laboratory, a technology centre, and a private company. The programme currently funds four projects per year with up to 200,000 Dinar. The figure shows that this determinant was rated as clearly above average has received the best assessment of the Tunisian innovation system.

Findings: Applied R&D Programmes

Another programme run by the Ministry of Industry and Technology is PIRD (Prime d'Investissements dans les Activités de Recherche-Développement).[13] The aim of the programme is to encourage businesses, public and private institutions and scientific associations to implement projects of research and development. The grant funding is given either to companies or to research institutes. Currently there are 20 project applications per year.

However, it can be seen in Figure 13 that this determinant was rated as quite underdeveloped. This evaluation is based on the fact that the topics of the *Applied R&D Programmes* do not conform to the demand of the researchers and to the standard of the international research community. The number of *Applied R&D Programmes* is not satisfactory, but it ensures a minimum number of funded projects.

Findings: Joint Funding Schemes

Joint Funding Schemes in the energy sector have not yet been initiated by Tunisian innovation support programmes. Tunisian researchers often benefit from *Joint Funding Schemes* that are initiated by other countries, such as Japan.

Findings: Accompanying Measures to Support STI

Even though Tunisia is engaged in tackling the potential of science, technology and innovation, *Accompanying Measures to Support STI* in the energy sector have not been realised yet in Tunisia. The few measures that exist are not visible.

---

[12] More information is to be found at: http://www.industrie.gov.tn/fr/directdoc.asp?docid=319

[13] More information is to be found at: http://www.industrie.gov.tn/fr/directdoc.asp?docid=318

Findings: Entrepreneurial Support

Entrepreneurial Support in the energy sector has been recognised as important for Tunisia's competitiveness, but relevant initiatives have not yet started.

Findings: Cluster Development Programmes

Cluster Development Programmes do not yet play a role in Tunisia's innovation landscape. The concept of knowledge spill-over through networking activities has not been perceived as relevant for the innovation performance of Tunisia so far. As indicated earlier, appropriate actions have just started to strengthen the maturity of clusters, also in the energy sector.

Findings: Internationalisation Support

The programmatic innovation support also includes *Internationalisation Support*, mostly through the participation in EU-funded projects. Stakeholders in the energy sector consider internationalisation support important to increase Tunisia's competitiveness at international level. The funding of international cooperation has a positive impact on the international competitiveness of especially the research institutes in Tunisia's energy sector.

5.1.4 Micro-level: Innovation Capacity Level – Energy Sector

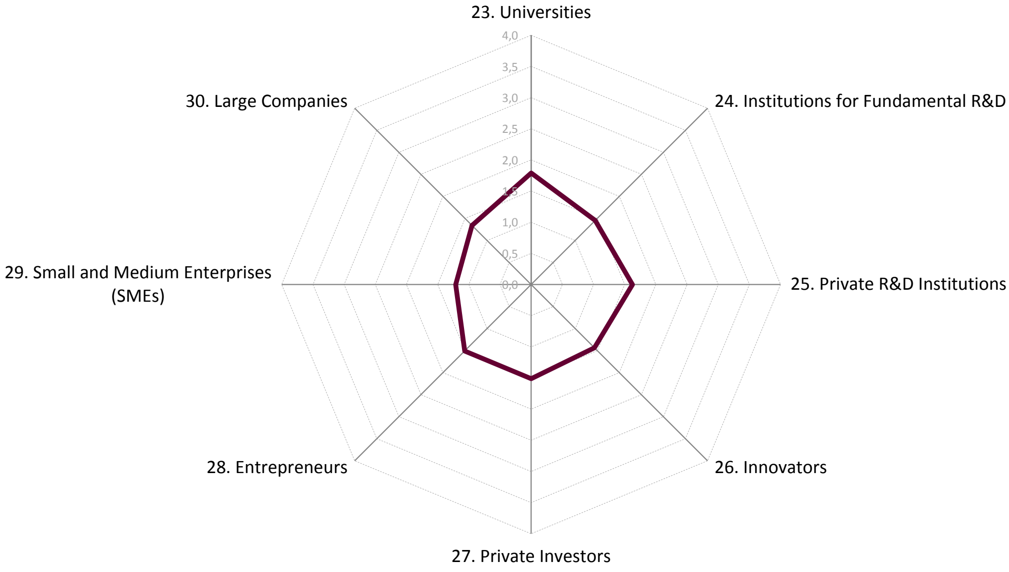

Figure 14 Determinants of the innovation capacity level (energy sector)

Figure 14 displays the status of the determinants where innovation actually happens. With regard to Tunisia's energy sector, it can be said that *Universities* are relatively advanced (value of 1.8) compared to all other determinants at innovation capacity level (values of 1.6 or below). This figure actually mirrors the result of the too few innovation support activities taking place in Tunisia in the energy sector (see Figure 10 - Figure 13). As a consequence, the maturity of this level is very low (average 1.5, see Figure 15).

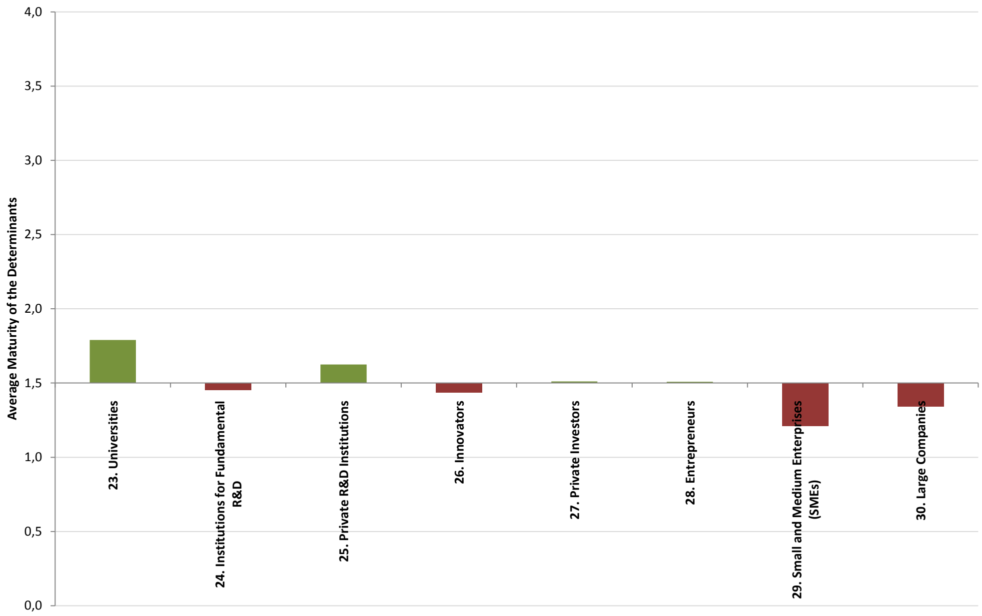

Figure 15 Determinants of the innovation capacity level compared to this level's average (energy sector)

The average value shown in Figure 15, based on the eight key determinants (Figure 1), was rated as 1.5 on a scale from 0 to 4 (cf. chapter 2.2). This figure affirms that, except for *Universities* (value 1.8), none of the determinants has reached a status that allows an innovation-oriented performance. These findings are backed by the day-to-day practice in Tunisia characterised by only a few companies and other actors that can be considered as drivers for innovation.

One of the most significant weaknesses that were pointed out during the discussions in the workshop is the little or even non-existent entrepreneurial education, which yields in a very unstable industry in the energy sector (see very low values for *SMEs* and *Large Companies*) and disorientation in institutions for fundamental R&D and private R&D institutions. The lack of entrepreneurial support schemes hampers any development that could enhance the industrial structure in the energy sector.

Thus, the conditions for *Institutions for Fundamental R&D*, for *Innovators*, for P*rivate Investors*, *Entrepreneurs*, *SMEs* and *Large Enterprises* are not satisfactory. The impact which is usually achieved on this level through the implementation of innovation support measures has not yet been reached.

Findings: Universities

The main deficits of *Universities* focussing on energy-related technologies arise from too little or non-existent connections to industry, little competitiveness at international level, inability to attract world class researchers or high potentials, a low level of training and education of students, and insufficient equipment.

Findings: Institutions for Fundamental R&D

With regard to *Fundamental R&D Institutions,* the situation is similar. They are even considered as less relevant for innovation than universities. Most of these institutions are acting according to their own priorities instead of orienting towards national concerns, which is actually not a surprise, since the national priorities often do not conform to the current need. *Fundamental R&D Institutions* are only of little interest to researchers from abroad specialised in the energy field.

Findings: Private R&D Institutions

The maturity of *Private R&D Institutions* is at a lower to medium level. Even though they are often poorly equipped and understaffed, they are recognised as important innovation providers for SMEs in the energy sector.

Findings: Innovators, Private Investors, Entrepreneurs, SMEs and Large Companies

The importance of *Innovators, Entrepreneurs, SMEs* and *Large Companies* for the Tunisian innovation system has not yet been recognised in the energy sector. So far, these determinants receive only little support from policy level and are isolated instead of participating in innovation-oriented networking activities. *Private Investors*, private equity firms and risk capital are often not available. They do not receive sufficient support, even though the experience made in other countries has already shown that particularly private investors are better able to differentiate good from bad investments than any charity organisation, especially in the renewable energy business.

5.2 Results of the Analysis of the Water Sector

One of Tunisia's main challenges is to manage its scarce water resources. According to Louati & Bucknall, Tunisia has undergone a change from traditional practices to modern water management: "Tunisia is an example of good planning and management." (Louati & Bucknall 2008, p. 158). Managing water resources mainly means to equally allocate the water resources to the different regions of the country.

This task is difficult, as the water supplies are limited, the costs of the generation and storage of water are increasing, and the demand for water is ever growing (Louati & Bucknall 2008). At policy level, strategies have been set up that give proposals for the handling of agricultural water, drinking water, waste water and the re-use of water. New technologies are being installed to manage these tasks, such as the application of geographic information systems in order to control water usage and water supply. The stakeholders working on these challenges include the Tunisian Ministry of Agriculture and Water Resources (MARH), the National Water Information System (SINEAU) and the National Company for Exploitation and Distribution of Water (SONEDE).

Despite these regulatory, institutional and technical measures aiming to improve the maturity of the water sector in Tunisia, the assessment of the determinants of the innovation system in this sector remains low as laid down in the following chapters (chapter 5.2.1 – chapter 5.2.4).

According to the answers of experts from the innovation support level and from the innovation capacity level given during the workshop, the water sector is weakly developed in the Tunisian innovation system. With an average value of 1.3, it can be concluded that many determinants have not yet reached a status that helps to become an innovation-oriented sector.

The following subchapters (chapter 5.2.1 – chapter 5.2.4) show the results of the expert opinion surveys based on the interviews with the experts of the Tunisian water sector. Thus, the values presented in the following reflect the opinion of the interviewed experts who are familiar with the policy agendas and innovation support activities relevant for the water sector in Tunisia.

In order to easily depict the maturity of the determinants within the water sector at each level of the Tunisian innovation system, the interview results are presented by means of radar charts and bar charts.

The radar chart figures give an overall impression of the maturity of the individual determinants for each level of the water sector. Well matured and weakly developed determinants can thus be depicted easily.

The bar chart figures show the particular average of each level in the water sector, serving as orientation to visualise the determinants at a very low state and those being at least above the country-specific and level-specific average.

5.2.1 Macro-level: Innovation Policy Level – Water Sector

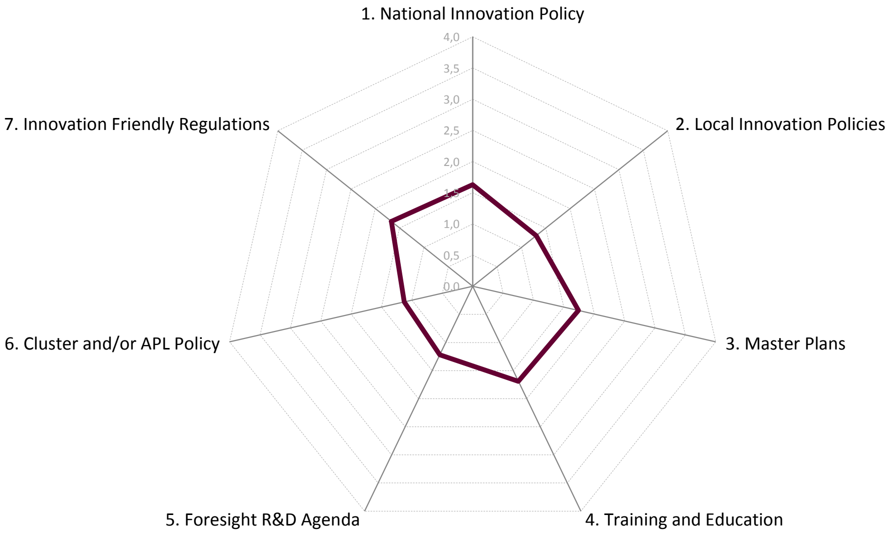

Figure 16 Determinants of the innovation policy level (water sector)

Figure 16 depicts the low level of maturity of the determinants of the innovation policy level within Tunisia's water sector. The determinants *Master Plans* and *Training and Education and Innovation-friendly Regulations* have been rated at 1.7. All other policy activities in this sector, namely *National Innovation Policy*, *Local Innovation Policies*, *Foresight R&D Agenda* and *Cluster Policy,* have been ranked even lower (value 1.6 or below). One reason for this result may be that although policy papers and strategy agendas exist, a practical implementation in form of concrete policy actions failed. This picture is similar to the results presented for the energy sector.

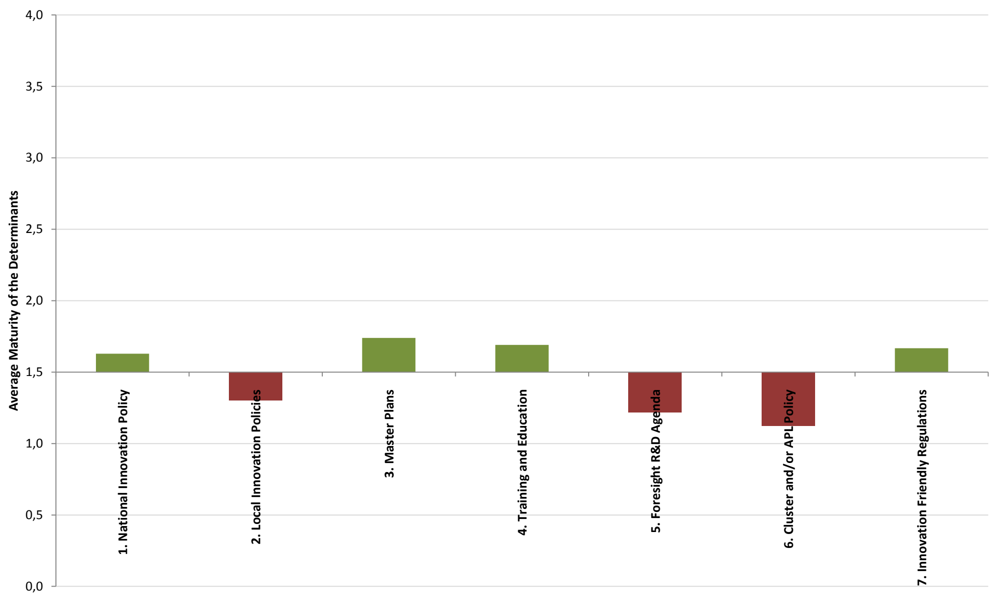

Figure 17 Determinants of the innovation policy level compared to this level's average (water sector)

The average value shown in Figure 17 is based on seven key determinants (Figure 1) and was rated at 1.5 on a scale from 0 to 4 (cf. chapter 2.2).

The determinants *Master Plans* and *Innovation-fFriendly Regulations* are the only determinants that have reached a level of advancement allowing the set-up of an innovation-enhancing landscape with regard to Tunisia's water sector. All other determinants do not provide the necessary maturation for starting any innovation-related activities. The determinants *Foresight R&D Agenda* and *Cluster Policy* show only rudimentary signs of concrete initiatives and may therefore not be seen as real innovation policy measures in Tunisia.

The Tunisian Ministry of Agriculture and Water Resources (responsible for the overall supply and use of water) and the Tunisian Ministry of Environment and Sustainable Development (responsible for impact studies and monitoring of environment systems) have made the topic water rank high on Tunisia's national strategy agendas (OECD 2010a) and have installed national water policies. Despite these high ambitions, Figure 17 shows that the policy level has been rated quite low according to the answers given by the experts during the workshop.

The expert opinion surveys have evealed that the policy level has to invest much more in establishing and developing interfaces to the other levels of the innovation system. Often, the representatives of the policy level do have the appropriate knowledge to understand the needs of academia and industry.

Findings: National Innovation Policy & Master Plans

Tunisia has set up a *National Innovation Policy* that focuses on the issues of water technologies – the *Water Master Plan* set up in 2003 by the Ministry of Agriculture and Water Resources (Ministère du Développement et de la Coopération Internationale 2004). It sets clear thematic priorities according to the national demand and turns them into practice through significant efforts of public engagement in innovation, science and technology.

However, only a small group of experts has been involved in the design of the innovation policy. Consequently, many aspects, such as clearly defined responsibilities of the stakeholders in the water sector related to the implementation process, have not been considered.

Findings: Local Innovation Policy

Local Innovation Policies have so far neither been put into practice, nor are they linked to or harmonised with the national innovation policy.

Findings: Training and Education

Training and Education Schemes as well as curricula in science and technology are only sporadically available. They do not reflect the national demand.

Findings: Foresight R&D Agenda, Cluster Policy and Innovation-friendly Regulations

A *Foresight R&D Agenda* including issues on water does not rank high on Tunisia's policy agenda. The same applies to *Cluster Policy* not yet playing a major role in the Tunisian innovation policy. Although *Innovation-friendly Regulations* including issues on water technologies are in force and do stimulate innovation, these regulations are not harmonised with other innovation policies or measures.

So far the water sector in Tunisia has been managed by public authorities only. The inclusion of private companies and the decentralisation of the water management have not yet been considered as a driver for innovation in this sector.

5.2.2 Meso-level: Institutional Innovation Support – Water Sector

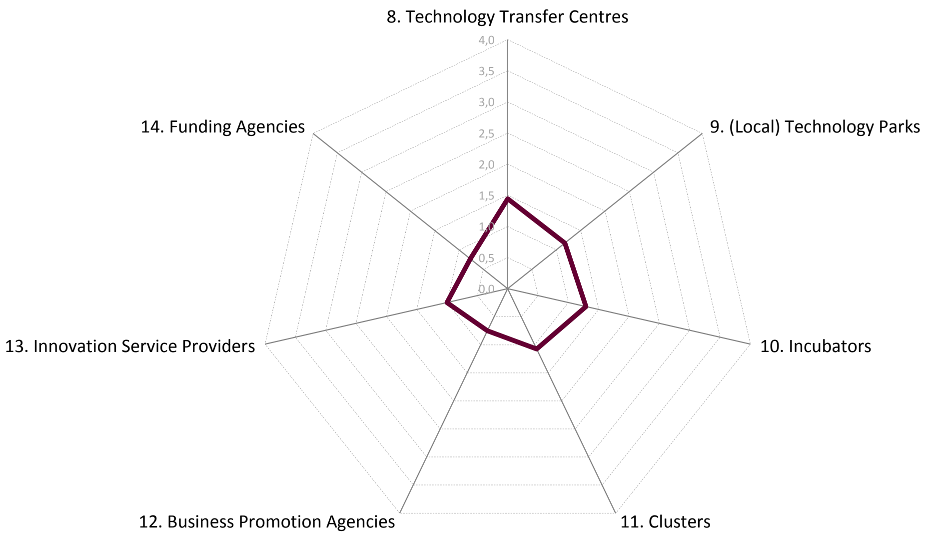

Figure 18 Determinants of the institutional innovation support level (water sector)

Due to the weakly developed determinants on policy level (as shown in Figure 16 and Figure 17), also the innovation support level shows room for improvement as depicted in Figure 18. Institutions that help industry and academia to convert innovative projects into products and technologies are not well supported and most often, the staff working at these institutions lack the proper education, e.g. in management skills and business administration. As a consequence, people that would need institutional innovation support are not well advised.

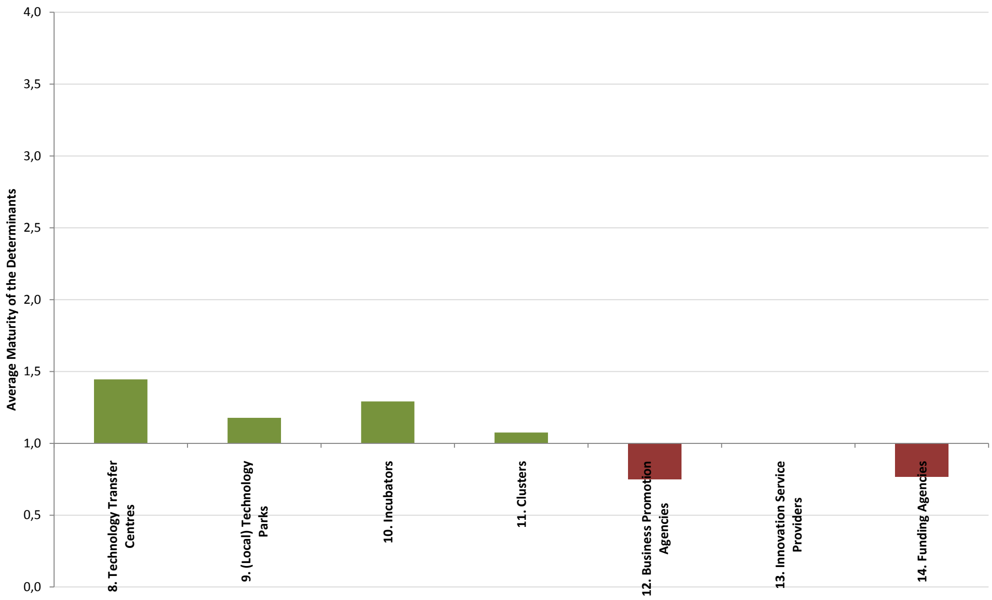

Figure 19 Determinants of the institutional innovation support level compared to this level's average (water sector)

The average value shown in Figure 17 is based on the seven key determinants (see Figure 1) and was rated at 1.0 on a scale from 0 to 4 (cf. chapter 2.2). The advancement of the determinants of the programmatic innovation support level is thus very low. This result is the direct consequence of the insufficient activities at policy level (cf. Figure 14 and Figure 15).

At least the determinants *Technology Transfer Centres*, *Technology Parks*, *Incubators*, and *Clusters* have been rated above the level-specific average, but are all still under the value of 1.5. This indicates the efforts that are currently taking place to improve these institutions, e.g. workshops organised in the context of EU-funded projects aiming at the increase of innovation capacity in Tunisia.

Findings: Technology Transfer Centres

The national *Technology Transfer Centres'* scheme in the water sector is rather weakly developed. *Technology Transfer Centres* in this sector have not yet been recognised as important instrument for the innovation culture in the water sector in Tunisia. As a consequence, not a single Technology Transfer Centre has been established that focusses especially on water technologies. The policy level in particular is not aware of the value of *Technology Transfer Centres*.

Findings: Technology Parks

Although *Technology Parks* are meant to support the innovation policies in place, they are currently strongly depending on public authorities, lacking staff and equipment, are not recognised as important innovation partners for local SMEs, and are thus often not integrated in the public discourse on innovation. SONEDE is Tunisia's main industrial partner in water technologies, especially because of its responsibility for the efficient use of drinking water in Tunisia.

Findings: Incubators

Incubators mostly act isolated and are not connected to the latest innovation topics. They also depend on public authorities, are poorly equipped and understaffed, are not part of a network, and are not recognised as source of innovation.

Findings: Clusters

Clusters only exist in a few industrial or technological areas (e.g. Tunisian Waste Cluster). The concept of clusters is new to Tunisia. Measures to address this topic and to overcome this knowledge gap are missing.

Findings: Business Promotion Agencies, Innovation Service Providers and Funding Agencies

Business Promotion Agencies and other *Innovation Service Providers* that focus on the water sector rarely exist in Tunisia. They are understaffed and have not come up with an explicit strategy so far. With regard to water related issues, *Funding Agencies* are not yet considered as an important tool to put innovation policy measures into practice.

5.2.3 Meso-level: Programmatic Innovation Support – Water Sector

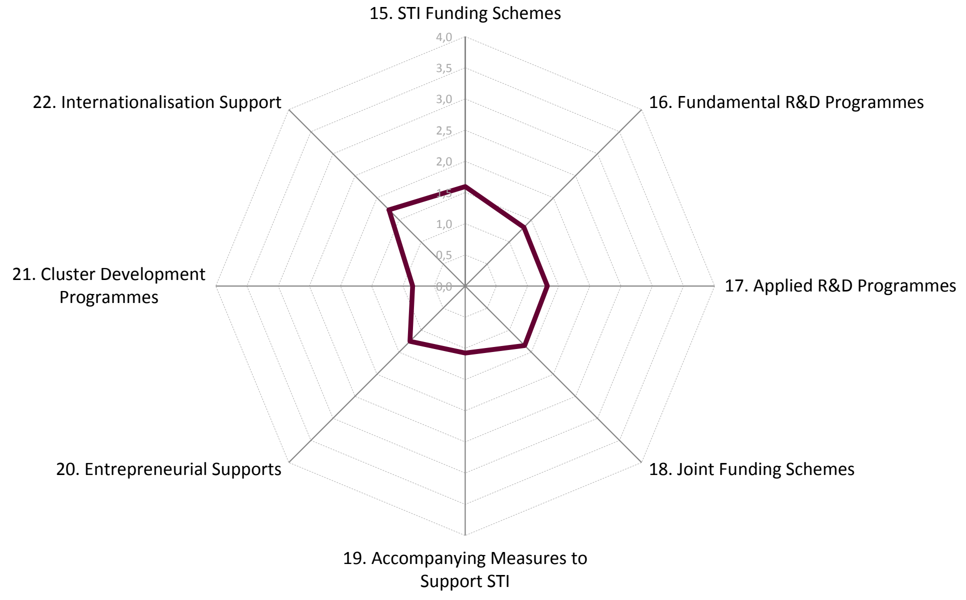

Figure 20 Determinants of the programmatic innovation support level (water sector)

Since the respective policies in the field of water technologies are still at a comparatively low level, there has not been made any great visible progress on the programmatic innovation support level as well.

Basically, the status of maturity of the programmatic innovation support level is the result of actions undertaken or not undertaken by the policy level (Figure 20). Most of the determinants (*Fundamental R&D Programmes, applied R&D Programmes, Joint Funding Schemes, Accompanying Measures to Support STI, Entrepreneurial Support, Cluster Development Programmes*) have a very low maturity (values at 1.3 or below).

These programmes lack a professional setting-up and a successful implementation ensuring a well-coordinated distribution of the grant budget according to the actual research demand. Only *Internationalisation Support* and *STI Funding Schemes* reveal some effort towards innovation-oriented support measures (values at 1.7). Here, mostly the input from foreign countries, e.g. through EU-funded projects, leads to some effects at the programmatic innovation support level.

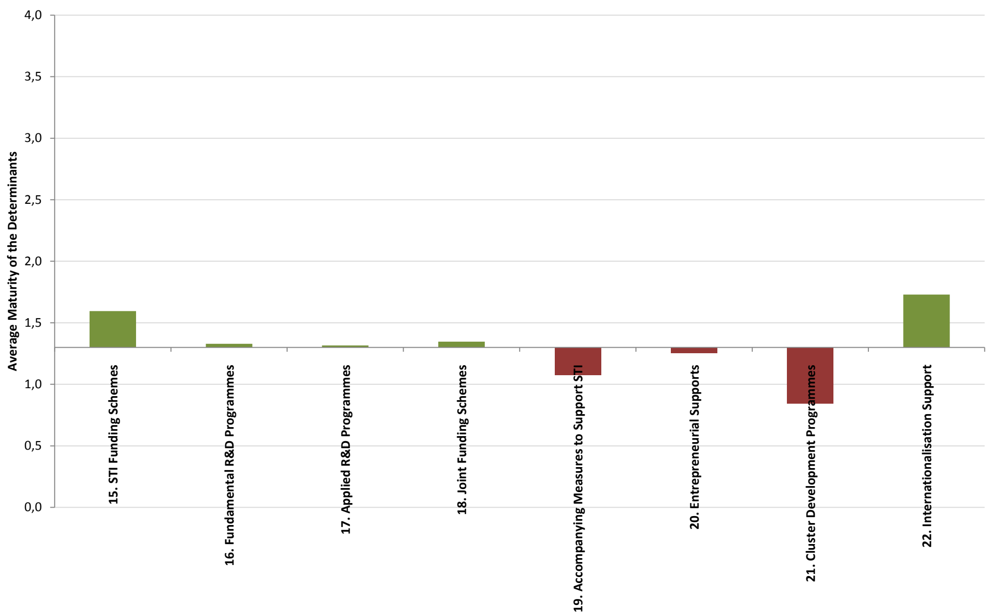

Figure 21 Determinants of the programmatic innovation support level compared to this level's average (water sector)

Figure 21 visualises the low development stage of the support programmes in place as most values are below the specific average of this level (1.3). This is a strong indicator for Tunisia's difficulties in designing funding programmes in the water sector and their implementation. Especially, *Cluster Development Programmes* fail since cluster policy does not play a major role in Tunisia yet (cf. Figure 16 and Figure 17).

Findings: Funding Schemes

Public funding of Science, Technology and Innovation (STI) through programmes in the water sector is well established compared to the other determinants. However, the amount of public funds as well as the diversity of R&D funding programmes are not sufficient and do not accord to the national demand. Public funding is mainly coming from national sources. Third-party funding from foreign sources only play a minor role. The access to public funding is limited by thematic priorities. However, little efforts are spent to make the project outcomes visible for the public. The impact of programmatic innovation support has not been assessed yet.

Findings: Fundamental R&D Programmes

With regard to *Fundamental R&D,* the programmes are not demand-oriented and do not meet national priorities. However, transnational cooperation between researchers is actively encouraged within existing fundamental STI funding schemes.

Findings: Applied R&D Programmes

With regard to A*pplied R&D,* the number and variety of funding programmes is at a good level and accords to the national demand and national priorities.

Findings: Joint Funding Schemes

In contrast to that, *Joint Funding Schemes* are rather not demand-oriented and do not meet national priorities as they do not include collaborative STI funding. However, some of the collaborative STI programmes of the past have contributed to close the gaps between industry and academia. Still, most of them had been terminated by the end of 2009.

Findings: Accompanying Measure to support STI

Accompanying Measures to Support STI are weakly established and therefore not acknowledged. The availability of funds is insufficient and does not consider the national demand.

Findings: Entrepreneurial Support

With regard to *Entrepreneurial Support,* the framework conditions for technology-oriented entrepreneurship are poorly developed. Only a few measures for supporting the pre-incubation or starting phase, such as business-plan training or financial planning, exist.

Findings: Cluster Development Programmes

Cluster Development Programmes are not yet existent. Thus, networking activities have not been standardised yet in Tunisia.

Findings: Internationalisation Support

The *Support of Internationalisation* through funding schemes is also not existent in the water sector, except for international cooperation projects mostly funded by the European Commission.

Tunisian researchers mostly benefit from EU-funded projects; e.g. PASRI (“Supporting the research and innovation system of Tunisia”) which provides solutions to research and innovation problems in Tunisia and triggers employment by strengthening ties between research and production systems.

5.2.4 Micro-level: Innovation Capacity Level – Water Sector

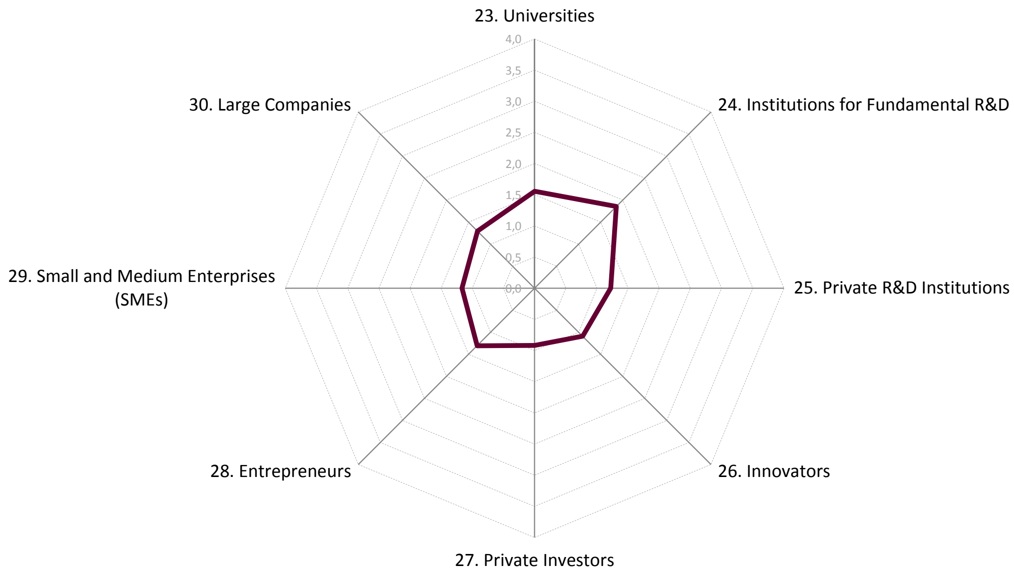

Figure 22 Determinants of the innovation capacity level (water sector)

Not surprisingly, Figure 22 shows that the innovation capacity level has many deficits. The values for the determinants *Private R&D Institutions, Innovators, Private Investors, Entrepreneurs, SMEs* and *Large Companies* are below 1.5. This means that they are in a status that lacks an innovation-oriented strategy. Under these conditions, the production and diffusion of innovative products and services in Tunisia's water sector cannot increase. Only the determinants *Universities* (value at 1.6) and *Institutions for Fundamental R&D* (value at 1.9) seem to benefit from some effect of Tunisia's innovation support activities in the water sector.

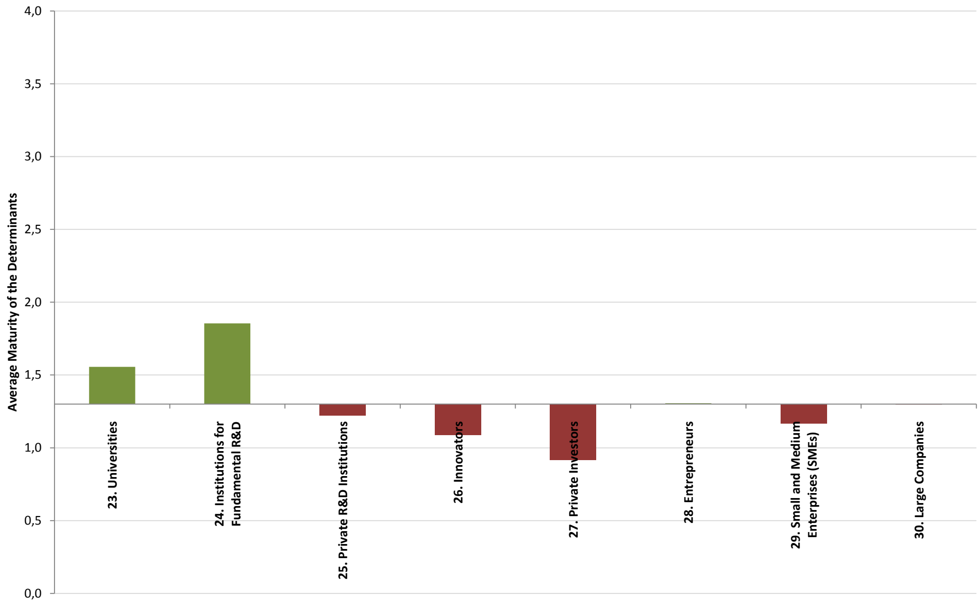

Figure 23 Determinants of the innovation capacity level compared to this level's average (water sector)

When looking at the maturity average of this level which is at 1.3 (Figure 23), it becomes even more obvious that the innovation capacity level presents satisfactory results in two aspects (*Universities* and *Institutions for Fundamental R&D*) and weak results in all other determinants.

Obviously, only *Universities* and *Institutions for Fundamental R&D* benefit from the however poor programme implementation and other innovation support measures. *Entrepreneurs, SMEs* and *Large Companies* have not been recognised as innovation drivers and are therefore not sufficiently considered by the government. Thus, the maturity level of the water-related industry is very low in the Tunisian innovation system.

Findings: Universities

Tunisia has several *Universities* having a medium-scale spectrum of research and education opportunities. The *Universities* are considered to play an important role in the national innovation system when it comes to issues on water treatment, water purification and waste water. However, the personnel headcount at the universities is not sufficient, and often the equipment lacks important parts and materials.

The linkages of the universities to industry are only weakly developed. *Universities* are mainly institutionally funded, but also receive funding from public programmes. At international level, only some universities are acknowledged. However, world-class researchers are only partly attracted by the international research programmes set up in Tunisia. The level of training and education of students is quite good; the curricula are developed according to the current needs. Hence, scientific excellence with regard to water technologies is provided by many universities in Tunisia.

Findings: Institutions for Fundamental R&D

Although *Institutions for Fundamental R&D* are existent, they do not cover the full spectrum of R&D. However, they play an important role in the national innovation system. *Institutions for Fundamental R&D* in Tunisia are fairly well-equipped and appropriately staffed. They are acting to a great extent according to national priorities and generate ample, usable input for applied R&D. Many are visible at international level. They are mainly institutionally funded. The *Institutions for Fundamental R&D* in Tunisia are well known for providing scientific excellence with regard to water technologies. However, they are rather of medium interest to world- class researchers or high potentials.

Findings: Private R&D Institutions

Private R&D Institutions with special focus on water technologies have not yet been established.

Findings: Innovators

With regard to *Innovators,* the number of researchers with individual interest is at medium level. Innovation culture in general has not yet been recognised as important in Tunisia. The support schemes for innovators to convert ideas into products or services are only weakly developed. A rewarding system for new ideas does not exist. Innovators work rather individually than within a network. The public understanding of science and innovation is at a good medium level.

Findings: Private Investors

With regard to *Private Investors* in the water sector, there is a big gap in Tunisia. Private investors and thus also venture capital are rarely existent due to unfavourable investment conditions.

Findings: Entrepreneurs

Entrepreneurship in the water sector is supported to a marginal extent. Although there are researchers and inventors with individual interest in starting their own science, technology or modernisation business as a commonly accepted practice, the level of entrepreneurial education, such as management skills, is low. Instruments to reduce the personal risk of entrepreneurs or to secure sufficient financing are not known.

Findings: SMEs and Large Companies

The number of *SMEs* in the water sector, but also in general in Tunisia, is very low. They do not play such an important role as drivers for innovation. They are not involved in developing new technologies or innovative products, have a weak position within the innovation system and cannot be considered as competitive. Also *Large Companies* are not seen as innovation drivers. However, they had been considered as more important than *SMEs* by the participants of the workshop.

6 Comparing the Sectors Energy and Water

The radar charts of the following chapters (6.1 - 6.2) depict a comparison of the Expert Opinion Survey results for the sectors energy and water. Basically, the sector energy has been assessed as slightly more matured than the water sector. As such, the water sector could benefit from already existing successes in the energy sector through mutual learning.

However, both sectors show rather low levels of innovation support activities. Therefore, many projects at innovation capacity level do not fully leverage their potential or are being cancelled before their innovative momentum. The following subchapters give a short description of the statuses for both sectors and introduce first proposals for improvement of some of the determinants.

6.1 Macro-level: Innovation Policy Level

At policy level, the results of the water and the energy sector show almost the same pattern (Figure 24). With regard to *national innovation policy* and *master plans,* Tunisia's maturity is assessed as moderate by the EOS. A better coordination between both sectors, e.g. through the exchange of experience concerning innovation-related measures could be one of the measures contributing to mutual benefits for both sectors.

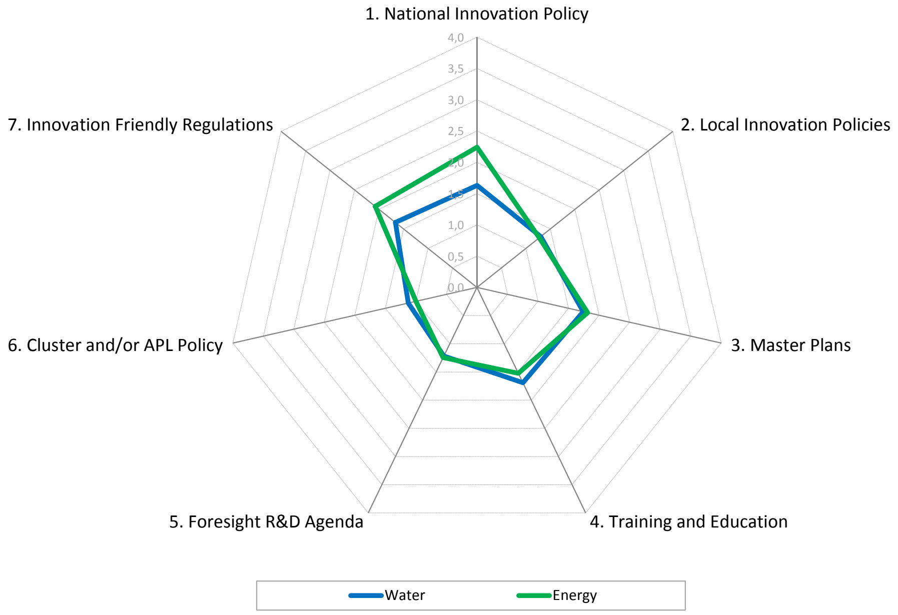

Figure 24 Comparison of the Tunisian water and energy sector at policy level

6.2 Meso-level: Institutional Innovation Support

The maturity of the institutional innovation support level in the energy sector was rated significantly higher than the maturity level of the water sector (Figure 25), whereas all the relevant determinants are on a quite low level. The reason for this difference seems to be the slightly better implementation of the policy measures in the energy sector. *Technology Transfer Centres* were ranked at the same low level. This is due to the fact that the centre approach has not yet been consequently implemented. Reasons have been mentioned in the previous part of this study. Significant differences can be seen for *Business Promotion Agencies* and *Funding Agencies*.

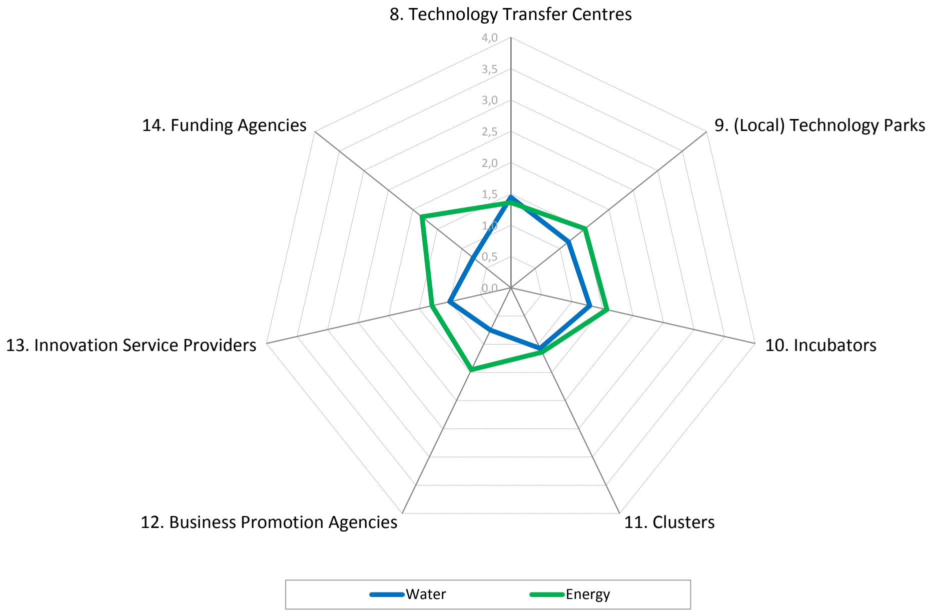

Figure 25 Comparison of the Tunisian water and energy sector at institutional innovation support level

6.3 Meso-level: Programmatic Innovation Support

The comparison at programmatic innovation support level clearly shows that the respective determinants are much better developed for the energy sector (Figure 26). Various programmes and funding schemes of the energy sector are established and implemented in a better manner than in the water sector. Especially, when it comes to *Fundamental R&D-Programmes,* there is a significant difference between the energy and the water sector.

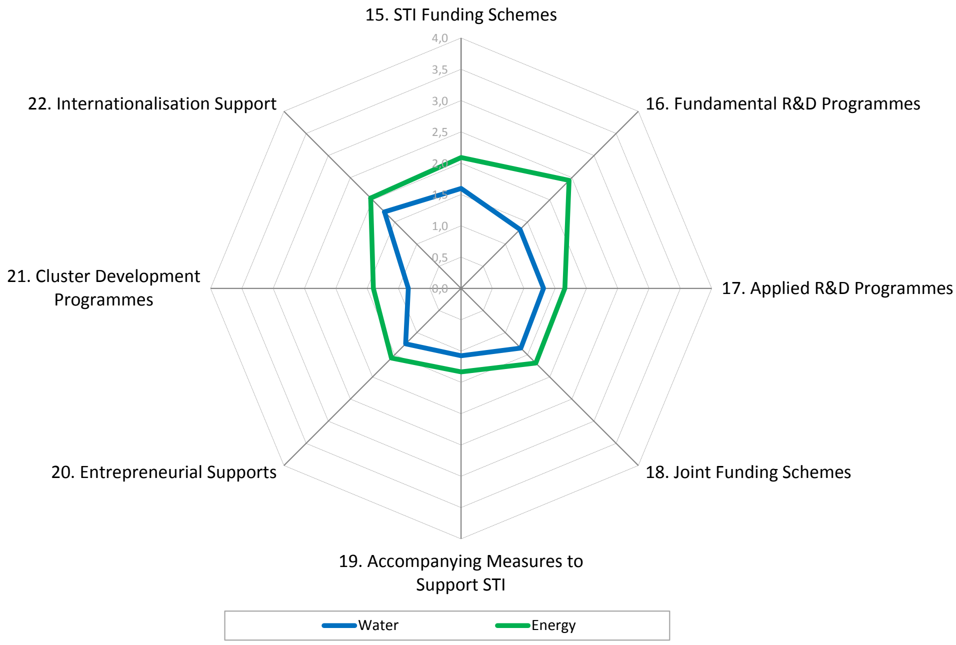

Figure 26 Comparison of the Tunisian water and energy sector at programmatic innovation support level

6.4 Micro-level: Innovation Capacity Level

At the innovation capacity level, all relevant determinants are weakly developed (Figure 27). Especially the *SME* structure, which can be considered as one of the main drivers for innovation, seems to be underdeveloped, since there are no funding schemes in place which focus on this target group.

Taking the significantly higher values of the determinants of the institutional innovation support as well as of the programmatic support level for energy into account (Figure 25 and Figure 26), it is surprising that the differences shown in Figure 27 are only small.

Of course, some determinants, such as *Private R&D Institutions*, *Innovators or Private Investors*, are ranked higher, though not significantly. There is no difference for *SMEs* in the energy and water technology sector. One explanation might be that active STI support in the energy and water technology field is quite new. Consequently, a certain time is needed to realise visible benefits at innovation capacity level.

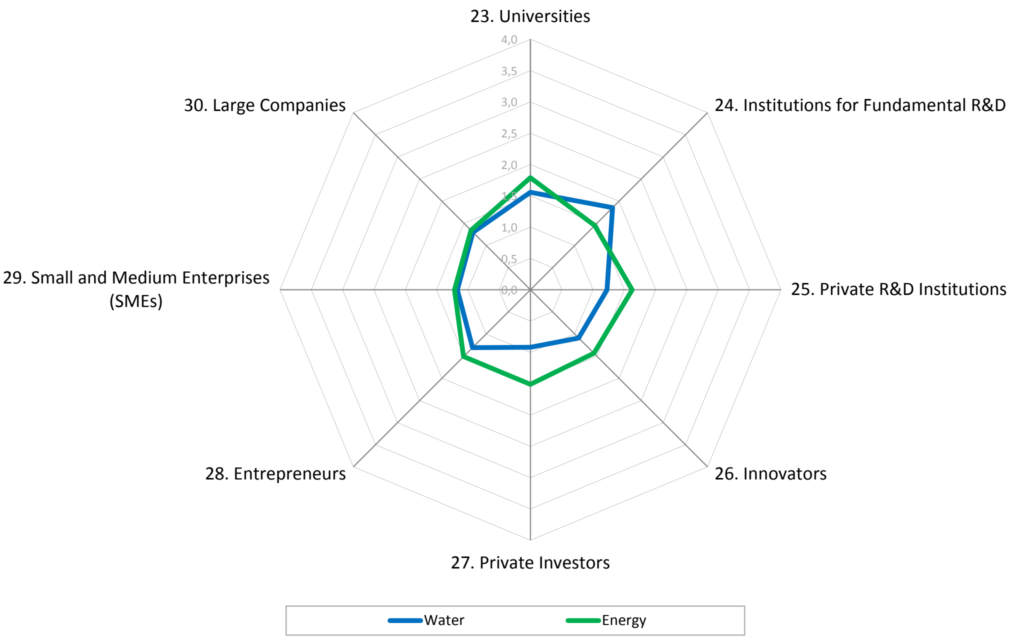

Figure 27 Comparison of the Tunisian water and energy sector at innovation capacity level

7 Comparing Tunisia with Similar Economies

In order to further classify Tunisia's current status of its innovation system, it is compared to other countries, which have already been analysed with the ANIS approach, and classified as efficiency-driven economies. As mentioned in chapter 2.4, the countries used for the comparison are **Jordan**, **Namibia** and **Indonesia**. Although being defined as transition country by the GCR, we have furthermore included **Egypt** in the comparative portfolio. Due to the revolution and political uncertainties during the last years in both countries, Tunisia and Egypt may also be considered as "moving" countries between different stages.

Jordan, Namibia, Indonesia and Egypt have also been analysed with the ANIS tool and are therefore used as comparative portfolio in the following subchapters (7.1 - 7.4).[14]

Furthermore, VDI/VDE-IT (iit) has carried out a short-term consulting project targeting the Industrial Council for Technology and Innovation of Egypt and its Centres (TICs). The project was executed within three months between October and December 2012. It has been supported by the GiZ and financed by the German Federal Ministry for Economic Cooperation and Development. The work included a comparison of the current status of the technology and innovation centres with their status as of 2008, the identification of success factors for technology and innovation centres, and an assessment of their work. One of the main results was that the status of the Egyptian innovation system has not changed significantly since 2008.

The selected countries are especially relevant for comparison with regard to the water sector as they are all suffering from scarce (drinking) water resources (Haddadin 2006; Pérard 2008; WIRA Study Team 2012). Egypt's water policy, which has led to a 100% drinking water coverage and is currently striving for this result in the waste water sector, provides a good example for coping with this challenge (OECD 2010a).

Furthermore, in all of the above mentioned countries, the institutional conditions for renewable energies are at similarly low levels. Tunisia and Jordan have nevertheless started to establish a strategy for renewable energies and energy efficiency including environmental protection and the constant availability of energy (OECD 2013b).

Back in 2010, Tunisia was considered the leading country in North Africa with efficient government structures and good educational conditions (Schwab 2010). However, when comparing Tunisia with other countries, this statement by the GCR must be qualified as the following figures of this chapter will show. This is mainly due to the fact that the situation in Tunisia has changed dramatically during the last two years. This conclusion is substantiated by the Global Competitiveness Report of 2011-2012 according to which the country's unrest has led to a decrease of Tunisia's competitiveness index ranking by eight positions (Schwab 2011). The GCR of 2011 recommends a further improvement of the business environment in terms of an enhanced competitiveness.

The GCR attributes this dramatic drop in competitiveness to the prevailing uncertainty about the future of Tunisia and its innovation system as well as to a "higher public awareness of the countries' structural weaknesses, resulting mainly in poorer assessments of different aspects of public and private institutions" (Schwab 2011, p.

[14] The ANIS reports for these countries were published as follows: Egypt 2008, Jordan 2009, Namibia 2010, Indonesia 2011.

37). These statements are validated by the results of the ANIS questionnaire (see chapter 5).

The following comparisons moreover assess and benchmark Tunisia's national innovation system and identify options for enhancing its overall performance.

7.1 Macro-level: Innovation Policy Level

The pattern for the innovation policy level exhibits similar results for all countries (Figure 28). Generally, the level of maturity is relatively low. Except the determinant *National Innovation Policy* shows slightly better results for Tunisia than for the other countries. One of the main outcomes of this relatively stable *National Innovation Policy* might be the launch of several R&D policy programmes since 2003, including for example the "National Research and Innovation Programme" (Chaabouni, 2008).

The radar chart (Figure 28) shows good results for Egypt's *Innovation-friendly Regulations*. One reason for this might be that in Egypt, the industrial and innovation policies target on a selective development of sectors, subsectors and sometimes also highlight specific aspects of high potential. Their purpose is to coordinate and to align actors in the innovation system with regard to the implementation of support and fiscal measures.

The figure below shows however that the countries have similar problems in developing policy programmes. Comparative workshops for specific determinants, such as *Foresight R&D Agenda,* could help to complement each other's strategies in a process of mutual learning.

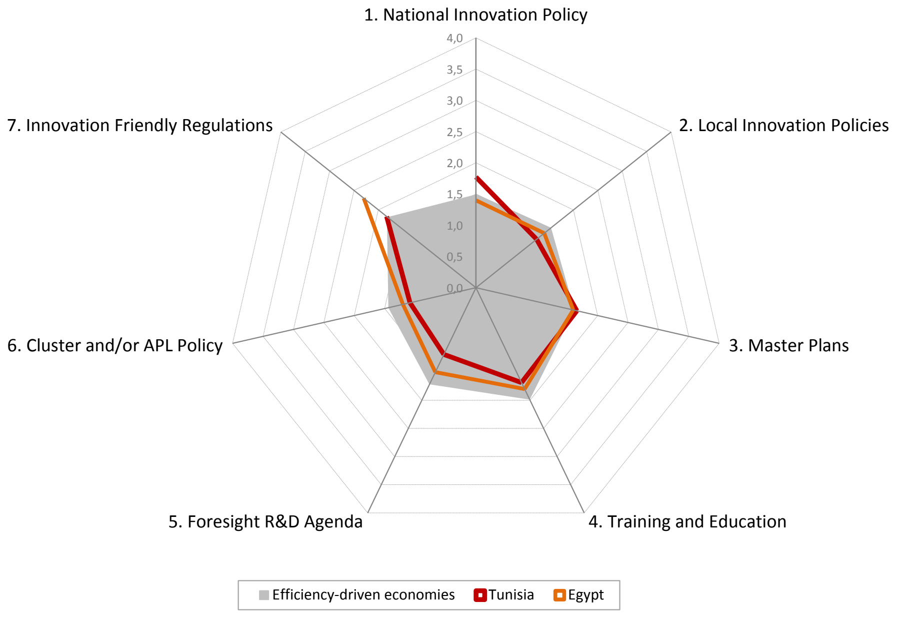

Figure 28 Maturity of the determinants of Tunisia's policy level in the water and energy sector, compared to the average of selected efficiency-driven economies and Egypt[15]

[15] The countries that are used for the comparative portfolio are Jordan, Namibia, Indonesia and Egypt. The grey shaded area depicts their average. The red line shows the average values of Tunisia (sectors energy and water combined). The orange line shows the average values of Egypt.

7.2 Meso-level: Institutional Innovation Support

Figure 29 shows that the institutional innovation support level is very little developed in Tunisia. Even though the average of the comparative portfolio display values at medium level, especially in the cases of *Incubators, Business Promotion Agencies, Innovation Service Providers* and *Funding Agencies*, Tunisia struggles with too little recognition of these determinants. As described by the experts during the workshop, the main weakness is that these determinants are not yet considered important support tools for innovation. Simply setting up an innovation policy, such as the "The National Programme for Technology Parks", is hence not sufficient.

There is an urgent need in Tunisia to improve the existing innovation support institutions by implementing concrete activity plans, staff training measures, and by raising awareness at policy level.

It is very interesting to see in Figure 29 that although at policy level all countries have a relatively similar status, the countries of the comparative portfolio are definitely more successful in "using" their innovation support institutions than Tunisia.

This is especially valid for Egypt and its Technology and Innovation Centres. For most of the Egyptian Technology and Innovation Centres, the emphasis is laid on supporting the modernisation process, transferring modern business and technological knowledge and practices to the clients at innovation capacity level, and supporting their coordination and cooperation. The Egyptian Technology and Innovation Centres have been consequently implemented and sufficiently staffed; their performance is constantly monitored by the respective ministry.

Although the Egyptian Technology and Innovation Centres are also struggling, they operate on a much higher level. There are many success stories, e.g. on how they contributed to turn inventions into dedicated products and technologies (Hahn & Meier zu Köcker, 2012). Hence, they act as innovation service providers, and as a consequence, this determinant has been rated quite high for Egypt. Furthermore, the other determinants have received high values as they all supply satisfying innovation support.

All in all, it can be concluded that the implementation and governance of innovation support institutions, which do play an important role, is weak in Tunisia, especially when compared with Tunisia's neighbours or peers.

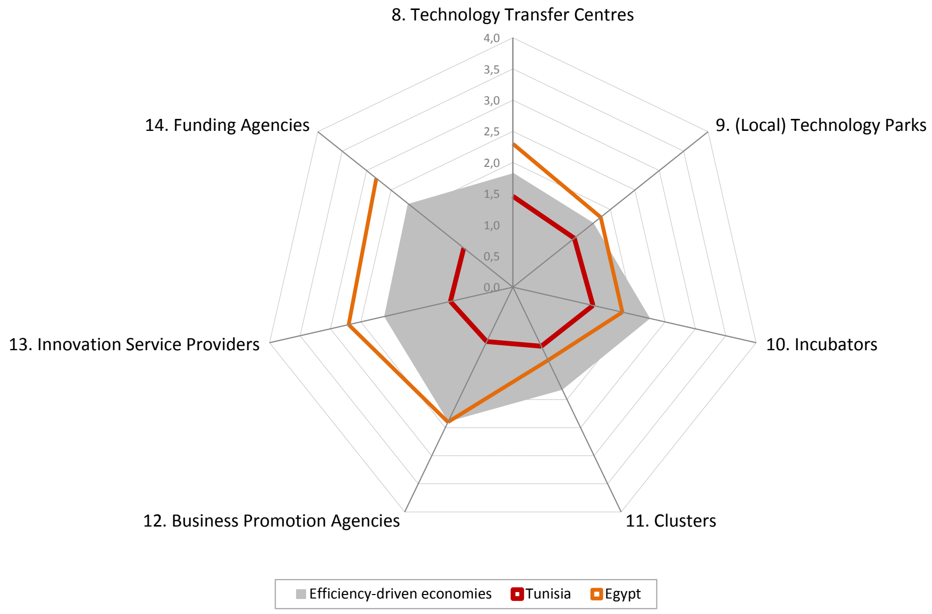

Figure 29 Maturity of the determinants of Tunisia's institutional innovation support level in the water and energy sector, compared to the average of selected efficiency-driven economies and Egypt

7.3 Meso-level: Programmatic Innovation Support

At the programmatic innovation support level, Tunisia is also below the average of efficiency-driven countries. Figure 30, however, displays that the individual determinants and the average value show a similar trend in maturity. *STI Funding Schemes, Fundamental R&D and Internationalisation Support* seem to be based on a good programmatic implementation.

Nevertheless, the overall effort at this level appears to too low for making Tunisia catch up with the other countries. Especially, with regard to *Cluster Development Programmes* and *Entrepreneurial Support,* a greater knowledge and know-how at macro- meso- and micro-level would be required to advance the country's innovation process. Particularly when comparing the values of Egypt to the values of Tunisia, it becomes even clearer that Egypt has successfully applied its know-how in implementing support programmes. Values above 2.0 for *STI Funding Schemes* or *Applied R&D Programmes*, or a value of 3.0 for *Entrepreneurial Support* reveal a focussed innovation support strategy.

A major issue in Egypt is the strengthening of national and local manufacturing. To achieve this goal, the focus should be on national services, such as the support of sustainable growth of existing and new companies along competitive national value chains. Further innovation support services would comprise knowledge and technology support in general, including management knowledge as well as access to finance and legal support.

To sum it up, Figure 30 shows that similar to the results of the institutional innovation support level, also at programmatic innovation support level, the comparative countries perform much better in implementing their innovation support programmes despite comparable basic conditions at policy level.

A considerable difference can be seen for *Entrepreneurial Support Programmes*, which rank high on the policy agenda in Egypt and other countries of the comparative portfolio. When it comes to *Cluster Development Programmes*, Tunisia and Egypt obtain lower results than those countries of the comparative portfolio. Indeed, cluster support measures in both countries are provided by third-party donors with rather low success.

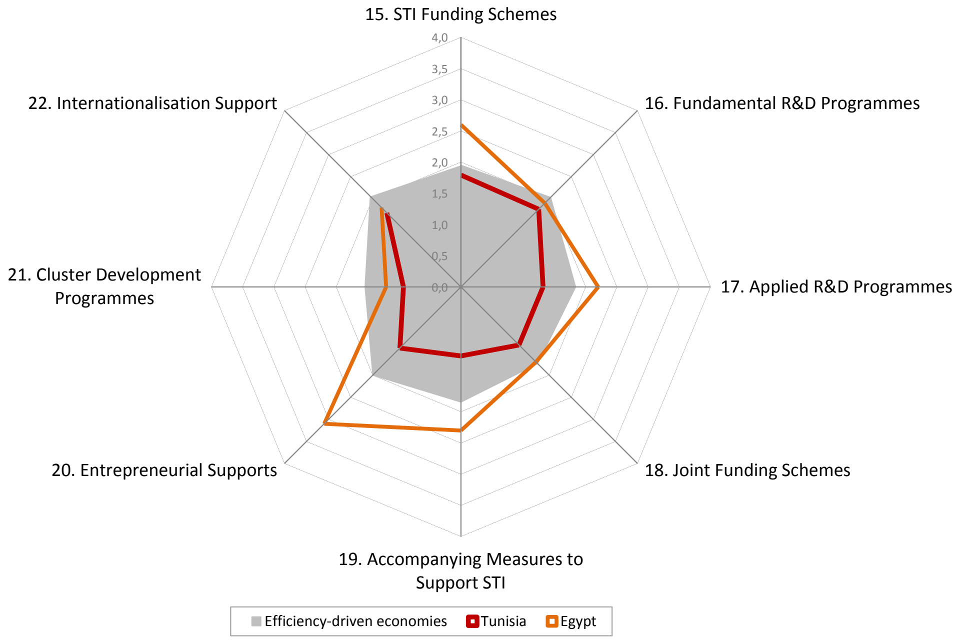

Figure 30 Maturity of the determinants of Tunisia's programmatic innovation support level in the water and energy sector, compared to the average of selected efficiency-driven economies and Egypt

7.4 Micro-level: Innovation Capacity Level

The innovation capacity level of the energy and the water sector is clearly below the average of the comparative countries (Figure 31). Since the Tunisian questionnaires have mainly been answered by experts from the innovation policy and the innovation capacity level, it shows that Tunisian scientists and researchers have a very critical view towards their innovation support system.

The main reason behind this major difference is probably the political unrest in Tunisia during the last years. People at the innovation capacity level are dissatisfied with their current situation and therefore see the main innovation factors as quite critical. A rebuilding of trust among the players should be one of the next actions in order to regain self-consciousness at this level.

Not surprisingly, since the innovation support level of the comparative countries registers more positive results than Tunisia's innovation support level, the innovation capacity level of the comparative portfolio does also provide more innovation-oriented projects and services. This proves that the establishment, roll-out and implementation of innovation support measures lead to more innovation capacity, not only in industrialised nations, but also in efficiency-driven countries. Tunisia should therefore learn from the countries of the comparative portfolio and not hesitate to implement innovation policy measures in the water and energy sector.

This role model approach applies especially to Egypt. The values displayed in Figure 31 confirm that a successful innovation support (cf. Figure 29 and Figure 30) leads to good results at innovation capacity level as well. Furthermore, almost all determinants at innovation capacity level of Egypt show an advanced development. Particularly small and medium-sized enterprises, which are of utmost importance, seem to benefit from the innovation support activities in Egypt. In Tunisia, this determinant has been almost neglected so far.

Hence, with regard to measures at company level, the management capabilities of Tunisian entrepreneurs would also need to be trained. *Technology Transfer Centres* at innovation support level could for example perform this task. The development of entrepreneurial skills could moreover lead to a better managed industry. Especially in the water sector, the inclusion of private companies could help to expedite the decentralisation of the water management in Tunisia allowing for a better coverage of the drinking water supply and a technology enhancement with regard to water desalination (Pérard 2008).

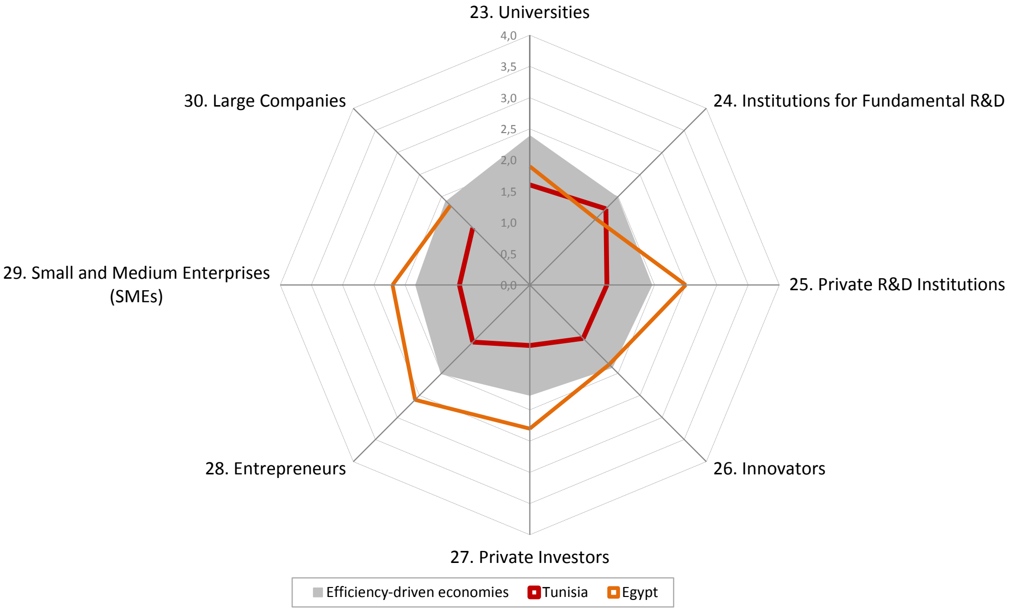

Figure 31 Maturity of the determinants of Tunisia's innovation capacity level in the water and energy sector, compared to the average of selected efficiency-driven economies and Egypt

8 Main Challenges and Scope of Intervention in Tunisia

The status of maturity of the sectors within the Tunisian innovation system and the performance of its actors can be improved by policy measures addressing the improvements of single determinants or even several of them. The prospective impact can be expected on all three levels if policy programmes are adequately formulated and implemented with focus being placed according to the identified potentials.

In the third part of the workshop, the experts were asked to rate the determinants of the Tunisian innovation system within their specific sector according to their effort and impact.

In order to prioritise the measures that improve given determinants - especially those that were rated below average with respect to scarce resources - a portfolio analysis was conducted with the ANIS tool. Thus, effective measures could have been distinguished from those that involve extensive effort and high risks with regard to implementation.

In the next step, it is now very crucial to know and to make use of effective policy tools in order to enhance the performance of single determinants as well as the overall performance.

When improving a given determinant, two indicators can be calculated. Firstly, the **Impact Index** (Quality & Quantity of Impact) describes the effectiveness of an expected impact on the innovation system and is calculated by multiplying the innovation support quality with the diffusion enhancement of the measure. .

Secondly, the **Effort Index** is used to assess the costs of a certain measure and its implementation risks, including e.g. difficulties in the coordination between ministries, the insufficient authority for the implementation of measures, or the complexity of an implementation measure.

Impact and Effort indices have been calculated separately for all determinants of the Tunisian innovation system and for each sector. If an innovation system is to be improved, certain determinants must be addressed. It is quite clear that some determinants are easy to improve while others are much more complex. For this reason, we have grouped the determinants according to their complexity for improvement and used a portfolio with two different scales, as displayed in Figure 32 and Figure 34. The vertical scale represents the "efforts needed" (How extensive is the needed amount of investment to enhance the performance of the determinant?), the other represents the "expected impact" (What range of improvement can be expected?).

To answer the question "What is the scope for intervention?" with the highest potential for improvement of the capability of the innovation system, the results of the interviews and the background information are visualised in the following portfolio. The determinants in the figures have been marked with the same numbers that are to be found at the beginning of the present study (Figure 1).

Generally, it can be said that even though the portfolio of intervention has been developed separately for each of the two sectors, the following actions including their recommendations can be applied to both, the water and the energy sector.

8.1 Improving the Determinants of the Energy Sector

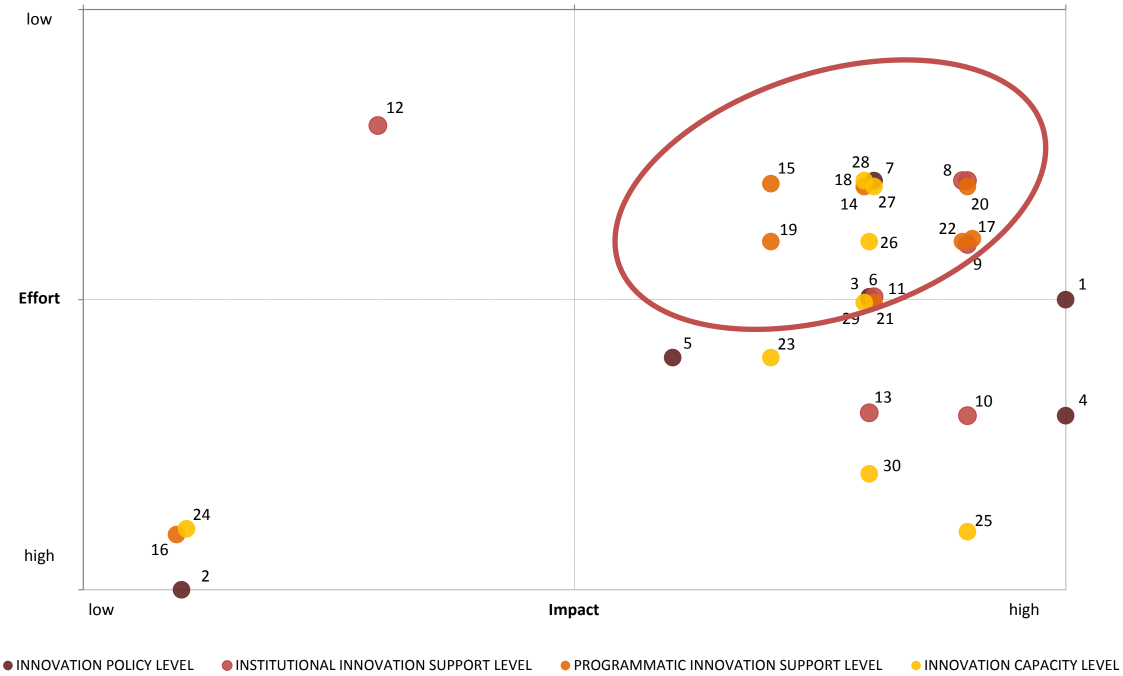

Figure 32 Portfolio – Scope of intervention of innovation support schemes in the Tunisian energy sector

Recommendation 1: Improving the implementation and management of current STI support programmes

According to the Expert Opinion Surveys, there are many determinants that can be improved with relatively small effort and high impact (Figure 32, upper right corner). Some of them belong to the programmatic support level:

- *STI Funding Schemes (15),*
- *Applied R&D Programmes (17),*
- *Joint Funding Schemes (18),*
- *Entrepreneurial Support (20) or*
- *Internationalisation Support (22).*

Most of them have been ranked comparatively low (area between 1.5 and 2.0). When having a closer look at these programmes, it becomes clear that the main reason for their low ranking is the fact that the implementation and management of these programmes is not as efficient and demand-oriented as it could be. The corresponding programme calls are considered to be quite complicated from the beneficiary's point of view. The proposal evaluation procedures are considered as hardly transparent and time-consuming. Even the eventual confirmation that a proposal will be funded does not necessarily mean that the beneficiary will actually receive funding in the end. In addition, the programme objectives have not changed over the last years and thus, do not correspond to the industrial demand.

Summarising all these observations, the improvement of the above mentioned determinants is not a matter of political willingness or financial resources. Instead, the determinants at programmatic innovation support level can be improved by enhancing the implementation and administration of these programmes.

The current situation is characterized by a lack of capacity with regard to an efficient programme implementation and administration in the corresponding ministries. An international benchmarking of STI programme implementation and management (including programme design, implementation, administration, monitoring, etc.), which means a voluntary comparison with other, similar STI programmes from other nations, could be a good way to stimulate mutual learning among Tunisian policy-makers and those who are in charge of the programme implementation and management.

The result of such a benchmarking is not a “good” or “bad” evaluation or any other kind of ranking, but rather a new insight on how other programme owners deal with similar challenges and how they address certain issues in the best way. During such benchmarking exercises, all core elements of an STI programme “life cycle” will be compared with similar STI programmes, starting with analytical actions before an STI programme is launched and ending with an impact and success measurement.

The following core elements/actions of an STI programme are benchmarked:

- Phase I: Analytical phase: all actions that have usually to be conducted before the implementation of an STI programme will be compared;
- Phase II: Development process of core programme design features;
- Phase III: Call design and call implementation;
- Phase IV: Communication and awareness raising;
- Phase V: Programme management and administration of the programme;
- Phase VI: Monitoring;
- Phase VII: Adaptation and continuous improvements.

The benchmarking (and coaching on how to implement improving actions) shall be done according to these phases. In the end, Tunisian policy-makers and administrative staff will identify areas for improvement and can learn from their peers.

Recommendation 2: Using evaluation and impact measuring for a better STI programme governance

Evaluation and impact measuring of STI support programmes are important tools to justify public investments in STI and adopting programme designs and objectives. Such activities help to identify success stories as well as areas for sectorial improvement.

There are different evaluation approaches (e.g. ex-ante, ex-post or formative evaluations), which are commonly used worldwide. Figure 33 reveals a rough evaluation design, which can be adapted to different STI support programmes. It can serve as a guide during a particular evaluation, as it depicts all levels (policy, programmes and beneficiaries) that are typically involved in such evaluation activities. However, according to the individual needs, certain groups can be ignored; e.g. in the framework of an impact analysis, the policy level is usually not regarded.

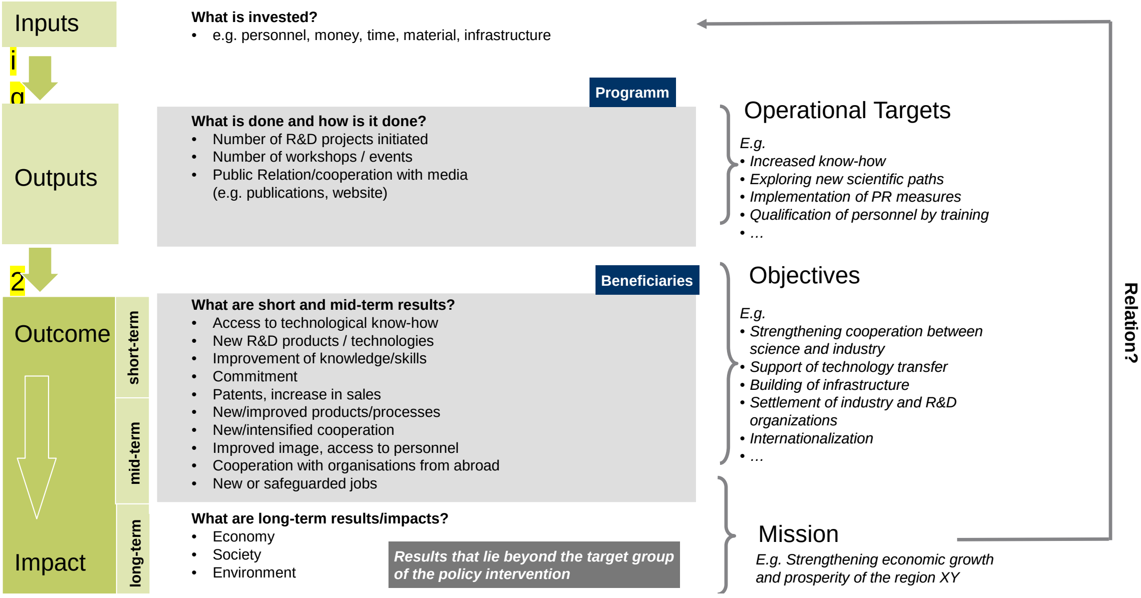

Figure 33 Evaluation Design (Kind, 2013)

It is strongly recommended to run evaluations of on-going STI programmes for the above mentioned reason. With regard to the current lack of evaluation capacities within the corresponding ministries, external evaluation coaches would be helpful. They could coach the whole process, starting with a proper evaluation design until defining appropriate indications and involving the right stakeholders. In the end, Tunisian policy-makers will have a realistic picture of the impact of their programmes and will know where to undertake corrective actions.

Recommendation 3: Improving the impact of Tunisian Technology Transfer Centres

Figure 32 further reveals that the impact of *Tunisian Technology Transfer Centres* could also be improved with manageable efforts. Technology Transfer Centres today are a very popular tool to bring together industry and academia, and enable more sustainable innovations.

Provided they are adequately staffed with researchers and fully technologically equipped, *Technology Transfer Centres* can offer innovation-related services according to their clients' needs. The Slovenian Centre Polimat or the Austrian Centre PCCL can be considered as best-practise examples here.[16]

The clients are mostly enterprises that need support in creating innovations. The current weakness of the *Tunisian Technology Transfer Centres* is the poor implementation of their mission and the lack of sufficient staffing, equipment and management capabilities. Consequently, this recommendation focuses on a better implementation of the centre approach.

It is not necessarily a question of finance, but rather a question of political commitment and centre management. There are several options how to improve the management

[16] For further information see www.polimat.si and www.pccl.at.

competence of such centres. One option could be benchmarking exercises according to the European management excellence approach.[17] Another option could be study visits to neighbour countries, such as Egypt or Turkey. Both countries have made good progress in implementing and using *Technology Transfer Centres*. The policy level should also be involved in such coaching and training measures, since the political governance of these centres has to be improved as well.

Recommendation 4: Strengthening regional networks and clusters

A special role should be assigned to the determinants *Cluster Policy (6) (at policy level), Clusters in general (11) (at institutional innovation support level) and Cluster Development Programmes (21) (at programmatic innovation support level)*. These determinants were rated as having a relatively high impact when improving them with medium to high effort. The experts in the workshop were of the opinion that the support of clusters and the implementation of a sound cluster policy could have a major positive impact for the energy sector in Tunisia. Since the concept of clusters is relatively new in Tunisia, the effort to implement cluster-related measures was assessed with medium to high values.

By establishing cluster structures, the lack of cooperation between industry and academia could be abolished. Therefore, the development of a nationwide cluster policy focussing on the water and energy sector would support this process. This should also include the development of an implementation plan to foster regional sector-based networks of innovation and the building-up of already existing cluster activities towards a better performance.

Currently, a cluster policy is not installed in Tunisia. There are some activities on-going supported by third donors, such as the GiZ, but with limited success. It is recommended to better involve local stakeholders and policy-makers in the cluster development process. A common process to develop a national cluster policy would be an option. In addition, coaching and advice should focus on cluster management excellence rather than on setting up more clusters. Consequently, further support actions should focus on the cluster organisations as such. In this context, the European Cluster Excellence Initiative ECEI has developed clear criteria and guidelines how to improve cluster management in practice.

[17] The European Cluster Excellence Initiative ECEI has developed benchmarking and excellence indicators for Technology Transfer Centres as well (www.cluster-analysis.org).

8.2 Improving the Determinants of the Water Sector

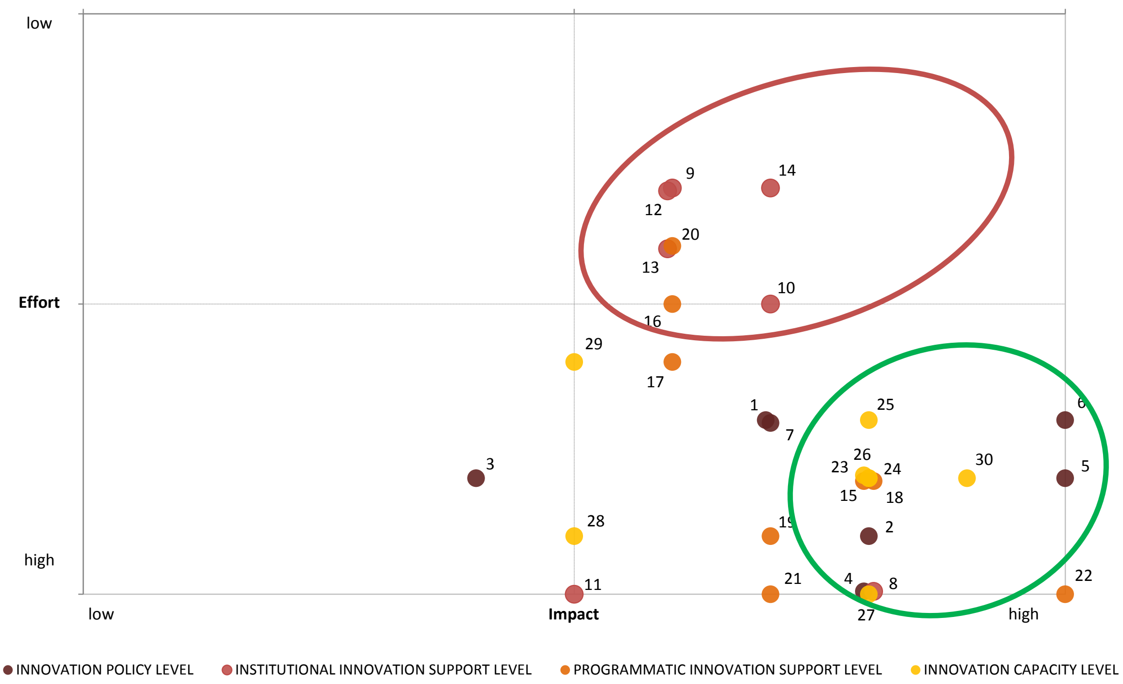

Figure 34 Portfolio – Scope of intervention of innovation support schemes in Tunisia – water sector

Recommendation 5: Strengthening the existing institutional innovation support providers

Compared with the energy sector, considerably more effort will be needed for improving the water sector. Many determinants are very weakly developed. That is why it is no surprise that only a few determinants are to be found in the quadrant with little effort and high impact (Figure 34). In any case, strong efforts will be required to improve those determinants that promise the most impact for the water sector.

Yet, the determinants in the water sector that could have a high impact while spending only little effort are *Technology Parks (9), Incubators (10), Business Promotion Agencies (12), Innovation Service Providers (13), Funding Agencies (14), and Fundamental R&D Programmes (16)* (Figure 34, upper right corner).

Similar to the energy sector, many institutional innovation support entities are poorly implemented or exist only on paper. Thus, it is strongly recommended to have a more detailed look at these institutions and to support the Tunisian government in better implementing such entities. There are two dimensions:

- <u>The policy dimension:</u> The respective entities must be able to operate as flexibly as possible. They should not be too much under governmental control , e.g. it is not appropriate to operate such entities as part of the ministries or similar state institutions. Although there is no doubt that the government shall be able to monitor the development, a minimum of flexibility is needed. Here, policy learning and benchmarking could be a first step to get to know how this is done in other countries. Policy-makers also have to acknowledge that a minimum of investment in staff and equipment will be mandatory.

- The management dimension: The management of such entities is the key for success. Future support measures should clearly focus on upgrading the management capabilities of these entities. It is recommended to run some benchmarking exercises or to conduct a training need analysis first before setting up a proper training agenda.

Recommendation 6: Developing a national research agenda

The Tunisian STI funding scheme in the water technology sector is still very weak. Although significant improvements will require extensive efforts, it is recommended to start appropriate actions. Similar to the energy sector, the STI programme landscape shall be evaluated in order to have less, but more powerful STI programmes in place.

Based on a commonly developed Tunisian research agenda, STI programmes shall focus on those areas in the water technology field, where highest impact is expected. So far, there are too many programmes with far too little impact. Therefore, it would be better to merge programmes in order to gain a critical mass. In addition, actions mentioned for the energy sector (recommendation 1 and 2) should also be applied for the water technology sector. Following this recommendation, significant progress can be expected at innovation programme level.

9 Recommendations for the Cooperation of the Tunisian and the German Ministries

The **continuous improvement** of the conditions of the Tunisian innovation system will more likely take place, if the Tunisian government receives tailor-made support and advice from third parties. Yet, compared to previous approaches, conducting additional training measures will not sufficiently contribute to any improvement. Instead, the overall challenge in Tunisia will be the implementation of cohesive policies and innovation support approaches. Thus, the support of the German government has to be more practical than it has been so far.

The findings clearly reveal that it seems to be much too early to implement common bilateral calls for joint research. Instead, the contribution of the German government should focus on the previously mentioned recommendations.

- **Recommendation 1: Improving the implementation and management of current STI support programmes**
  German ministries and funding agencies have long-term experience in implementing manifold innovation support measures. A good approach therefore would be the comparison of good practices and the benchmarking of implementation and administrative procedures, provided that this is done in a very practical manner. This means that the steps of implementation and administration have to be compared and benchmarked in a very detailed manner. As long as the implementation and administration of Tunisian STI is still at such an embryonic level, the implementation of joint calls is too early and would therefore not be successful.

- **Recommendation 2: Using evaluation and impact measuring for a better STI programme governance**
  A further German contribution could be to jointly run an evaluation of one or more Tunisian STI programmes. This would include the core activities: 1) joint definition of the evaluation design, 2) demarcation of success criteria and 3) description of improving actions. In the end, appropriate knowledge and know-how can be transferred from Germany to Tunisia aiming, again, at better implementing STI policies and programmes. German ministries and funding agencies have extensive experience in this field.

- **Recommendation 3: Improving the impact of Tunisian Technology Transfer Centres**
  The German government actively supported the setting up of *Technology Transfer Centres* in Germany in the 1990s. Nowadays, *Technology Transfer Centres* play an important role within the German innovation system.

  Hence, following the German example, Tunisia could focus on the policy implementation level (policy actions and programmes for setting up *Technology Transfer Centres*) as well as on the management level. Benchmarking *Centres of Excellence* and peer reviews would be efficient tools to improve the capability of *Tunisian Technology Transfer Centres*.

- **Recommendation 4: Strengthening regional networks and clusters**
  Germany's cluster policy is considered to be one of the most advanced ones in Europe. There are many different programmes in place focussing on different cluster excellence levels, e.g. setting up new regional networks (*ZIM NEMO)* or the *Cutting Edge Competition* for world class clusters. Here, the German contribution could be to advise the Tunisian government how to set up an appropriate and tailor-made funding scheme. Based on an analysis of the maturity of already existing Tunisian clusters, appropriate support measures should be defined. So far, Tunisia does not have any policy or support measure for clusters in place.

- **Recommendation 5: Strengthening the existing institutional innovation support providers**
  Here, similar actions are proposed as for recommendation 3, yet with a broader scope. Not only *Technology Transfer Centres* should be focussed on, but any kind of institutional innovation support providers.

Appendices

Further Key Questions Discussed During the Workshop

One of the most effective means to enhance the local innovation environment in Tunisia for both, the energy and the water sector, is the implementation of business incubators and knowledge hubs, respectively. They possess the absorptive capacity to gather relevant knowledge and also to transfer this knowledge to the appropriate actors. As such, it is possible to provide SMEs with information that helps them to initiate new projects and processes.

Business incubators and knowledge hubs in Tunisia are still in early stages of development. These entities enhance the transfer from the generation of new knowledge in research institutes to the implementation of new products or services through (start-up) companies.

In order to support innovation at innovation capacity level, it could be helpful to invite people from all levels of the innovation system and make them discuss the conditions in which SMEs, universities, large companies, R&D institutes can possibly grow. Having analysed these conditions, a network of knowledge can be developed.

Table 2 summarises the main points of the discussion held during the expert workshop. It can be considered as an addendum to the results of the expert opinion surveys and as a “further steps”-agenda for the Tunisian ministries.

The left column of Table 2 displays the stakeholders of the innovation capacity level. The right column of Table 2 shows the measures that should be initiated by the innovation support level in order to set up favourable conditions for the innovation capacity level. The entire table represents a list of questions to be discussed at policy level when developing Tunisia’s innovation policy agenda.

Participant of the innovation system	Questions	Measures
Training & Education (Institutions)	– Are the students well prepared for practical (R&D) work? (at the companies?) – Do they know what makes a business idea a good one? (or where to find out) – Is entrepreneurial activity encouraged? – Is research and development activity enhanced?	– Consider alignment of curricula (partly) with local industry demands – Offer support and/or qualification in checking feasibility of business ideas – Offer qualification in entrepreneurship – Promote entrepreneurial spirit – Offer infrastructure for start-up
Research Institutions	– Are inventions enhanced? – Is the invention unique? (patents, publications) – Does it contain potential for a superior technical function in research or commercial products? – Does the application of the technical function add enough value to the solution/product that	– Enhance motivation of inventors (image of inventor/entrepreneur) – Enhance qualification of inventors and/or support for evaluation of inventions (e.g. co-operation economic/engineering faculties) – Support spin-offs (entrepreneurial coaching)

	makes the invention commercially exploitable?	
Cooperation between Industry and Research Institutions and Educational Institutions	– What R&D requirements do local companies have? – What additional future R&D requirements could local companies have? – What relevant R&D projects do the local research institutions offer? – What additional or varied R&D projects could the local research institutions offer?	– Round table "industry and research" – Explore the value chain of a specific industry – Find out what specific invention would be valuable to local development – Disseminate knowledge about financing possibilities – Start co-operative research for sustainable regional development (spin-offs, incubators, entrepreneurial coaching, patenting agency)
Industry	– What technology innovations do companies and suppliers need? – What R&D offers can local research institutions provide? – What education requirements do I have? – Is there financing for R&D?	– Round table „industry and research" – Explore the innovation need of the specific value chain – Find out what invention would be a valuable contribution to commercial success – Find out about financing possibilities – Start (co-operative) research for sustainable regional development (spin-offs, incubators)
Innovation Support Agencies/Incubators	– What R&D requirements do local companies have? – What additional future R&D requirements could local companies have? – What relevant R&D projects do the local research institutions offer? – What additional or varied R&D projects could the local research institutions offer?	– Enhance entrepreneur image – Evaluate business ideas, offer coaching and consulting for IPR and entrepreneurial activities – Supply/disseminate knowledge about financing (industry) – Support co-operation between industry and research – Offer space for well-defined businesses

Table 2 Levels and actors within a national innovation system

Agenda of the Workshop

INSTITUTE FOR INNOVATION AND TECHNOLOGY

Under the Auspices of the Tunisian Ministry of Higher Education and Scientific Research

****

ANIS-Workshop on the sectors of *Water Technologies & Renewable Energy*
22 – 23 April 2013
Venue: Hotel Novotel, Mohamed V

Day 1: April 22, 2013

08:00 – 09:00	Registration
09:00 – 09:30	Opening of the Workshop by Mr. Dr. Moncef BEN SALEM, The Minister of Higher Education and Scientific Research
09:30 – 10:00	Presenting the aims of the Workshop by Lysann Müller & Nadine May (VDI/VDE Innovation + Technik GmbH, Germany)
10:00 – 10:15	Speaker 1: Mr. Zied KBAIER (CRTEn, Borj-Cedria) Borj-Cedria Ecopark presentation
10:15 – 10:30	Speaker 2: Pr. Mohamed BEN AMOR (CERTE, Borj-Cedria) Exemple d'un cas d'Innovation dans le secteur de l'eau
10:30 – 11:00	Coffee break
11:00 – 12:30	Introducing ANIS as a tool and guide to install effective innovation policy measures
	Framing the topic "Water Technologies" and "Energy"
	Milestone 1: Mapping the Tunisian innovation system focusing on the sector "Water Technologies" and "Energy"
12:30 – 14:00	Lunch break
14:00 – 15:30	Starting the ANIS Questionnaire
15:30 – 15:50	Coffee break
15:50 – 17:00	Continuing the ANIS Questionnaire

Moderators : Lysann Müller & Nadine May (VDI/VDE Innovation + Technik GmbH, Germany)

1

Day 2: April 23, 2013

08:30 – 09:00	Registration
09:00 – 10:00	**Milestone 2:** Continuing and finishing the ANIS Questionnaire + discussion
10:00 – 10:30	Coffee break
10:30 – 12:30	**Milestone 3:** Extraction of the most relevant determinants for influencing the current status of the innovation system within the sector "Water Technologies" and "Energy"
	Discussion on how these determinants can be improved
12:30 – 14:00	Lunch break
14:00 – 15:30	Discussion on how these determinants can be improved
15:30 – 15:50	Coffee break
15:50 – 17:00	**Milestone 4:** Setting up of portfolio of intervention with recommendations for the sector "Water Technologies" and "Energy"

Moderators : Lysann Müller & Nadine May (VDI/VDE Innovation + Technik GmbH, Germany)

2

Participants List Energy Sector

Policy Level (Macro-level)

N°	Organisation	Abbreviation	Participant	Position
1	Ministère de l'Enseignement Supérieur de la Recherche Scientifique (MESRS)	MESRS-DGVR	Pr. Khemaies ZAYANI	Director
2	Ministère de l'Enseignement Supérieur de la Recherche Scientifique (MESRS)	MESRS-DGCI	Pr. Slim CHOURA	General Director
3	Ministère de l'Industrie (MIT)	MI-DGE	Mr. Rachid BEN DALY	General Director
4	Ministère de l'Enseignement Supérieur de la Recherche Scientifique (MESRS)	MESRS-Cabinet	Pr. Radhouane CHTOUROU	Minister's Counselor
5	Ministère de l'Enseignement Supérieur de la Recherche Scientifique (MESRS)	MESRS-DGRS	Pr. Rachid GHRIR	General Director
6	Ministère de l'Industrie (MIT)	MI-DGIIT	Mr. Ridha KLAI	General Director

Institutional Innovation Support Level (Meso-lLevel)

N°	Organisation	Abbreviation	Participant	Position
1	Agence Nationale de Promotion de la Recherche Scientifique (ANPR)	ANPR	Pr. Bahri REZIG	General Director
2	Agence Nationale pour la Maîtrise de l'Energie (ANME)	ANME-DER	Mme Hélène BEN KHEMIS	In charge of RI Projects
3	Agence de Promotion de l'Industrie et de l'Innovation (APII)	APII-CIDT	Mr. Mohamed BELHAJ	Deputy Director
4	Institut National de la Normalisation et de la Propriété Industrielle (INNORPI)	INNORPI	Mr. Nafâa BOUTITI	Deputy Director

Programmatic Innovation Support Level (Meso-level)

N°	Organisation	Abbreviation	Participant	Position
1	GIZ Tunisie (Deutsche Gesellschaft für Internationale Zusammenarbeit)	GIZ-PAEI	Mlle Fatma M'SELMI	Expert
2	Unité d'Appui au Projet d'Appui au Système de Recherche et de l'Innovation (UAPASRI)	UAPASRI	Mlle Hasna HAMZAOUI	Team Leader
3	Unité d'Appui au Projet d'Appui au Système de Recherche et de l'Innovation (UAPASRI)	UAPASRI	Mr. Patrick CREHAN	Expert
4	Mediterranean Innovation and Research coordination Action (MIRA)	MIRA	Pr. Moez JEBARA	National Coordinator
5	Réseau des Experts Innovation et Développement Durable (IDNET)	IDNET	Mr. Nizar BEN SALEM	President
6	The German Academic Exchange Service - Tunisia (DAAD - Deutscher Akademischer Austausch Dienst)	DAAD Tunis	Mme Beate Schindler-KOVATS	Director

Innovation Capacity Level (Micro-level)

N°	Organisation	Abbreviation	Participant	Position
1	Société de Gestion de la Technopole de Borj-Cedria (SGTBC)	SGTBC	Mr. Talel SAHMIM	Director
2	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn	Pr. Brahim BESSAIS	General Director
3	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-LPT	Mme Kamilia BEN YOUSSEF	Principal Engineer
4	Industrial Innovation Centre (IIC)	IIC	Dr. Fahem FANTAR	Scientific Researcher
5	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-LPV	Pr. Abdellatif BEL HADJ MOHAMED	Director
6	Ecole Nationale d'Ingénieurs de Tunis (ENIT)	ENIT	Pr. Chiheb BOUDEN	Director

Participants List Water Sector

Policy Level (Macro-level)

N°	Organisation	Abbreviation	Participant	Position
1	Ministère de l'Agriculture, Cabinet du Ministre	MA-Cabinet	Pr. Lokman ZAIBET	Senior Legal Secretary
2	Ministère de l'Agriculture, Cabinet du Ministre	MA-Cabinet	Pr. Mohamed Salah BACHTA	Senior Legal Secretary
3	Ministère de l'Agriculture, Cabinet du Ministre	MA-Cabinet	Dr. Slah NASRI	Senior Legal Secretary

Institutional Innovation Support Level (Meso-level)

N°	Organisation	Abbreviation	Participant	Position
1	Société Nationale d'Exploitation et de Distribution des Eaux	SONEDE	Mr Youssef SELMI	Director of Exploitation
2	Institution de la Recherche et de l'Enseignement Supérieur Agricoles	IRESA	Dr. Thameur CHAIBI	Director of Laboratory

Innovation Capacity Level (Micro-level)

N°	Organisation	Abbreviation	Participant	Position
1	Centre de Recherches et des Technologies des Eaux, Technopole Borj-Cedria	CERTE	Pr. Mohamed Ben Youssef	General Director
2	Centre de Recherches et des Technologies des Eaux, Technopole Borj-Cedria, Laboratoire des Georessources	CERTE-LabGeoR	Pr. Mourad BEDIR	Director of Laboratory
3	Centre de Recherches et des Technologies des Eaux, Technopole Borj-Cedria, Laboratoire des des traitements des eaux Naturelles	CERTE-LabTEN	Pr. Mohamed BEN AMOR	Director of Laboratory
4	Centre de Recherches et des Technologies des Eaux, Technopole Borj-Cedria, Laboratoire des des traitements des eaux Naturelles	CERTE-LabTEN	Dr. Mohamed TLILI	Scientific Researcher
5	Centre de Recherches et des Technologies des Eaux, Technopole Borj-Cedria, Laboratoire des Traitements des Eaux Usées.	CERTE-LabTEU	Dr. Ismail TRABELSI	Scientific Researcher
6	Centre de Recherches et des Technologies des Eaux, Technopole Borj-Cedria, Laboratoire des Traitements des Eaux Usées.	CERTE-LabTEU	Dr. Imen KHOUNI	Scientific Researcher

Organisation Committee

N°	Organisation	Abbreviation	Participant	Position
1	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-BuTT	Mr. Zied KBAIER	Principal Engineer
2	Centre de Recherches et des Technologies de l'Eau (CERTE)	CERTE	Mr. Mohamed KEFI	Scientific Researcher
3	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-BuTT	Mr. Mohamed Haythem RAOUADI	Principal Engineer
4	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-BuTT	Mme Olfa OUKHAI	Technician
5	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-BuTT	Mme Aida Darghouth ASLI	Principal Engineer
6	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-BuTT	Mr. Slim NAOUI	Principal Engineer
7	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-BuTT	Mr. Houcemeddine JAIBI	Principal Engineer
8	Centre de Recherches et des Technologies de l'Energie (CRTEn)	CRTEn-BuTT	Mr. Ahmed BELKHECHINE	Principal Engineer

References

ANME (2012). *Promotion of Photovoltaic in Tunisia*. National Agency for Energy Management. Presentation by Abdessalem El Khazen. June 2012 at the Intersolar, Munich.

African Development Bank, Organisation for Economic Co-operation and Development, United Nations Development Programme, United Nations Economic Commission for Africa (2012). *African Economic Outlook 2012*. OECD Publishing.

Chaabouni, Refaat (2008). *Progress towards the Implementation of the National Innovation System in Tunisia.* In: Communications of the IBIMA, Volume 2, 2008, p. 188 – 191. Norristown: IBIMA Publishing.

CRTEn (2013). The Research and Technology Centre of Energy (CRTEn). Presentation by Zied Kbaier at the ANIS workshop. March 2013, Tunis.

Dii (2013). Desertec Industry Initiative – Länderfokus Tunesien. Available at: http://www.dii-eumena.com/de/country-focus/tunisia.html. Accessed on 27 May 2013.

Freeman, C. (1995). *The National System of Innovation in Historical Perspective*. In: Cambridge Journal of Economics, No. 19.

GENI (2013). *Tunisia's electricity network*. Global Energy Network Institute. Available at: http://www.geni.org. Accessed on 27 May 2013.

Gingkomaps (2013). *Tunisia's topographic landscape*. Available at: http://www.ginkgomaps.com/de/rl3c_tn_tunesien_landkarte_illdtmcolgw30s_ja_mres.jpg. Accessed on 27 May 2013.

Global Water Partnership Africa (2011). *Implementation of the Water Climate and Development Programme in Africa.* [Online]. Available at: http://www.gwp.org/en/WACDEP/IMPLEMENTATION/Where/Tunisia/. Accessed on 1 August 2013.

GTAI – Germany Trade & Invest (2012). *Wirtschaftsdaten kompakt: Tunesien*. *November 2012*. [Online]. Available at: http://ahk.de/fileadmin/ahk_ahk/GTaI/tunesien.pdf. Accessed on 6 May 2013.

Haddadin, M.J. (2006). *Water Resources in Jordan: Evolving Policies for Development, the Environment, and Conflict Resolution*. Washington: RFF Press.

Hahn,P. & Meier zu Köcker, G. (2012). *The Egyptian Innovation System – An Exploratory Study with Specific Focus on Egyptian Technology Transfer Centres*. Berlin: Institute for Innovation and Technology (iit).

Kind, S. (2013). *Wirkungen und erfolge durch Cluster messen*. In: Cluster – Zwischen Hard Facts und Soft Factors. Berlin: Institute for Innovation and Technology (iit).

Louati, M. E. H. & Bucknall, J. (2009). *Tunisia's Experience in Water Resource Mobilization and Management*. In: World Bank. 2009. *Water in the Arab World: Management Perspectives and Innovations*. [Online]. Available at: http://documents.worldbank.org/curated/en/2009/01/10882103/water-arab-world-management-perspectives-innovations. Accessed on 6 May 2013.

Ministère du Développement et de la Coopération Internationale, Banque Mondiale et Programme "Participation Privée dans les infrastructures méditerranées"(PPMI) (2004). *Etude sur la participation privée dans les infrastructures en Tunisie*, Volume III.

Nordic Council of Ministers (2009). *Nordic Innovation Monitor*. Copenhagen: FORA.

OECD (1997). *National Innovation Systems.* Paris. OECD Publishing

OECD (2010a). *Progress in Public Management in the Middle East and North Africa: Case Studies on Policy Reforms*. OECD Publishing.

OECD (2010b). *SMEs, Entrepreneurship and Innovation. In: OECD Studies on SMEs and Entrepreneurship*. Secretariat of the OECD Centre for Entrepreneurship, SMEs and Local Development.

OECD (2011). *Economic Policy Reforms 2011: Going for Growth*. OECD Publishing.

OECD (2012a). *African Central Government Debt 2012: Statistical Yearbook*. OECD Publishing. [Online]. Available at: http://dx.doi.org/10.1787/acgd-2012-en. Accessed on 6 May 2013.

OECD (2012b). *OECD Investment Policy Reviews: Tunisia 2012*. OECD Publishing.

OECD. 2013a. *New Entrepreneurs and High Performance Enterprises in the Middle East and North Africa*. OECD Publishing and International Development Research Centre.

OECD (2013b). *Renewable Energies in the Middle East and North Africa: Policies to Support Private Investment*. OECD Publishing.

Pérard, E. (2008). *Private Sector Participation and Regulatory Reform in Water Supply: The Southern Mediterranean Experience*. OECD Publishing.

Schwab, K. (Ed.) (2009). *The Global Competitiveness Report 2009-2010*. [Online]. Available at: http://www.weforum.org/reports. Accessed on 6 May 2013. Geneva: World Economic Forum.

Schwab, K. (Ed.) (2010). *The Global Competitiveness Report 2010-2011*. [Online]. Available at: http://www.weforum.org/reports. Accessed on 6 May 2013. Geneva: World Economic Forum.

Schwab, K. (Ed.) (2011). *The Global Competitiveness Report 2011-2012*. [Online]. Available at: http://www.weforum.org/reports. Accessed on 6 May 2013. Geneva: World Economic Forum.

Schwab, K. (Ed.) (2012). *The Global Competitiveness Report 2012-2013*. [Online]. Available at: http://www.weforum.org/reports. Accessed on 6 May 2013. Geneva: World Economic Forum.

WEC (2010). *Survey of Energy Resources 2010*. World Energy Council, London.

WIRA Study Team (The World Bank, Ministry of Public Works Indonesia, Water Partnership Programme) (2012). *Indonesia Water Investment Roadmap 2012-2014*. [Online]. Available at: http://water.worldbank.org/sites/water.worldbank.org/files/publication/WATER-Indonesia-Water-Investment-Roadmap-2011-2014.pdf. Accessed on 6 May 2013. The World Bank.

Wikimedia Commons (2009). *Medjerda river drainage basin*. [Online]. Available at: https://commons.wikimedia.org/wiki/File%3AMedjerda_river_drainage_basin-fr.svg. Accessed on 6 August 2013. Wikimedia Commons.

World Bank (2010). *Innovation Policy: A Guide for Developing Countries*. Washington, D.C.: The Workd Bank.

World Bank (2013). *Tunisia in a Changing Climate: Assessment and Actions for Increased Resilience and Development.* Editor: Verner, D. Washington, D.C.: The World Bank.

World Bank (2009). *Water in the Arab World – Management Perspectives and Innovations.* Editors: Jagannathan, N.V., Mohamed A.S., Kremer, A. Washington, D.C.: The World Bank.