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The Egyptian Innovation System

An Exploratory Study with Specific Focus on Egyptian Technology Transfer and Innovation Centres

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gtz

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1 Preface

Occupying the northeast corner of the African continent, Egypt is bisected by the highly fertile Nile Valley, where most of its economic activities take place. In the 1970–2000 period, the Egyptian government reformed the highly centralised economy, and in recent years Egypt has enjoyed moderate but constant growth. In parallel, the Egyptian government took various measures to set up the main elements of a relatively comprehensive national innovation system to stimulate industrial modernisation, SME development and entrepreneurship, investment, venture capital and business incubators. In the period 1985–2005, various long-term innovation policies were instituted by the Egyptian authorities and diverse government-controlled innovation programmes carried out, funded mainly by third country donors. A comparison of the national economy of Egypt with those of the Maghreb countries shows Egypt's competitiveness in quite a different light. As far as the GDP per capita is concerned, for example, Egypt ranks low compared to the Maghreb countries (Figure 1). On the other hand, Egypt has ranked top for real GDP growth for several years now.

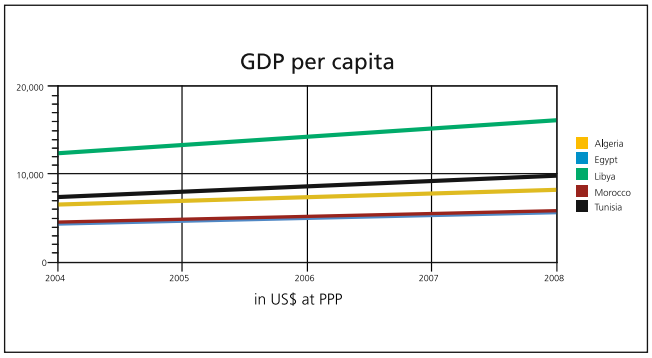

Figure 1:
Benchmarking of the GDP per capita for several Maghreb countries[1]

As a consequence of the increased attention to innovation matters by the Egyptian government over the past years, a wide range of organisations has been conceived and created to finance and support education, R&D and innovation in Egypt. Among others, the Ministry of Trade and Industry MTI has started to become active in the field of innovation. It owns various institutions for implementing its innovation policy in Egypt. The two most important institutions are

- the Industrial Modernisation Centre (IMC), and
- the Egypt Technology Transfer and Innovation Centres (ETTICs), which are mainly sectorally oriented.

Besides these institutions, the MTI utilises tax and toll measures to design and execute industrial and innovation policy.

The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH cooperates with the MTI in the Private Sector Development Programme, especially through the realisation of specific projects and consulting activities intended for the ETTICs. In the context of this cooperation, VDI/VDE-IT was asked by GTZ to perform a study on innovation in Egypt with regard to the ETTICs.

The objectives of the study were:

- to identify the framework conditions set by the Ministry of Trade and Industry to enhance the innovation in and technology transfer to the private sector,
- to consider the possible role of ETTICs in the strategic options of MTI and in the innovation landscape,
- to identify institutions and programmes dealing with the promotion of innovation in the private sector,
- to identify the private sector's ability/demand/interest in innovation and technology transfer, and
- to assess the cooperation between the private sector and the R&D sector.

The study was carried out between June and August 2008 by VDI/VDE-IT in close cooperation with GTZ.

Two stays in Egypt by VDI/VDE-IT experts served the purpose of conducting a series of interviews with actors within the Egyptian innovation system, consisting mainly of representatives of two ministries (Scientific Research and Higher Education, Trade and Industry), representatives of the ETTICs and other Egyptian research organisations, universities, science parks, innovation support programmes, foreign donors and stakeholder organisations from industry (chambers of industry). The complete list of interviewees is given in Appendix IV.

The study is structured as follows: The research results are discussed in hypotheses laid down in Chapter 3. These were presented, discussed and verified with representatives of several ETTICs and the MTI in August 2008. Recommendations for the future development of the ETTICs within the Egyptian National Innovation System are made in Chapter 4. In addition, critical factors of success for ETTICs are defined and discussed in Chapter 5. By request of the MTI, some leading German innovation implementation agencies are described in the study, in

[1] Meier zu Köcker et al. *Benchmarking National Innovation Systems in the Maghreb Countries*, 2008 (to be published)

order to reveal the broad spectrum of protagonists active in the relatively complex German innovation system. The authors do not recommend copying these institutions, but some features could be usefully adopted by the ETTICs. Since the Egyptian partners were interested in learning more about design features of innovation programmes in Europe, selected examples of such programmes are described in the Appendix in order to show the varying spectrum and design features of publicly funded innovation programmes in Europe.

Berlin, September 2008

2 Innovation and Technology Transfer Centres in the Egyptian Industrial Development Strategy – Concept and Current Status

The development of a dynamic, modern knowledge society as concerns industry, research and society is one of the important goals being strived for by Egypt. In the 1985–2005 period, various long-term innovation policies were generated by the Egyptian authorities and several government-controlled innovation programmes were set up. As far as these activities are concerned, the Egyptian innovation policy is characterised according to the European TrendChart on Innovation as a clear but incomplete policy.[2] However, the Egyptian authorities have an increased awareness of the need for further steps to address the systemic nature of innovation and to harness resources residing in different ministries in a coherent way.

As early as the 1980s, the Egyptian authorities became aware of the fact that information technologies would play an important part in the economic and industrial development of the country. Rising to this challenge, in 1985 the Information and Decision Support Centre was set up under the supervision of the Cabinet of the Prime Minister. The most important objectives of the Information and Decision Support Centre were to accelerate technological development by using state-of-the-art IT and to build up the national infrastructure. To achieve these main objectives, in 1993 the Information and Decision Support Centre introduced the Technology Development Programme.

In order to give scientific and technological issues more importance, the Secretary of State for Scientific Research was established under the auspices of the Ministry of Higher Education and Scientific Research in 1998. In addition, the Supreme Council for Research Centres, an organisation co-chaired by the Minister for Higher Education and Scientific Research and the Secretary of State for Scientific Research, was set up in 2000 in order to improve the coordination of research efforts on a national level and across all ministries. The Supreme Council for Research Centres usually meets once a month and brings together representatives of the following ministries: Foreign Trade and Industry; Water Resources and Irrigation; Agriculture; Transport; Electricity and Energy; Health and Population; Communication; Further Planning and International Cooperation; and National Defence and Arms. The "Fund for studies, technological and scientific research" is the main instrument of the Secretary of State for Scientific Research for transferring know-how to industry.

Furthermore, the Ministry of Foreign Trade and Industry, the Ministry of Communication and Information Technology, and the Ministry of Investment also operate in the context of innovation. Under the supervision of the Ministry of Foreign Trade and Industry there is also the Egyptian Organization for Standards and Quality, the only official and competent national authority on standardisation. There are more than 5600 Egyptian standards, but 95 % of these are voluntary, although ministries can adopt technical regulations when health or safety is involved.

A schematic diagram of the main actors of the Egyptian Innovation System is shown in Figure 2. A Natural Innovation System can be defined as a network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies (Freeman, 1987).

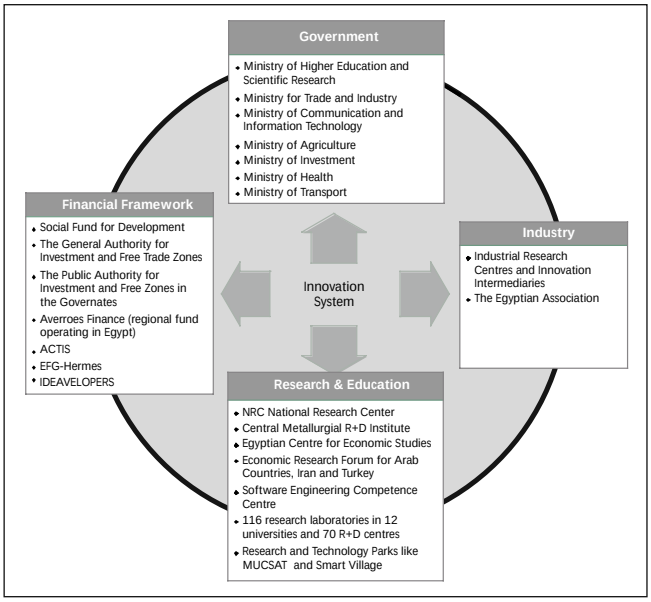

Figure 2:

The main players in the Egyptian Innovation System (besides of industrial actors)

[2] European TrendChart on Innovation, Country Group Report 2005 for MEDA Countries

The ETTICs and their Role within the National Innovation System in Brief

Neither the Egyptian science and technology community nor industry is as yet in the position to develop new major technologies or products according to its specific needs by itself. There may be some positive exceptions, but in most cases technologies and innovative products have to be transferred from abroad. These will either be imported from foreign partners or provided by local agents, and then channelled to local manufacturers through a well-established technology market (Figure 3).

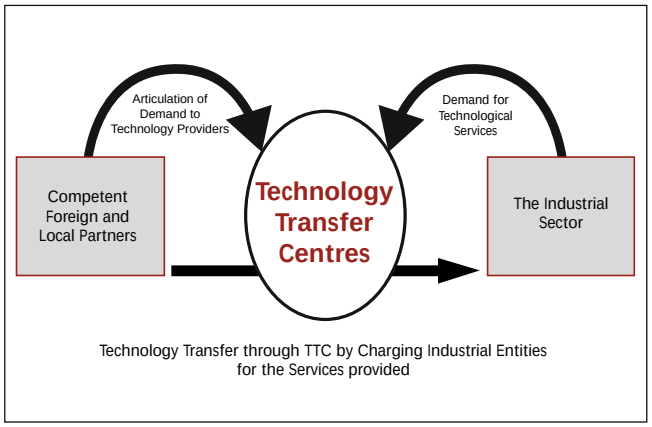

Figure 3:
The current technology transfer approach in Egypt

As far as technology transfer issues are concerned, the current Egyptian Industrial Development Strategy states the following intentions with regard to ETTICs, taking the current situation into account (in the past, the abbreviation ETTCs was used instead of ETTICs, which is common today[3]):

"The main objective of the establishment of ETTCs is to fulfil the technological needs of the Egyptian industry and in particular of the exporters to become constantly competitive. They are meant for transfer and diffusion of new technologies and innovations by the efficient management of top-notch technologies, brought about from global technology markets."

Accordingly, the ETTCs operate on three principles:

- First, there is the adoption of a demand-driven approach in providing technological services to the private sector. ETTCs will conduct regular demand surveys to identify the needs of the private sector and assess the gap between local and global technologies used by each sector. This will be done in collaboration with existing export councils, new industrial clusters, and the Federation of Egyptian Industries, capitalizing on their established channels with the industrial units.
- The second principle is twinning with competent foreign partners who will provide the required technology. Each centre will establish strong partnerships with one or more foreign technology transfer centres in order to provide state-of-the-art technologies to local clients. Close ties with foreign TTCs shall place local ETTCs, and thus the whole industrial sector, within a worldwide network of technology transfer and innovation centres.
- The third principle is providing technological services through a business model, i. e. charging clients for the services provided. This will secure the financial sustainability of ETTCs in the long run, and help to extend the services they provide for the industrial sector.

The ETTCs can be considered as sectorally, sub-sectorally, or horizontally operating centres. There are in total nine technology transfer centres with sectoral orientation, each serving certain industries, as well as seven projects for the transfer of cross-sectional technologies that have broad applications in the industrial sector. The primarily targeted sectors are:

- ready-made garments
- leatherwear, textiles
- plastics, engineering
- traditional industries
- food
- furniture
- marble and granite.

According to the main objectives, and the ETTC related strategy defined by the MTI in 2006, "the ETTCs provide a broad range of services to the industrial sector: Technology transfer through patents and licensing, technical assistance in product and production development, quality audits and management, advanced human resources development, such as training designers and senior engineers, environment and social management, and contracting R&D and innovation projects. The ETTCs do not rely exclusively on foreign sources for providing their services. Each centre is obliged to twin with one or more local research institutes that are able to supply high-quality technical assistance and consultancy services to the industrial units through an ETTC. In this respect, ETTCs will act as liaisons between manufacturers and local technological service providers, following the same business model adopted with technology transfer."

[3] Therefore, in some parts of the text describing the objectives and strategies defined by the MTI, we the abbreviation ETTCs is used instead of ETTICs.

Over the past years, this strategy has begun to be implemented and turned into practice. Today, there are more than one dozen ETTICs, most of them sectorally oriented (plastics, cleaner production, fashion and design), a few of them with cross-sectional foci (cleaner production, Kaizen). All of them are co-funded by foreign donors.

In distinction to earlier plans, the ETTCs have started developing into ETTICs, the added "I" highlighting the innovation function of the centres. Although good progress has been gained so far, the ETTICs, in the future have to regard "Innovation" in daily work much more than nowadays.

- the replacement of products/services
- reduced energy consumption
- conformance to regulations.

The ETTICs are in different states of development. Some have developed to become well-functioning service agencies, while others are still in an early phase of building up their operational capabilities.

Among the main services offered by some of them are:

- training with a focus on technology transfer and
- individual consulting on technologies.

Some of the centres have additional foci on:

- testing (e.g. plastics)
- piloting processes (food) or
- collaborative development projects.

3 Major Findings and Discussion

Desktop studies, on-site interviews, various discussions with Egyptian citizens and subsequent evaluations of the statements resulted in a group of major hypotheses to be presented in the following. The views and opinions expressed as hypotheses in this chapter are those of VDI/VDE-IT GmbH and not necessarily shared by GTZ or Egyptian policy makers. They are based on an empirical survey and anecdotal information provided by a wide range of national policy makers and Egyptian citizens. As such, the hypotheses were verified and confirmed in various discussions. They were compiled to the best knowledge of the authors and deliberately include initial ideas as to what actions could arise from these hypotheses. These ideas should be seen as pure examples serving to illustrate the points made. It was the intention of the authors to initiate a broad discussion directed at the joint, coordinated and professional design and implementation of sectoral innovation policy and programmes with ETTICs in the central focus. The hypotheses do not intend to convey a complete picture of the innovation system or even of the ETTICs, nor should this paper be understood as a comprehensive and complete study about the Egyptian national innovation system.

Hypothesis 1

Egypt needs a harmonised national science and technology plan and national innovation-oriented goals.

Findings and Reasoning

There is no long-term Egyptian National Science, Technology and Innovation (S&T) plan in existence. Although a macro- (Ministry-) level committee was installed to elaborate such national science and technology plans, a corresponding document has not been finalised yet. The S&T plan is of major importance for an effective national innovation strategy and typically constitutes the base for any innovation support programmes and initiatives. Only a coordinated approach will make it possible to

a) focus on priorities according to the Egyptian needs and thus concentrate limited resources in promising areas, and
b) avoid redundancies between different uncoordinated programmes.

S&T plans are state-of-the-art in industrial countries and are becoming ever more so in transition countries as well. They give orientation to the beneficiaries of the research as to which topics are on the national agenda and what they can expect to receive from national research institutions. In this respect, even the omission of a topic from the national agenda can support the industry: by clearly stating towards entrepreneurs that they may look for other researchers to solve specific technology development problems that are not listed in the S&T plan. In a positive way, an S&T plan could help to support other policy areas: preservation technologies of surfaces for archaeology, river-ship building technologies for tourism and similar activities.

Specific national S&T goals are a good basis from which to start awareness campaigns in order to foster technological interest and increase motivation to study the respective engineering topics. "Man in space" and "Flying to the moon" were subjects that strongly supported a high esteem of technology and thus

motivated ongoing students to take up engineering-related courses of study.

Potentials for Improvement

A national S&T plan should be elaborated, involving all ministries involved in science, technology and innovation. From the perspective of innovation, the S&T plan should consider the added value to research excellence and societal problems, but also keep in mind the demands of the national industries. We refer here not only to industrial technologies but also to those in high national demand such as tourism-related commerce and archaeology. Developing a national S&T plan is a challenging task to accomplish, involving many actors. The European Commission, for example, chose a technology platform approach to channel industry's requests. When elaborating the proposed S&T plan, Egyptian policy makers should make use of national experts from academia and industry, including representatives from the ETTICs. This is common procedure in Germany and other industrial countries, which involve diverse expert councils to support setting up national S&T plans. The agencies and institutions mentioned in Appendix I are typically very much involved in supporting German policy makers in elaborating an S&T plan of this kind (for Germany: The German High-Tech-Strategy).

Hypothesis 2

The MTI is in the position and has the responsibility to further develop ETTICs into appropriately formed innovation agencies.

Findings and reasoning

ETTICs were founded only a few years ago, just as the IMC and most other Egyptian meso-level innovation support organisations were. Many of them are still in the process of developing their full portfolio of competencies and services. A few centres have still not completed contracting all the resources required to realise full operational capacity. Others, in contrast, have made considerable progress towards becoming nationally recognised innovation actors. The MTI is in a position to further stimulate the development of the ETTICs into important innovation agencies in their respective sectors, an advance which would enable them to support the ministry itself much more than they can now in innovation policy matters. To date, the MTI does not use the full potential and competence of some of the leading ETTICs.

Potentials for Improvement

With the ETTICs, the MTI has a powerful tool to become more active in innovation policy matters, having appropriate centres of innovation excellence available. The intention of linking the centres not only through regular meetings but through a common, privately organised holding would be a promising start towards governing ETTICs like service-oriented enterprises, providing innovation-related support and services for the MTI as well as for other clients.

In this regard, a range of critical success factors should be taken into consideration to make the ETTICs effective tools for implementing innovation programmes as well as for supporting the MTI directly. These success factors are explained in detail in Chapter 5. Besides legal, management and governance aspects, coordination and cooperation with initiatives and counterparts from the other ministries are critical for the effectiveness of the ETTICs. Joint or coordinated action is hard to realise but bears high potential for enhanced effectiveness and impact and could even lead to the continued contracting of ETTICs to realise joint innovation programmes. Synergy effects with other MTI initiatives like the EEN, industrial training centres, industrial parks and the national quality system organisations can well be expected.

On the meso-level of Egyptian TTICs and the IMC, expertise is growing and the first sectoral networks have been established. These may be utilised to foster the expert-driven design of coordinated sectoral programmes. More detailed recommendations concerning the ETTICs are made in Chapter 4.

Hypothesis 3

Existing Egyptian innovation institutions should be further developed rather than new ones created.

Findings and reasoning

"Egypt does well on the basic requirements of institutions, infra-structure and the macro economy"[4], is what the initial Medibtikar study stated. This can be fully confirmed with regard to the public innovation system institutions in the narrower sense. A sound base of dedicated public innovation institutions is in place in Egypt. They constitute valuable tools for designing and implementing innovation support policies and programmes. Important innovation actors such as chambers of commerce, universities, research centres, vocational training institutions, funding agencies and business and technology parks are in place to support the Egyptian industry. But they have different

[4] Medibtikar: EGYPT- The Innovation System

strengths and weaknesses with regard to innovation aspects and, to date, not all of them fully exploit their impact potential. In addition, for various reasons many of them do not act as effectively as needed. Discussions about public innovation support should focus more on policies, programmes and the realisation of programmes through existing institutions, rather than discussing the formation of new institutions.

From the client's perspective, it is appropriate to channel new policies through existing channels of trusted communication. Only if entirely new groups are targeted with innovation policies may the foundation of another institution be considered. In addition, setting up new meso-level institutions takes more time and is – at least in the beginning – likely to be less efficient, less effective and less capable of carrying out new innovation programmes.

Furthermore, appropriate programmatic approaches are urgently needed to turn any future innovation policy into practice.

Potentials for Improvement

With the ETTICs, the MTI has innovation centres available which could play a stronger role within the National Innovation System. As far as the ETTICs are concerned, this implies that they should be structured in a way that allows for or even fosters change and internal innovation. Broad competency and flexibility require intensive networks and networking to the ministry as well as to the research, educational and industrial stakeholders. The constant development of the employed experts and a high level of organisational management capability is a precondition to realise this, as is a governance and legal frame that allows the ETTICs to act in a dynamic, customer-oriented, supportive and unbureaucratic manner. Together with the IMC and possibly other funding organisations like the RDI programme management, the ETTICs may represent the best available practical knowledge about innovation matters, programme deployment, customer perception and impact aspects of the innovation support programmes. The MTI and other ministries can benefit very much from this experience. Innovation support programmes leverage considerable amounts of money, and the quality of the design and execution of the programmes have a great impact on their effectiveness. Experts from the ETTICs and above-mentioned institutions should

- be given the opportunity to learn about good innovation programming practices in other countries,
- be intensively involved in the design of innovation support programmes, and
- act as active counterparts to policy makers involved in innovation-related issues.

Hypothesis 4

ETTICs need exceptional management capability to further develop the innovation capability of companies.

Findings and Reasoning

Marketing and a lack of communication have been considered weaknesses of the Egyptian industry (WEF 2006, Medibtikar 2006). Achievable results of innovation are listed in the definition of innovation used here, among them "Improved Quality", "Creation of New Markets", and "Extension of the Product Range". They are easy to understand, but the realisation of innovation requires much more from those involved. Innovation orientation starts with a mindset of constant striving for the fastest improvements, and in companies this is technically realised through comprehensive management concepts of market-oriented products, effective high-quality production, investment calculation, development of excellent resources, participative leadership behaviour and, often, technological competency and professional marketing approaches. Only if all the subtasks of management are executed in a professional way will innovation succeed.

The ETTICs are located in an interface position that requires excellent communication and marketing skills. To identify the target groups and their needs, to approach them in the right way and with the right support is an entrepreneurial task just like the offer of any other service. ETTIC managers need to be well educated in management concepts to accomplish this task. Moreover, ETTIC experts must be able to assess the managerial strengths and weaknesses of their clients and need to be perceived as esteemed experts or consultants by them. ETTIC employees need to be experts in innovation management in their respective fields.

Potentials for Improvement

In order to become nationally recognised and active driving forces for innovation in Egypt, the ETTICs should offer additional services – consulting, training, coaching – concerning managerial aspects for their clients. With regard to participation and productivity enhancement, cross-sectional cooperation with the Kaizen Centre could be envisaged. As far as improving innovation support services is concerned, the ETTICs could consult each other in a structured way to improve their performance by learning from each others' management and deployment practices. More elaborated key performance indicators could enhance the striving for managerial excellence and innovation impact of ETTICs.[5]

[5] For more information see Quality Frame – A fact based peer review approach for the mutual development of organisational excellence of innovation agencies, 2008, Institute for Innovation and Technology Berlin, www.iit-berlin.de

Hypothesis 5

Corporate innovation is a comparatively complex approach that needs intensive marketing and training to be entirely comprehended and utilised in Egypt.

Findings and Reasoning

Egyptian entrepreneurs get varying marks on innovation performance. On the one hand, "Almost all the enterprises covered by the survey were family businesses, in every case the business operation was powered by an energizer, the entrepreneur. … entrepreneurs were found to share a number of characteristics: they are individuals of vision and purpose, personally ambitious, … a few of them are also benevolent and humanitarian. All of them are passionately devoted to their businesses. They are progressive and not complacent, they strive for excellence … creative by nature and have started their own businesses, while others are carrying on a family tradition."[6]

On the other hand, ESCWA states that "[…] most manufacturers tended not to be innovative, basically because they were lacking in entrepreneurship and did not possess entrepreneurial skills". During the interviews it was stated that the comprehension of innovation in Egypt often is restricted to a matter of investment in technology upgrading only. As far as Egypt is concerned, it may be speculated that both is true: Innovation takes place but is driven by the "one" inventor and entrepreneur, and management systems, especially as innovation-oriented comprehensive concepts, are not abundant amongst those enterprises.

This poses two serious risks that are also prevalent in Germany and Europe, for example:

- Medium-sized family enterprises go through critical phases when they grow in size and complexity beyond the size of units that may be managed in a centralised "feudalistic" way.
- The point in time when the owner-entrepreneur retires becomes even more critical if no decisive and capable management and innovation systems and resources have been put into place at an earlier stage.

Potentials for Improvement

It is not the point to persuade inventive technology-oriented entrepreneurs of the relevance of improved quality or the creation of new markets. For these companies, it may be important to raise awareness of management paradigms and the importance of innovation systems that allow constant innovation to become a management and leadership principle. On the other hand, one argument often heard from family businesses is "why should I, it has gone well for such a long time …". Thus, appropriate awareness or training measures conveying tailor-made innovation management concepts should be implemented in order to remove the potentially existing mental barriers described above. ETTICs or other innovation actors could act as a contact point for companies to promote innovation as a complex multi-actor concept for maximising long-term growth and profits. They should approach the targeted community with marketing for innovation and capacity-building activities such as training.

Hypothesis 6

Egypt's public sector research needs enhancement of exploitation and demand orientation to utilise national research for national industry and to contain brain drain.

Findings and Reasoning

Egyptian research centres are, by tradition, financed mainly by public funding and not by orders from industry. This leads to an inefficient management structure of Egypt's research institutes, characterised by "… inadequate resources; weak links between R&D institutions and industry … relative isolation of S&T institutions from larger socioeconomic activities."[7]

On the other hand, historical ties exist between industry and research. CMRDI, the Centre for Metallurgical Research and Development for example is located on the premises of a large state steel company, which was also its co-founder. And with regard to mechanical engineering, the universities of Alexandria and Cairo for example have reported successful long-lasting development cooperation schemes.

Nevertheless, the gap between research and industry is still significant, a fact regretted in many of the interviews we conducted. This fact is acknowledged by the Ministry for Higher Education and Scientific Research (MHESR). The actual funding strategy of STDF of the MHESR follows a concept of advanced research with the aim of completing the innovation cycle of research organisations (4P – Publication Patent Prototype Product). Several interviewees reported that the classical and preferred career of scientists is a scientific career in research organisations or universities, with international activities being the general aim and indicator of success. Industrial careers are not popular among young scientists. Brain drain is another re-

[6] (ESCWA, 2001, p.32; 37–38)

[7] (UNCTAD, 1999, p.14)

sult, because scientific employment opportunities in research and education are limited.

Formal rules for scientific careers foster this science-oriented career path: credits for a scientific career can only be gained through classical scientific activities (publishing papers, teaching, etc.), not through internships in companies or consulting for companies for applied research or development support. Furthermore, the university agencies for private consulting reportedly are not financially attractive enough for university researchers to engage in joint projects with industry.

Potentials for Improvement
Structural changes to formal requirements are advisable: scientific careers should be credited for industry cooperation activities as well, even if they do not result in published papers. Applied research awards or key performance indicators considering not only scientific but also exploitation excellence could be introduced for relevant science sectors. A wide range of potential instruments is deployed successfully in European countries to connect students during studies and researchers during their research with industry. Business skills are taught during the course of studies of researchers and engineers. Through these measures, a culture of industrial orientation can be fostered.

It is obvious that linking research with industry in Egypt is not possible to the same extent in all sectors, but some research areas are predestined for interaction with industry, such as all engineering subjects, agriculture, telecommunication and informatics.

Hypothesis 7

Regulatory and fiscal measures are not yet fully utilised for innovation in Egypt.

Findings and Reasoning
The MTI has demonstrated its ability to effectively realise coordinated strategies for innovation, e.g. with fiscal measures for the extension of the national added value in the marble business, accompanied by a support scheme carried out by the sectoral ETTIC. It is a good example of the practical combination of fiscal and innovation policy.

On the other hand, some other existing fiscal and subsidy measures are a serious barrier to innovation: petrol subsidies on the micro-level, for example, are a serious barrier to efforts targeting energy efficiency or the use of renewable energies. The effectiveness or impact of any programme related to energy saving or energy efficiency will be minimised by such petrol subsidies. Besides energy-related programmes, other general societal goals may be supported through fiscal measures, such as the export of plastics for recycling.

Potentials for Improvement
Regulatory measures and incentive programmes can be used as valuable tools to foster innovation. There are numerous positive examples the world over demonstrating that measures of this kind can have a positive impact and result in value outcomes. The enhancement of occupational safety is another field for potential regulatory actions to support innovation. Not only do enhanced requirements reduce accidents and their entrepreneurial and societal costs, they also stimulate investment in the necessary technical equipment and quality testing infrastrukture (construction site safety, safety of machinery operation, limitation of concentration of toxic substances in the workplace, etc.). An alternative to regulation would be incentive programmes for occupational safety such as awards or production site certification ("the safety-tested production plant"). Such an approach would also be a first step toward preparing a sufficient base for the adaptation of selected EC Directives, which will become mandatory over the next ten years.

Hypothesis 8

Innovation is a multi-actor-multi-task affair that requires intensive and well-functioning network links, communication and coordination among the Egyptian actors.

Findings and Reasoning
The European TrendChart Report on Innovation for the MEDA countries[8] described Egypt's National Innovation System as being characterised by a weak culture of dissemination and information, and thus showing an overall poor match between education and industry. The World Economic Forum lamented the difficult access to communication and information. Innovation and its support are a cross-sectional activity: research, education, economy, tolls and tariffs, energy, telecommunication, agriculture, finance and military are the ministry departments affected by general innovation policy on a macro-level. All of them are also potential policy makers, and innovation policy-making is a cross-sectional task. Structured coordination is essential to avoid wasting resources, to realise synergies, and to support the relevant actors in a non-disruptive way with con-

[8] European TrendChart on Innovation, Annual Policy Trends Report for the MEDA countries,2006

stancy of purpose. On the meso-level of research, the necessity for coordination of actors is equally evident.

Potentials for Improvement

Education and industry associations, public funding agencies, and subsections of ministries with specific tasks like the ETTICs are potential candidates for setting up networks, communication and coordination mechanisms on this level. Vertical integration of actors along the intertwined, but basically sectoral innovation value chain needs to be coordinated within a functioning structure: sectoral education, such as courses of study for the education of specific technicians or engineers, needs to be coordinated with industry demands, public sector purchasing and regulatory activities with the research needs and development strategies of companies.

Links between industry, research and education are fairly seldom established in Egypt on the meso-level. In some research institutions they are realised through the adoption of a demand-oriented concept of dissemination for research, and a focus on applied research – applied to the needs of Egyptian industry.[9] Applied, in this case, means not only research for new functions but also for new processes and the up-scaling of processes – innovation in a broader sense. In educational institutions, the concept of innovation and demand orientation should be open to adopting the needs of industry into the curricula. This applies both to vocational and to higher education institutions. While vocational training efforts are under way, evidence for coordination between higher education and industry was found only in isolated cases.[10]

4 Recommendations

Earlier studies and investigations have shown that Egypt has started on a promising way to foster innovation. Basically, we came to the same conclusion. This verdict is backed up by some up-to-date figures shown in the table below. In the left column, it compares Egypt in terms of competitiveness with the 25 participating African countries. In the right column, a comparison of Egyptian competitiveness is made with 125 countries.[11]

Some of these indicators are directly linked to innovation, such as the availability of scientists and engineers, the prevalence of foreign technology licensing, firm-level technology absorption, university/industry research collaboration, and company spending on R&D. As far as these indicators are concerned, Egypt usually ranks in the middle of the 25 African countries. Morocco and Tunisia rank significantly higher. This demonstrates that there is considerable space for improving the National Innovation System in Egypt (Figure 4).

In Chapter 3, we presented our main findings. We also presented some approaches for potential improvements. Since the emphasis of this study is on the ETTICs, we will now concentrate our attention on them and provide recommendations as to how they can play a more effective role in the Egyptian National Innovation System, thus increasing the ability of all relevant actors to become more innovative and competitive than they are today. Recommendations will also be made on the innovation policy level, where the ETTICs can play a more active role for the benefit of the ministry and in this way help improve the creation, ventilation and application of innovation.

4.1 Functional Legal and Organisational Structure for ETTICs

The MTI and its foreign cooperation partners began developing a set of sector-oriented technology transfer centres over the past years, the so-called ETTICs. These should act according to the principle of demand orientation, supporting industry in its efforts to modernise and innovate. Currently, the ETTICs are departments of the MTI, and almost all of them, as public authorities, are subject to its rules and chains of command. The recommendations made in this chapter are a direct response to hypotheses 3 and 4 above and partly to hypothesis 5 as well.

[9] Some positive examples exist: Alexandria University, CMRD and Cairo University do engage in common development and engineering projects.

[10] Seventy per cent of Egypt's more than 300 S&T institutions are involved in higher education, while only 16 per cent are involved in the productive sector. (UNCTAD, 1999, 14)

[11] Corresponding to data from the "Executive Opinion Survey", 2007

Notable Competitive Advantages			
Growth	Competitivness Index Technology	Rank out of 25 African countries	Rank out of 125 countries
3,13	Quality of competition in the ISP sector	1	33
3,04	Prevalence of foreign technology licensing	11	40
3,12	Internet access in schools	2	42
3,14	Government priorisation of ICT	11	42
	Other indicators		
10,02	Value chain presence	3	33
5,02	Railroad infrastructure development	5	46
5,03	Port infrastructure quality	6	49

Notable Competitive Advantages			
Growth	Competitivness Index Technology	Rank out of 25 African countries	Rank out of 125 countries
3,02	Quality of competition in the ISP sector	14	71
3,08	Prevalence of foreign technology licensing	7	54
3,06	Internet access in schools	8	52
3,01	Government priorisation of ICT	4	52
	Other indicators		
6,09	Value chain presence	20	95
8,01	Railroad infrastructure development	7	67
5,04	Port infrstructure quality	11	66
10,12	Extent of staff training	9	66
4,02	Quality of public schools	7	62
8,08	Private-sector employment of women	9	62
3,10	Availability of scientists and engineers	7	57
6,18	Informal sector	7	55

Table 1:

Indicators of competitiveness and innovation, sorted according to notable competitive advantages and disadvantages (Egypt compared with 25 participating African countries as well as with 125 countries world-wide)

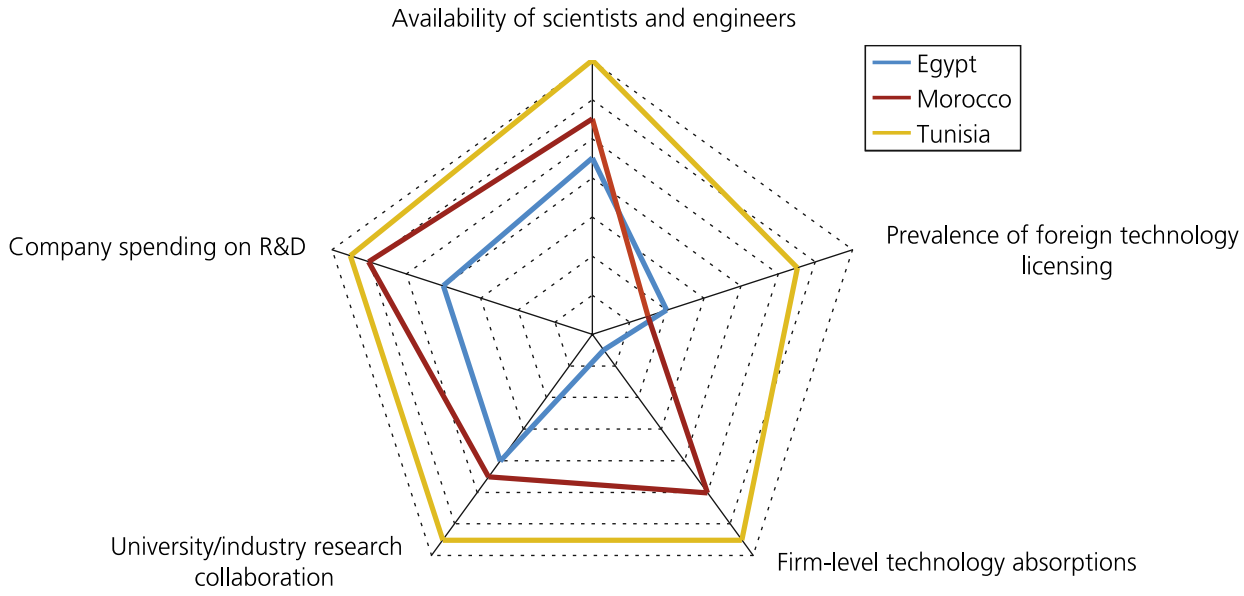

Figure 4:

Comparison of innovation-related indicators of Egypt, Morocco and Tunisia (relative comparison, high value means high ranking)[1,12]

Private law company as an appropriate legal frame for Egyptian TTICs

According to the principle of demand orientation, the ETTICs should serve their clients rather than executing a top down public regulation or administrative procedure. Today, the ETTICs are a specific part of the MTI. As a consequence, the Ministry chain of command hampers the flexibility of the operational work of the ETTICs. The ETTICs, as part of the MTI, can often not serve their clients adequately due to a lack of operational flexibility. Operational decisions of the ETTICs, as well as payment authorisations, cannot be judged properly unless they are based on client orientation rather than being part of the execution of a general administrative procedure. On the contrary, it is appropriate for the MTI in its function as owner

- to explicitly refrain from individual decisions concerning support or payment,
- to focus on public programme- or target group-specific measures for the support, and
- to control the overall financial results and societal impact of Egyptian TTICs.

These requirements suggest governing the ETTICs in the manner of a "holding company". The legal frame should, in the first place, give the ETTICs freedom and flexibility. Daily operational decisions should be fully in the responsibility of the ETTICs. The implementation of support is most effective when it is based on dedicated procedures and rules for the centres and/or the programmes they are to realise. The choice of a legal frame should take ease of management into account . For this reason, a well-known and often-used form of private enterprise such as a Ltd. is most appropriate.[12] In Germany and in Europe, many institutions similar to the ETTICs are legally constituted as Ltds. while being owned by public authorities. Table 2 lists some of the German ones.

Appendix I includes several examples of German innovation actors, of which most are publicly owned but have a legal constitution as a Ltd. Thus, such an approach would benefit both sides, satisfying all the needs of the MTI as well as those of the ETTIC. The legal frame should be identical for each centre. Freedom of decision in principle does not mean that the MTI loses control over the ETTICs. On the other hand, in the context of negotiation (and payment) of innovation *programmes*, the financing party MTI would directly or indirectly be in a position to make the *rules* for individual innovation support measures; these could be financial support, individual testing, development, consulting or any other support measure. Moreover, the standardised periodic overall planning and reporting activities, conforming to the legal framework and contingent individual by-laws, are powerful and well-tested tools for controlling the actions of the ETTICs.

Name of institution	Legal framework	Role within the German Innovation System (activity level)
Fraunhofer Society – FhG	Publicly owned, private law association	Mainly micro level research, all sectors
The Forschungszentrum Karlsruhe – FZK –Research Center	Publicly owned, private law limited corporation	Micro level research, focus on manufacturing technologies
Project Implementation Agency within the Forschungszentrum Karlsruhe (PTJ)	Publicly owned, private law limited corporation	Meso level innovation agency (generic scope)
VDI/VDE-IT	Owned by two associations, private law limited corporation	Meso level innovation agency, Macro level innovation consulting
Institute for Textile Research, ITV Denkendorf	Privately and publicly owned foundation	Meso and micro level research

Table 2:
Survey of selected German Innovation Implementation Agencies/Technology Transfer Centres

[12] European TrendChart on Innovation, Annual Policy Trends Report for the MEDA countries,2006

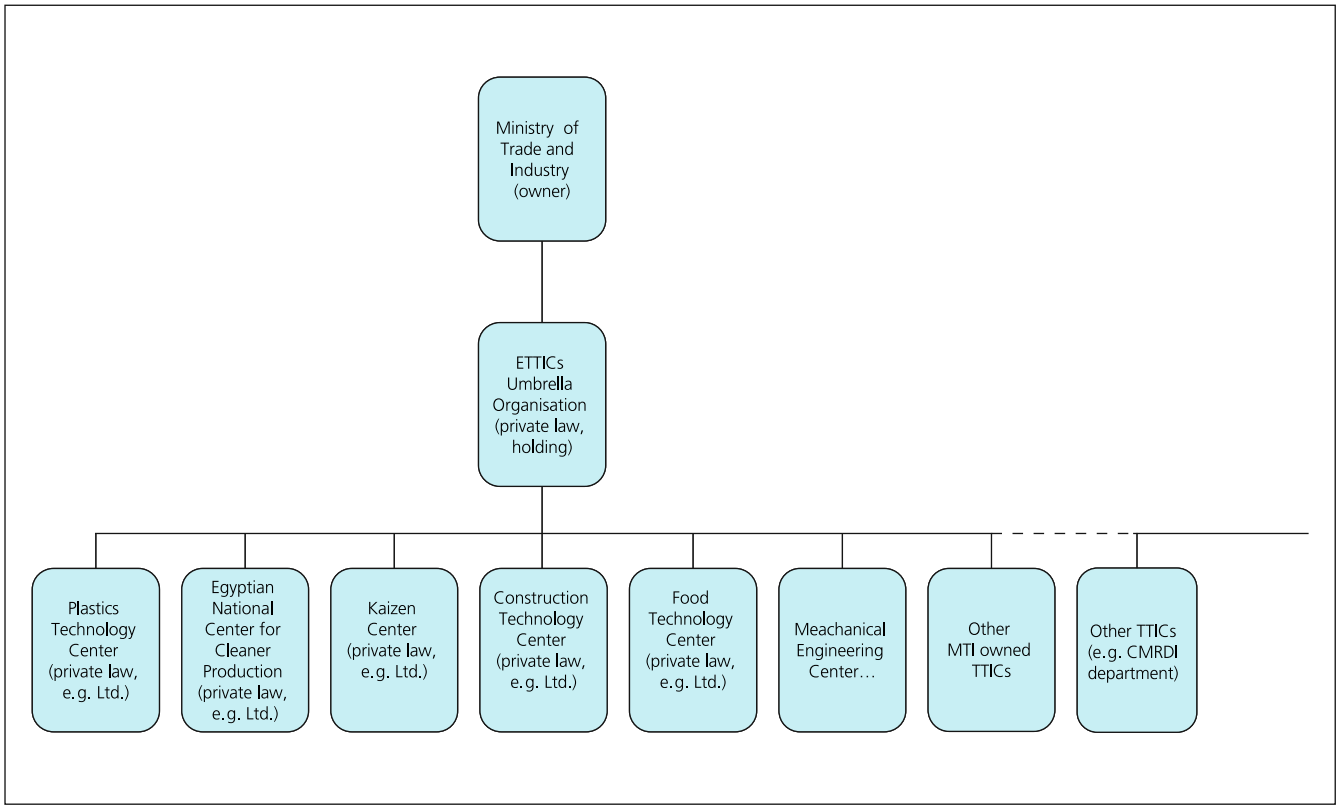

Figure 5:
Proposed legal and governance frame for ETTICs

Joint umbrella "holding company" for ETTICs

It appears also to be recommendable to subsume the legal ownership of the ETTICs under a common umbrella organisation. This entity shall

a) simplify the governing task from the perspective of the MTI as the owner,
b) enhance the coordination of roles of individual ETTICs and
c) address cross-sectional aspects and tasks.[13]

In this supportive and non-bureaucratic structural framework for action, MTI could take a leap forward in developing a powerful and directed organisation of ETTICs, which can for their part concentrate on fulfilling their clients' demands. MTI will be the owner of organisations which appropriately implement innovation policy through programmes, and it will have access channels to all relevant parties on the meso-level in the innovation system. It should be emphasized at this point that this *basic* innovation support infrastructure with all its established networks and competencies should be financed by the MTI, independently of directed innovation policies and programmes which must be financed by their respective owners. A task force composed mainly of MTI representatives, ETTIC managers and interested donor organisations could work out details to be realised by the MTI and the management of the ETTICs.

4.2 Coordination and Programming of Innovation Support

Egypt lacks a national science, technology and innovation plan to coordinate innovation policy and programmes on the macro- and meso-levels. In the past, the national foci on the science, industry and modernisation sectors were based mainly on isolated initiatives. Different financiers chose different channels of implementation without effective coordination or a client-oriented "single face to the customer" philosophy. Long-term perspective was scarce and not explicitly part of or integrated into an overall coordinated national vision. This issue refers to hypothesis 2 and, partly, hypothesis 8.

[13] These could, for example, be "learning from other TTICs", innovation prize awards, website maintenance, event service, legal and IPR services, etc. or common administrative tasks such as bookkeeping, consolidated reporting, etc.

A coordinated programming effort could for example consist of the following elements:

National Science, Technology and Innovation Plan

The Ministries in charge of innovation should finalise a national science, technology and modernisation plan. Capable innovation actors, such as the ETTICs or the IMC, should be actively involved in this process. Other meso-level actors from NRC, chambers of commerce, major universities and their associations should be assembled to negotiate the plan, in the context of an "S&T Plan Council", for example. The council should be supported by teams of technology experts and investment assessment experts, which should assess national efforts, competencies and societal benefits for the prioritisation of topics and elaborate alternative scenarios/roadmaps. The plan should identify and describe prioritised technological and innovation areas of high importance for Egypt and the relevant industry/application sectors for support, including measurable societal objectives as well. The elaboration of this plan is a mid-term project. The process should be guided on ministry level or by the Prime Minister himself.

In direct connection with the identification of industrial and science priorities, it is necessary to foresee and set budgets for innovation supporting initiatives.

The ETTICs and the IMC are two candidates for the task of supporting and advising the policy makers in creating a national plan of this kind. The IMC could be the most suitable organisation for ensuring the appropriate realisation of the process in the area of actions and initiatives more closely related to science and technology. Due to the competence and position of the ETTICs, which are very close to the industrial and scientific community, the ETTICs could also play a role in providing expertise in the field of company-based innovations and related measures (testing, mandatory quality infrastructure, etc.) through their expert network. Figure 6 shows a schematic drawing depicting the roles of all potential partners involved in the elaboration of a National Science, Technology and Innovation Plan.

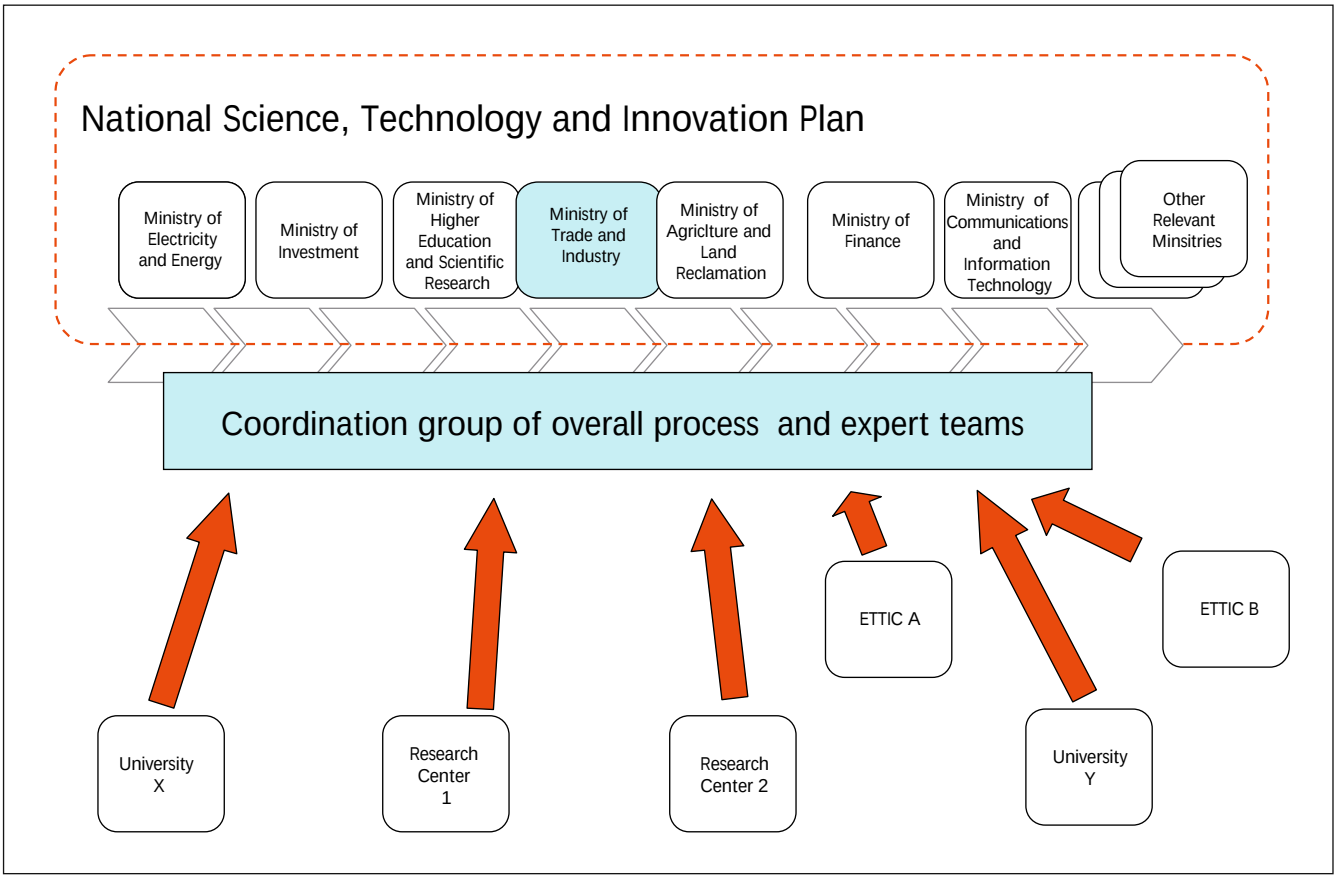

Figure 6:
Involvement of relevant actors in the development of a National Science, Technology and Innovation Plan

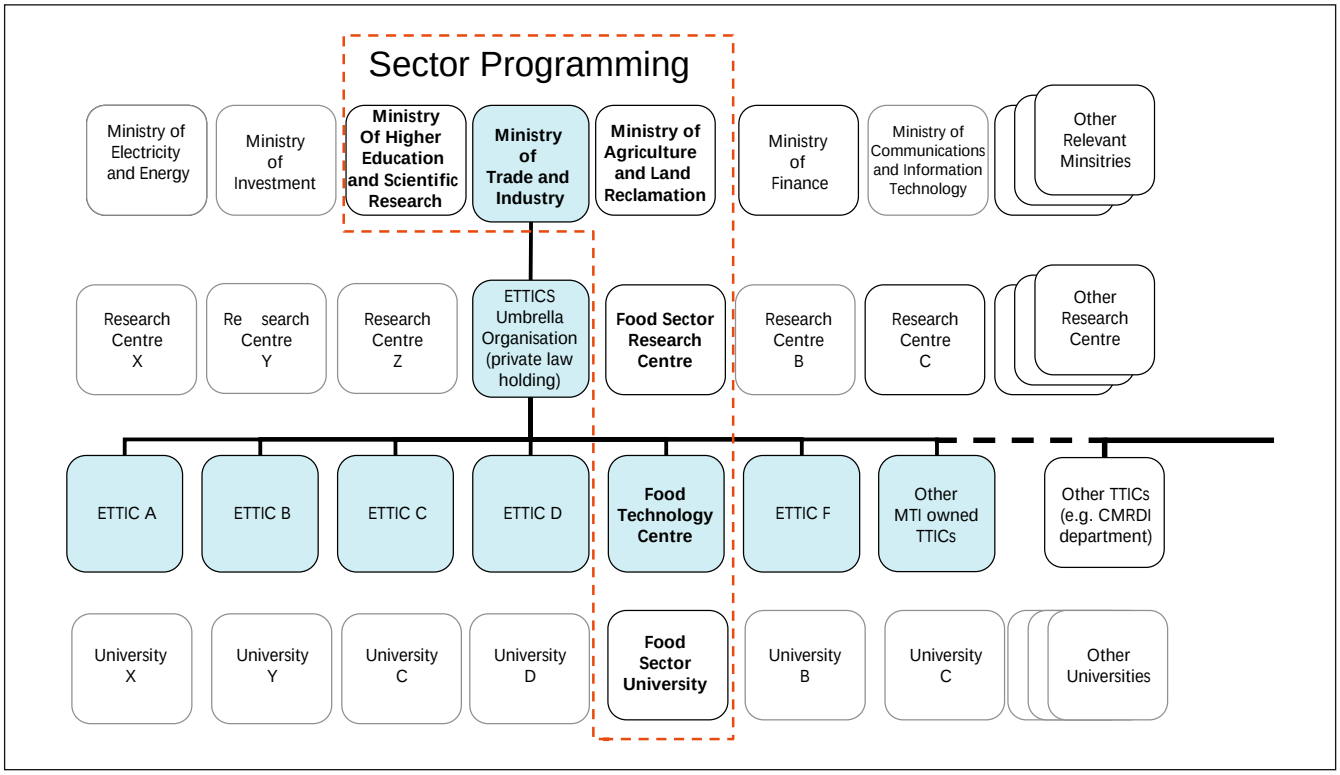

Figure 7:
Potential actors related to sector programming. Food sector example

Sectoral Programming

In the past, sector studies have been elaborated for an initial range of sectors, resulting in sector strategies and programmes (very often these sector studies were conducted by a certain ETTIC),[14] but they did not on the whole follow explicit national priorities. For this reason, the research sectors were not in all cases integrated in the planning. We suggest the creation of "sector councils", which could assemble major stakeholders from the relevant universities and research centres, chambers of commerce, ministries, and ETTICs. The sector councils should be supported by sector expert teams. They should perform sector studies with the following goals: to identify demands and potentials; propose appropriate funding and legal, fiscal, teaching, structural and consulting measures; form mid-term strategies for the targeted sectors; and identify appropriate impact and result indicators to measure the effectiveness of the strategy and the quality of the implementation.

Sector ETTICs could be the appropriate network organisations to ensure the realisation of this process, as "general contractors" or "permanent offices of the sector council" for instance. Figure 7 shows the main actors as far as sector programming is concerned.

Appendix II contains a survey of some interesting innovation support programmes and initiatives from all over Europe. It shows the broad spectrum of programme design features, all serving individual national priorities to be tackled by these programmes. This survey should demonstrate that there is no common approach for innovation support programmes, but rather individual country-specific approaches. However, all the programmes mentioned are intended to increase the innovation capabilities in those countries to further increase the competitiveness of the private sector.

Innovation Support Implementation and Monitoring

Dedicated (sector) programmes like these should be realised by single or multiple ETTICs for their respective industry sectors. Because of their meso-level networks, they are in an ideal position to address and support the target groups appropriately. Financial means from different ministries or multi-sector programmes can be administered and distributed to clients and individual ETTICs by the IMC. Sector monitoring studies ("programme evaluation") should be carried out periodically in order to collect facts for the redesign of existing and future programmes.

[14] The term sector here indicates a clearly defined, relatively homogeneous target group.

4.3 Strengthening the Capabilities of ETTICs and Establishing their Long-Term Role

In order to be truly capable of playing a stronger role in the National Innovation System, some training and supporting activities are needed to support the management and employees of the ETTICs, enabling them to perform their tasks competently. In the following, the main activities are described. These are based on hypotheses 4, 5, 7 and 8 established in the previous chapter.

Building up competencies in the framework of innovation and innovation policy

To design and implement publicly funded innovation programmes, management capability and scientific and technological expert knowledge are required. At the same time, a profound understanding of innovation on a societal and industrial level is necessary. On a micro level towards (potential) clients, modernisation and innovation have to make sense in an economic way. On the macro level, innovation must be justified by its societal objectives. Network building, network maintenance and cooperation management are other fundamental and challenging activities to be professionally executed by ETTICs.

Depending on the status of industry sectors and the targeted client groups, the training programme may include such features as: measures to raise public awareness ("Public understanding of science"); economic case studies for specific sectors; financing consulting; marketing for programme participation; and so on. For the ministry as a future potential client of consulting for programming, ETTICs should maintain methodological knowledge for roadmapping and technology foresight, market research, etc. Once a National Science, Technology and Innovation Plan has been set up, the ETTICs should put it into practice by setting up appropriate publicly funded programmes and initiatives. All these tasks must be professionally executed. They determine the capability required of the ETTICs (and their network experts).

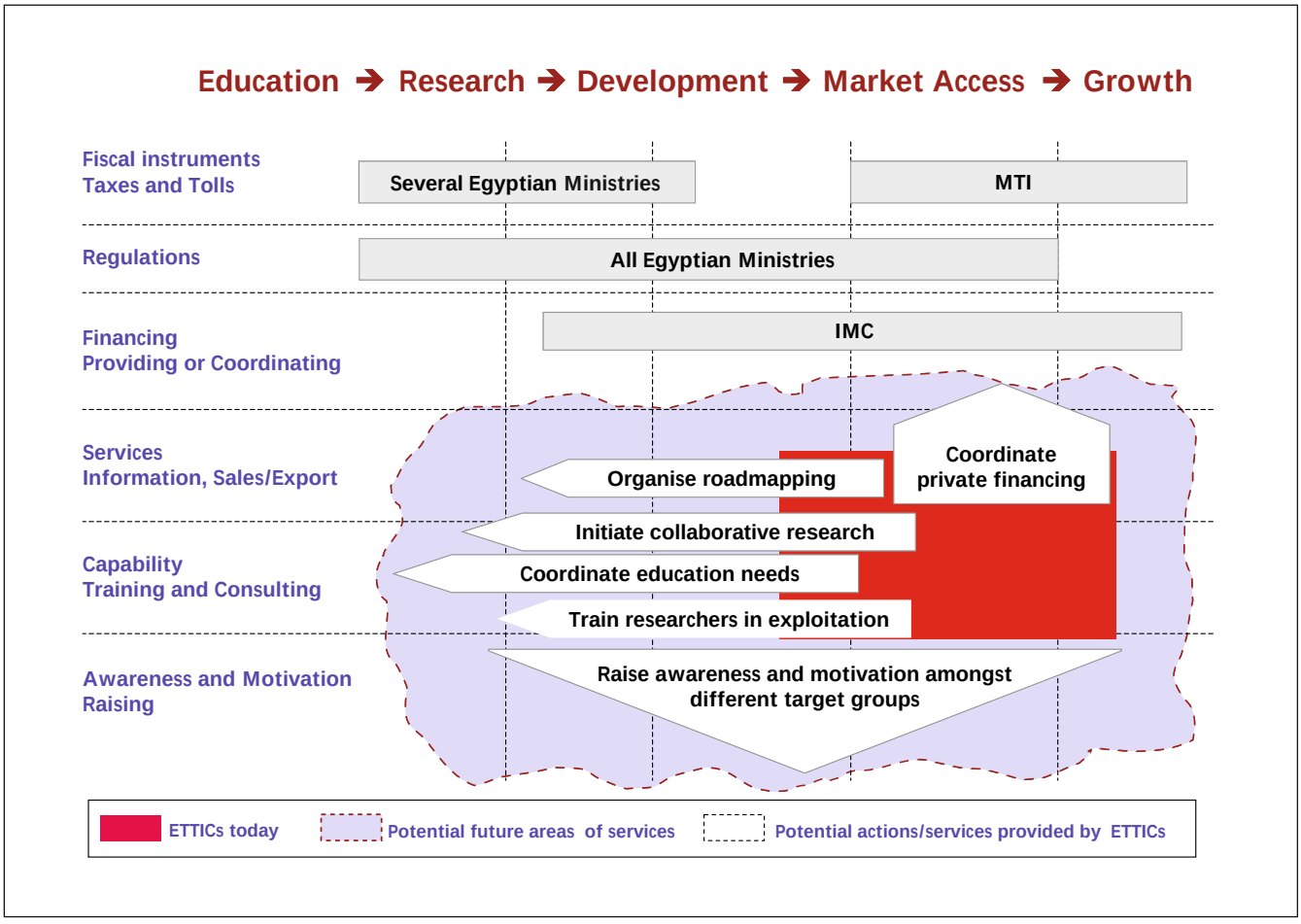

Figure 8:
Role of ETTICs – Status and Future Potential

Establishing long-term roles of individual ETTICs in the Egyptian National Innovation System

The role of the individual ETTICs within the National Innovation System should be specified and defined in writing. This specification process includes defining the spectrum of services and the fields of activities in which the ETTICs will be involved in the future. This planned enlargement must be carefully communicated to other ministries and innovation actors, in order to gain sufficient acceptance. Figure 8 shows the elements of the innovation value chain, the main actors and the tools available in order to turn innovation into practice. The red area depicts the field of current activities of the ETTICs. The blue area and the labelled arrows describe the area of future activities. This enlargement can be realised without generating any competition with other innovation players.

The items requiring specification include the sector, sector borders and interfaces to other sectors, a catalogue of general service offers, and a list of client groups in industry, research and education. As a result of the specification process, a mission and service offer portfolio, stakeholder policies, and a catalogue of required knowledge and capabilities for the ETTICs will be generated. It can be used for the further development of internal experts, human resources and network expertise.

An appropriate next step would be a joint study tour for the managers of the ETTICs to similar established centres in other countries. Most European countries have innovation implementation agencies that cover the exact tasks described by the blue area in Figure 8.

As a follow-up measure, ETTICs internal workshops for the development of service portfolios could be continued, taking the information gained during the study tour into account. Sector workshops assembling the major stakeholders could be utilised to acknowledge the service portfolio and to form or modify sector innovation councils. In any case, general management and innovation knowledge must be a cross-sectional competency to be explicitly required of all TTIC experts with client-consulting or training functions.

5 Critical Factors of Success for the Future of Technology Transfer and Innovation Centres

In the previous chapters, we concentrated on discussing the potential future tasks and objectives the ETTICs should fulfil within the Egyptian NIS in order to contribute to a higher efficiency. The success of the ETTICs, as well as innovation agencies in general, strongly depends on the extent of added value they are able to provide through the implementation of policy measures (“additionality”). In fact, this “additionality” is the main reason to extend the field of activities of the ETTICs.

Innovation agencies usually act as catalysts of demands and requests of the three major parties involved in innovation and innovation support:

- government and ministries (macro-level)
- associations, lobby groups and other multi-actor interest groups from research, education and industry, like sector business associations, chambers of commerce etc. (meso-level)
- individual organisations, companies, research institutes, universities (micro-level).

The innovation agency can operate on three different levels. The level of operation depends on the owner (initiator or financing party) of the innovation programme for which the innovation agency is responsible.

On the micro-level, support is provided for a specific company and focussed on a certain innovation task. The innovation agency provides a dedicated solution for the benefiting company. High technical skills are needed by the staff that provides this kind of services.

On the meso-level, support is provided for a certain technical or industrial area, e. g. through a support programme focussed on a specific technology, or a research centre for a business sector.

On the macro-level, higher public sector or government institutions act as initiators of innovation programmes or agencies, but may also be clients of innovation consulting. In an advanced NIS, actors are available on each level, all contributing to support the national industry and science in becoming innovative and competitive.

Regardless of the specific shape of a NIS and how advanced it may be, innovation agencies operating on at least one of the three levels must fulfil certain critical factors of success in order to meet the expectations of the programme owner or stakeholder. In this regard it does not matter how the innovation agencies are structured in detail. These factors are equally rel-

evant for the ETTICs today and in the future. In the following, the main critical success factors will be described with respect to the ETTICs.

5.1 Scope and Mission

Scope and mission differ from role and strategy mainly in that they are of a fundamental nature and change only slightly, even over longer periods of time. Independently of level and actor, the ETTICs need clearly defined missions and scopes of purpose. There are many good reasons for this requirement.

From the outside perspective of institutions, the following can be named:

- For clients, public displays of missions and scope indicate on first sight whether an institution or programme is suitable for their own intentions or requests.
- From the perspective of the financing parties, redundancy of institutions or programmes can be avoided.
- For owners and financing parties, mission and scope clearly indicate a constancy of purpose, which is of utter importance for the long-term support and/or financing of the agency or programme.

From the internal perspective, it may be noted that

- General scope definitions and mission statements *can* give directions to everybody as to what is intended and what is not. Mission statements are a very practical instrument to avoid endlessly detailed, specific, and often inappropriate internal regulations specifying strategies and operations. General scope and mission statements are most effective if elaborated together with all the experts involved in operational work, and, yes, also the back office. Seen this way, they are a management tool.
- General scope definitions and mission statements are formative guidelines for the development of strategies and measures. These must adhere to the mission and must necessarily be designed in such a way as to realise the mission. In this way, they are important for coordination purposes.

5.2 Defined Role within and Integration into the National Innovation System

Roles define specific functions of the ETTICs ("positioning"), and may also constitute perceived perspectives. "Export support", for example, is a clearly defined role. The roles of the ETTICs may vary from programme to programme, and are less constant than scope and mission.

National Innovation Systems are complex sets of diverse actors with diverse scopes, missions and roles. The actors need to cooperate in networks intensively. The role of the ETTICs also defines communication channels, boards and advisory groups, which the organisation or programme managers are invited to attend. The external perception should have equal capabilities provided by the innovation system actor. A clear communication of roles helps to avoid misunderstandings about intentions, capabilities and scope of action. In the rather intransparent world of meso-level innovation support actors, a clear perception of the role of the ETTICs' networking experts is a base to be identified as a potential provider of specific services in the future.

Moreover, from an explicit marketing perspective, the definition of the role is also an instrument for defining and communicating target markets, core competencies, etc.

5.3 Stakeholder Orientation

Stakeholder orientation primarily means shareholder orientation – serving the owner, supported by secondary concepts like (pretension of) customer orientation. This is also valid for the ETTICs.

But, for the ETTICs or any other innovation support agencies world-wide, life is not structured that simply. Usually, there is a long list of stakeholders:

- the society/people, usually financing the activity, expecting the money to be spent to foster societal progress, employment, general aspects of quality of life, etc.
- the government official in charge of representing taxpayers' intentions (who is quite often not 100 % identical with the public interest)
- the owner of the ETTICs, (industry association, public foundation, other not for profit organisation or privately organised professional association, or private companies)
- financing parties (e. g. in the case of base financing, major contractors or donors)

- the clients, the respective target groups of programmes, as defined in scope, mission and role
- cooperation partners in the innovation system, be they external experts or other cooperation partners. This may include owners and clients.
- employees, representing type and quality of professional capability and motivation
- In addition, "the environment" may also be considered a stakeholder.

Organisational theory and practice state that organisations which manage to provide benefits for all relevant stakeholder parties will prosper. This also holds true for the ETTICs. In a fairly political business like innovation support, it is helpful to build long-term ties with and between specific stakeholder groups to soften potential conflicts of interest.

5.4 Finance

"He who pays, rules!" True, but again, in the semi-public spheres of innovation support, financing comes from different sources. Different types of financing for ETTICs can be distinguished:

- a base financing, paid by members of an association or the government,
- fees for individual innovation support services, e.g. non publicly funded (parts of) innovation services for clients,
- fees for programme-based financing, paid by the (usually public) "owner" of the innovation support programme.

Which type of financing is predominant depends on the type of ownership, the scope and mission of the institution, and simply on "the market" – the market, in this case, indicating the disposition of stakeholders to fund an ETTIC. This, again, is determined by national research agendas, the missions of owners having the legal status of foundations, the decisions of owners in the legal form of professional associations, and the type of services delivered.

5.5 Legal Framework/Incorporation

In distinction to earlier plans, the ETTICs' task is also to foster innovation, through publicly financed programmes and other means. The corresponding missions of the ETTICs have not yet been adopted accordingly, which seems to be necessary. In addition, their legal framework must support the following basic preconditions:

1) ETTICs need to act in a transparent way, based on statutes and rules, to maintain the trust of all stakeholders in the credibility of their operations.
2) ETTICs need to perform their activities like a highly professional, dynamic, customer-oriented service company to support innovation rather than delaying or hampering it through formal constraints or bureaucratic burdens.
3) As an institution in a complex and ever changing environment, they should be able to flexibly reorganise themselves.

Condition number 1 is usually achieved through a combination of

- mission statement and formal purpose in the statutes of the association or the corporation
- contract clauses with descriptions of work and their related reporting
- (public) standardised evaluation criteria and standard operating procedures for the processes that lead to selections, financings or any other benefit for clients
- detailed formalised evaluation/ranking/rating feedback to applicants
- (semi-) publicly financed impact and activity reporting, at least towards governing bodies and major stakeholders.

Condition number 2 is usually achieved through

- a legal framework that allows the ETTICs to act just as independently as a private service provider
- excellent management abilities with exceptional communication and networking capabilities.

Condition number 3 is usually achieved through

- a small central organisation with a broad network of experts that are utilised on a case by case basis
- again, the freedom to make and end contracts in a statute and rule-based fashion, but without requiring external authorisation in individual cases. This is necessary, for example, to contract appropriate experts for limited periods of time in a non-bureaucratic manner.

It is of subordinate importance in which of the distinctive types of private or association legal frameworks the ETTIC operates, as long as it fulfils the conditions named above. Moreover, the status of a "not for profit" organisation may not always be helpful. In Germany, for example, this legal frame creates more barriers than benefits for a technology transfer centre. Standard legal frameworks have the big advantage that most questions have already been answered and as such they are easy to handle.

5.6 Governance and Management Capability

Governance may be considered here as the activity of formalised bodies in order to control, audit or support the ETTICs. They are an instrument of external control, but they may also be part of a participative management system, appropriately formalising crucial coordination between stakeholders and with other players in the innovation system. The private industry is adequately regarded in these governance bodies.

In the first place, governance for ETTICs is undisputedly the instrument for controlling the organisation with regard to the expectations of the MTI, just as it is for any other organisation. Shareholder or associates' meetings with standardised agendas usually fulfil this function. It must be stated that governing boards should audit results and plans according to legal requirements, and should strictly limit their influence on operational decisions. It is advisable to turn it more into practice in order to keep the management responsibility with the management.

Apart from this legally imposed supervision, supporting or advisory boards are widely used as part of essential coordination and networking activities. Supporting bodies, advisory boards, etc. may play an important role for the long-term integration into the innovation system, and realise the fine tuning of roles, cooperation potentials, joint activities, etc. Here, also, specific by-laws help to formalise the activity in a positive way, and to assure constancy of action.

Consequently, the number of governance bodies in total should reflect all constant and essential coordination topics with external parties. They should be assembled with representatives of cooperating innovation system organisations, possibly accompanied by professional experts. It is advisable to distinguish the (owner) spheres of auditing and supervision from the (innovation network coordination) spheres of consulting and support to the ETTICs. Boards are of a long-term nature, and should only be used for long-term, repetitive, clearly defined tasks. An "education curriculum board", for instance, could assemble educational institutions of the relevant sector, industrial employers and an expert on the respective sector of technology. A customer satisfaction board, including customers, could periodically evaluate and discuss customer satisfaction responses, and make proposals for improvements to the management, etc.

Representation in formalised boards attracts members as long as it is connected with clearly defined important tasks, titles and possibly an allowance. The repetitive nature of boards makes them a nucleus for long-lasting business networks.

Management capability for ETTICs should include sectoral technology competency. This is indispensable to credibly design, realise and evaluate the technological quality of the support measures, and in order to select the right professional experts for networks and tasks. With the same importance, management for ETTICs as network institutions should excel in coordination and professional comprehensive (service) business development competency.

Well-educated experts, internal or external, need rather to be coordinated than supervised, and rather motivated to learn in a self-determined way than be taught general aspects. Thus, organisational skills are necessary. Marketing competency is required to reach the targeted clients. In a knowledge-based organisation it is of utter importance to maximise the use of the entire available expert knowledge. From the perspective of behavioural management typology, a low-profile organiser, rather than a self-centred, power-oriented achiever, is the appropriate leader type for ETTICs.

6 Summary

A National Innovation System (NIS) defines the core actors of innovation, their behaviour and their interaction. There is no consensus on the exact definition of an innovation system, and the concept is still emerging. Innovation is often the result of the interaction among an ecology of actors, and the term 'innovation ecosystem' is occasionally used to emphasize this.

National research funding within a fully developed NIS is based mainly on two supporting elements: institutional funding and project funding. The latter is realised within publicly funded innovation programmes. Through project funding, public authorities are able to shape the course of research policies directly. This instrument offers the possibility of prompt and flexible responses to topical issues, new developments and challenges. The implementation of the programmes by the ministries is supported by programme management or implementation agencies.

To put a policy into practice, there are three main tools commonly available in a functional national innovation system:

- programmes and initiatives (mostly publicly funded),
- technology transfer and/or programme management and implementation agencies (like the ETTICs in Egypt),
- national laws and regulations.

Based on the analyses and interviews we conducted within this study, we came to the conclusion that the main actors within the Egyptian NIS have been put in place and that public awareness concerning innovation is increasing. Initial experience has also been gained by various ministries and institutions in setting up and managing publicly funded projects, most of them, however, financed by third country donors. This approach may have some advantages (e.g. external funding sources) but it also has disadvantages (strong dependency on externals, adoption of certain administrative regulations, especially in the case

of EC-co-funded initiatives). However, although there are positive signs and examples of innovation support activities, it is quite clear that there is ample room for improving and increasing their efficiency.

In this study, we concentrate particularly on the ETTICs with respect to their possible future role in supporting the MTI in putting its innovation-related political objectives into practice. We also ask what framework conditions would have to be changed in order to enable the ETTICs to fulfil their potential role as one of the main drivers of innovation in Egypt. The major findings (barriers) are described in terms of hypotheses and key recommendations (enablers) are made.

Finally, we come to the conclusion that it might be possible to improve the role of the ETTICs as national innovation drivers as well as to increase the efficiency and demand orientation of services provided by the ETTICs. Appropriate recommendations are made and European best practices described as well. It becomes clear that it is more a question of political commitment than financial or practical issues to follow the recommendations set forth here. It will be up to the MTI to decide whether the way we have proposed is in line with the political objectives of the MTI and suitable for Egypt.

Appendix I: German Key Players on Innovation

In the following, some German institutions, being actively involved in the German Innovation System, are characterised in brief and assessed according to the respective success factors mentioned in Chapter 5. When describing these institutions, a broad spectrum has been selected in order to demonstrate the wider spectrum of activities and the role of such institutions.. It should be noted that R&D departments in industry, academia and the non-university research institutions are also the driving forces behind Germany's scientific and technological abilities. Since the German NIS is quite diverse, the respective role of such institution is also very complex.

Fraunhofer Society

Institutional Profile

The Fraunhofer Society (German: *Fraunhofer-Gesellschaft*) is a German research organization with 56 institutes spread throughout Germany, each focusing on different fields of *applied* science (as opposed to the Max-Planck Geselllschaft, which works primarily on basic science). It employs over 12,500, mainly scientist and engineers. Nowadays, the Fraunhofer-Gesellschaft consists of more than 80 research units, including 56 Fraunhofer Institutes (universities), at 40 different locations in Germany. Some basic funding for the Fraunhofer Society is provided by the state, but about two-thirds of the funding are earned through contract work, either for government sponsored projects or from industry.

By developing technological innovations and novel systems solutions for their customers, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their region, throughout Germany and in Europe. Their research activities are aimed at promoting the economic development of our industrial society, with particular regard for social welfare and environmental compatibility.

Fraunhofer-Gesellschaft is a fixed element in the German research landscape. It is committed to excellence in its research activities and maintains close ties with institutions engaged in fundamental research. The purpose of Fraunhofer-Gesellschaft is to transform scientific findings into useful innovations. In this way, it helps to further economic growth, structural evolution and full employment.

The Fraunhofer-Gesellschaft is also active on an international level: Affiliated research centres and representative offices provide contact with the regions of greatest importance to present and future scientific progress and economic development.

Legal Framework

The Fraunhofer Society was founded in Munich on 26 March 1949 by representatives of industry and academia, the government of Bavaria, and the nascent Federal Republic. Nowadays, the Fraunhofer Society and its institutes are owned by the German public, the federal government together with the German *Länder*, "owns" the Fraunhofer Society.

Role within and Integration into the Innovation System

The Fraunhofer Institutes undertake applied research of direct utility to private and public enterprise and of wide benefit to the society. As a consequence, Fraunhofer Society can be considered as one of the key actors in the German NIS, especially in the field of applied research. Fraunhofer Society is excellently integrated in the German system and respected as neutral partner for science, industry and public. Fraunhofer Society takes active part in the ongoing dialog between the scientific community and the general public. It openly participates in the political and social debate surrounding areas of research in which it is active or concerning which it is capable of presenting factual information. The so called Fraunhofer model is internationally well known and exported all over the world.

Stakeholder Orientation
Fraunhofer-Gesellschaft acts autonomously in defining its own strategic orientation, on which it bases its planned research activities. This orientation is closely aligned to the objectives of national and European economic and research policy. It is an independent organization and takes a neutral stance with respect to the demands of individual interest groups in the domains of politics, industry or society.

Financing
The Fraunhofer Society earns ca. 60 % of its income through contracts with industry or specific government projects, whereas the most industrial research projects are co-funded by the public. The other 40 % of the budget is sourced in the proportion 9:1 from federal and state (Land) government grants and is used to support preparatory research. Last years an annual research budget was about €1.3 billion. This funding model applies not just to the central society itself but also to the individual institutes. Of the €1.3 billion, more than 1 billion is generated through contract research. Two thirds of the research revenue is derived from contracts with industry and from publicly financed research projects. Only one third is contributed by the German federal and *Länder* governments in the form of institutional funding.

Dependency on Governmental Investments in Innovation
The size of the society's budget depends largely on its success in acquiring industrial research projects. As a consequence, there is a significant dependency of Fraunhofer financial overall budget on the amount the German government is ready to invest. It is not that strong as for other innovation actors, since the Fraunhofer Society also has other financial resources, like R&D projects completely financed by the German industry or international R&D projects funded by the European Commission. Nevertheless, the 40 % co-financing of the annual budget coming from the federal and state government grants, directly depends on the amount of money the Fraunhofer Society was able to acquire from industrial or public funded R&D projects.

Focus on Innovation Level
Consisting of more than 40 institutes, the Fraunhofer Society covers all scientific fields of *applied* science. Therefore it is the most dominate player on the micro-level. Fraunhofer researchers. Fraunhofer provides a dedicated solution for the benefiting company solving its innovation challenge.

To a minor extent, some Fraunhofer institutes as well as the Society itself is also active on the meso- level since it is sometimes in charge to run projects more related to an industrial sector, like manufacturing. In these cases Fraunhofer is involved in conducting sectoral studies or market analyses for different clients.

Forschungszentrum Karlsruhe (FZK)
The Research Center Forschungszentrum Karlsruhe

Institution Profile
Forschungszentrum Karlsruhe (FZK) is a research organisation divided into the "Research Division" and the "Decommissioning Division". The Research Division consists of four executive divisions and comprises a number of scientific institutes and organisational units fulfilling supporting tasks in infrastructure and is active in eleven research programmes. The research and development programmes of the FZK are of public interest and serve peaceful purposes exclusively. They extend over areas of industrial pre-commercialisation phase research, product and process development, provident research, and fundamental scientific research. In pursuing these research activities, the FZK cooperates with partners in science and industry. Furthermore, it operates large-scale facilities also for external users. Since the beginning of the eighties, the focus of activities has shifted from the development of nuclear engineering, the task defined when founding the centre, to a broader spectrum. Main features of the tasks pursued today are their complexity, long-term objectives, and the necessity of multidisciplinary cooperation. Today's research and development activities of the FZK are embedded in the superordinate programme structure of the Helmholtz Association of National Research Centres and concentrate on eleven programmes in five research areas.

FZK has more than 3800 employees, of these, approx. 1420 scientists (including 190 foreign guests), 60 professors, 185 pre-doctoral students, and approx. 300 trainees. In the Nuclear (without the Karlsruhe Reprocessing Plant) 156 persons are employed, of these, 112 in the Central Decontamination Department. The research activities cover a total of 11 programmes in fiveresearch areas. There are 22 scientific insitutes and scientific and technical central departments.

Legal Framework
FZK has been founded in 1956 and is owned by the German government, represented by the BMBF (90 %) and the State of Baden-Württemberg (10 %).

Role within and Integration into the Innovation System
Due to its excellence competences in science and technology, FZK is a strong player in the innovation landscape in Germany. Researchers of FZK have many core competences in fundamental research, especially in emerging technologies, like nuclear technology, nanotechnology, etc. In addition, FZK is strongly linked to the BMBF and other ministries responsible for the innovation strategy in Germany.

Stakeholder Orientation
FZK mainly belongs to BMBF and therefore also depends of BMBF's innovation policy. This gives FZK a strong position in this field, however they are not too flexible. The director of the FZK is also the state secretary of the BMBF. Due to the scienfic competences and its size, FZK has a grave position in the German innovation landscape.

Financing
As a public organisation, FZK's budget consists of an institutional budget and a R&D budget which comes from public funded R&D programmes. The latter is quite flexible and must be acquired on a conventional way. Nevertheless, due to the excellent reputation, the overall financing is never an issue for FZK.

Dependency on Governmental Investments in Innovation
FZK is very active in the field of innovation and gains its main budget from public sources. As a consequence, FZK very much depends on the readiness of regional or federal Ministries and Programme owner to invest in innovation. FZK does not have any income on commercial base.

Focus on Innovation Level
FZK covers a broad spectrum of fundamental and applied science. Therefore it is the most dominate player on the micro-level, comparable to the Fraunhofer Society.

Project Implementation Agency within the Forschungszentrum Karlsruhe (PTJ)

Institutional profile
Embedded within the FZK, there is one of Germany's leading project management organisations (PTJ). With the capacities in research and innovation management PTJ serves different contractors at federal and federal state level and in the European Commission to realise their research targets. In 1974, the Federal Minister for Research initiated the foundation of PTJ within the FZK. In the beginning its brief was to implement the Federal Governments Energy Research Programme. Today, the staff of around 340 employees acting in ten fields of work covers a broad thematic array.

The main scope of activities comprises:
- Determination of the research need together with representatives of industry and science
- Initiation, conception, and design of R&D projects
- Scientific and organisational consulting of applicants and beneficiaries
- Assistance in project execution in terms of contents and administration
- Commercial and administrative execution of R&D projects
- Dissemination of research results, with particular emphasis lying on smaller and medium-sized enterprises (SME)
- Support in the launching, design, and execution of international cooperative ventures to promote European and international research
- Management of European R&D projects

Legal Framework
FZK is only stakeholder of PTJ. Nevertheless, PTJ operates as a largely independent unit within FZK, using the qualified scientific environment and relying on an efficient infrastructure.

Role within and Integration into the Innovation System
PTJ is partner and co-designer in the funding of scientific research and technical development. Its main task as a programme implementation agency consists in supporting federal and regional ministries and other programme owner in the programme-bound project funding and dissemination of research results.

Since there are many programme implementation agencies existing in Germany, PTJ plays an important role, since it belong to the bigger implementation agencies in Germany, but do not play any dominant role. PTJ manages an annual programme budget of several hundred Mio EUR on behalf of different Ministries.

Stakeholder Orientation
PTJ is an administrative department of FZK and can operate quite independently of it. Since FZK as well as PTJ belongs to 90 % the German government, mainly the Ministry for Education and Research (BMBF), there is a strong dependency of the BMBF in practise. As the main owner as well as contractor of PTJ the BMBF can easily steer the strategic and operational work of PTJ.

Financing
The financing of PTJ's work is mainly based on management fees for the implementation and management of public innovation programmes, mainly on behalf of the BMBF. The annual budget is guaranteed by the stakeholders, whereas the total amount slightly differs from year to year. It mainly depends on the overall amount of programme funds PTJ is managing. PTJ is not allowed to operate on a commercial base, e. g.. for private or industrial clients

Dependency on Governmental Investments in Innovation

Since public money is the only financial source of PTJ, it strongly depends on public investments on innovation, mainly on investments of the BMBF. This dependency is reduced by the fact that the annual budget is assured since PTJ is a public body.

Focus on Innovation Level

As a administrative oriented programme implementation agency, PTJ mainly operates on the macro- level. It is responsible for the design, implementation and management of public funded programmes, which are mostly generic ones (no dedicated technical focus). The staff of PTJ mainly operates on administrative and management level. Technical experts are acquired by external experts from case to case.

VDI/VDE Innovation + Technik GmbH (VDI/VDE-IT)

Institutional Profile

VDI/VDE Innovation + Technik GmbH (VDI/VDE-IT) is known as a reliable partner in economics, research and politics for more than 25 years. With the product lines research funding, technology politics, and innovation management, VDI/VDE-IT covers the whole spectrum of the innovation process from research over implementation to market production and utilisation of new technologies.

VDI/VDE-IT accompanies the clients in fulfilling their visions with our competences and experiences in important key technologies like microsystems technology, bio and nanotechnology as well as multimedia, which are used in key industries such as automotives, mechanical engineering or plant construction. For the individual needs of our customers, we continuously develop new ideas and methods.

The interdisciplinary team of more than 100 natural and social scientists, engineers and economists is designing the future day by day. They do not only solve the individual customer tasks, but also make a valuable contribution to accomplish urgent economic and social challenges for instance in health care and environmental protection.

Federal research programmes are an important motor for innovation. As partner of the government, states and the European Commission, VDI/VDE-IT ensures the tailor-made design, implementation and realisation of the respective funding programmes. The programmes VDI/VDE-IT is responsible for support the goal-oriented transfer of research and development results into trend-setting products and therewith ensure the political success of the research programmes. VDI/VDE-IT also organises conferences and contests on national and international level and arrange access to experts and their know-how for our customers. We make complex technology-political topics manageable and show how socially relevant problems can be solved by means of technology. This is our contribution to ease the access into new technologies and make them more acceptable in the society.

Legal Framework

VDI/VDE-IT is a commercial company, owned by the both German association VDI and VDE, since 1989. Before, VDI/VDE-IT only belonged to the VDI.

Role within and Integration into the Innovation System

VDI/VDE-IT plays an important role in the German Innovation System. It is very much linked to main innovation players like BMBF, BMWI, VDI, VDE and others. Compared to other German Implementation Agencies, VDI/VDE-IT is middle sized with its 130 employees. In addition, it has excellent links to the industry on national as well as on international level.

Stakeholder Orientation

VDI/VDE-IT can operate quite independently from its both shareholders VDI and VDE. In addition, as a commercial innovation service provider, VDI/VDE-IT operate very demand oriented according to its client's needed.

Financing

As a commercial innovation service provider, VDI/VDE-IT does not have any fixed budget. The main part of the annual turnover of €16 Mio is earned by the management and implementation of public funding programmes.

Dependency on Governmental Investments in Innovation

The business of VDI/VDE-IT is strongly related to innovation. As a consequence, VDI/VDE-IT depends on public investments in innovation, but not too much, since a significant part of the turnover comes from commercial innovation related business

Focus on Innovation Level

VDI/VDE-IT is mainly active on the macro and meso activity level. As a programme implementation agency, VDI/VDE-IT manages thematic as well as generic innovation supporting programmes. In addition, dedicated activities are related to certain industrial sectors, like Micro- and Nanotechnologies, ICT or Renewable Energies. By means of market and technology studies as well as evaluation, VDI/VDE-IT serves according the specific needs of the sectoral clients.

Institute for Textile Research (ITV Denkendorf)

Institutional Profile
ITV Denkendorf is the biggest textile research institute in Germany, founded in 1921. It covers the whole innovation chain from raw materials to marketable products. Consultation as well as active support in technology transfer issues of medium-sized industrial partners forms the basic tasks of ITV Denkendorf – the Institute for industrial joint research.

ITV initiates research projects for the benefit of the industrial partners. It is governed by a scientific committee with members from textile fibre industry/mechanical engineering, teaching institutions and associations. Progress in scientific and technical developments is usually presented at conferences and colloquia regularly taking place at Denkendorf where problems in textile research and industrial practice are discussed with experts. ITV Denkendorf is also directly involved in applied oriented research activities. It contains central testing laboratories as well as up to date research facilities. The director of the ITV Denkendorf also holds the chair at the Technical University in Stuttgart, which results in perfect connection to the university. The testing laboratories are accredited according to ISO 17025 and are internationally recognised.

Beside R&D activities ITV Denkendorf also consults its clients in different areas, mostly related to innovation and commercialisation of new textile based products and manufacturing technologies.

Legal Framework
ITV Denkendorf is owned by the German Institute for Textile Research Denkendorf (DITF), which is a foundation with more than 300 employees and an annual turnover of € 18 Mio EUR. DITF gathers three different research institution, one of them is the ITV Denkendorf.

Role within and Integration into the Innovation System
As a Technology Transfer Centre for the German textile industry, ITV Denkendorf plays an important role as innovation service provider in this sector. It is very much linked to the sectoral innovation system (textile and textile manufacturing). In this respect, ITV Denkendorf is one of the main player we have in Germany.

On the national level, ITV Denkendorf has a weaker position, which is quite typical for such a kind of Technology Transfer Centre. Nevertheless, it has an excellent international reputation.

Stakeholder orientation
ITV Denkendorf's policy and strategy is dominated by the DITF and very much in line with the industrial needs of the German textile industry. Due to its international activities, DTV Denkendorf has also a high international reputation. As main service provider for the German textile industry, DTV Denkendorf reveals a strong stakeholder orientation in day-to-day business.

Financing
The annual budget of DTV Denkendorf is composed of 40 % industrial research project funded by industrial clients as well as 60 % by publically funded research activities.

Dependency on Governmental Investments in Innovation
ITV Denkendorf is not too much depending on public investments in innovations, since the major part of the annual budget derived from the industry. For sure, some significant contributions are expected from the public, but compared to other innovation players, the dependency is quite low. The overall competitiveness of the German textile industry as well as the overall economic situation has a more considerable impact on the business of the ITV Denkendorf.

Focus on Innovation Activity Level
As a sectoral innovation service provider, ITV Denkendorf very much operates on the micro and meso activity level. By means of its scientific competences and the research and testing facilities, ITV Denkendorf is able to provide dedicated technical support for its clients. It is also very much involved in applied research projects, together with industrial companies.

Representing the interests of the sector (textile) ITV Denkendorf is also capable to provide innovation related services for the whole textile sector in Germany, by conducting market or technical studies, workshops, training, etc.

WISTA – Germany's Leading Technology Park

Institutional Profile
The WISTA, located in Berlin, is Germany's leading Science and Technology Park. Since 1991, the location has developed on an area of 4.2 square kilometres (1,038 acres), embedded in an overall urban planning project of Berlin. Nowadays WISTA hosts more than technology oriented firms with around 4,600 employees and 12 non-university affiliated research institutes with around 1,600 employees, of which 800 are scientists.

The main technical areas, the WISTA members are dealing with are:

- Information and Media Technology
- Photonics and optical technologies
- Material and Microsystems Technology
- Environmental, Bio and Energy Technology

The Science and Technology Park also includes the natural science institutes of Humboldt University Berlin with 6,600 students, additionally WISTA is Berlin's biggest media location with 145 companies.

WISTA offers a broad spectrum of services to its clients, like acquisitions, letting, leasing and sales or communication and marketing. Services are also provided for settling external companies or for accelerating business start-ups. The main assets of WISTA are a comprehensive building infrastructure, international networking and conference as well as event services.

Legal Framework

The WISTA Technology Park is managed by the WISTA-Management GmbH. The shareholders are the Federal State Berlin as well as other public regional bodies. Several legal bodies take care of distinctive Technology Park and innovation services. Innovations-Zentrum Berlin Management GmbH e. g.. houses and services an incubator type of real estate, and OWZ – Internationales Gründerzentrum is an institution dedicated to support international networking.

Role within and Integration into the Innovation System

Representing such a big amount of companies as well as research institutions, the WISTA plays an important role in the regional innovation system of Berlin. In this region, WISTA is very much linked to programme owners and other important regional innovation actors. Due to its shareholders, WISTA also receives a strong politically backing in the Berlin region.

On national level, WISTA has a good reputation, but is not considered as strong as on regional level. Nevertheless, WISTA seeks to extent its network within Germany and on international level.

Stakeholder Orientation

The management of WISTA is done by a professional agency, which operates as service provider. As a logical consequence, this management agency on one side operates very much service oriented. On the other side, WISTA has to contribute fulfilling the expectations of its shareholders wishing the WISTA to turn the regional innovation strategy into practise.

Financing

WISTA is mainly financed by the rental income of tenants of the Technology Park and services offered on a commercial base. Since many years WISTA do not need any additional public funds, which was needed in the beginning.

Dependency on Governmental Investments in Innovation

Since WISTA is able to cover all expenses by its own, there is no dependency on public investments in innovation.

Focus on Innovation Activity Level

WISTA mainly operates on the micro activity level since it offers full service directly for companies and start-ups. The clients are coming from different areas, whereas WISTA does not have a dedicated technical focus.

Comprehensive Overview

The following table lists the presented organisations and characterises them with regard to the critical success factors of ET-TICs:

Institution	Legal Framework	Role within NIS Activity Level	Primary Stakeholders	Financing	Financial Dependency on Governmenal Innovation Policies and Investments	Focus on Innovation Level	Technical and Scientific Competence
FhG	Publicly owned, private law association	Micro level Research mainly, all sectors	Federal and state Governments	Mainly public App. 20% base, rest project based	High	Micro	Very high
FZK	Publicly owned, private law limited corporation	Micro level Research, Meso level innovation agency, production technologies	Federal Government	Large public base financing, research project funding, Public Innov. programme contracts	High	Micro	Very high
FZ K/PTJ	Publicly owned, private law limited corporation	Micro level Research, nuclear and single other sectors, Meso level innovation agency (broad scope)	Federal Government	Mainly public base for research, base and project. Few public Innov. programme contracts	High	Macro	Low
VDI/VDE-IT	owned by Association, private law limited corporation	Meso level Innovation agency, Macro level Innovation consulting	Federal Government	Mainly public innovation programme funding, innovation project contracts	High	Macro and meso	Medium
ITV Denkendorf	Privately and publicly owned foundation	Meso and micro level research	Industry Association and members, state	Private as well as publicly subsidised research contracts	Medium	Meso and micro	High
WISTA	Publicly owned private law corporations	Macro and Meso level. Micro level support	State of Berlin (Real estate) Various state and public donors (support)	Real estate: self financed. Support measures: publicly highly subsidised	Low (Real estate) High (support)	meso	Low

Table 3:

Auccess factors for selected innovation actors in Germany

Appendix II: Innovation Programmes and Systems in European Countries

Introduction

The expenditure for innovation in the EU Member States and related countries is over €200 billion per annum and growing. The overall impact of innovation on competitiveness, sustainable economic growth and quality of life, however, is limited by the fragmentation of national innovation programmes. All EU Member States and related countries have set up innovation programmes into force, considered to be one of the most import tools to implement a nation's innovation policy. Closely linked to that approach are the National Implementation Agencies. Although the funding Ministries are completely responsible for these programmes, all of them have appointed National Implementation Agencies to implement and manage the respective programmes. The Ministries rely on these agencies that cover the complete administrative process with all facets.

It is worth to mention that all these national programmes are mainly designed to follow country-specific issues. As a consequence, the thematic priorities as well as the individual programme design features very much differs.

Innovation programmes in Europe are closely linked with the respective implementation agencies. Figure 10 shows a simplistic overview of the research landscape in each country, including the dominant type of programme (framework, generic or thematic programme types) and the degree of diversity of programme implementation agencies. The structure in the larger countries is particularly complex with programmes funded by Ministries, Research Councils and a variety of Agencies. Germany is a good example, having more than 10 different Implementation Agencies in charge to manage and implement the different innovation programmes.

At the other extreme, some countries have established a single organisation to coordinate and manage all research programmes. This is obviously more common in the smaller countries. In the medium size countries, there is a wide range of different organisational models and programme policies. Implementing agencies are a common feature in European countries for managing the national programmes on behalf of the funding Ministries. The innovation and programme implementation activities are constantly changing and are particularly dynamic in the new EU Member States. This is another illustration of the relative diversity and fragmentation of national programmes across Europe.

Applied innovation programmes are, typically, sponsored by economic or industry ministries of a nation. Thematic applied research, particularly for non-industrial research on societal issues like agriculture, environment and transport, is normally carried out by another ministry or delegated to a specialist agency. In some countries, however, the industry ministry may also sponsor applied non-industrial research.

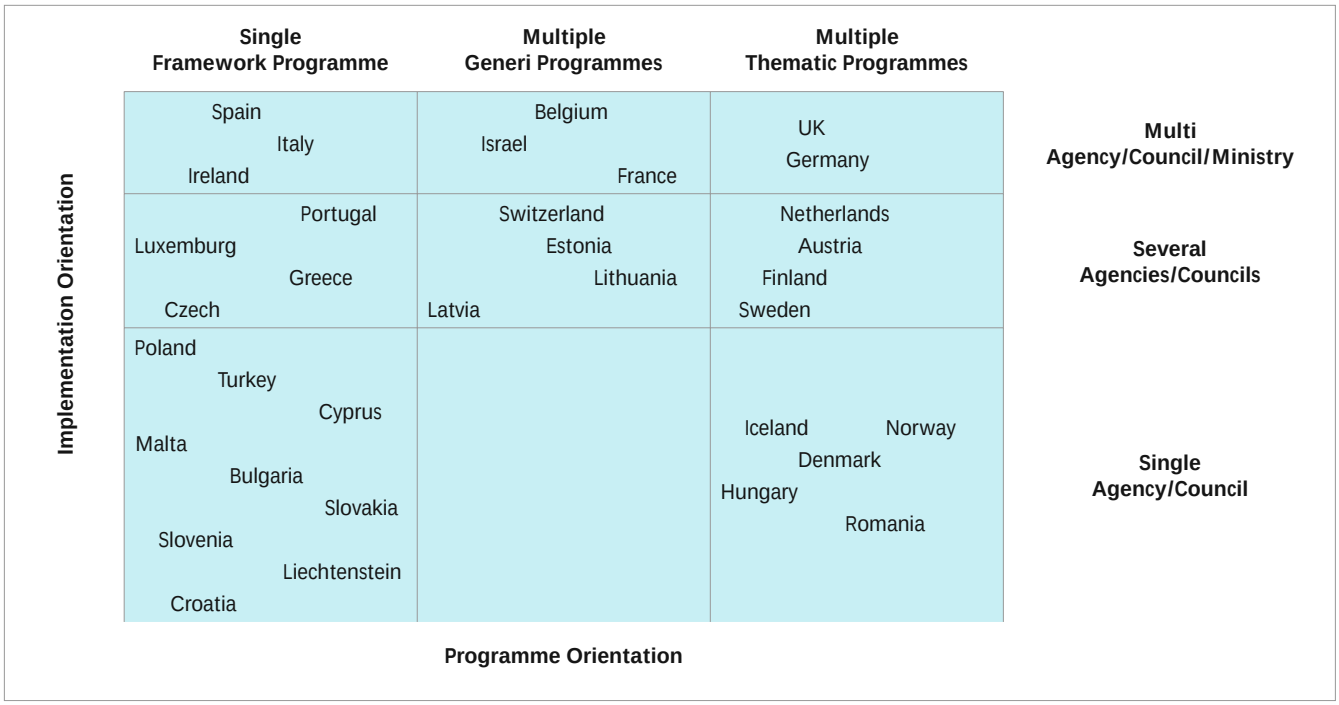

Figure 10:
Programme and implementation orientation in Europe

In general, the national strategies in Europe seem to depend on economic size and location within Europe:

- The larger economies tend to have a complex administration implementation structure and a fragmentation of programmes across government ministries and agencies. Thematic prioritisation is common because of the intense national competition for funding.
- More integrated programme administration structures are apparent in the medium sized countries particularly in central/northern Europe. The favoured model seems to be a Research Council for scientific research and an Implementation Innovation/Technology Agency for applied research. Generally, these are cross-funded by various ministries.
- The most common model in eastern/southern Europe and smaller countries is an R&D framework programme. These have many forms. Some, particularly in the new EU Member States, are designed for partial alignment with the EU RTD Framework Programme. Others are aligned to multi-annual development plans.

In the following we present some relevant innovation support programmes in selected European countries as well as the NIS of most European countries.

Selected Innovation Programmes

In the following we highlight several interesting examples of innovation programmes and design features. The following examples were selected because they offer contrasting perspectives and experiences at both policy and programme level across the different types of programmes. They are typical of the innovative approaches that are being taken in different European countries to achieve the benefits of transnational cooperation and the difficulties that they have encountered.

- Aide à l'innovation Programme (France)
- Corint Programme (Romania)
- Industrial PhD Programme (Denmark)
- ProInno II Programme (Germany)
- Research & Technology Innovation Fund (Hungary)
- Aide à l'innovation (France)

Key point summary

- Programme re-designed to encourage more international projects
- Flexible and open ended programme, delivered through regional offices
- Annual budget of €215 million

Overview of the programme and its objectives

Aide à l'innovation is a programme to increase innovation activities mainly within SMEs. This includes the creation of innovative companies, supporting technology transfer projects in business (ie to develop new products or processes, to support access to external competencies), to find investors and/or partners in France or abroad, accessing financial markets and feasibility studies. The programme is a modification of two prior measures 'support for the creation of innovative companies' and 'support for technology transfer'. Furthermore, within the programme, a special initiative called "youth and innovation" is carried out in order to help young people creating their own innovative project or company and to contribute a better professional integration for young people.

The Aide à l'innovation programme has since been redesigned (with the agreement of the Ministry for Industry, SMEs and Research) to change its perspective towards the support of European aspects of competitiveness and innovation. This was based on increased interest in transnational activities from programme users.

The main objectives of the programme are to:

- Support the achievement of national markets,
- Motivate collaboration and cooperation with partners,
- Smooth the way towards international markets,
- Sustain growth and employment through the development of innovation,
- Support the access to financial markets and specific funds for the development of SMEs.

Projects to be supported must show a high-technology content, have economic interest, have high growth potential and take into account the creation of employment. The industrial, commercial and financial capacity of the SME or entrepreneurs is also important to the funding criteria.

For the development of a new technology-based product: a zero interest loan, reimbursable in case of success, is provided to the SME. The loan can cover over 50 % of the total project cost. For the creation of an innovative company, a grant of over €30,000 is available.

Practical experience

The programme supports more than 2,000 SMEs every year and €185 million is spent on over 400 feasibility studies. Around €24 million is spent on technology transfer projects. The transnational activities within the programme have led to higher quality results, increased research capacity and a better opening to the European market. The regional structure of the French Innovation Implementation Agency OSEO anvar allows innovation support to be provided to SMEs in a simple and flexible way, since the administrative structure is flat. The access to financial support is also very easy. Due to increasing interest, the programme has been redesigned within 2005

CORINT (Romania) Increasing the relevance and impact of R&D activities

Key point summary

- Programme part of the National RDI Plan
- Around 5 % of the overall budget of the RDI plan
- 25 % of programme budget is allocated for transnational activities
- Accompanying training and consultancy support is available to facilitate transnational cooperation

Overview of the programme and its objectives

CORINT started in 2001 as part of the National Research, Development and Innovation Plan, which is managed by the Romanian Ministry of Education and Research. The Ministry delegated the responsibility for Research programmes to the National Centre for Programme Management (NCPM). The CORINT programme budget accounts for 5.5 % of the total national RDI Plan. It encompasses six sub-programmes, namely:

- EU-RO (80 projects)
- NUC-INT (6 projects)
- EUREKA-R (20 projects)
- NATO-STI (8 projects)
- ESTROM (Environmental Science and Technology in Romania)
- CEEX Research of Excellence (new programme, 13 projects so far)

The purpose of the CORINT programme is to strengthen Romania in well defined fields of high national interests including harmonising Romanian legislation with the EU (EU-RO), achieve EU-standard in nuclear affairs (NUC-INT), facilitate the cooperation between EU and Romania with regard to advanced technologies (EUREKA-R), stimulate SME development related to environment, social and human protection (NATO-STI), increase development in environmental science and technology (ESTROM) and promote the national participation into the European and international research programmes (CEEX). The international aspects of the programme account for 25 % of the budget.

The overall strategy of the programme is to:

- Increase the relevance and impact of R&D activities
- Stimulate innovation to support principles of economic and social demands, with respect to the sustainable development of the economy;
- Transform the innovation process into a direct support for increasing the quality of the products and services offered by Romanian companies and increasing their capacity to be competitive in the global market;
- Implement the specific 'AQ communautaire', in order to ensure the compatibility between the legislation, institutional bodies and procedures in Romania and European Union.

Therefore, the programme management agency NCPM aims to create standardised financial administration for all programmes, enabling the total openness towards national and international cooperation. It also aims to achieve flexibility in disseminating the information on project elaboration, through the creation of a special training-focused Management Unit. Furthermore NCPM provides consultancy and technical assistance to support the process of elaborating and running the projects carried out within national and international programmes.

Practical experience

NCPM regards further accompanying measures as relevant for running successful RDI programmes. Therefore, they organise training sessions and maintenance within the process of project formation. NCPM provides assistance in finding partners and forming fellowships for projects included in RDI programmes.

Projects within CORINT are funded by from three sources; 50 % from the European Social Fund, 25 % from the budget of NCPM and 25 % from project partners.

Industrial PhD Programme (Denmark)

Internationalisation of business through young mobile researchers

Key point summary

- Primary aim is to stimulate R&D in enterprises in Denmark and to encourage networking between enterprises in Denmark and Danish and foreign universities
- For Danish PhD fellows it is mandatory to study three to six months abroad or in external organisations or universities. Most traditional PhD fellows chose to study one semester abroad. Around one third of Danish Industrial PhD fellows study three to six months on foreign universities
- Industrial PhD fellows don't need to be Danish nationals
- The Programme allows participation by foreign universities

Overview of the programme and its objectives

Industrial PhD is funded in cooperation with private enterprises in Denmark and the Ministry of Science, Technology and Innovation. Its main objective is to develop R&D within enterprises in Denmark and create networking between enterprises and universities. It does this by educating PhD researchers within business and industry, enabling them to gain insights to the applied aspects of R&D and by supporting researchers in the development of personal networks, which include companies, universities and research institutions.

The Industrial PhD fellow is employed in the enterprise during the three years of study. The fellow can be employed in the enterprise prior to the application date but can also be employed when the application is approved. The fellow must have top grades from a relevant research based Master Course (a BA + MA degree). The programme subsidises 35 % of the salary, the university fee and parts of the costs to courses and conferences while the fellow completes a defined R&D PhD project that must be within the business area of the enterprise. The enterprise pays all other costs to research and office equipment, counselling and administration in the enterprise. On average, the enterprise covers 65–70 % of all costs. The PhD fellow spends half of their time at the enterprise and the other half at a university. If appropriate, the project can further involve a government research institute or other enterprises as third parties.

The company in which the Industrial PhD fellow is employed does not have to be Danish but it must be located in Denmark and have sufficient capacity in terms of competencies and financial strength to see the project through to completion. Ownership of the project and its outputs, including technologies that are developed or transferred, lie with the company (although it may need to negotiate with the university). This creates an additional incentive for the company to make the project a success. The Industrial PhD Programme qualifies the fellow for both an official PhD degree and a certificate of successful participation in the Danish Industrial PhD Programme.

Practical experience

As there is no requirement for the participating university to be Danish, approximately one third of PhD fellows train in an overseas university, using a supervisor from a Danish university. This is less than for an average Danish PhD due to the requirement to spend half of their time working within the company in Denmark.

There is no requirement for the PhD fellow to be a Danish national and between 5 and 10 % of participants are from outside Denmark, including China, Portugal, France, Hungary, Italy, Iceland and Sweden.

Feedback from participants shows that:

- There is increased knowledge at the universities and improved networks and cooperation with businesses – this includes networks outside of Denmark.
- The quality level of the PhD work is typically as good as or better than a regular PhD.
- Companies enhance competencies and develop new fields of world-class R&D.
- 44 % of companies expected to see increased turnover as a result.
- Around half of the companies which have hosted Industrial PhD projects in the last six years claim that the project has resulted in one or more patents.
- PhD fellows enjoy and value their international experience, with it adding a perspective to their study that they had not envisaged before.
- The unemployment rate of all fellows who have completed the education since 1988 is less than 1 %.

Initially the programme managers had to overcome administrative difficulties to allow it to work within timescales that are acceptable to companies. They did not have any legal or political barriers to designing a transnational programme.

PRO INNO II (Germany)

Key point summary

- Encouraging SMEs to become more knowledge based
- Inter-company and research/industry cooperation encouraged
- 10 % extra grants for international projects
- Programme manager facilitates cross-border partnerships through its network of offices in other countries
- 13 % of projects have international partners

Overview of the programme and its objectives

PRO INNO II; the German programme to increase innovation competencies within SME, is funded by the German Ministry for Education and Research. It is the follow up programme to PRO INNO I, which was implemented from 1999–2004. The programme objectives and targets have not changed. The objective is to support a variety of R&D-projects within companies and cooperation and collaboration between companies, also between companies and research institutes and through staff exchange with research institutes. All activities are accompanied and promoted by foreign offices of the programme owner AIF (Association of Industrial Research Institutes), which carries out cooperative research for SMEs in various sectors of economic activity.

The main objectives of the programme are to:

- Encourage market oriented research and development within industry,
- Decrease the technological and economical risks of R&D,
- Facilitate high-grade R&D cooperation,
- Decrease transaction costs,
- Strengthen collaboration activities.

Projects with the purpose of developing innovative products, processes or other technical services can be funded. The programme covers all technologies.

The PRO INNO II programme aims to support Germany's economic structure, since more than 95 % of industry in Germany is small and medium sized companies. The former communist part of Germany is actively supported within this programme by special funding rates. Projects can receive 50 % of the total cost up to a maximum of €300,000. Higher rates can be provided for certain types of company and consortium. SME's, projects with EUREKA status and projects with partners from other countries can receive 60 % of their costs.

The programme is very popular as it is very flexible and can support four types of project.

Cooperation between companies:
These projects should aim to strengthen the competitiveness of all involved companies. There should exist a certain kind of mutual understand between the involved companies but no contractual relations. At least two companies must cooperate and none of them should obtain more than 75 % of the whole costs within the project. The cooperation should contain at least one company fulfilling the PRO INNO definition of SMEs. Other cooperation partners may come from abroad and need not be SMEs. The foreign partners cannot receive funding and it is quite normal for these cooperations to be EUREKA projects.

Cooperation between companies and research institutes:
These projects are normally concerned with technology transfer. There does not need to be any contractual relationship between project partners, only a mutual interest in cooperation. Each partner applies separately for funding. Companies obtain 50 % of project costs but research institutes should obtain not less than 25 % of the projects budget.

Cooperation by one company within R&D project:
One company carries out a collaborative R&D project and therefore can be funded. The R&D partner (eg institutes, universities) should get between 25 % and 50 % of eligible personnel costs. The client is the company, which receives all rights of use.

Staff exchange:
This part of PRO INNO II enables certain kinds of staff exchange within a company-led R&D project. The company can hire research staff on a full-time basis for a period between three months to two years to assure the achievement of new competencies for the company, in general.

Practical experience
The original PRO INNO I programme supported over 450 projects and 72 new projects have already been funded by PRO INNO II. In PRO INNO II, nearly 80 % are cooperation projects and 20 % are concerned with staff exchanges.

Partners from more than 50 nations have participated in PRO INNO I, which is the previous programme to PRO INNO II. Widespread participation of other nations can, therefore, be expected in the new programme. Around 13 % of all funded projects are internationally assigned. The majority of funded projects have been in the areas of ICT, engineering and materials. Higher incentives (ie 10 % extra grant) for cooperation with foreign partners is highly appreciated by the applicants. This was emphasised when the original programme (PRO INNO I) was reviewed and the special rates for projects with foreign partners was dropped. These incentives have been reintroduced within PRO INNO II and the proportion of international projects has increased.

An advantage of the PRO INNO II programme is the fact that the programme owner AIF has several foreign offices, which enables international projects to be facilitated. The core of any international SME engagement is personal contact. Those first experiences lead to further activities like research projects or an R&D mission with foreign partners. AIF is, therefore, running cooperation events once a year in order to initiate contact between companies and researchers from Germany and abroad. Nearly 50 % of all international projects within PRO INNO II come from countries where offices from AIF are situated.

Due to the programmes design, and the international accompanying measures of the programme owner, the PRO INNO II programme seems to be an excellent example of how national priorities can successfully be achieved through transnational cooperations. There is no technological restriction in the programme's design and it is sufficiently flexible to allow several different types of cooperation to be achieved.

Research & Technology Innovation Fund (Hungary)

Key point summary
- Policy objective to speed up economic growth through a more efficient innovation system
- Different types of instruments used to enable the R&D and industrial communities to work together to create internationally competitive products & services

Overview of the programme and its objectives
In order to speed up economic growth in Hungary, the institutional and legal frameworks have been revised. A new government office, the National Office of Research and Technology (NKTH), was established in 2004, supervised by the Minister of Education. Under the supervision of NKTH, the Agency for Research Fund Management and Research Exploitation (KPI) is responsible for managing innovation programmes. The Research

and Technology Innovation Fund was established to promote demand-driven innovation and knowledge-based competitiveness of companies. It is a framework programme for a number of thematic sub-programmes and other instruments and is partly funded by mandatory contributions from all companies registered in Hungary.

One of the interesting instruments of the Fund is the establishment of applied research centres that are jointly funded in partnership with another country. Three thematic research centres have been established with other countries, including France (biotechnology), Germany (ambient intelligence) and Russia (nanotechnology). Each of these centres has between 50 and 100 researcher staff working on joint projects. The new framework programme also supports bilateral networking and mobility.

Practical experience
The R&TI programme in general has increased the scale and quality of applied research projects and these are now considered to be comparable with EU standards. In addition, the applied research centres have become more multilateral through the participation by visiting researchers from other countries on mobility missions and international fellowships. The aim of the R&T Innovation Fund is to create innovative products and services through collaboration between the academic and industrial communities, including experts from other countries and international businesses

National Innovation Landscapes in Europe in Brief

Austria
The Austrian Innovation Policy is defined by the Austrian Government, which is mainly consulted by the Council for Research and Technology Development. Two national Agencies, FFG (Austrian Research Promotion Agency) and FWF (Austrian Science Fund) are in charge of implementing and managing national innovation programmes. The FWF is Austria's central body for the promotion of basic research, the FFG is the central national body for the promotion of applied research. The national innovation programmes are mostly thematic but generic and horizontal programmes are also ongoing in Austria.

Belgium
The research programmes in Belgium are highly decentralised and distributed between the federal and regional/community levels. More than 70 % of the public sector funding is channelled through the regional administrations and agencies. There are a broad range of programmes, which are mostly non-thematic and continuously open. In general, programmes are open to the participation and payment of foreign researchers so long as there are clear benefits to Belgium.

Bulgaria
To date there is no specific policy that supports national Innovation activities. Bulgaria is focusing instead on the stabilisation of the macroeconomic system. In 2002, the Ministries of Economy and of Science and Education started the development of a Strategy for Science, Technology and Innovation in Bulgaria. The implementation of this policy will improve the innovation environment in Bulgaria and provide alternative sources to fund research and development.

Croatia
Science and research is under the authority of the Ministry of Science, Education and Sport (MSES). The National Science Council acts as an advisory board for all issues of science in Croatia. In 2001, the government launched the Croatian Programme for Technological Development – HITRA. No transnational activities are planned. The MSES is responsible for the administration of the programme. The budget was € 1.5 Mio in 2006.

Cyprus
Research programmes in Cyprus are mainly implemented by the Research Promotion Foundation through its multi-annual Framework Programme for Research and Technology Development. The current three year programme is for the period 2006–2008. The programme is very open to transnational cooperation and has specific instruments to support participation in EUREKA, ESF activities and bilateral projects. It also encourages the participation by leading researchers from other countries by allowing up to 30 % of the budget to be spent on foreign partners.

Denmark
The Ministry of Science, Technology and Innovation (VTU) is solely responsible for innovation in Denmark and the implementing agency, the Danish Research Agency, has two research councils - Strategic and Independent. Denmark restructured its research system in 2004 and further changes took place following the government's 'globalisation council' in Spring 2006. One of the aims was to strengthen the connection between national and international research efforts, with a focus on cooperation and mobility, with thematic priorities being adapted to match those of other European countries.

Estonia
The Ministry of Economic Affairs and Communication is responsible for planning, coordinating, executing and monitoring the national Innovation Policy. It is advised by the Innovation Policy Council and assisted by Enterprise Estonia, the main funding and implementation agency. The Ministry of Educa-

tion and Research is responsible for all Research and Education Policy related aspects. Currently there are several generic programmes ongoing in Estonia aimed at different technological and scientific fields.

Finland

Finland has separate science and industry ministries and two main implementing agencies for publicly funded research – the Academy of Finland (basic research), which has four research councils, and the National Technology Agency (TEKES, applied/industrial research). Finland has a large number of relatively low budget thematic programmes. TEKES openly invites other technology-oriented foreign entities to work with it, with cooperation in the shape of joint projects, technology transfer or simply the exchange of information.

France

In France there are two ministries dealing with research activities; the Ministry of Research and New Technology and the Ministry of Economic Affairs. The Centre of National Science (CNRS) is a publicly-funded research organisation, acting as a Research Council, which defines its mission as producing knowledge and making it available to society. The administration of innovation activities has been centralised by consolidating the French Agencies for innovation and financial support under the frame of a new organisation (OSEO anvar).

Germany

The main actors in innovation policy among the Federal Ministries are the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Economics and Technology Labour (BMWi). The BMBF's main activities in innovation policy refer to financing public INNOVATION infrastructure, running technology programmes (direct innovation promotion through thematic programmes) and fostering innovation in Eastern Germany. The BMWi's innovation policy focus is on competition policy, Innovation programmes in energy, aviation and multimedia and on innovation support programmes for small and medium-sized enterprises (SMEs). Several other Federal Ministries are also engaged in innovation policy to some extent. Several implementation agencies are responsible for generic and thematic programmes. Germany is participating in several multilateral programmes with transnational focus as well as an active partner in EUREKA to stimulate innovation activities with its neighbour countries.

Greece

Greece has separate ministries for Education and Development, which provide the majority of public funding for innovation. There are no research councils (i.e. no basic research programmes) and the main implementing agency for applied, industrial, SME and mobility programmes is the General Secretariat for Research and Technology (GSRT). Greece has a multi-annual framework programme, the 'Operational Programme for Competitiveness (OPCOM)', running from 2007 ongoing. This is mainly non-thematic and largely funded via the European Structural Funds.

Hungary

Research funding in Hungary is implemented by the Hungarian Academy of Science and the new National Office of Research and Technology (NKTH), which was established in 2004. Applied research funding is distributed through a new National Framework programme, known as the Research and Technology Innovation Fund, which includes thematic sub-programmes and is partly funded by an industrial levy.

Iceland

Iceland has separate science and industry ministries, with one implementing agency for all science and technology programmes (RANNIS). New legislation regarding science and technology policy and funding was enacted in Iceland in January 2003, resulting in the formation of the Science and Technology Policy Council, chaired by the Prime Minister. There are a small number of programmes, with a mixture of thematic and non-thematic content. Iceland has a strong track record of international cooperation with the majority of its researchers training overseas, resulting in strong relationships with international institutions.

Ireland

Research programmes in Ireland are organised within a multi-annual National Plan for research, technology, development and innovation (RTDI). The current programme covers the period 2007–2010. Within this framework, there are a broad range of implementing organisations, agencies and two Research Councils that manage both thematic and non-thematic programmes. The main implementing agencies are Science Foundation Ireland for basic research and Enterprise Ireland for industrial research. The programmes, generally, have a high degree of flexibility.

Israel

Industrial research programmes in Israel are implemented by the 'Office of the Chief Scientist' within the Ministry of Trade and Labour. Basic research programmes are operated by the Israel Science Foundation. Both organisations are primarily government funded. These programmes are not open for transnational cooperation, due to the fact, that Israel has several special programmes for international cooperation. These bi- and multi-national funds, imply participation in a joint INNOVATION programme with foreign counterparts (e.g.. BIRD, Israel USA). Basic and applied research is funded by these programmes.

Latvia
The priority of the Latvian government is the development of the Latvian infrastructure to an equal level with other Member States of the EU. The Latvian Council of Sciences controls 50 % of the national science budget. The budget is mainly spent on supporting the implementation of targeted applied research projects, the development of research infrastructure and the development of the educational sector.

Lithuania
The Ministry of Education and Science plays the most significant role in innovation funding, allocating two thirds of the annual budget, with the Lithuanian State Science and Studies Foundation allocating the remainder. The main target for Lithuania is to develop national business competitiveness to EU-levels.

Luxembourg
The Ministry of Culture, Higher Education and Research is responsible for devising and implementing national policy for public innovation. The National Research Fund was set up in 1999 and concentrates on a small number of niche thematic areas. The government has made commitments to encourage the development of international mobility and to develop world leading expertise in specific niches that will encourage international cooperation and inward investment. So far, 5 different innovation cluster have been set up since 2007 and currently coordinated by the INNOLUX, the National Innovation Agency.

Netherlands
Basic research programmes in the Netherlands are sponsored by NWO (Netherlands Organisation for Scientific Research), which is linked to the Ministry of Science. Applied research and innovation programmes are implemented by SenterNovem (Technology Agency), which operates under the structure of the Ministry of Economic Affairs. Both are cross-funded by various government departments. National policy on science and innovation is becoming more consolidated through the establishment of a high level 'innovation platform' involving both ministries and high level stakeholders from the industrial and scientific communities. The majority of programmes are thematic and there is increasing concentration on specific priority areas. NWO is very proactive in international cooperation but SenterNovem is much more constrained in what it is able to do.

Norway
Responsibility for innovation is divided between all ministries, each responsible for promoting and funding research activities within its own area. The Ministry for Education and Research is responsible for overall R&D policies, for funding the majority of basic research and for coordinating sector R&D policies. The Research Council of Norway is a national strategic body and funding agency for research and innovation activities. Approximately 50 % of its budget is spent on programmes, most of them thematic. Internationalisation is one of three structural priority areas (together with 4 thematic and 3 technology areas) in Norwegian research policy from 2006–2010. National research efforts will be evaluated in light of international developments, research cooperation with the EU will be of key importance, world class infrastructures will be used as platform for international collaboration and to attract more foreign scientists to Norway.

Poland
Since February 2005, the Minister of Science and Information Society Technologies (MSIST) is responsible for the funding of scientific research. Previously, the Minister acted as a Chairman of the State Committee for Scientific Research that governed all public R&D funds. With the new Act, an advisory Council for Science with 71 members, 33 of them elected by the scientific community, is formed. There is one programme "Strengthening of Co-operation between the R&D Sphere and the Economy", which will run until 2008.

Portugal
R&D in Portugal is funded by the Ministry of Science Innovation and Higher Education and, under this, public R&D is controlled by the National Foundation for Science and Technology (FCT). The Innovation Agency (ADI) also operates under the ministry and funds projects and programmes relating to innovation, applied/industrial research and SME support. Programmes are a mixture of thematic and non-thematic.

Romania
The Ministry of Education and Research (MER) has the main responsibility for the National RDI Plan, currently consisting of 14 thematic programmes. The MER is also responsible for core programmes, sectoral programmes, scientific events and mobility activities, with the aim of building up the country's infrastructure to prepare it for EU membership. The National Council for Science and Technology Policy coordinates RDI policy and other social and economic policies. The responsibilities for programme agencies are currently being rearranged.

Slovakia
The Ministry of Education of the Slovak Republic is responsible for the National Science and Technology Policy and also for the National Research and Development Programmes. In Slovakia there are five cross-cutting programmes and four thematic programmes which are carried out from 2003. Their administration and funding is under the Ministry of Economy, the Ministry of Agriculture, the Ministry of Employment, Social Affairs and Family, the Ministry of Construction and Regional Development and Slovak Academy of Sciences.

Slovenia
The Ministry of Higher Education, Science and Technology is responsible for basic research. The main objective is the strengthening of the scientific infrastructure, regarding equipment and human resources. The Ministry of Economy, which is responsible for innovation policy, runs several applied R&D programmes for enterprises and also a Young Researchers Programme.

Spain
The Inter-Ministerial Commission on Science and Technology is the body devoted to the coordination of the activities of the various ministries involved with innovation policy. It is also responsible for the coordination of the National RDI Plan, with the support of the General Secretariat for Scientific Policy. As consultative and support departments, there are two main bodies: the General Council on Science and Technology and the Advisory Council for Science and Technology. The General Council on Science and Technology has as its main objective the coordination of the Autonomous Communities and the relations between them and the central administration. The Advisory Council on Science and Technology has been created to promote the participation of society in R&D policy. The Centre for Development of Industrial Technology (CDTI) plays a major role in implementing RDI policy, with a budget of €250m. Regional support for R&D can also be seen and within 17 autonomous communities a wide range of regional science and research plans and programmes can be regarded. They all carry out their regional plan for innovation related technological development and wish to develop relevant research and innovation infrastructure, as well as network for sustainable development.

Sweden
All ministries in Sweden support research activities by the 'sectoral research principle', by which each sector assesses its own needs for R&D and weighs these against others. The Ministry of Education and Science supports basic research via the Swedish Research Council. The Ministry for Industry, Employment & Communications supports applied, industrial and SME research via a number of agencies, with programmes primarily controlled by the Swedish Agency for Innovation Systems (VINNOVA). Sweden has a policy of promoting R&D and investing the most, in percentage GDP terms, in Europe. It is continually increasing the level of participation in European framework programmes and networks as well as developing multilateral programmes within the Nordic region.

Switzerland
The Swiss National Science Foundation is responsible for various national and international research programmes. It has the autonomy it needs to promote independent scientific research. The most important instrument is the Swiss Innovation Promotion Agency (KTI/CTI). It supports applied R&D projects that are carried out by innovative firms with third-level institutions. Through funding and innovation management services and know-how, the KTI/CTI provides support for the setting-up and development of high-tech firms. As Switzerland is a very small country, the national authorities have assigned the lead on policy development to a group of renowned science and technology experts. These experts guarantee an international level of research, science and technology for Switzerland.

Turkey
Most of the research programmes are designed and implemented by TUBITAK, the Scientific and Research Council of Turkey, which reports directly to the Prime Minister. The programmes are generally non-thematic. Public sector funding for R&D is increasing rapidly from a relatively low base and participation in international projects is encouraged. This includes financial incentives for Turkish research groups to involve Turkish companies in international projects like EUREKA.

United Kingdom
Research programmes in the UK are widely distributed through seven government departments and eight Research Councils. Additional programmes are funded by the national agencies for environment and food standards and the regional agencies for economic development. Most of these funding organisations implement their programmes through a thematic prioritisation structure. Industrial research programmes have recently become more consolidated into a single 'Technology Programme' and most of the SME programmes are implemented through the regional economic development agencies. The degree of openness and flexibility to transnational activities varies between the funding organisations.

Appendix III: Literature

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Appendix IV: List of interview partners

Institution	Name	Function
Cairo University, Faculty of Engineering	Prof. Amr A. Adly	Elect. Power & Machines Dept.
Central Metallurgical Research and Development Institute	Prof. Mahnmoud I. Nasr	President
Chamber of Engineering Industries/Arab Federation for Engineering Industries	Nabil Farid Hassanen	Chairman
Chamber of Engineering Ind. F.E.I	Farouk Shalash	Executive Director
Delegation of European Commission	Dr. Daniel Weiss	Economic Modernisation
Delegation of European Commission	Dr. Mostafa Ghada	Programme Coordinator
Development Science & Technology Enviornment	Dr. Omeima Kamel	Media Advisor
Egypt National Cleaner Production Center	Hanan El Hadary	Director
Egyptian Industrial Detergents S.A.E.	Eng. M. Fikry F. Abdel Shafei	Chairmann & Managing Director
EuroMed Innovation and Technology Programme Medibtikar	Prof. Dr. Smair Elsayyad	Principle Consultant
EuroMed Innovation and Technology Programme Medibtikar	John Yates	
Food Technology Center	Dr. Ahmed Fouad Mandour	Executive Director
Industrial Modernisation Centre	Adham Nadim	Executive Director
Industrial Modernisation Programme	Helmy Abouleish	Chair of Management Council
Institute of Graduate Studies & Research, Alexandria	Prof. Essam El Rafey	Dean

Institution	Name	Function
Ministry of State for Scientific Research	Prof. Dr. Aly El Shafei	Assistant Minister for Technological Development
Ministry of Trade & Industry	Dr. Eng. Mohamed Hany Barakat	First Undersecretary
National Research Centre	Prof. Dr. Esmat Abdel Ghaffar	Vice President for Research & International Relations
National Research Center	Dr. Nabil Saleh	Prof. Emeritus
Ministry of State for Scientific Research	Dr. Maged Al-Shirbiny	Deputy Minister for Scientific Research
Plastic Technology Center	Eng. Magdy G. Farag	Managing Director
Research, Development and Innovation Programme	Abdelhamid El-Zoheiry, MD	Programme Coordinator
Research, Development and innovation Programme	Dr. Abeer Shakweer	Planning and Execution of the EU-Egypt Innovation Fund