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**Barriers to successful innovation policy implementation in developing countries:**

**The relevance of informal institutions in the case of Egypt and Morocco**

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Abstract

The importance of innovation for socio-economic development has been widely discussed in the existing literature, however most studies in the context of innovation systems in developing countries focus on the analysis of formal institutions, while the role of informal institutions has not been sufficiently addressed. This paper provides original insights into how institutional change is conditioned by informal institutions, affecting the national innovation systems of developing countries, by focusing on innovation support in the ICT sector in Egypt and Morocco. Specifically, it reviews the efforts made by the respective governments in the area of science, technology and innovation (STI) policy and identifies the obstacles they face. Empirical data has been collected from high-level government representatives, firm executives and academics through questionnaire-based interviews. While the two countries share similar institutional obstacles within their innovation systems, the findings of this study suggest that informal institutions have a considerable impact on formal institutions and the propensity to innovate. Therefore, STI policy definition and implementation require a deep understanding of informal institutions and the culturally rooted needs of the private and public sectors as well as academia. Recognising the role of informal institutions and embedding them in STI policy development will help policy makers in developing countries to address the systemic deficiencies of their innovation systems more effectively, thereby contributing to socio-economic development.

Keywords: Innovation policy, developing countries, institutional change, informal institutions, innovation systems.

## 1. Introduction

Innovative countries generally experience significant economic growth (Hollanders and Arundel, 2007; Lundvall et al., 2009), for many developing countries a necessary precondition to achieve social and human development (Aubert, 2005; Kraemer-Mbula and Wamae, 2010). Effective innovation support policies and institutional arrangements can promote entrepreneurship and have a significant impact on the innovation performance of local firms (Celikel-Esser, 2007; Aubert, 2010; Fagerberg, 2016). However, the definition and implementation of innovation support policies in developing countries have been characterised by an unsystematic and incoherent approach, essentially aiming at correcting market failures and focusing on trade policy, FDI, and technology transfer (Cimoli et al., 2005). Moreover, these policies have been put in place by individual ministries or agencies without much coordination with other institutional actors, let alone with the involvement of non-institutional stakeholders (Edquist, 2004). The lack of systematic policy development and implementation reflects a range of obstacles faced by governments in developing countries, e.g. limited resources (human and financial), missing institutional capabilities, inadequate education and cultural barriers (Padilla-Pérez and Gaudin, 2014).

Countries in the Middle East and North Africa (MENA) region, an academically understudied area when it comes to innovation policy, are not an exception: rigid bureaucracies, university curricula lacking content that promotes creativity and entrepreneurship, limited public investment in science, technology and innovation (STI), and a private sector insufficiently involved in the definition and implementation of relevant policies (Selmanovic, 2015). In recent years, however, governments in the region have recognised the importance of innovation for socio-economic development and concrete policy instruments and innovation support mechanisms have been introduced. Strategic plans and priorities for national STI systems have been elaborated and (semi-) coordinated initiatives have been launched (Degault et al., 2012).

Several macro economic and political developments have led to this shift in priorities. First, the market-oriented policies implemented between the 1970s and 2000s, albeit some successes, did not lead to the expected economic growth or to a significant reduction of unemployment rates (North et al., 2013). Second, trade openness and the strong focus on exports and FDI, for example in Egypt, did not produce the high benefits expected (Brynard, 2005; Makinde, 2005; Oladipo, 2008). Third, success stories of emerging economies, which achieved high economic success through investment in STI served as a role model.

Policy makers' focus on ICT in the MENA region has increased as the sector has produced significant economic growth, improved public and private service provision as well as contributed to the creation of (new) jobs and social inclusion of young women and men. With half of the population being less than 25 years old and with the highest youth unemployment rates in the world, the ICT sector has the potential to offer new opportunities to the young generations of the region (Center for Mediterranean Integration et al., 2016). This paper aims to study recent STI policies and supporting institutional changes within the National Innovation Systems (NIS) of Egypt and Morocco, the two largest non-oil economies of the MENA region. Furthermore, this contribution aims to identify the main obstacles to formulating effective STI policies and implementing institutional arrangements supporting innovation in the two countries.

Evaluating single initiatives is an impossible task in absence of well-defined objectives and corresponding systematic follow-up reviews. This paper presents institutional arrangements set up to support innovation in the ICT sector of the two countries, noting the perception of their impact according to their users (firms and entrepreneurs) as well as the role of informal institutions in hampering their implementation and limiting their effectiveness. Unlike the abundant literature on innovation obstacles from the private sector's perspective or the limited literature on obstacles to policy implementation in developing countries (see Cimoli et al., 2005; Padilla-Pérez and Gaudin, 2014), this research combines the perspectives of public, private and academia stakeholders to identify the main institutional obstacles to effective STI policy in Egypt and Morocco.

This paper contributes to the limited research available on in-depth microanalysis of innovation systems in developing countries (Lundvall et al., 2009; Padilla-Perez and Gaudin, 2014). The empirical evidence is based on an extensive review of the two countries' NIS and 72 face-to-face interviews conducted in the first half of 2012 with high-level stakeholders from public institutions, industry and academia in Egypt and Morocco<sup>1</sup>. The next section summarises the literature on innovation systems and policy in developing countries, introduces the adopted theoretical framework and proposes a structured approach for the analysis of empirical evidence on obstacles to innovation. The third section provides an overview of STI strategy and innovation supporting institutional arrangements relevant for the ICT sector of Egypt and Morocco. The fourth section discusses the identified barriers in light of the prevailing cultural traits in the region. The final section presents the conclusions.

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<sup>1</sup> In total 30 high-level government officials (15 in each country) in charge of developing and implementing innovation policy and institutional arrangements set up to support innovation, 36 Chief Executive Officers of SME operating in the ICT sector (18 in each country) and 8 representatives of academic institutions (4 in each country) were interviewed. See Selmanovic (2015) for detailed descriptions of participants.

## 2. Theoretical background

The importance of innovation for economic growth has been extensively studied since Schumpeter's (1911, 1934) work on the Theory of Economic Development. New products, markets, production methods or business models, as well as new forms of organisation, stimulate economic growth and wealth creation (Rosenberg, 1982; Dutrenit and Dodgson, 2005; Fagerberg et al., 2006; Metcalfe and Ramlogan, 2008). Chudnovsky et al. (2006) demonstrate that firm-internal R&D and innovation activities in a developing country (Argentina) have a positive impact on firms' productivity and on the introduction of new products and services.

Scholars and policy makers have widely acknowledged the role of institutions and the need for active government involvement in innovation activities (Stiglitz, 2012; Mazzucato, 2013), moving away from the neoclassical input-output model of innovation towards an emphasis on the relationships between economic actors and their interactions within the institutional context (Nelson, 1993; Rodrik, 2004). The institutional environment is an essential component of NIS (Freeman, 1989; Lundvall, 1992; Freeman and Soete, 1997)<sup>2</sup>, which can be defined as: "all important economic, social, political, organizational, institutional, and other factors that influence the development, diffusion and use of innovations" (Edquist, 2004 in Fagerberg et al., 2006, p.183).

This broad definition has met increasing criticisms (Lundvall et al., 2009) and alternative approaches have been proposed, either restricting the scope of the analysis (e.g. technological innovation systems in Carlsson and Stankiewicz (1995), sectoral innovation systems in Malerba (2002) and regional innovation systems in Asheim and Iskasen (1997) or Cooke et al. (1997)), or putting the industry-university-government relations at the centre of analysis (like the triple helix models in Etzkowitz and Leydersdorff (2000)). Lundvall (2007) views these additional levels of analysis as complements rather than alternatives to the NIS approach. By revealing the processes that underlie the creation of innovation and knowledge within specific boundaries, they allow for a better understanding of NIS (Watkins et al., 2015). This research adopts Edquist's definition as it can be applied to contexts with different levels of institutional maturity<sup>3</sup> and recognises the role of informal institutions (Lundvall et al., 2009).

The literature on the main obstacles for successful innovation policy in developing countries is scarce and micro-level research, albeit increasing, is still lacking (Lundvall et al., 2009). According to Aubert (2005), the major weaknesses hampering innovation in developing countries are low levels of education; poor quality of the business environment and governance; and underdeveloped infrastructure. Padilla-Pérez and Gaudin (2014) make an important contribution by studying the barriers to effective STI policy in six Central American countries on the basis of interviews with high-level policy makers, arguing that firm-internal innovation obstacles have been widely studied. Their findings however do not take into account the views of stakeholders from the private sector and academia, failing to acknowledge the importance of their perceptions of implemented STI policies and the implications for their success. This paper addresses this gap, triangulating information obtained from the public and private sector as well as academia to study the NIS of Egypt and Morocco.

In general, most empirical studies on NIS in developing countries are overly focused on formal institutions (see, for example, Lundvall, 2011; Padilla-Pérez and Gaudin, 2014), underestimating the role of informal institutions. In their work on the evolution of NIS, Groenewegen and van der Steen (2006) emphasise the importance of the nature and "speed of change" of interconnections between the different layers of NIS. It is widely accepted that culture is an important determinant of firms' or countries' propensity to innovate and their innovation performance (Barnett, 1953; Wallace, 1970; Shane, 1992; Lee, 1998). Citing North's (1990) work on "shared mental maps" and the hierarchical dependency of formal on informal institutions, whereby the latter permeate and guide the evolution of the former, they establish that the reverse is also true: culture, norms and values of a society are influenced by technological development, which in turn is shaped by formal institutions, their institutional arrangements and, ultimately, the actions and behaviours of all NIS actors (Groenewegen and van der Steen, 2006).

Several authors have attempted to categorise cultures and model the collective patterns of thought by defining their aggregate characteristics according to different variables (for example Hall, 1959, 1966, 1976, 1983; Hofstede, 1984; Hofstede et al., 2010; Trompenaars and Hampden-Turner, 1997). Originating from subject areas like sociology and anthropology, cross-cultural studies are now widely applied to business studies and economics, recognising the relevance of human behavioural patterns for economic development and their institutional context (Giuso et al., 2006). Tayeb (2001) objects to the "dimensionalisation of culture" inherent in some of these contributions. While acknowledging that such approaches bear advantages of comparability, she rather advocates for a "multi-paradigm approach", whereby "non-cultural factors" complement the cultural ones, combining positivist and constructivist worldviews (p.104). A detailed discussion of cultural models and dimensions is outside the scope of this paper. Hofstede's model is adopted here, as it is the most widely used in social science research (Williamson, 2002). Its main four

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<sup>2</sup> The concept of NIS can be traced back to Friedrich List (1841). More explicit references can be found in inter alia Freeman (1982; 1995), Dosi et al. (1988), Nelson (1993), Lundvall (1985; 1997), Edquist (1993; 1997), Niosi (2002) and Fagerberg et al. (2006).

<sup>3</sup> In developing countries STI policies are mostly planned and implemented on national level (Lundvall et al., 2009; Padilla-Pérez and Gaudin, 2014).

dimensions developed in the 1980s (and later complemented by additional ones) include power distance, masculinity, uncertainty avoidance and individualism (Hofstede, 1984, 1991).

In the context of the (limited) empirical literature on the relationship between innovation and culture (see, for example, Herbig and Dunphy (1998) or Jones and Davis (2000)), Sun (2009) correlates the countries' scores assigned by Hofstede (1991) with an indicator developed by Porter and Stern (2001) to assess national innovation capabilities in the Global Competitiveness Report. The results indicate that, where the dominant culture is characterised by long power distance, collectivistic traits and strong uncertainty avoidance (like in the MENA region), countries tend to be less innovative (Sun, 2009). Informal institutions condition formal institutions and institutional arrangements (North et al., 2013).

This study focuses on institutional arrangements supporting innovation in the ICT sector of Egypt and Morocco as follows<sup>4</sup>:

- Governance – providing or supporting a regulatory framework
- Funding – offering direct financial support or promoting its availability for innovative projects or product development
- Capacity building – promoting awareness and culture of innovation, knowledge exchange and positioning of R&D outputs
- Infrastructure – offering technological infrastructure or means for its development.

These categories include programmes launched to target specific needs according to their mandates (e.g. support to industry-academia collaboration), possibly resulting in the provision of new services or the creation of new physical structures (e.g. one-stop shops). Multipurpose schemes offering some or all of the above type of support to innovators, often but not exclusively within a physical arrangement, are included in the infrastructure category.

In summary, innovation has been found to be a major driver of socio-economic development and the relevance of institutions within NIS has been widely studied. The interplay of formal and informal institutional components of NIS has still not been adequately addressed, in particular how the latter condition the effectiveness of the former in the context of STI policy. The resulting barriers and opportunities for developing countries have not yet been sufficiently studied, in particular in the context of the MENA region.

### **3. Institutional arrangements for innovation support in Egypt and Morocco**

#### **3.1 High-level STI strategy**

The most relevant policy actors within the NIS of Egypt and Morocco are summarised in the following<sup>5</sup>. In Egypt, the Higher Council for Science and Technology comprises eight ministries and non-governmental experts, including expatriate scientists. It is the highest policy adviser to the government and has developed a national priority plan for research. The main governmental body dealing with STI policy in Egypt is the Academy of Scientific Research and Technology (ASRT): it is the major coordinator of governmental research programmes and has established 15 specialised scientific councils, which serve as discussion forums, facilitate contacts between industry and research centres and contribute to policy development. Other high level entities involved in the elaboration of relevant policies include the Information and Decision Support Centre, with an advisory role and activities in the area of capacity building, and the Ministry of Higher Education and Scientific Research, the main stakeholder in the area of research policy and strategy.

In Morocco, institutions defining and implementing innovation policies include the Permanent Inter-ministerial Committee for Scientific Research and Technological Development, the National Business Environment Commission and the Hassan II Academy of Science and Technology. At the operational level, two ministries are particularly active: Ministry of Higher Education, Scientific Research and Professional Training (MHESRPT) and Ministry of Trade Industry and New Technologies (MTINT). The Ministry of the Modernisation of Public Sectors has initiated reforms relating to administrative simplification. Further relevant intermediary organisations in Egypt and Morocco include technology parks, incubators and technology transfer offices, increasingly supporting research and innovation.

In both countries strategic frameworks for innovation policy are in place since 2006, with similar priorities albeit differently expressed. The Egyptian Industrial Development Strategy (IDS), with explicit reference to innovation, sets the goal of becoming by 2025 a regional top player for industrial performance and export of medium-technology products and, by 2050, the leading industrial power in the region (Ministry of Trade and Industry (MTI), 2006). The implementation foresees three phases with corresponding strategic objectives:

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<sup>4</sup> This categorisation has been developed on the basis of Edquist (2004) following the thematic analysis of the fieldwork results in Egypt and Morocco.

<sup>5</sup> For a detailed historical account of the evolution of the two NIS, see Selmanovic (2015).

- Phase one (short-term): increase exports and employment
- Phase two (medium-term): increase industrial efficiency
- Phase three (long-term): building innovation capacity

These strategic objectives are cascaded down in operational objectives: a continued focus on export development and inward FDI; industrial competitiveness; and shifting industrial focus towards high-tech industry development through investment into skills and technology. To address them, MTI identifies corresponding areas of intervention: building domestic capabilities (explicitly referring to the NIS); promoting inward FDI and developing export capabilities; and improving relevant institutions by fostering social values supporting the desired development (MTI, 2006).

In Morocco, MHESRPT published a strategic framework for STI policy, the “National Strategy for the Development of Scientific Research by 2025”, with the vision for Morocco to become “a Muslim and modern country with an open and competitive economy and a strong cohesive society conciliating specificity and universality” (MHESRPT, 2009, p.2). It outlines the pre-conditions for the realisation of its underlying objectives: modernising the country by fostering education and fighting poverty and exclusion. The strategy lists critical priorities for promoting STI: the governance of the NIS, development of human capital, diversifying financial resources and improving financial management for research projects, increasing scientific production, enhancement of STI infrastructure, and increased focus on international collaboration (MHESRPT, 2009). The high-level themes identified are translated in a comprehensive roadmap for innovation support called *Initiative Maroc Innovation* aiming at positioning Morocco as a technology producer, supporting a higher value-added economy and attracting more foreign investment.

The next section summarises relevant institutional arrangements supporting innovation in the ICT sector in Egypt and Morocco, presented according to the conceptual framework adopted in the four categories governance, finance, capacity building and infrastructure.

### 3.2 Institutional arrangements supporting innovation in the ICT sectors of Egypt and Morocco

#### *Governance/regulatory framework*

The Egyptian Patent Office (EGYPO) is an institution financially dependent on the ASRT. Its mandate includes registering of applications for and granting of patents, providing legal support to inventors in the area of IPRs and publishing legal, technical and general information on patents (EGYPO, 2013). EGYPO offers face-to-face and distance learning courses on IP matters in collaboration with the World Intellectual Property Organisation (WIPO). The office does not however engage in a broader range of activities for IP education, awareness building or promotion. For example, patent data could only be obtained by physically visiting the office (and paying for it), as online services were not available (STDF, 2012). Even if this limitation has been addressed as of 2013, the level of technical and legal expertise among EGYPO’s staff members and Egyptian patent attorneys as perceived by the private sector remains an issue. Confidentiality and the corresponding lack of trust in the process further hamper the pursuit of intellectual property rights (IPR) protection in the country.

The corresponding institution in Morocco is the Moroccan Intellectual Property Office (MIPO). The office is self-financed through income generated from procedural fees (e.g. for registering industrial designs, patents and trademarks as well as commercial names) and IP information services. It participates in projects related to IPR promotion, for example, in collaboration with WIPO for the utilisation of technological information included in patent applications. MIPO’s activities are valued as professional and efficient by the private sector. In 2011, MIPO launched *Moubtakir* (Arabic for *innovative*) in collaboration with MTINT to promote innovation. Through an online portal as well as physical presence in universities and companies, MIPO collects and screens innovative ideas from individual researchers and enterprises to be presented to potential investors. Partnership agreements with universities, launched in 2010, entail the provision of training on the importance of IPRs and on writing patent applications, with the goal to increase the number of patents filed by Moroccan universities. Universities can apply for IPRs and pay the corresponding filing fees not at submission but rather on a quarterly basis. Outstanding fees are then reduced by 50 per cent to further encourage universities to protect their IPRs<sup>6</sup> (OMPIC, 2015).

#### *Finance*

In 2006, a reorganisation of public STI funding mechanisms took place in Egypt, with most grant-giving functions transferred from ASRT to the Science and Technology Development Fund (STDF). STDF offers grants for innovative activities across sectors via innovation funding programmes for basic and applied research, to young researchers and to expatriates willing to return to Egypt for their research (STDF, 2013). STDF is not allowed to grant funds to industrial entities, but only to academia and public research

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<sup>6</sup> The fee reduction applies also to SMEs and individuals. Since agreements with universities were introduced, patents filed from academia have considerably increased, from zero in 2009 to 130 in 2014 (see also OMPIC, 2015).

centres, whereby 80% of IPRs are retained by STDF and only a fifth by the institution producing those rights. It is not considered by the private sector as a fund aimed at innovative product development, as it requires a close cooperation with academia. To address this limit, STDF cooperates with the Industrial Modernisation Center (IMC), a funding body in charge of supporting the industrial modernisation of Egyptian companies. With the programme “Professor for every factory” it encourages industry-academia partnerships to promote technology transfer<sup>7</sup>.

The Research Development and Innovation (RDI) Programme, managed by the Ministry of Scientific Research, promotes innovation and entrepreneurship in Egyptian SMEs. Widely known in the private sector, it is funded by Europe AID and is obliged to measure project outputs (e.g. number of new products, patents, scientific publications and jobs created). The programme included the launch of the Innovation Fund for innovative projects leading to marketable products or innovative processes (funds were distributed to industrial enterprises and scientific research entities<sup>8</sup>), the creation of the RDI Network for the dissemination of research funding information, and the assessment of the Egyptian innovation landscape. In a second phase, it led to the creation of innovation clusters to improve industry-academia collaboration in research areas of national importance as well as measures to increase awareness of the importance of IPR creation and commercialisation. RDI reported a high success rate of supported projects; for example six projects that received financial support of about two million Euros subsequently generated revenues of over 40 million Euros.

In Morocco, the Moroccan Innovation Centre (MIC) was established in 2011 as a one-stop shop for innovation funding. It addresses two axes of the national innovation strategy, i.e. priorities, coherence and coordination of the national research system, and financing and management of research activities. An intermediary organisation between the public and the private sector, MIC is privately managed and administers a fund of 40.5 million Euros over four years to support advanced technologies like biotechnology and nanotechnology. MIC operates via three investment vehicles that differ in terms of target group: companies younger than two years, companies older than two years and companies with revenues of up to 500,000 Euros. The success rate of submitted proposals stood at 10% in 2012 (two out of 24 proposals received funding), mainly because applicants were not able to demonstrate that they could finance their share or because of issues regarding the repartition of costs and IPRs amongst co-applicants within one project.

In 2010, MTINT<sup>9</sup> launched the *Maroc Numeric Fund* (MNF) as the first investment fund for innovative start-ups in the ICT sector. Endowed with 10 million Euros, its objectives include promoting entrepreneurship, encouraging the emergence of new enterprises, filling the gaps in Morocco’s environment for start-up finance and providing opportunities for long-term investment partnerships (MNF, n.d.). The MNF supported eight start-ups<sup>10</sup>, all successfully operational after incubation. Their experiences with the fund management team were positive, particularly in terms of responsiveness, timeliness and the quality of advice received.

The Ministry of Economy and Finance is involved in several innovation and entrepreneurship funding schemes. The Support Fund for Innovation in the Information Technology and Communication Sector funds innovative projects in the ICT sector proposed by local ICT companies with at least three years of experience. *Moukawalati* is a support programme for young Moroccans aged between 20 and 45 launched in 2006 with the aim to create 30,000 small companies. Successful applicants with innovative business ideas receive funding in form of low-interest loans. According to a study published by a reputable Moroccan newspaper, the programme produced only 526 new enterprises by the end of 2008 (L’Economiste, 2009), possibly because, in order to obtain funding, guarantees such as real estate were requested, which young entrepreneurs usually do not possess.

#### *Capacity Building*

The Industrial Modernisation Centre (IMC) is an independent institution, which aims at increasing export competitiveness by investing in local skills and competences<sup>11</sup>. With executive board members from public and private sectors, IMC operates on three levels. At national level, it contributes to the Egyptian export development strategy and provides consultancy services to local institutions in the areas of quality assurance and accreditation (see also STDF, 2012). At sector level, IMC collaborates with industrial

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<sup>7</sup> Egyptian enterprises with effective R&D departments are relatively few, limiting the uptake of technology transfer offices. Requests for funding from academia outnumbered those from industry (respectively 70 and two), partially for the reasons mentioned above and also as the STDF’s website, the main communication channel, is predominantly followed by researchers from academia looking for grants.

<sup>8</sup> Funding was distributed in two rounds (11 million Euros for 2007-2011 and 20 million Euros for 2012-2015).

<sup>9</sup> In partnership with Moroccan Information Technology Company and four Moroccan banks.

<sup>10</sup> Status as of 1<sup>st</sup> September 2013.

<sup>11</sup> Overall, the IMC has contributed to the achievement of its major objective: in 2011, a particularly difficult year in view of political unrest, supported companies increased their exports by 6%, while Egypt’s overall exports decreased by 5%.

chambers to increase the competitiveness of national companies through Technology Transfer and Innovation Centres, which are however not considered effective by companies in the ICT sector or academia. At company level, IMC offers subsidised business development services, the most appreciated support mechanism in the perception of the private sector.

The General Authority for Investment offers capacity building services to local companies as well as foreign investors in Egypt. The main focus is placed on increasing SMEs' shares in GDP and employment through the Small and Medium Investment Initiative<sup>12</sup> launched in 2008 and the creation of the Bedaya Centre for Entrepreneurship and SME Development in 2010. The centre collaborates with a network of consultants to run workshops free of charge in the areas of strategic planning, marketing, legal issues and IPRs and co-organises several entrepreneurship competitions. Its activities are familiar to the private sector and the one-stop shop for company creation is considered a major facilitating factor in matters concerning business registration.

Several Non-Governmental Organisations (NGOs) have emerged as significant actors in Egypt's NIS, providing capacity building to entrepreneurs in various sectors, including ICT. Three NGOs are active in the area of innovation and entrepreneurship: *Nahdet El Mahrousa*, *Misr El Kheir* and the Egyptian Centre for IP and IT. *Misr El Kheir*, established in 2007, is particularly effective in supporting research and innovation. Headed by the Mufti, Egypt's highest religious authority, it uses Zakat<sup>13</sup> money to fund its projects. Through its Science, Technology and Innovation programme<sup>14</sup>, the NGO supports applied research in the areas of agriculture, medicine, renewable energy, social sciences and water. Its *Helolnabeokolna* programme offers financial and expert help with IPRs and the commercialisation of new products, in collaboration with ASRT.

The National Centre for Research in Science and Technology (NCRST) is one of the oldest institutions of the Moroccan NIS and is the coordinator of the Moroccan Incubation and Spin-Off Network. Initially meant to conduct scientific research, its purpose was redefined in 2001 to offer: logistical support through state-of-the art laboratories and equipment; funding programmes for research projects (also in collaboration with foreign partners); accreditation of centres of excellence in the area of scientific research; and research commercialisation services through dedicated networks, promoting scientific culture and entrepreneurship. As the oldest research support entity in the country, NCRST is well known among all NIS stakeholders.

The National SME Agency is the national coordinator for the Enterprise Europe Network. The agency supports the competitiveness of local SMEs through two programmes: *Moussanada* (Arabic for "support") focuses on productivity enhancements, marketing strategy and organisational matters, subsidising expert consultancy; *Imtiaz* (Arabic for "excellence") provides financial support for the modernisation of SMEs by acquiring new skills and modernising equipment and processes. The agency runs an annual survey amongst participants, the SME competitiveness barometer, to collect data on its programmes' impact and the results indicate a statistically significant, positive effect on employment, turnover, exports, and future business prospects. These results are reflected in the perceptions of the private sector and academia who are very well aware of the agency's services.

R&D Maroc is a professional association created in 1997 to promote R&D in Moroccan enterprises. It is one of the most active institutional arrangements in Morocco's NIS and involved in all governmental innovation support programmes: it conducts studies and surveys in the area of R&D and innovation, supporting the government in the definition of the national innovation strategy and the underlying innovation performance indicators. The association provides a broad range of capacity building services, offering seminars and workshops in the areas of R&D and innovation management, strategic planning, and management of innovative projects. Participating in many innovation support programmes of the country (like the Technology Diffusion Network in collaboration with the European Commission), its most prominent programme is Innov'Act, which funds collaborations between the private sector and academia. Albeit being generally well appreciated, criticisms have been raised by the private sector on the low amount of funding distributed (20,000 Euros per applicant), which may result in innovations with limited impact. Nevertheless, the programme facilitates partnerships between academia and industry, else lacking in absence of a legal basis for rewarding researchers involved: the association directly manages the projects and remunerates researchers for their work and academic institutions for the utilisation of their facilities.

#### *Infrastructure and multipurpose*

A range of science parks has been established in Egypt. The most active in the ICT sector is the Smart Villages Company (SVC), created in 2001 as a public-private partnership<sup>15</sup> "to establish and manage a branded chain of Technology cluster and business parks" (SVC, 2012). The first park, the Pyramid Smart Village, opened in 2011, hosts 500 local and multinational enterprises, financial

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<sup>12</sup> The main goals are to increase the share of employment created in SMEs and their share in GDP.

<sup>13</sup> Zakat is one of the five pillars of Islam and refers to a type of income and capital tax Muslims pay to people in need.

<sup>14</sup> The programme's objectives are to: "Develop & Promote World Class Scientific Research; Capacity Building; Promote a Culture of Scientific Research; and Encouraging NGOs to support Science and Technology" (Misr El Kheir, n.d).

<sup>15</sup> 80 per cent of the shares are owned by the private sector.

and educational institutions and government bodies, employing approximately 100,000 staff (World Bank Info Dev, 2013; SVC, 2012). In its premises operates the Technology Innovation Entrepreneurship Centre (TIEC), launched by the Ministry of Communications and Information Technology (MCIT) to stimulate ICT based innovation and entrepreneurship (TIEC, 2010). Its initiatives include support to R&D projects in ICT, investments in the country's ICT infrastructure, an e-learning competence centre, awareness building activities on the importance of ICT for development, start-up and incubation support, and an annual ICT innovation award. A dedicated entrepreneurship and IP Commercialisation Centre manages the Technology Incubation Programme (TIP) for innovative start-ups with high potential to contribute to the country's economic development. The scope of TIP gradually expanded to include university-based incubation via dedicated centres in three major Egyptian universities.

Established in 2004 as the executive branch of MCIT, the IT Industry Development Agency (ITIDA) focuses on increasing the competitiveness of the national ICT sector through financial incentives, comprehensive training programmes, support to public private partnerships for innovative ICT projects, awareness-building in the area of IPRs and the development of the national ICT infrastructure. ITIDA collaborates with local financial institutions to secure low-interest loans for ICT companies and provides technical support for SMEs to enter NILEX, the Egyptian Stock Exchange. Training courses provided include IPR awareness workshops for entrepreneurs, legal and technical training for judges and enforcement officers, and general management training. It funds collaborative industry-academia projects for the development of proofs of concepts, prototypes and novel products as well as running two public-private excellence centres in the areas of nanotechnology, data mining and computer modelling (ITIDA, 2012; 2013). Considered a particularly effective example of strong involvement of the private sector (its activities are praised within the private sectors for their professionalism and effectiveness), ITIDA is funded by ICT companies, which contribute with 1% of their annual turnover to fund the agency's innovation support programmes.

Building on a pre-existing cooperation with two Moroccan universities, the Moroccan Foundation for Advanced Science, Innovation and Research (MASciR) was created in 2010 to help create scientific solutions for significant national issues and encourage public-private partnerships. MASciR operates according to three models: marketing of IPRs resulting from innovative projects funded; co-funding and development of a innovative ideas with a university, enterprise or research centre; approaching pro-actively clients looking for a solution to problems related to biotechnology, microelectronics or nanotechnology. To stimulate a patenting culture, the foundation has launched an incentive scheme offering researchers financial awards for filing patents.

The Moroccan Incubation and Spin-Off Network was launched in 2003 to set up incubation centres within Morocco's universities and facilitate the creation of innovative new businesses (spin offs). The network consists of 13 incubators across Morocco, one at NCRST premises, 11 based in public higher education institutions and one privately managed incubator (Technopark). The network provides financial support, office space and basic equipment to successful applicants. Training sessions on business plans, market research, prototype development and legal matters are provided. Only a limited amount of companies have materialised from project proposals due to several factors: administrative burdens, unclear legal status for the remuneration of university researchers and delays in the funding procedures. Furthermore, following successful incubation, there is a lack of post-incubation funding, e.g. through venture capital. The situation has been alleviated through recent developments such as the Moroccan Innovation Centre.

Technopark Casablanca, Morocco's first business and technology incubator, is a major institutional arrangement set up to support innovation in the ICT sector. Established in 2001 through a partnership between MTINT and public and private banks, in 2012 Technopark hosted 160 companies (accounting for 10% of the national ICT sector). In May 2012, Technopark Rabat was launched and in 2013 the two structures together hosted 217 companies (Technopark, 2013). Two innovation-funding entities, Maroc Numeric Fund and the Moroccan Innovation Centre, are hosted in Technopark together with private and public agencies. Incubation services provided include substantially subsidised office space and equipment, mentorship, training and networking events. Finally, Technopark hosts the *Softcentre*, an association in charge of promoting R&D in the software sector in Morocco to help local enterprises produce new software solutions at low cost. Softcentre provides consultancy and software development services to private and public entities. Entrepreneurs who profited by Technopark services are among the most innovative and successful ICT businesses in the country and valued the received support accordingly.

#### **4. Main barriers for STI policy development and implementation in Egypt and Morocco**

The review of the major institutional arrangements supporting innovation in the ICT sector summarised in the previous section illustrates the extent to which Egypt and Morocco have executed their STI strategy with implementing initiatives. Results in terms of innovation outputs and impact on socio-economic development are still below expectations. Desk research and the fieldwork conducted indicate that the challenges faced by the NIS in Egypt and Morocco are similar and can be grouped in the four themes proposed in the adopted analytical framework.

##### *Governance*

Morocco has a more explicit STI strategy, while Egypt has not clearly formulated and communicated its strategic priorities to the broader public: an assessment of the Egyptian innovation landscape in 2010 run in collaboration with the Fraunhofer Institute

highlighted as one of the existing issues the lack of strategic alignment in Egyptian research institutes. Moreover, despite the presence of overarching strategic plans as well as inter-ministerial coordinating bodies for policy implementation, Egypt and Morocco lack a systematic private sector involvement in the definition and implementation of STI policy. A culture for constant evaluation and improvement is missing in both countries. Initiatives are rarely launched with clear objectives and corresponding, predefined key performance indicators to measure progress and change direction if necessary. In Morocco, the launching of innovation initiatives is more often linked to concrete measures for impact assessment, however resources to follow up on them are not systematically foreseen. There are exceptions, such as the RDI programme in Egypt, mainly when initiatives are launched jointly with external partners (e.g. the EU) and performance management mechanisms are a prerequisite for funding.

### *Finance*

Innovators in both countries face major hurdles when trying to get financial support for their activities: the bureaucratic burdens when applying for public funding for R&D activities are extremely high, the associated processes are lengthy and not transparent (e.g. funds are available, but the criteria to be fulfilled for accessing them are unclear), and the specific needs relating to the intrinsic nature of innovative activities are neglected in the execution of such funds (e.g. flexibility in adapting to unexpected but promising outcomes of R&D). Minor deviations from initial plans for publicly funded projects require in some cases several approval steps, complicated and time-consuming, despite unnecessary delays may be eventually fatal to their success. Moroccan innovators appear to face higher obstacles after the start-up stage, for example when trying to obtain funding for the development of prototypes and proofs of concept<sup>16</sup>. New funding schemes represent an improvement, however, the excessive time needed for de-blocking funds still represents a systemic weakness. The absence of comprehensive public or private venture capital schemes underlines how, in this case too, innovators in both countries face similar challenges.

### *Capacity building*

The education systems in Egypt and Morocco do not adequately support the development of the skills necessary to successfully engage in innovation: for example, the equipment available at schools and universities to conduct scientific research is inadequate and university curricula lack innovation and entrepreneurship modules. In general, education appears to focus on theory, with limited attention to applied research (for example, students' graduate projects usually do not address manufacturing problems or market needs). Between those completing higher education, many seek relatively secure employment in multi-national enterprises incentivised by the government to set up production facilities locally, a clearly inadequate utilisation of locally scarcely available qualified human resources.

These deficiencies affect the establishment of industry-academia partnerships, as private companies do not appreciate their potential added value. Despite the availability of a range of initiatives to strengthen industry-academia collaboration and the availability of the corresponding financial support, private companies are often simply not interested in collaborating with academia. This misalignment is worsened by the lack of involvement of the private sector in the definition of programmes meant to support technology transfer from and collaboration with academia, for example in the selection of relevant research topics. The current legal framework represents a further obstacle to such collaborations (e.g. remuneration of participating university researchers, ownership of IPRs and financial support for their protection and commercialisation), limiting the likelihood of university spin-offs and reinforcing auto-referential behaviours in academia.

### *Infrastructure*

One-stop shops for business creation in both countries have been successful in reducing administrative burdens impeding innovation, for example considerably facilitating start-up creation. However, heavy administrative processes still exist following business creation (e.g. in relation to taxes, hiring and business closure). To cope with the burden of compliance young businesses either dedicate precious internal resources to dealing with administrative procedures or outsource those tasks to lawyers and external consultants, in both cases consuming financial and human resources that could be invested in innovation and business development activities. The limits of the legal framework are apparent also in relation to the general issues of IPR protection, the latter dramatically aggravated in Egypt by the excessive length of the judiciary process, or financial management: moving financial means to and from abroad involves in Morocco a lengthy, bureaucratic procedure and Moroccan credit or debit cards are not allowed for online purchases abroad, limiting the access to tools that could facilitate innovation (e.g. software downloadable via Internet).

### *Informal institutions*

There are substantial similarities in the informal institutions of Egypt and Morocco: both countries are characterised by large power distance, high uncertainty avoidance and a strong focus on collectivism (Hofstede, 1991; Hofstede et al., 2010). The combination of

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<sup>16</sup> The launch of the Moroccan Innovation Centre aims at increasing the availability of public funding after the start-up stage.

these cultural traits results in rule-oriented societies with limited possibility for social (up-ward) mobility. The strong focus on loyalty and the needs of the group may hinder the development of a culture which respects and promotes strong intellectual property rights, negatively affecting the motivation to innovate. Moreover, religious rituals are an important component of daily life in Egypt and Morocco and the vast majority of their populations practice Islam. The religion is not achievement-oriented nor does it place great value on material things. Individuals trust God to control their lives, while the latter is “regulated” by the Koran in detail. Islam also represents a political unity and therefore most Muslim states are not secular. These religious traits make political and technological changes, including innovations, very difficult, unless approved by the highest religious leaders in society (Herbig and Dunphy, 1998).

These obstacles are difficult to overcome as their underlying causes are rooted in cultural specificities that may contribute to the weak innovation performance of the private sector and the slow transition of formal institutions towards an innovation enabling rather than controlling role<sup>17</sup>. As society values security, most graduates seek employment in the public sector or large multinational corporations, looking for a dependable source of income as family members and friends, whose working life is equally geared along the same values, encourage them to follow this path<sup>18</sup>. Similarly, innovation was not one of the traditional objectives of companies, explicit in their core missions and activities, as it is easier in the short term to make financial gains following known paths, either counting on relative low-cost labour or reverse engineering innovation produced elsewhere.

Cultural traits influence as well those working in innovation supporting institutions and institutional arrangements: here risk avoidance translates in unnecessary obstacles for innovators wishing to access funding schemes. Interestingly, concerns on the utilisation of public funds are expressed also by users of such schemes: this confirms the need to document and increase their success rate (i.e. the efficiency of the scheme), possibly through a more rigorous selection procedure, in order to progressively address resistance within and outside the responsible institutions. The main conclusion that can be drawn from the analysis of schemes operating in the area of capacity building is that a higher positive impact on innovation activities is achieved when the public sector assumes an intermediary role, rather than being directly involved in them.

When looking at the quality of the governance system and the transparency and trustworthiness of local institutions, the corruption perception index (CPI)<sup>19</sup> is a useful reference point for evaluating the former. Both countries scored relatively similarly in the CPI 2012 with a score of 32 for Egypt and 37 for Morocco<sup>20</sup>, indicating a serious corruption problem in both countries and confirming the lack of trust in local formal institutions. Innovation support programmes need to overcome the issues of lacking transparency and reliability as well as problems with timeliness, responsiveness and confidentiality to be successful: for example, the reason for the low uptake of joint R&D projects is often linked to the underlying lack of trust between academia and industry. In general, uncertainty avoidance affects the propensity to accept and manage risks: it may explain the tendency to avoid setting clear, quantifiable objectives for innovation support programmes. This represents a major limitation for a proper follow-up of their implementation and constitutes a missed opportunity: as responsible institutions rarely conduct impact assessments of their initiatives, lessons cannot be learned and a continuous improvement cycle cannot take place.

## 5. Conclusions

Innovation policy in the MENA region has received little attention in academic research. This paper contributes to the micro-analysis of policy initiatives developed to support innovation in Egypt and Morocco, the study of the challenges faced by the stakeholders of the respective NIS in their execution, with particular focus on how these are perceived by the private sector and academia. It aims to deepen our understanding of the role of informal institutions as an underlying root cause of the difficulties experienced. Policy makers in the two countries have recognised the potential of innovation to support socio-economic development and have defined a range of organisational schemes to support it. Their successful implementation is conditioned by informal institutions: most notably, locally dominant cultural traits that do not value freedom of thinking and the pursuit of new ways to achieve social and economic growth.

These restrictions represent a major obstacle to developing the capabilities required to foster research and innovation in a globalised world. If these shared mental maps would deterministically define behaviours, there would be limited opportunity for change. Innovation offers opportunities for socio-economic transformation and organisational schemes set up to support innovation have the potential to alter informal institutions. There is a need for an endogenous and inclusive reflection on which innovation

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<sup>17</sup>For example, a stronger engagement in the provision of IP related information, a weak point lamented by the private sector.

<sup>18</sup>See interview transcripts in Selmanovic (2015).

<sup>19</sup>A measure constructed by Transparency International with scores ranging between 0 (high corruption) and 100 (low corruption).

<sup>20</sup>Both countries improved in 2014 (37 for Egypt and 39 for Morocco) and slightly deteriorated in 2015 where both scored 36 (Transparency International, 2016).

policies and implementing initiatives fit best the informal institutions of Egypt and Morocco, explicitly recognising the reciprocal influence of formal and informal institutional components of their NIS and the resulting barriers.

There are significant similarities in the informal institutions of Egypt and Morocco. The extensive reviews of the two national innovation systems on the basis of desk research and the fieldwork conducted (see Selmanovic, 2015) indicate that also the challenges faced by innovators in Egypt and Morocco when interacting with formal institutions and institutional arrangements are similar:

- failure to develop and implement a comprehensive innovation strategy for the country (theme Governance);
- difficulty in accessing innovation funding (theme Funding);
- inadequacy of the education system and the lack of collaboration between academia and the private sector (theme Capacity Building); and
- excessive bureaucracy when dealing with governmental entities, leading to excessive transactional costs, direct and indirect (theme Infrastructure).

To address the systemic deficiencies of their NIS, policy makers need to recognise that these countries miss a culture that favours long-term investments or risky undertakings, necessary for R&D and (product or process) innovation, in exchange for the possibility of high returns. Therefore, particularly in the area of STI, policy definition requires a deep understanding of the needs of all individual actors: from the private sector, from academia and from the formal institutional arrangements. It is therefore essential to triangulate findings on innovation policy and activities from different perspectives, such as the triple helix (industry-government-academia) (Etzkowitz and Leydesdorff, 2000). Their early involvement represents more than an opportunity for designing the right instruments: it is an essential step to build the necessary reciprocal trust between all stakeholders of these collectivistic societies, raising the horizons of the single groups to embrace the common goal of national socio-economic development.

This research acknowledges the limitations inherent in an assessment based on a single set of interviews, albeit the level and distribution per group of stakeholders has provided a broad spectrum of contributions. To ensure higher validity and better assess the impact of implemented policies, their input should be collected over a longer period of time, possibly combined with surveys addressing a higher number of participants. Moreover, further micro-level research is needed in more countries of the region to enrich our understanding of the role of local informal institutions, how they evolve and how these changes are influenced by innovation, in particular endogenous innovation facilitated by existing support policies.

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