沙漠研究 **24**-1, 69-72 (2014)
Journal of Arid Land Studies

－ DT11 Refereed Paper －

Comparative Study on Higher Education and Innovation for Sustainable Development in North Africa

Takahiro MORIO*[1)]

Abstract: Recent international competition under economic globalization and extension of global issues such as environment, water management, energy, food security and public health had strong impact not only on developed countries but also on developing countries. They were a driving force for the governments of developing countries to promote science and technology and higher education in order to reinforce competitiveness of the domestic industries and to solve the issues for their sustainable development. In this study, I focus on the measures for innovation and higher education in three North African countries which have improved higher education and science and technology since their independence and are about to transform themselves into knowledge-based societies to solve global competition and global issues. I introduce three different examples of center of excellence of innovation in North Africa, Tunisian Technopark Project, Egypt-Japan University of Science and Technology and Institute of Science and Technology - Rosso, Mauritania and discuss their perspectives and issues from the viewpoints of short and middle term as well as long term.

Key Words: Collaboration between industry and academia, Higher education, Innovation, North Africa

1. Introduction

Recent trend of globalization has been involving the economy of developing countries into international competition as well as that of developed countries. It has become a driving force for their governments to pursue measures to reinforce competitiveness of existing domestic industries and to create new innovative industries based on science and technology researches in order to survive the global competition and to realize sustainable economical and social development. The measures include financial, legal and institutional privilege, promotion of investment and technology transfer, establishment of centers of excellence for science, technology and innovation, reforms of higher education, promotion of mobility of students and researchers and installation of new mechanisms and infrastructures to promote collaboration between industry and academia.

In this paper I focus on three countries of North-Africa: Tunisia, Egypt and Mauritania. European countries were the largest trade partners with these countries since their independence. Till the end of the 20th century, the domestic industries of North African countries were protected by the import quotas and other privileges including tariff barrier. However, transition to free trade by expiration of Multi-Fiber Arrangement Regarding International Trade in Textile industry on 1 January 2005 and conclusion of Association Agreement with European Union gave considerable impact to the conventional domestic textile industry.

On the other hand, issues such as environment, water management, energy, food security, public health and social stability threaten their sustainable development. Since most areas in North Africa are semi-arid and arid, stable food production and water security are critical factors. In order to promote the industries and to help the society be more competitive and sustainable, the governments of North African countries have invested large budget to education, science and technology and innovation. For example, Tunisia emphasized development of human resources as compensation for shortage of natural resources and has spent around 20% of its GDP on education. In addition, Tunisia installed and improved its infrastructure for innovation such as science and technology universities and science and technology parks.

In this paper, I discuss three different examples of centers of excellence for innovation and higher education implemented in North Africa and discusses their perspectives and issues from the viewpoints of short and middle term as well as long term.

2. Three Examples of Centers of Excellence for Innovation in North Africa

2.1. Tunisian technopark project

Tunisian government has implemented a policy to establish 10 technoparks (technopoles in French) aiming to create innovation-based industries and to solve national needs by synergy of higher education, scientific research, innovation and production (**Fig. 1A**). The technopark consists of four

* Corresponding Author: morio.takahiro.fu@u.tsukuba.ac.jp
1-1-1 Tennodai, Tsukuba Ibaraki 305-8577, Japan
1) Office of Global Initiatives, University of Tsukuba, Japan

(Received, October 8th, 2013; Accepted, November 27th, 2013)

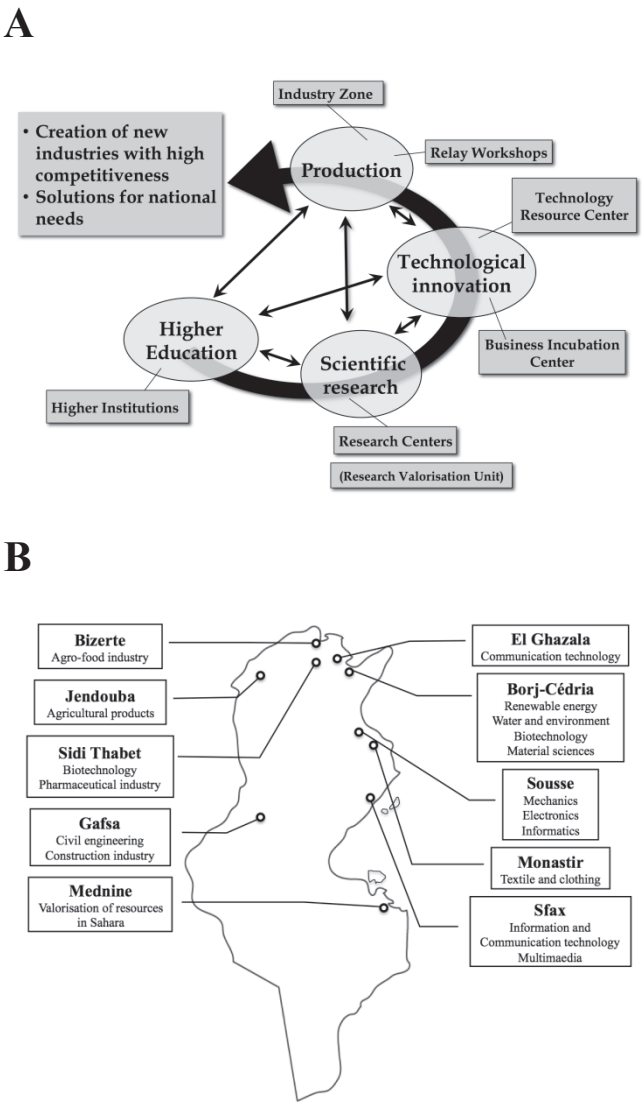

Fig. 1. The Tunisian Technopark project. A, The concept and components of the Tunisian Technopark: B, Ten technoparks including the ones projected and their specialties.

components corresponding to the respective functions above (Fig. 1A). Higher Institutions provide education and training of researchers and highly skilled engineers. Research Centers take charge of scientific research and training of graduate students and young researchers.

Tunisia has a Research Valorization Unit to evaluate research results and to give suggestions for their application to industry and solution of practical issues. Business Incubation Centers (Pépinière d'enterprises) and Technology Resource Center provide business incubation and technological facilities and services. For production, Relay Workshops are facilities to improve manufacturing process and Industrial Zone provides space and facility for commercial-scale production. Each technopark is assigned specific fields of research and innovation based on regional context and national priority (Fig. 1**B**).

Among the technoparks, Borj-Cédria Technopark (Technopole de Borj-Cédria, TBC: http://www.ecopark.rnrt.tn) is one of the most advanced technoparks. TBC is assigned four specialties: renewable energy, water and environment, plant biotechnology and material sciences. The higher education component, includes a Higher Institute of Environmental Sciences and Technologies (Institut Supérieur des Sciences et des Technologies de l'Environnement: ISSTE), the first higher education school in Africa and Middle East focused on environmental sciences and an engineering school of informatics

Since its establishment, TBC has cooperated with Japan as a strategic partner through technical cooperation, loan by Japanese government, and research collaboration with Japanese universities. It is remarkable that some amount of the loan was spent for scholarship program for 29 PhD candidates to study in Japan, which was the first project of Japanese governmental loan to African countries.

The ambitious concept of Tunisian technopark project to install all-in-one package of innovation and commercialization will be a potential model for innovation in developing countries which have poor infrastructure and experiences for higher education, innovation and production. However, there is still a gap between scientific research and technical development. It is symbolized by the fact that the components of higher education and research center are under jurisdiction of the Ministry of Higher Education and Scientific Research, whereas those of technological innovation and production are of the Ministry of Industry. To fill the gap, the role of the Research Valorization Unit should be emphasized as a pillar of basic research results, communicator and coordinator between research and application to industry and solution of regional, national and global issues. Especially, development of human resources in charge of Research Valorization Unit will be a critical key to success. It will be better to establish higher institute of management technology in the technopark to provide postdoctoral young researchers one or two years program including some months of internship.

2.2. Egypt-Japan University of Science and Technology

Egypt-Japan University of Science and Technology (E-JUST: http://www.ejust.edu.eg) was established in cooperation with Japanese government and universities. It has 3 graduate schools (Master and Doctoral) in science and engineering including School of Electronics, Communication and Computing, School of Innovative Design Engineering and Energy, Environmental and School of Process Engineering. In addition undergraduate schools will accept students in fall 2014 and two additional schools of humanities and business are planned to open.

E-JUST adopted Japanese style, laboratory based and

project oriented research and education system. Japanese Supporting University Consortium consisting of 12 Japanese universities supports educational programs and supervision of students. E-JUST is regarded as a model of educational cooperation between Japan and developing country and bilateral student and faculty exchange. In March 2013, the first batch of PhD and the third batch of MSc students graduated. It should be noted that Egyptian and world labor markets found added value in the graduates.

2.3. Institute of Science and Technology - Rosso, Mauritania

In contrast to the two examples above, which pursue advanced technology and innovation, Institute of Science and Technology (Institut Supérieur d'Enseignement Technologique, ISET: http://www.iset.mr) located in Rosso, Mauritania rather specializes in investigation, education and application of appropriate technology to regional agriculture and environmental issues.

ISET is a research and educational institute for agriculture. It has four core areas of competitive agricultural and animal production systems, nutrition and food safety, food production and processing, and natural resources and environmental systems. As educational activity, ISET provides three and five year training programs. Because one of the main missions of ISET is technology transfer to local communities, its research activities are oriented to regional issues focusing on development of easily applicable technologies. For example, overgrowth of a weed *Typha australis* on the Senegal River close to Rosso causes disturbance of river flow and is a threat of water resource management and river transportation. In order to solve the problem, a research project was implemented to produce charcoal at low cost using simple apparatus. It succeeded to replace conventional charcoal of lignin origin and saved wooden biomass.

Currently, the research and innovation activities of ISET orient to improvement of productivity rather than commercialization towards the world market. But they have potential to create local SMEs such as *Typha* charcoal business, if appropriate financial and technical assistance for starting new venture through its Business Incubator.

3. Discussion

It is undoubtedly significant and essential to develop highly educated human resources and to promote innovation for solution of regional and global problems and establishment of competitive and innovative knowledge-based society and its sustainable development.

On the other hand, however, youth (aged 15-24) unemployment rate in North Africa and Middle East in 2011 is still much higher (27.1 % and 26.2%, respectively) than the average rate in the world (12.7%), which is regarded as one of the major factors in the recent political uprising in the region, so-called "Arab Spring" (International Labour Office, 2012). Especially, the unemployment rate of youth who received higher education has been not improved or even has become worse for recent years (Kashiwagi, 2011). One of the main reasons is immature growth of private sector to absorb labor force of university graduates and high dependence on public sector (Richards and Waterbury, 2008; Kashiwagi, 2011). For example, in Egypt, 73% and 13% of researchers work at universities and national institutes, respectively and only 14% at private sector (Center for research and Development Strategy, Japan Science and Technology Agency, 2011 [A)]). In Japan, in comparison, 26%, 5% and 68% work at universities, national institutes and private sectors, respectively. One of the solutions will be development of human resources such as highly trained engineers for local small and medium enterprises (SMEs). In the case of Tunisian technoparks, some including TBC have a plan to establish higher institute of technologies and higher institute of information and communication technology. It should be carefully considered whether the human resources developed in the institutes meet current and future demands of the SMEs and add value. In Japan, there is special education system, College of Technology (KOSEN), a five-year education from 15 years old to develop highly trained engineers (http://www.kosen-k.go.jp/english/index.html). It is expected that cooperation between KOSEN and the institutes by sharing know-hows and experiences and developing collaborative curriculum will give some keys to fill the gap between higher education and labor market.

Considering long-term impact, the three examples of centers of excellence mentioned above, especially Tunisian technoparks and E-JUST, will contribute to reinforcement of domestic private sector and extend its labor market for highly educated youths. However, it is uncertain whether they could satisfy immediate demand for employment because commercialization of results of scientific researches and creation of employment take long time. In the case of ISET which focuses on agriculture sector and appropriate technology, graduates will be accepted to local agriculture community as leaders of technology transfer.

As discussed above, human resources who play the role of a bridge between scientific research and industry are very important for successful innovation and its acceleration. Those human resources are continuously demanded not only in developing countries including North Africa but also in developed countries. Systematic training of management of technology and technology marketing for postdoctoral young

researchers will give them new opportunities of career as innovation consultant and manager as well as 'conventional' researcher. In addition, North Africa has been a 'crossroad of cultures' where African, Arab-Islamic and European cultures encountered and interacted. Based on the historical and cultural background, integration of cross-cultural study and experiences in educational program will add value and advantage to North African graduates for working in global innovation market. E-JUST has a plan to establish academic programs international business management and cross-cultural management and therefore it is highly expected to develop multi-disciplinary academic programs.

The centers of excellence for innovation themselves also have potential new competitive industry as international higher education like Australia where international higher education and related industry is the third largest export industry with marked growth. North Africa has advantages of lower cultural gap for Middle Eastern and African students, accessibility to arid land and deserts to develop and train appropriate technology under this context and well-established field of cross-cultural studies and experiences. Taking these advantages, establishment of reputation as the global center of development of certain human resources, as India succeeded as center of developing ICT specialists, will create employment in middle term and will contribute to national value. The advantage will be also attractive to promote investment from developed countries by installing regional branches of their universities in North Africa.

Finally, it should be emphasized that the centers of excellence discussed above and others in North Africa should not be mutually exclusive and should avoid unnecessary competition. Rather they should cooperate and complement each other for sustainable development of the whole North African countries as well as each one.

Note

A) Center for research and Development Strategy, Japan Science and Technology Agency (2011): Report on the Trends of the Policy on Science, Technology and Innovation: Egypt 2010 (in Japanese). Published on the web: http://www.jst.go.jp/crds/pdf/2010/OR/CRDS-FY2010-OR-07.pdf, (accessed on 20 March 2013)

References

International Labour Office (2012): Regional Economic and Labour Market Developments: Middle East, North Africa. *In Global Employment Trends 2012*. pp. 71-77.

Kashiwagi K. (2011): The 25th January Revolution and the Egyptian Economy: Economic Background and Challenges (in Japanese). *Journal of Middle Eastern Studies*, **512**: 81-91.

Richards A., Waterbury J. (2008): *A Political Economy of the Middle East. 3rd ed.* Westview Press, U. S. A.