

Challenges of Innovation in the Developing Countries. The Need for Engineers' Education

Maciej Klósak, Ilias Majdouline
Universiapolis Agadir, Morocco

There has never been any doubt about the importance of promoting innovation that speeds up the development of all domains of our lives. Processes, services, products, everything needs to be improved in a permanent way. However, to innovate means to make effort. Kline has proposed a chain-linked model that describes the innovation process. The market need is the main source to innovate, but a proper interaction between production, marketing and R&D is required to dynamise innovation. The performance of innovation can be measured by the number of patents, R&D applications or professional literature citations

Keywords: logistics infrastructure, engineers' education, developing countries.

1. INTRODUCTION

There has never been any doubt about the importance of promoting innovation that speeds up the development of all domains of our lives. Processes, services, products, everything needs to be improved in a permanent way. However, to innovate means to make effort.

Kline has proposed a chain-linked model that describes the innovation process. The market need is the main source to innovate, but a proper interaction between production, marketing and R&D is required to dynamise innovation. The performance of innovation can be measured by the number of patents, R&D applications or professional literature citations.

Innovation may account for approximately five percent of the economic activity, however, in the more developed countries this contribution may rise up to 10 percent. In the innovation based economics this ratio may reach 30 percent of the economic activity. This confirms the need to innovate.

One should distinguish between the incremental innovation and more radical innovation, the first type being more popular and logical in the developing countries. However, it is frequent that developing countries adopt an imitation method of innovation. i.e. they accept solutions that are

already well developed in other countries. This seems to be the most efficient way to implement innovative ideas, products or solutions.

As the developing countries are unequal, it is difficult to describe a well-predefined pattern of how to implement innovations. In the fast growing countries such as China or Korea, the imitation was replaced by the fast absorption and a very creative adoption of new technologies, thus guaranteeing accelerated growth.

The global discussion about the role of different factors in the process of the country development mentions the importance of educational institutions. As sometimes these institutions play the key role in the national policy, therefore public and private educational institutions are encouraged to take leadership in the innovation transfer and economical development of the country.

2. CASE OF MOROCCO

Morocco is a fast developing country. The growth rate of 4.7 % in 2013 proves the stable development beyond the average. Public investment helps to keep such good results, but it is also due to the growing domestic consumption. The government encourages the private sector and promotes new production domains. The most spectacular new strategic branches are automotive

and aeronautics. This is where the most innovative solutions are placed in the Moroccan industry.

One good example of the private institution which understands this trend and its role in the country development is Universiapolis of Agadir. Universiapolis was the first private higher education institution to receive the accreditation from the Moroccan authorities. It deployed a Canadian system of education which turned to be a perfectly tailored innovation to the market. During the past 25 years Universiapolis has not stopped to maintain its leading role in the sector. Nowadays, it remains the leader in the private education sector in the southern part of the country. In 2011, in collaboration with the Luxemburgish Henry Tudor Research Centre the doctoral school has been opened in order to enable running PhD studies as well as to navigate innovation processes. Universiapolis has well understood its role to be the leader in the innovation application system both for the educational sector and for the country development. Universiapolis is the member of the Cartagena Network of Engineering - the international platform of international educational and industrial bodies which collaborate to better answer the challenges of the global competition and fast new technologies spread.

In the response to the strategic changes in the Moroccan economy and industry, Univeriapolis opened in 2013 the Institute of the Civil Aviation and Aerospace to provide training for air traffic control officers. A large educational offer of Universiapolis also helps to face the problem of unemployment rate of young people (up to 25 of age) which remains high (19%), yet smaller than the average EU rate.

3. UNIVERSIAPOLIS IN NUMBERS

Universiapolis consists of 5 schools of higher education and 3 doctoral schools. Approximately 40% of foreign students attend lectures. They mainly come from the French spoken Subsaharian Africa.

The understanding of the necessity for the innovation implementation can be best shown at the Technical University (Ecole Polytechnique d'Agadir) which is a part of Universiapolis. It educates 480 students of 12 nationalities. The academic staff consists of 25 full-time professors, 30 part-time professors and 22 visiting professors from all over the world including Canada, France, Poland and Luxembourg. In order to remain the leader in education as well as in innovating, the

university strategy focuses on the international partnership. It has 9 francophone partners (Polytech Montréal, UQO, ENIB, UDL, Université de Strasbourg, Henri Tudor Research Centre...) and 3 Anglophone partners (GoergiaTech, Poznan University of Technology, Wuhan University). As stated before, Ecole Polytechnique d'Agadir is well recognised by the Moroccan authorities which is proved by 8 diplomas of the technical studies accredited by the state. These are:

Bac+3 (equivalent to Bachelor degree):
Computer Engineering, Electrical Engineering and Industrial Engineering,

Bac+5 (equivalent to Master degree):
Mechanical Engineering, Computer Engineering - Option Software Engineering, Electrical Engineering - Option Automatism, Industrial Engineering - Option Automation of Production Processes, Industrial Engineering - Option Food Industry.

The graduates of Ecole Polytechnique d'Agadir have good perspectives on the labour market. Very often they continue their education abroad. It should be underlined that over 160 students per year take this opportunity to study abroad. Figure 1 presents the statistics about the activities undertaken just after completing the studies.

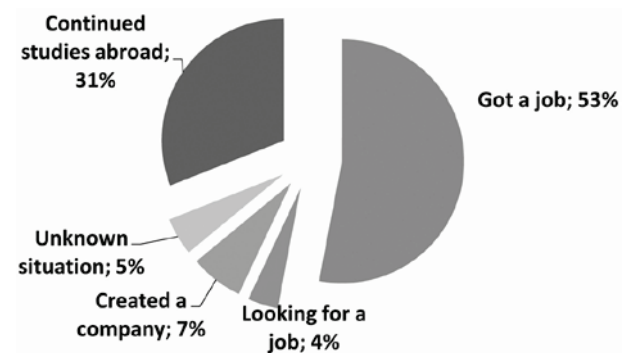


Fig. 1. The situation of the graduates of Ecole Polytechnique d'Agadir; survey based on 3 first graduate years.

Ecole Polytechnique d'Agadir understands perfectly the challenges of engineering education in Morocco and continuously improves results by increasing the students' number and by opening new technical studies (civil engineering in preparation phase). However, it should be pointed out that the target defined by the state is not yet reached. Morocco educates approximately 6,000 engineers per year while the target is 10,000. This is by far insufficient. In France, for example, in technical universities, the number of engineer

students is 30,000 whilst in China it reaches 700,000. These values clearly demonstrate the need to accelerate the changes in the educational systems.

Another important discussion is that Moroccans themselves are not very innovative. Figure 2 demonstrates a distribution of patents filled in different industrial sectors. One conclusion is that patents in the food sector are low compared to its importance for the Moroccan economy. Another remark is that unfortunately most of these patents are not of the Moroccan origin. The latter conclusion clearly confirms that imitation as the way to implement innovation to the market seems to be the most common in Morocco.

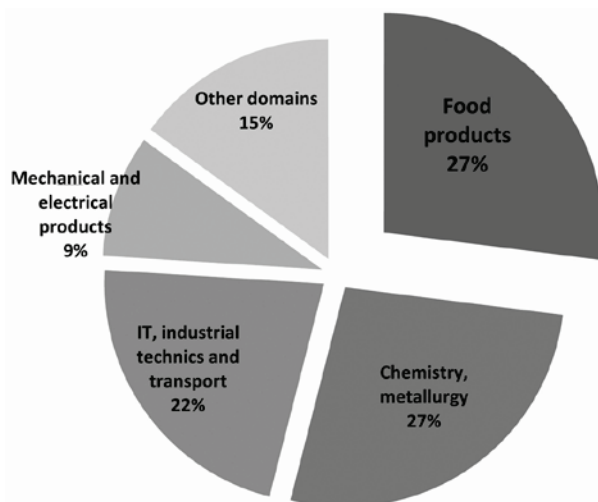


Fig. 2. The proportion of patents filled in the food sector is relatively low compared to the importance of this sector for the Moroccan economy; based on statistics of OMPIC (2010).

The new industrial branches implemented in Morocco (automotive, aeronautics) bring hope to change this tendency in a positive way. On the other hand, the educational sector seems to react correctly to these changes by increasing the education level. The higher level, the more innovative engineers and - as a result - the more innovations on the market. This change is a time consuming process, but it looks like Universiapolis perfectly understands this trend.

In order to answer the need of focusing on R&D as a source of innovation, Ecole Polytechnique d'Agadir has launched a research project to construct a gas gun based on the Hopkinson Split Bar. The project has been run in collaboration with ENIM France and Poznań University of Technology in Poland. Dynamic tests start to be carried out in order to study the

mechanical behaviour of various materials at high strain rates and at high speeds of impact. The most common applications of such dynamic material analysis may be found in the automotive, aviation, civil engineering or military industries. The gas gun of Agadir holds the Moroccan speed record of 104 m/s of the projectile to perforate the specimen. Figure 3 presents the apparatus as well as the specimen subjected to the perforation tests.

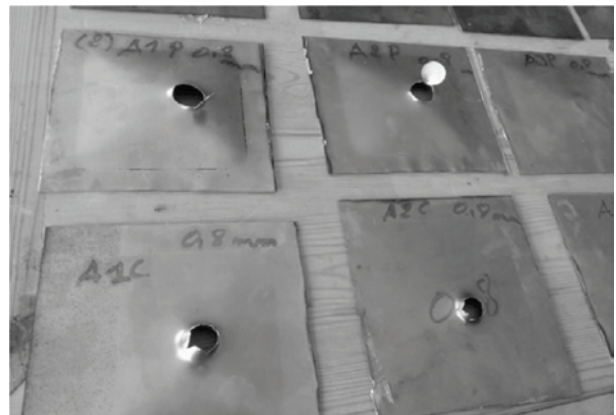


Fig. 3. Innovation through R&D activities: first tests using the new experimental equipment. All kinds of materials may be analysed including high resistant steels or ceramics.

4. CONCLUSIONS

Innovation is one of the most important elements of the national economy growth. In particular, the developing countries should be aware that innovation may become the key factor to improve their economical results. There is a big challenge for educational institutions to help to accelerate the process of innovation implementation. Universiapolis - the Moroccan private university described in this paper is a good example of how education institutions should contribute to the country growth and success.

REFERENCES

- [1] W. Naude, A. Shirmai and M. Goedhuys, Innovation and Entrepreneurship in developing countries, United nations University, Policy Brief, I 2011
- [2] S.J. Kline, Research, Invention, Innovation and Production: Models and Reality, Stanford University, Mechanical Engineering Department, Report INN-1 1985
- [3] M. Klósak and I. Majdoulina, Engineers and challenges of innovation in the developing countries, The 6th Congress of the Cartagena Network of Engineering CNE-RCI, Wrocław 2014

Maciej Klósak
Universiapolis Agadir, Morocco
maciej.klosak@gmail.com

Ilias Majdoulina
Universiapolis Agadir, Morocco
ilias@e-polytechnique.ma