Chapter 5
Robotics Education in Africa:
Africa Compete

Marwa Soudi
Ideas Gym Science Center, Egypt

ABSTRACT

The world is approaching a third industrial revolution. This is forcefully reflected in the phenomenal advancement in the robotics field. In order for Africa to compete in this new era, a change in education policies must take place in the African educational system. In this chapter, African initiatives in science, technology, and innovation are presented as initial core projects. International initiatives as well Egypt's experiences in the robotics field are presented for benchmarking for interested African countries. The focus of the chapter is how to build a knowledge-based society supporting educational ecosystem.

INTRODUCTION

Robotics has been of great interest for many people for a very long time, but we are now at a stage where we can say that the robotics will play a very important role in developing societies. Many countries have started to focus on robotics as a goal for development within the next 50 years.The "Russian 2045 initiative" (Itskov, 2012), and the European initiative EMARO (Emaroteam, 2012) are typical examples. Science, Technology and Innovation is not new to the continent of Africa. As Urama et al(2010,p.9) inform us:

Science, Technology and Innovation (STI) in Africa are as old as humanity itself. STI has been an integral part of the pre-historic man and thus integral to Africa and the evolution of mankind. Documented evidence suggests that Africa is amongst the most strategic continents in the history of STI development, globally. Some of the most important technological innovations for human survival have unique origins in Africa. For instance, development in tool making industry has its root in Africa. About 2.3 million BC "homohabilis' residing in East Africa developed the first tool-making industry called "Olduwan". Following this, the Acheulean stone tool industry (characterized by hand axe) emerged in Africa in 1.5million BC, and spread to Middle-East and Europe around 800,000 and 600,000 BC. A significant development, which influenced all later stone tool industry, is the creation of bone tools and black blades in Southern and Eastern

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Africa around 90,000 to 60,000 BC. Use of iron in smelting and forging for tools appeared in West Africa around 1200 BC making it the first birth place of the iron-age. Before 1800, Africa's methods of extracting iron were employed in Brazil, until more advanced European methods were instituted, while copper smelting developed independently in West Africa around 900 AD. Investigation into space and time also began in Africa. "Paleolithic Africans" began a process of stargazing as far back as 40,000 years ago. The process transformed into a systematic observational science in the Nilotic lands of Africa between 6,000 and 12,000 years ago. The most important result of the Nilotic stargazing was the invention of the calendar and the basis for the modern astronomy. The "proto-technology" of the modern world is traceable to the iron-ore mining 43,000 years ago in Southern Africa and the emergence of "proto-mathematics" from the Africa's Great Lakes region over 25,000 years ago. From these beginnings, science and technology underwent steady development in Africa, with the continent reputed to be the earliest origin of formal mathematics, astronomy, engineering, architecture, navigation and map-making. The recent discovery of the Timbuktu manuscripts rekindled confidence that Africans were studying mathematics and astronomy at least over 300 years ago. Other discoveries also record that there were advanced concepts of modern physics in Mali. From the foregoing, it could be argued that Africa had great beginnings in its role in shaping global science and technology.

Again it bears noting that:

… although agriculture and natural resource will continue to be important drivers of Africa's economic growth, it is the application of modern technologies that will have the most significant impact on the growth trajectories of most African economies. Specifically, the greatest opportunity for growth will come from technological innovation and the adoption of new technologies in services sectors, such as banking, insurance, health, education and agriculture. New opportunities have arisen that make it possible for low-income economies to leapfrog other countries by adopting technologies that are suitable to their specific circumstances. Those countries that embrace and invest in technology will be able to sustain growth and be competitive regionally and internationally (Kemenyi & Moyo, 2011, p.13).

Africa's STI productivity remains very low (<2% of the global output); and her investment in STI is even lower with only South Africa approaching an investment rate of 1% of her GDP on research and development in the whole of the sub-Saharan Africa. Overcoming this would therefore require transformational changes in how STI is socially defined and constructed, prioritized and funded, communicated, monitored and evaluated in Africa. A better understanding of the changing forms and directions of STI policies in the global economy would be required to ensure more balanced criteria within which African STI is governed and evaluated. A central part of dealing with this challenge lies in planning for the needs of Africa's next generation of students especially in the fields of electrical and computer engineering technology where undergraduate curriculum must be up to date and relevant. The curriculum should effectively teach the rapidly changing technology widely used in industry.

Africa as a continent full of resources and great potential needs to set its own goals and unite its efforts to compete in the near future. African countries have a similar history and face common problems. Unfortunately since the colonial interregnum, African responses to her problems have not been encouraged. This is compounded by "brain drain" where large numbers of Africans migrate to study, live and work in western companies or universities.