

# Scientific Research And Innovation For Human Development-The Concept Of Science Parks For Universities In Kenya

**Prof. Geoffrey Mwanza Muluvi**

Vice Chancellor, South Eastern Kenya University,  
Kenya

**Dr. Josphert Ngui Kimatu**

Director, Research, Innovation and Technology,  
South Eastern Kenya University, Kenya

**Dr. Jonathan Muema Mwanja**

Director, Kitui Town Campus,  
South Eastern Kenya University, Kenya

**Dr. Joseph Munyoki Mwinzi**

Department of Educational Foundations,  
University of Nairobi

**Abstract:** Sustained competitive innovation is not seldom an outcome of the effort of a single industry or institution. This realization has spurred governments to direct resources to stimulate the emergence and strengthening of research institutions and universities in Kenya. Universities in the 21<sup>st</sup> century aim at providing solutions to challenges facing human society through structured research and the generation of ideas for new products. This paper explores how the established institutions in Kenya have generated research to develop those areas where they are geographically located. Among the questions to be answered by this paper include; where are we in terms of scientific and technological research? what has been done and what remains to be done? Has the research quality and quantity changed since the establishment of several other universities? How well have the Kenyan university researchers disseminated their findings to industrial sector and how has funding affected the generation of new innovations? How individual universities have mobilized resources for the sake of research? The paper too proposes the creation of science parks as a proven method that university researchers in Kenya can use to commercialize their innovations and make industrial products more relevant and competitive as they help the government in creating more jobs. The generalized assumption is that research in science in Africa is faced by almost similar challenges and thus the Kenyan experiences, challenges and solutions can inform other regions in the developing world.

**Key Terms:** Research, human capital, technology, Commercialization of research, knowledge incubation, innovations

## I. ROLE OF UNIVERSITIES IN RESEARCH, INNOVATION AND THE INCUBATION OF IDEAS

In her paper, *Transformation of Higher Education in Kenya*, Kinyanjui, 2007 called on the government to consider establishing universities in various regions of the country with the aim of promoting research to spur economic development. The universities so created were to be centers of innovation, knowledge incubators and were to partner with other research institutes to promote research in specific areas for national development. The Kenyan government has also promoted research through the bodies like the Kenya National Academy

for Sciences, National Commission for Science and Technology, National Council for Science and Technology and many other research institutes in the country. However, there is need to re-examine the trends and sustainability of the envisioned research and technology strategies. All the facets of the role of Universities in spurring economic development has not been fully utilized in Africa. Manuel Castells (2001) argues that apart from universities being avenues of socialization of the elite they are centers of scientific research. The developmental ideology of societies is a central concept that is perpetuated by universities in most countries worldwide. When knowledge becomes so important and

sought after then universities and generally higher education is highlighted. In the United States for instance, universities are considered to be the principal strength of the national innovation system. Universities have been centers of innovation and incubators of the best ideas in most countries. It is these progressive ideas that have been shaped and reconstructed to foster industrial, technological and hence economic development in different countries.

In the recent past universities have experienced two major revolutions, according to Etzkowitz (1998). The first was an academic revolution, which made research a role of the university; while the second is the integration of economic function into the academic equation. Universities are now becoming more entrepreneurial and business-minded. Powell et al. (1996) notes that there is a complex web of relationships among academics—with universities originating business enterprises in which academics themselves are involved. This is well illustrated by Nobel-prize winner, Arthur Kornberg, in his book: 'The Golden Helix' (Kornberg, 1995). Here, he expressed bafflement that a highly focused academic scientist, such as himself had become an advocate of industry/academic intersection, finding it fruitful for both science and business (Blumenthal, 1986). This is the direction of these centers of knowledge generation. Research and the marketing of the same research to industrial world so that finally it becomes a catalyst for industrial development.

Kent Hill (2006) notes that, "The most important source of technological progress over the past 150 years has been the advance of scientific knowledge. A dependence of industrial innovation on science first became evident the 19th century. Application of principles of chemistry and physics became central to the commercial success of manufacturers of steel, rubber, chemicals, drugs, and electricity. Industries came to rely on universities to train the scientists and engineers they would employ in their research laboratories. This points to the fact that for industrial revolution to take place in the African continent then we have to invest in scientific research and link the same to the industries. Most worthy Universities in Africa have realized these very central functions and as a result began to train industrial scientists and engineers in an effort to be alternative sources of research for national development.

These paper examines how well our African universities achieved this goal. My focus mainly being Kenya where university education has expanded tremendously in the past ten years.

Kenyan government is focused on the vision 2030 which is an economic blueprint to make the country a middle income economy and join the league of newly-industrialized countries with a higher quality of life to all its citizens by the year 2030. One of the pillars of vision 2030 in Kenya is the education pillar. One of the fundamental first-focus objectives of the education pillars in this blueprint is to offer opportunities for advancement of learning beyond basic education with strong leaning towards tertiary level scholarship and research. Such a concern underscores the importance of the university in Kenya in realizing vision 2030. The University Education Policy of 2012 in Kenya spells clearly that, "Kenya's future as a prosperous and internationally competitive nation will depend on her university education system. As a nation Kenya will rely on this system to create a pool of highly trained human

resource capital that underpins our national ambitions of being a knowledge-based economy. It is such thinking that went ahead to inform the mission, vision, and core values of the most universities in the country. Research has been core mandate in most universities in Kenya where the focus has been to generate scientific knowledge for national progress towards vision 2030. Knowledge producers world over are the drivers of industrialization process and thus Kenya is pursuing a policy paradigm that places universities and research institutes at the centre of knowledge and technology generation and dissemination. The story of the Silicon Valley resulted from university research and so Kenya is on the verge of adopting such research, industrial and economic models in the vision 2030.

According to World Development Report (2009) Kenya scores only 3% in terms technology exports as a percentage of manufactured exports and a Technology Achievement Index (TAI) of around 0.129. At the same time Science and Engineering enrolment in the Universities was around 0.3%. The situation has changed slightly but then there are positive indicators due to increased number of universities which are centers of research in science, engineering and technology. The National Council of Science and Technology has gone some strides in that organizing Science and Technology fairs in collaboration with universities so as to encourage scientific innovations.

Kenyan Universities are organizing conferences of international caliber in an effort to have forums to share the very progressive ideas in science and technology. These efforts are more pronounced in our Kenyan universities nowadays than any other time in our history. Our scientists have been honored regionally and internationally due to efforts they have made in research.

Some very innovative ideas have emerged from our university laboratories in Kenya. *Ecotran* idea from the University of Nairobi students was a novel project which is set to curb pollution and ease power demand and increase profits in transport industry more so in the use of *Boda boda* taxis. Elsewhere in an event organized by the National Council of Science and Technology (NCST) Technical University of Kenya students had created an autonomous robot in their Engineering laboratories. As a result of all these most universities in Kenya are coming up with technology and scientific innovation centers. A good example is the Technology incubation of The Technical University of Kenya. At the South Eastern Kenya University (SEKU) the Directorate of Research, Innovation and Technology produced low cost smoked water purification clay pots with the aim of tackling the problem of water scarcity and water borne infections in the County of Kitui. These pots reduced water borne microorganisms by 86% and reduced turbidity by 100% (Chung et al., 2013). The University of Nairobi has also been on the fore front in offering innovative solutions to national development, for example is set to be the first public institution of higher learning to develop a grid connected biogas facility after it expands its biogas project based at upper Kabete campus.

In Kenya, the government has partnered with Industries and universities in an effort to train current and future requirements of human capital. Universities in Kenya have

been set up in regions where they are supposed to spur research and develop the geographical regions where they are found. South Eastern Kenya University in Kitui is close to Mui Basin which has large deposits of Coal and where SEKU will play a key role from its Institute of Mining and Mineral Processing. Masinde Muliro University of Science and Technology is located in the Sugar growing areas of Western Kenya thus its role to spur research in Sugar Research. As a result the university has a Department of Sugar Technology which trains students in sugar engineering and other related courses. These undertakings are geared towards bringing the role of the university home in relation to the question of research. It cannot therefore be labored further that universities in Kenya are in the front line when it comes to research. With increased research activity in our universities the biggest question would be how are the researchers reaching the industries?

## II. COMMERCIALIZATION OF RESEARCH IDEAS IN KENYA

There is need to match research expertise and creativity with commercialization of the findings. Seminars, workshops, publications, informal contacts, staff exchange and training among other means are the ways in which research ideas reach the market. Knowledge dissemination should be seen as active, directed, and interactive process of communicating knowledge to the target group for adoption and application. Without dissemination and utilization of research ideas it may not be possible to realize tangible industrial progress. The University innovation process of doing Research, then Publishing, followed by Patenting the technology, the making a Prototype and finally commercializing the Product [RPPPP] has not been followed to the end by many researchers. This has been due to the working of the universities, industries and government in isolated silos as shown in the figure 1 below.

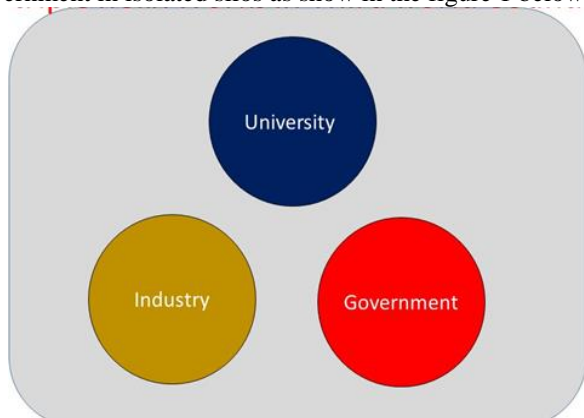


Figure 1: Show that although the Universities, Government and Industries are regulated by same policies in the same country in many developing countries, they are still working without strategic linkages to spur sustainable economic development

## III. THE ROLE OF INTRA AND INTER FACULTY COLLABORATIONS IN SHAPING INNOVATION

Most universities have not yet developed guidelines for faculty collaboration with researchers at other universities. Collaboration beyond student exchange is normally based on common research interests. This assumes that faculty in both universities are equally active in research. The limited research output of Kenyan lecturers reduces the opportunities for collaboration with industry and foreign universities. The study commissioned by CHE, according to Gichagaet *al.* (2005), found that there is limited collaboration between Kenyan universities and industry. This is partly due to the lack of awareness of local industry of the potential for research contributions from Kenyan universities, or to the lack of awareness of university researchers of industry's needs. This is compounded by the fact that multinationals employ and utilize research from their mother countries. This can urgently be remedied by the development of science parks as in happened in the USA in the late 1970s.

However, in the USA, there are research transfer issues which include; the negative effects of the commercialization of research at universities, possible conflicts of interests and barriers to access research tools, question of funding in the early stages and problems of intellectual property protection. According to Magnus Karlsson (2004) the problems of commercialization of research in the world dodge both the developed and developing world alike. The same problems that play in America are available in Kenya but within varying magnitudes.

In Kenya, conferences, workshops, policy briefs and seminars are the commonly used methods of dissemination of research findings. These methods are likely not to have the expected impact on the industry and as such low industrial intake of research. Nevertheless, what needs to be done is formulation of policy on strategies of dissemination, support culture of knowledge transfer, increase the motivation for the need of knowledge transfer, increase the levels of industry collaborations with the research institutions and increase the funding at the level of dissemination of university innovations and research. A deliberate effort must be made to make the universities, industries and government to collaborate in developing a sustainable innovation flat form. They can start by dealing with innovations in cross cutting issues like energy, transport and ICT. This flat form is what is called a science park. It is a physical place where regular meetings are held and ideas consolidated for impactful innovation as shown in Figure 2 below.

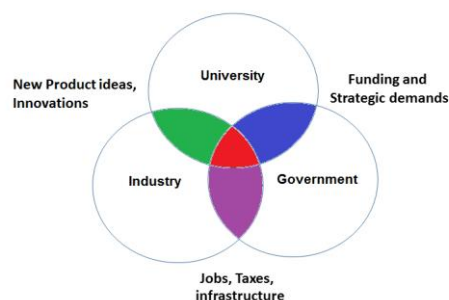


Figure 2: The formation of a science park (coloured red) which shows cross cutting issues between Universities,

*Industries and the government ministries. Other bi-specific issues and innovations (coloured blue, purple and green) can also be addressed like Jobs, taxes and infrastructure as shown at the links*

Research has shown that knowledge constructed in the context of solving problems is better comprehended, retained, and therefore more transferable. This is the reason why the universities in Kenya anchor their research on community service in an effort to solve the challenges that face these communities. Once problem solving research has integrated into the Kenyan academic life then knowledge generation and transfer will be practical and socially useful. This is the goal of the government and is also the way industries make profit.

#### IV. HOW THE SCIENCE PARK CAN SOLVE THE CHALLENGES OF SCIENTIFIC RESEARCH

James Otieno and Milton Obamba (2013) in their report to Organization for Economic Cooperation and Development (OECD) identify inadequate and undiversified funding in African universities as a major challenge to research at the university level. Although their study regarded Ghana, Uganda and Kenya it can also be said to be applying in other countries. Due to low economic growth government funding of research in our universities has gone down and that way the researchers' morale waned. Against underfunding is also the problem of numbers in the universities where the researchers concentrate on teaching at the expense of research. This is so because most researchers are faculty members in their universities.

It is unfortunate that most Universities have almost taken a business slant in Kenya and in an effort to do cost-cutting on some non-essential services and most of them are not funding research from the internally generated funds. This has left a research minded professor and other talented young researchers disenchanted and reluctant to initiate research in their areas of interest. Research students in Kenya also suffer from a lack of contact with other scientists, a problem made worse by the absence of any easily accessible database of the country's scientific efforts, or any inventory of the country's scientists. Even though scientists meet in the so called international conferences there is no internal means of exchanging ideas in the country and this gives research undertaking a beating.

Universities in Kenya cannot afford to offer attractive salaries for research staff. As in Africa generally, low pay and poor working conditions and terms of service are widely blamed for the 'brain drain' that continues to sap the country's resources. Over the years university staff unions have clashed with the government and university management over the same leading to closures and loss of utility time that could have been committed to research.

The generational clash is also affecting research in the universities where certain old professors think that modern or emerging technology is not of use. This pits those professors against young scholars who instead want to experiment new ways of doing things. Although this may not be documented as a serious problem I am convinced that it has continued to affect research in both the universities and institutes of

research. This being a question of technology gap calls for retraining and adoption of emerging ideas to both the established researchers and those who are joining them.

#### V. CONCLUSION

In conclusion it should be noted that Kenya has achieved great strides in research even though there are enormous challenges facing the Kenyan researcher. Underfunding by government, poor coordination of research undertaking, generational gaps between old professors and upcoming young researchers, increased student numbers in the universities leaving the university researcher with minimum time to commit in research are some of the problems underscored by this paper. However we pinpoint that the development of a science park shall be the remedy of the challenges facing innovation and technology in Kenya. This is the basis of the secret of the industrial and technological innovation in the whole world. By 1990, the number of science parks in USA was 398, Germany had 106, Japan 104, China 52, UK 50, France 35, Australia 33, Canada 31, Sweden 15, and Russia 14. The science parks are the ones which give rise to Techno cities or techno polis. Kenya shall benefit from the Konza Techno city if the science parks in the University are urgently developed.

We also suggest that universities in Kenya should proceed to spur development based on research in various areas. A research is needed in Turkana County where oil was discovered recently, Marine science and Fisheries should be strengthened in both the coastal areas and around Lake Victoria in order to realize increased fishing activity and creation of jobs. Dryland Agriculture in the arid and semi-arid regions should attract more research in order to feed growing population and create job opportunities. Mining and Mineral Processing should be funded more with the aim of utilizing the countries untapped mineral resources for national development.

It is the high time that universities partnered with other organizations to fund research in Kenya and to find solutions to economic growth and industrialization. Universities should create links with the local industries and multi-nationals with the aim of domesticating all the technology for national development. We cannot lament throughout but we need to learn from other countries as we get deeper and deeper into globalization. In a knowledge-based society, Universities, industries and the government have mutual roles and form a triple helix in stimulating and sustaining innovation. We have to do situational analysis of the Africa set up and carry out stakeholder engagement for the establishment of strategic science parks in most Universities. A University without a science park cannot have sustainable research and innovation, a company without a science park cannot survive global competition while a government without a science park cannot generate enough revenue and jobs to satisfy its citizens. The government in the triple helix, must support these linkages through creation of a favourable regulatory environment, provision of tax incentives and granting of public venture capital. On the other hand, the Industry should collaborate with the university in developing entrepreneurial universities



for new competitive global products. However, in areas where knowledge-based industries are lacking, the university-government interactions can help jump-start their creation and sustainability. Therefore the concept of science and Technology Parks shall be promote the economic development and competitiveness of regions and cities by: creating new business opportunities and adding value to mature companies; fostering entrepreneurship and incubating new innovative companies; generating knowledge-based jobs; building attractive spaces for the emerging knowledge workers; enhancing the synergy between universities and companies as envisioned by the International Association of Science Parks. It is amazing that only Egerton University is a member of the international association of science parks in Kenya, (www.iasp.ws).

#### REFERENCES

- [1] Blumenthal, 1986. *University-Industry research relations in biotechnology*. Science 232, 1361–1366.
- [2] Chung et al, (2013). Introducing efficient low cost smoked pots for water purification for developing countries. *Hydrology Current Res* 2013, 4: 152, pp. 2157 - 7587.
- [3] Desai M. et al (2002). *Measuring the Technology Achievement of Nations and the Network Age*. Journal of Human Development, Vol 3. No.1
- [4] Etzkowitz et al (2008). Pathways to the entrepreneurial university: towards a global Convergence. *Science and Public Policy*, 35(9):681-695.
- [5] Gichaga. F.J.et al (2005): *A study on university-industry linkage in Kenya*, a report submitted to the Commission for Higher Education, January 2005.
- [6] Hill K. (2006). *University Research and Local Economic Development*. (Productivity and Prosperity project). Arizona State University. Arizona.
- [7] James Otieno and Milton Obamba (2013). African Network for Internalization of Education. *Draft Report on Research and Innovation Management: Comparative Analysis of Ghana, Kenya, Uganda*.
- [8] Kornberg A. (1995). *Golden Helix: Inside Biotech Ventures*. University Science Books. California.
- [9] Nauwelaers Claire, Kleibrink Alexander and Stancova Katerina (2014). *The Role of Science Parks in Smart Specialisation Strategies*. Independent Policy Analyst, Brussels (Belgium) European Commission, JRC-IPTS, Seville (Spain) S3 Policy Brief Series no 08.
- [10] Magnus Karlsson (2004). *Commercialization of Research Results in the United States. An Overview of the Federal and Academic Technology Transfer*. Swedish Institute for Growth Policy Studies. Sweden.
- [11] Manuel Castells (2001), *The Network Society: From Knowledge to Policy*. Open University of Catalonia. Barcelona.
- [12] Powell W. et al (1996). Inter-organizational Collaboration and the locus of Innovation: Networks of learning in Biotechnology. *Administrative Science Quarterly* 41, 116–145.
- [13] Republic of Kenya (2007). *Kenya Vision 2030*. Government Printers: Nairobi.
- [14] Republic of Kenya (2012) *Policy Framework for University Education*. Government Printers: Nairobi.