Knowledge production and distribution by institutions of higher education in sub-Saharan Africa: Opportunities and challenges

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Abstract

This article focuses on available opportunities and challenges which institutions of higher education in sub-Saharan Africa face in producing and distributing knowledge. Institutions of higher education are also expected to produce knowledge workers for the knowledge economy. Knowledge production falls into Mode 1, in which problems are set and solved in a context governed by the largely academic interest of a specific community, and Mode 2, considered more socially accountable, accessible and reflexive. Knowledge produced by universities falls more into Mode 1. Objectives of the article are: to find out the potential role of sub-Saharan Africa-based institutions of higher education in producing and distributing knowledge; to explore ways of supplementing Mode 1 knowledge with Mode 2 knowledge, which has more social relevance; identify challenges faced by sub-Saharan Africa-based institutions of higher education in producing and distributing knowledge; find out how information technology may enhance knowledge production and distribution by institutions of higher education in sub-Saharan Africa; establish how the environments in which institutions of higher education in sub-Saharan Africa operate impact on knowledge production and distribution abilities of the institutions. A literature review was conducted to establish the state of knowledge production and distribution by institutions of higher education in sub-Saharan Africa. It was found out that institutions of higher education in sub-Saharan Africa face numerous challenges in producing knowledge. Challenges include poor infrastructure, declining budgetary allocations, brain drain and competition in knowledge production. Universities in sub-Saharan Africa can play a major role in producing knowledge and contributing to economic development in the region.

INTRODUCTION

It has recently been argued that production of new knowledge is no longer a domain of universities and other higher institutions of learning. Other actors in the production of new knowledge now include research hospitals, industries and government laboratories. Godin and Gingras (2000, 275) however argue that many research hospitals, government laboratories and industries work closely with universities in producing new knowledge. Rather than focusing solely on the significance of research and development activities and the transfer of knowledge to industries,

recent studies reflect on the place of universities involved in the contemporary knowledge production system (Etzkowitz and Leydesdorff 2000). Gibbons et al. (1994, 85) also observe that new knowledge is no longer produced only in university settings but is also found increasingly in many other loci including government laboratories, industries and think-tanks, and that new knowledge in the other loci tends to be produced in contexts of application. The duo foresee a situation in the new mode of knowledge production where the 'Universities, in particular, will comprise only a part, perhaps only a small portion, of the knowledge producing sector'. This article exclusively explores knowledge production at institutions of higher learning in sub-Saharan Africa. Knowledge production by universities and other institutions of higher learning may be affected and shaped by similar factors all over the world, but the author of this article thinks that the knowledge production activities at institutions of higher learning are shaped by the unique environmental factors in the region.

The philosophical study of epistemology is concerned with the nature, sources, and limits of knowledge (Maiese 2005). Institutions of higher learning may be considered as sources of new knowledge which results from research findings and subsequent publishing and patenting. Economic growth in the modern era has been grounded on the exploitation of scientific knowledge (Dasgupta and David 1994, 486). Institutions of higher education in sub-Saharan Africa may also be charged with the responsibility of training and educating knowledge workers who are in high demand in the knowledge economy. Scholarly publishing is considered the norm for disseminating and validating research results and is also crucial as an indicator of the rates of new knowledge production of an institution, a country or a region. Data on scholarly publication by a country or a region provide not only an indication of the levels of production of new knowledge but also research capacity of that country or region. Scholarly publication should be considered part and parcel of the process of the production of new knowledge. A low scholarly publication rate in sub-Saharan Africa suggests a problem of knowledge diffusion for the region and possibly low rates of the production of new knowledge.

PROBLEM STATEMENT

In a knowledge society, the basic economic resource is no longer capital, or natural resources or even labour, but knowledge. In the knowledge society, knowledge workers are supposed to play a central role. The essential contribution of knowledge to economic competitiveness and social welfare is now widely recognized. Such recognition has increased the attention to the role of universities in the production and dissemination of knowledge. Rather than training and turning out highly qualified human resources, institutions of higher education in sub-Saharan Africa have the other role of producing and distributing new relevant knowledge. Sub-Saharan Africa is a developing region which requires highly qualified human resources and knowledge for development. Knowledge is now looked upon not only

as an important factor of production, but also as a valued resource for boosting development, more so in the developing regions such as sub-Saharan Africa. Do the institutions of higher learning in sub-Saharan Africa have the capacity to produce relevant knowledge for the development of the region? For long, the sub-Saharan Africa region has been relying on the enormous natural resources and cheap labour, without any contribution of local intellectual added value, which has perpetuated underdevelopment in the region. Second, knowledge is not a commodity that can be bought and put to work with little additional effort. To achieve this successfully, a strong local knowledge base needs to be created and nurtured. Without it, the world's information riches are out of reach, and therefore become meaningless and of little value.

HIGHER EDUCATION

The beginning of institutions of higher education may be traced to the medieval age. Martin and Etzkowitz (2000) identify two major functions of the medieval university as:

- Teaching priests, public servants, lawyers and so on; and
- Scholarship in a variety of disciplines (biblical, classical, philosophical, medical, etc).

Over time as surrounding societal environment changed, so those two functions evolved. Two relatively distinct types of teaching emerged:

- To develop the full potential of the individual student,
- To produce trained people with knowledge and skills which were useful for society (priests, administrators, physicians, etc.).

As time went by, scholarship evolved and two fairly fundamental changes emerged:

- Scholarship was broadened to include the creation of new knowledge – in other words 'research' – as well as the re-analysis and synthesis of existing knowledge;
- A distinction emerged between two types of research – knowledge 'for its sake' as opposed to knowledge to meet the needs of society (Martin and Etzkowitz 2000).

According to the OECD (2009) higher education drives and is driven by globalization. It trains the highly skilled workers and contributes to the research base and capacity for innovation that determine competitiveness in the knowledge-based global economy. It facilitates international collaboration and cross-cultural

exchange. Cross-border flows of ideas, students, faculty and financing, coupled with developments in information and communication technology, are changing the environment where higher education institutions function. Co-operation and competition are intensifying simultaneously under the growing influence of market forces and the emergence of new players.

There may be no simple and easy definition of higher education. It may be easier to identify functions of institutions of higher education than to define the concept of higher education. The international definition of tertiary (post school) education divides it into two parts. Type A (Higher Education) and Type B (Further Education). In sub-Saharan Africa, some countries have one Department (Ministry) of Education while others have two separate departments – one for basic education and another for higher education. Kenya, Zimbabwe and South Africa are examples of sub-Saharan African countries which have two different departments (ministries) for basic and higher education.

Mbali (2011, 3) lists some of the fundamental purposes of higher education as:

- To produce educated citizens;
- To produce qualified engineers, doctors, surveyors, nurses, teachers and lawyers;
- To produce new knowledge;
- To pursue scholarship;
- To garner and sustain resources for high-level knowledge production; and
- To disseminate knowledge.

Nearly all the attempts to define higher education and/or identify purposes of higher education mention training of highly skilled personnel and production of new knowledge. If one goes by Mbali's purposes of higher education, one can see that production and distribution of new knowledge is only a portion of what institutions of higher education are expected to do. Institutions of higher education are also expected to produce highly qualified and/or skilled personnel. In a knowledge economy, the highly qualified and/or skilled personnel may be considered knowledge workers.

Martin and Etzkowitz (2000) examine what the future holds for the university. The duo looks at two very contradictory theses which have been put forward about the future of the university as an entity. On the one hand, there is a 'declinist' thesis with some pessimists believing that the very future of the university is under threat from governments and others to do more useful things – including producing more applied knowledge and developing more useful skills in its students.

According to UNESCO (2008), the sub-Saharan Africa region records the lowest tertiary education enrolment at 5 per cent in 2005. Tertiary education is relevant to the education for all (EFA) goals as a component of the gender equality goal and for teacher training. In sub-Saharan Africa, 3.5 million students were enrolled in tertiary institutions in 2005, an increase of 66 per cent since 1999. UNESCO reports that the

level of participation ranged from less than 1 per cent in Angola, Mali and the Niger to 10 per cent or above in Mauritius, Nigeria and South Africa. Whatever the levels of enrolment of a region or country, higher education is expected to be a major player in the production of new knowledge as well as production of highly skilled personnel for what has come to be known as the 'knowledge economy'. The level of tertiary education enrolment may serve as an indicator of the extent to which a country may claim the status of a knowledge economy.

KNOWLEDGE PRODUCTION

How does knowledge production happen or what is meant by 'knowledge production' in a knowledge society? What role should institutions of higher education play in knowledge production and distribution? There is the impression created that the knowledge society is yet to come, but Gibbons et al. (1994, 3) contend that the 'knowledge society' is already here and it is not a society that will be there in the distant future. There are two acknowledged modes of knowledge production – Mode 1 and Mode 2. According to Gibbons et al. (1994, 3), there has been a transformation from Mode 1 to Mode 2 forms of knowledge production. Gibbons et al. argue that the Mode 2 type of knowledge production started emerging from the mid 20th century. It is context driven, problem-focused and interdisciplinary. It involves multidisciplinary teams brought together for short periods of time to work on specific problems in the real world. They contend that the traditional kind of knowledge characteristic of Mode 1 is linear and almost exclusively academic, investigator-initiated and discipline-based knowledge production. On the other hand, Mode 2 knowledge production is non-linear and reflexive in orientation. Gibbons et al. outline the differences between Mode 1 and Mode 2 knowledge production thus:

> In Mode one, problems are set and solved in a context governed by the largely academic interests of a specific community. By contrast, Mode 2 knowledge is transdisciplinary. Mode 1 is characterized by homogeneity, Mode 2 by heterogeneity. Organizationally, Mode 1 is hierarchical and tends to preserve its form, while Model 2 is more heterarchical and transient. Each employs a different type of quality control. In comparison with Mode 1, Mode 2 is more socially accountable and reflexive. It includes a wider, more temporary and heterogeneous set of practitioners, collaborating on a problem defined in specific and localized context (Gibbons et al. 1994, 3).

Gibbons et al. seem to suggest that the 'knowledge society' favours the Mode 2 knowledge production characteristics. Delanty (2001, 150) argues that one of the chief characteristics of knowledge in a knowledge society is the growing importance of the cognitive dimension. Knowledge should be regarded as being more than just science or information; it also entails the deeper level of cultural models. From a sociological view point, Delanty says that knowledge could be considered as a socially constructed structure having a creative as well as an intellectual dimension.

However, knowledge is more than a social construction; it is also an open structure that admits of internal development.

The notion of Mode 2 knowledge production has elicited considerable discourses, but it has not been universally accepted as explained by Gibbons et al. Etzkowitz and Leydesdorff (2000, 116) argue thus:

> The so called Mode 2 is not new: it is the original format of science before its academic institutionalization in the 19th century. Another question to be answered is why Mode 1 has arisen after Mode 2: the original organizational and institutional basis of science, consisting of networks and invisible colleges. Where have these ideas, of the scientist as the isolated individual and of science separated from the interests of society, come from? Mode 2 represents the material base of science, how it actually operates. Mode 1 is a construct, built upon that base in order to justify autonomy for science; especially in an earlier era when it was still a fragile institution and needed all the help it could get (Etzkowitz and Leydesdorff 2000, 116).

Etzkowitz and Leydesorff (2000, 116) use the notion of the Triple Helix of the nation state, academia and industry to explain innovation, development of new technology and knowledge transfer. They argue that 'The Triple Helix' overlay provides a model at the level of social structure for the explanation of Mode 2 as a historically emerging structure for the production of scientific knowledge, and its relation to Mode 1. In the triple helix, universities are seen as taking on a third mission (in addition to the two missions of teaching and research), universities should also contribute to the local economy. According to Etzkowitz (1997), the taking up of this third mission represents the 'second academic revolution' (the first having been when primarily teaching institutions took on the role of research). The result is the emergence of the 'entrepreneurial university' which combines teaching, research and contributing to the local economy (Etzkowitz 1997, 151; Etzkowitz et al. 2000, 329). This argument makes it clear to countries in the sub-Saharan Africa region, that production of new knowledge should be a joint venture between the governments, institutions of higher education and industry.

DATA COLLECTION METHODS

This study adopted three approaches in order to establish the level of new knowledge production by way of scholarly publishing in Sub-Saharan Africa. A literature review was conducted to identify the challenges that sub-Saharan Africa institutions of higher education face in the production and distribution of knowledge; secondly, this author used his own experiences and knowledge in production and distribution of knowledge by institutions of higher education in sub-Saharan Africa to inform the study; and thirdly, an informetric analysis of the published literature was conducted to measure knowledge production of sub-Saharan Africa-based institutions of higher education between 1996 and 2007. The author considers 1996–2007 to be a

very productive decade for sub-Saharan Africa institutions of higher education in terms of knowledge production and distribution.

THE KNOWLEDGE ECONOMY

The 'knowledge economy' is a recent phrase in the literature that denotes the importance of knowledge management in economic growth and sustainability. To understand why knowledge management has grown in importance in recent years, it is necessary to look at the economic context within which it is developing (Morrow 2001, 389). Knowledge economy involves consideration of networked economy and the important role of information and knowledge in economic performance.

According to Morrow, networked and/or knowledge economy share common themes: (1) that developments in technology, especially information and communication technologies, are altering the economic bases of, at least developed countries; (2) that the key industries in this new economy are knowledge-intensive and heavily dependent on knowledge workers; (3) as a consequence of globalization, competitive advantage between nations rests on the extent to which they can develop their knowledge industries and knowledge workers; and (4) that the knowledge component of all industries is increasing and value added comes from the substitution of physical resources for intangibles.

Davenport and Prusak (1998, 17) emphasize that production of ideas and not goods is the source of economic growth. Morrow (2001, 389) credits technology facilitating growth in that it allows ideas in the form of techniques, research results, protocols, etc. to be globally distributed. Technology has also enabled industries to globalize and relocate to take advantage of low-cost, low-skilled labour elsewhere while still coordinating and controlling operations from home base. Technology has further facilitated the development of a new range of industries based primarily on the production of information and knowledge.

Tissen, Andriessen and Deprez (1998) identify certain signs of the presence of a knowledge economy as:

- Growth of technology-driven companies, with a major knowledge component are outgrowing almost every other company;
- Many traditionally industrial companies – those designed and built to produce physical products – are being forced to knowledge products and services;
- Knowledge workers are becoming the dominant factor in the knowledge economy, just as farmers were the dominant factor in the agricultural age, and as workers were in the industrial age;
- The increase in complexity has resulted in a growing need for specialization and this trend will only increase because the knowledge sector is where the jobs are;
- Employment opportunities in other sectors are decreasing in line with the

increase in knowledge services; and

- Industrial-based economies are declining and in many countries, services are providing a significantly larger share of GNP (Tissen, Andriessen and Deprez 1998).

In a knowledge economy, the question should not be whether knowledge-based and intangible assets are tradable. Instead, the question should be how to identify knowledge-based and intangible assets purposes of trade, measurement of value and management of such assets.

Other main characteristics of a knowledge-based economy or intangible economy according to Andriessen (2004) are:

- Knowledge replaces labour and capital as fundamental resources in production and intangible assets create a substantial part of the value added of companies;
- The knowledge content of the products and services is growing rapidly;
- The concept of ownership of resources has changed: knowledge resides in the heads of employees; and
- The organizations have changed and the management of intangible resources is different from tangible or financial resources.

A knowledge economy may not presently have a clear-cut universally accepted definition, but some characteristics of what is expected of it have been prominently alluded to. Some of the characteristics expected of a knowledge economy may include but are not limited to economies depending on knowledge for growth, provision of superior products and services, highly trained and educated people in society, and knowledge eventually replacing the traditional resources of production – labour, land and capital. In a knowledge society, organizations and governments are expected to train and educate their employees continuously. Institutions of higher education have a major role to play in training and continuous education in the knowledge economy.

Knowledge workers

In the knowledge economy, there is a category of workers who have come to be identified as 'knowledge workers.' Who are the knowledge workers and what is the nature of their work? Gurteen (2006) defines knowledge workers thus:

> Knowledge workers are those people who have taken responsibility for their work lives. They continually strive to understand the world about them and modify their work practices and behaviours to better meet their personal and organisational objectives. No one tells them what to do. They do not take "no" for an answer. They are self motivated.

Gurteen (2006) outlines the characteristics of knowledge workers as:

- Workers who take responsibility for their work;
- Workers whom cannot be coerced,
- They cannot be bribed, manipulated or rewarded
- No amount of money or fancy technology may 'incentivize' knowledge workers to do a better job;
- Knowledge workers see the benefits of working differently for themselves;
- They are not 'wage slaves' – they take responsibility for their work and drive improvement.

Knowledge work involves information gathering, imagination, experiment, discovery, and integration of new knowledge with larger systems (Myers, 1996). With this nature of knowledge work, Myers argues that bosses cannot order about knowledge workers like the ditch diggers or assembly-line bolt turners of the yore. Myers further contends that if knowledge workers are any good at all, they soon learn more about what they are doing on a specific project than their bosses can. Knowledge work inherently has a large component of self-direction and team and may be hampered by remote control from distant bosses. As we move further into the knowledge economy and beyond bureaucracy, ways should be found to organize so that all work is knowledge-based, bringing everyone's native intelligence and collaborative abilities to bear on constantly changing ways of achieving shared goals.

Regarding skills required by knowledge workers, Friedman (2005) reports that desk jobs in the fields of customer/technical support, computer programming, medical technician diagnostics, tax preparation, and legal research are now migrating from the USA to abroad. Friedman views the outsourcing of these categories of jobs as reason for higher education institutions in the USA to seriously examine what constitutes 'knowledge worker skills.' Friedman's argument is that graduates of institutions of higher education in the USA should be equipped with skills and capabilities which may enable them to function in jobs that can't be outsourced – and in some way justify the high remuneration that middle class workers have come to enjoy in developed nations.

Levy and Murnane (2004, 82) graphically represent the trend of tasks performed by USA workforce between 1969 and 1998. Are institutions of higher education in sub-Saharan Africa addressing the issue of skills required by knowledge workers or just churning out graduates? May be not by design, if at all. Levy and Murnane (2004, 84) raise the question of whether the current standards-based public education in the USA prepares graduates for mastery of the occupations set for the knowledge economy. The same question should be asked about the ability of universities and other institutions of higher education in sub-Saharan Africa. Are the universities equipping students with skills which may enable them to take up jobs as knowledge workers in the emerging knowledge economies of sub-Saharan Africa?

Using USA Bureau of Labour Statistics data, Levy and Murnane (2004, 80) that future job growth will be found in 'expert thinking' and 'complex human communications' as shown in Figure 1. By expert thinking, they mean the 'ability to solve new problems that cannot be solved by applying rules'. On the other hand, 'complex communication is the ability not only to elicit and transmit information but also convey a particular interpretation of information to others'.

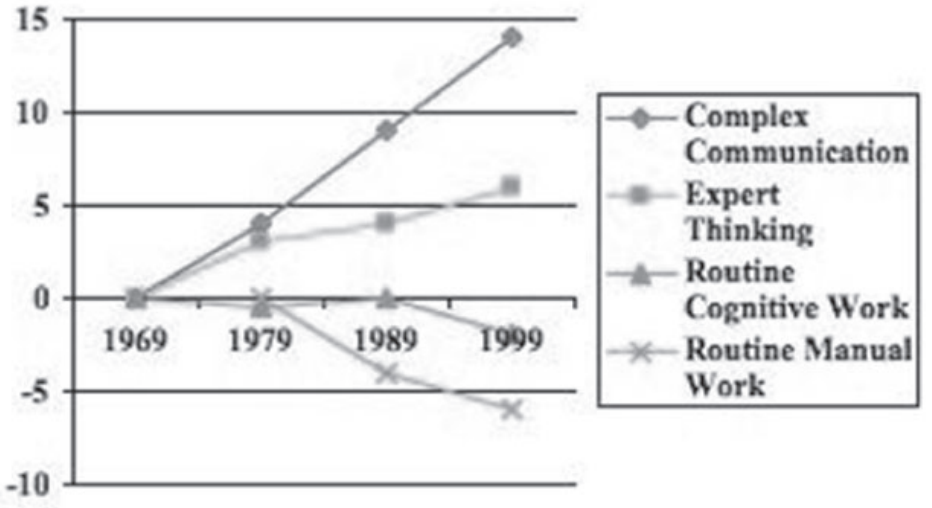

Figure 1: Trends in tasks done by the USA workforce (1969–1999) (Source: Levy and Murnane 2004, 82).

INSTITUTIONS OF HIGHER EDUCATION IN SUB-SAHARAN AFRICA AS PRODUCERS AND DISTRIBUTORS OF KNOWLEDGE

Institutions of higher education in sub-Saharan Africa operate in circumstances unique to the region. Zutz (2005) suggests that in order to increase their contribution to development through the production and distribution of knowledge, universities in developing regions need to transform themselves into 'developmental universities'. But to achieve this, other participants, such as industry and government, must also be prepared to take on new responsibilities. This article addresses the issues of:

- the potential role of sub-Saharan Africa-based institutions of higher education in producing and distributing knowledge;
- ways of supplementing Mode 1 knowledge with Mode 2 knowledge, which has more social relevance;
- challenges faced by sub-Saharan Africa-based institutions of higher education in producing and distributing knowledge;

- how information technology may enhance knowledge production by institutions of higher education in sub-Saharan Africa;
- the relevance of knowledge produced and distributed by institutions of higher education for development purposes in the region; and
- how the environments in which institutions of higher education in sub-Saharan Africa operate impact on knowledge production and distribution abilities of the institutions.

In addressing these issues, it should be remembered that an institution of higher education in sub-Saharan Africa does not operate in isolation. Just like other social organizations in the region, institutions of higher education in sub-Saharan Africa are socially embedded. The principal features of institutions of higher education in sub-Saharan Africa such as the mode of governance, the way students and academic staff are recruited, the methods of sourcing funds, and their guiding 'visions', are all highly influenced by local socio-cultural environments. Besides being seen as a producer and distributor of knowledge, an institution of higher education is also seen as an employer. Institutions of higher education in sub-Saharan Africa are in most cases not autonomous and do not independently decide on the kind of academic and support staff to hire. Many of the government-owned institutions of higher education in sub-Saharan Africa are treated as extensions of the civil services to the extent that even promotions in academic ranks are influenced by forces outside the institutions.

One may argue that despite the different environments in which they operate and their many differences, institutions of higher education all over the world face similar pressures to change many if not all of their traditional ways of operating. However, responses to such pressures cannot be quite similar in the developing regions such as sub-Saharan Africa. Institutions of higher education in the sub-Saharan Africa must come up with their own answers to issues on their role in the production and distribution of knowledge that is relevant to the development of the region.

In a survey of high technology company executives Premus (2003, 263) concludes that high-tech firms are drawn to quality university environments in order to gain better access to graduating students and to faculty research. Premus further argues that universities can have the largest impact on regional economic growth by excelling in advanced research and by augmenting the region's stock of human capital. Premus is convinced that the combination of growth in the stocks of knowledge and human capital offer increasing returns in a region's knowledge production system and in the commercialization of inventions.

In building a knowledge-driven economy, Castells (1994, 6) suggests that 'If knowledge is the electricity of the new information – international economy, then the institutions of higher education are the power sources on which the new development process must rely'.

Institutional knowledge production in sub-Saharan Africa

Different institutions of higher education have differing capacities for producing new knowledge. Knowledge production levels of different institutions may be indicated by the number of patents an institution of higher learning may register per year. A number of scholarly publications produced by scholars affiliated to an institution of higher learning may also serve as an indicator of the amount of new knowledge produced by a particular institution of higher education.

A study conducted by Ondari-Okemwa (2010) on the levels of knowledge production by institutions of higher education based in sub-Saharan Africa by way of scholarly publishing indicates that the institutions lag behind in knowledge production. The study found out that there can be no comparison of scholarly publications produced in the entire sub-Saharan Africa in ten years and scholarly publications produced in the USA in a single year. Table 1 shows scholarly publications of individual institutions of higher education in sub-Saharan Africa between 1996 and 2007. This does not show all the knowledge produced by the institutions, but it is an indication of which institution leads in knowledge production by way of scholarly publishing. The University of Cape Town leads with 4 080 scholarly papers in the period 1996–2000 and 5 093 papers in the period 2001–2007. Other institutions that were among the most productive in the study period include University of the Witwatersrand (3 804, 3 934), University of Pretoria (2 512, 3 958), University of KwaZulu Natal (2 170, 2 833), University of Stellenbosch (1 962, 3 443), University of Nairobi (862, 751), University of the Free State (853, 761), and University of Zimbabwe (738, 792) etc.

Leading knowledge producers (authors)

Table 2 provides a list of the most published sub-Saharan Africa authors in various academic disciplines. The names of authors were obtained from the address fields of each record entry as long as the record contained at least one Sub-Saharan African institutional address. It was observed that the most productive authors in sub-Saharan Africa are those affiliated to the most productive research and/or institutions of higher learning. It was further observed that the most productive researchers are based in South African institutions of higher learning and research. This may be attributed to the collegiate environments and superior facilities and other incentives provided by the institutions.

Table 1: The most productive institutions in sub-Saharan Africa (1996-2007)

	1996–2000 (N = 41287)				2001–2007 (N = 55588)			
No.	Rank	University	Records	%	Rank	University	Papers	%
1	1	Univ of Cape Town	4 080	9.88	1	Univ of Cape Town	5 093	9.16
2	2	Univ of Witwatersrand	3 804	9.21	2	Univ of Pretoria	3 958	7.12
3	3	Univ of Pretoria	2 512	6.08	3	Univ of The Witwatersrand	3 934	7.08
4	4	Univ of Kwazulu Natal	2 170	5.26	4	Univ of Stellenbosch	3 443	6.19
5	5	Univ of Stellenbosch	1 962	4.75	5	Univ of Kwazulu Natal	2 833	2.81
6	6	Univ of Nairobi	862	2.09	6	Rhodes Univ	1 088	1.96
7	7	Univ of The Free State	853	2.07	7	Univ of Ibadan	892	1.60
8	8	Univ of Zimbabwe	738	1.79	8	Univ of Zimbabwe	792	1.42
9	9	Rhodes Univ	693	1.68	9	Makerere Univ	775	1.39
10	10	Univ of The North-West	590	1.43	10	Univ of Johannesburg	762	1.37
11	11	Univ of Ibadan	563	1.36	11	Univ of The Free State	761	1.37
12	12	Univ of Johannesburg	554	1.34	12	Univ of Nairobi	751	1.35
13	13	Groote Schuur Hosp	520	1.26	13	Univ of Addis Ababa	740	1.33
14	14	Univ of Addis Ababa	510	1.24	14	Univ of The Western Cape	725	1.30
15	15	Univ of South Africa	490	1.19	15	Obafemi Awolowo Univ	630	1.13
16	16	Department of Hlth	474	1.15	16	MRC	617	1.11
17	17	MRC1	455	1.10	17	Minist Hlth	599	1.08
18	18	Univ of The Western Cape	451	1.09	18	Kenya Govt Med Res Ctr	509	0.92
19	19	Obafemi Awolowo Univ	429	1.04	19	Univ of Botswana	508	0.91
20	20	S African Inst Med Res	424	1.03	20	CSIR2	466	0.84

Source: Ondari-Okemwa (2010)

Table 2: Leading knowledge producers affiliated to sub-Saharan African-based institutions of higher education

	1996–2000 (N = 41 287)				2001–2007 (N = 55 588)			
No.	Rank	Author	Papers	%	Rank	Author	Papers	%
1	1	Wilkinson, D	94	0.23	1	Van Staden, J	208	0.37
2	2	Wingfield, MJ	91	0.22	2	Wingfield, MJ	203	0.37
3	3	Greenwood, BM	90	0.22	3	La Vecchia, C	190	0.34
4	4	Walker, ARP	87	0.21	4	Stein, DJ	147	0.26
5	5	Noakes, TD	85	0.21	5	Kremsner, PG	132	0.24
6	6	Moodley, J	83	0.20	5	Negri, E	132	0.24
7	6	Stein, DJ	83	0.20	6	Wingfield, BD	122	0.22
8	7	Marsh, K	81	0.20	7	Franceschi, S	113	0.20
9	8	Opie, LH	76	0.18	8	Nyokong, T	110	0.20
10	9	Chetty, R	72	0.17	9	Marsh, K	104	0.19
11	10	Crous, PW	71	0.17	10	Aaby, P	101	0.18
12	11	Van Staden, J	69	0.17	11	Chown, SL	100	0.18
13	12	Klugman, KP	67	0.16	12	Crous, PW	98	0.18
14	13	Kremsner, PG	66	0.16	13	Moodley, J	95	0.17
15	13	Reimold, WU	66	0.16	14	Noakes, TD	84	0.15
16	14	Harries, AD	64	0.16	15	Harries, AD	83	0.15
17	15	Auret, FD	63	0.15	16	Bosetti, C	78	0.14
18	16	Whittle, H	59	0.14	17	Molyneux, ME	73	0.13
19	17	Hudson, DA	57	0.14	17	Nahlen, BL	73	0.13
20	18	Coovadia, HM	56	0.14	19	Henning, MA	72	0.13
21	19	Aaby, P	55	0.13	19	Talamini, R	72	0.13
22	20	Ferreira, D	54	0.13	20	Bennett, NC	70	0.13
23	20	Snow, RW	54	0.13	20	Mulholland, DA	70	0.13
24	21	Chown, SL	53	0.13	20	Sanderson, RD	70	0.13
25	21	Sellschop, JPF	53	0.13	21	Gallus, S	67	0.12
26	22	Cooper, K	51	0.12	21	Roodt, A	67	0.12
27	22	Cowling, RM	51	0.12	21	Snow, RW	67	0.12
28	22	Jenkins, T	51	0.12	21	Van Helden, PD	67	0.12
29	22	Kotze, MJ	51	0.12	22	Coville, NJ	66	0.12
30	23	Goodman, SA	49	0.12	23	Beyers, N	65	0.12

OPPORTUNITIES OF PRODUCING AND DISTRIBUTING KNOWLEDGE BY INSTITUTIONS OF HIGHER EDUCATION IN SUB-SAHARAN AFRICA

Knowledge production and distribution may not be confined to institutions of higher education in sub-Saharan Africa. Other players in knowledge production and

distribution in sub-Saharan Africa may include government laboratories, research institutions, Nongovernmental Organizations, Research Hospitals and think-tanks among others.

Knowledge production and distribution in a wide range of disciplines

Institutions of higher education in sub-Saharan Africa still have an upper hand in producing and distributing knowledge in a wide range of academic disciplines. The other players in knowledge production and distribution may only produce and distribute knowledge in specialized areas. An agricultural research institute for instance may only produce and distribute knowledge in agricultural-related areas. A medical research institute may only produce and distribute knowledge in health-related areas only. Stehr (1994, 185) contends that we are moving into what he calls a 'knowledge-based economy' or 'knowledge society'. In such a society, the knowledge industry is no longer a minor affair run by an intellectual elite, an activity that might be considered by pragmatic leaders as expandable; it is a mammoth enterprise on a par with heavy industry, and just as necessary to the country in which it is situated (Graham 1998).

A primary source of new knowledge and skills

In a knowledge economy, institutions of higher education as arguably the primary source of new knowledge and of the skills that are required for the knowledge economy could become the engine of such an economy. Institutions of higher education in sub-Saharan Africa can play a leading role in producing and distributing knowledge in the knowledge society. Many sub-Saharan Africa economies may as yet not be classified as knowledge economies but every modern economy has some elements of a knowledge economy. The institutions of higher education in sub-Saharan Africa may equally play a leading role in supplying the knowledge economy with knowledge workers who are in high demand in the knowledge economy.

Research as the source of new knowledge

There is no doubt that the importance of research as the new source of knowledge in the knowledge economy is growing rapidly. Economies in sub-Saharan Africa may not be very competitive globally, but they are part of the global economic order. Globalization spells competitiveness. To be competitive, sub-Saharan African countries innovative ways of doing businesses. Innovation requires new technological and scientific knowledge which universities in sub-Saharan Africa can offer. Universities in sub-Saharan Africa as the primary source of new scientific and

technological knowledge can position themselves to play a central role in contributing to innovation, competitiveness and economic development of the region.

Continuous learning

In the sub-Saharan Africa region, there is growing demand for continuous learning and upgrading of skills both from individuals and organizations. Individuals need to acquire new skills, new capabilities and new knowledge in order to cope with new work demands in the knowledge economy. Organizations are convinced that if their employees acquire new skills and knowledge, they may be in a position to create higher value-added products and services and also acquire and maintain a competitive edge over competitors. Institutions of higher education in sub-Saharan Africa are the best-placed to satisfy the demand for new knowledge and skills. Zutz (2005) argues that the past few decades have witnessed a steady acceleration in the rate at which knowledge is accumulated, diversified and disseminated. One noticeable consequence of the steady acceleration in the rate at which knowledge is accumulated and used has been rapid obsolescence in the knowledge people posses, how they use that knowledge to solve problems, and even the manner in which they solve problems. Learning and accumulating new knowledge are therefore more important than ever. Continuous learning allows people, organizations, countries and regions to generate new knowledge and ideas and also to cope with changes. This may perhaps be how the concepts of a 'learning organization' and 'lifelong learning' have emerged. Institutions of higher education in sub-Saharan Africa should play a central role in enabling individuals and organizations to acquire new knowledge and skills for solving problems. Institutions of higher education in sub-Saharan Africa may also help organizations in the region to become learning organizations.

ICTs and knowledge production and distribution

Most institutions of higher learning in sub-Saharan Africa do not enjoy well developed information and communication technologies, but many of the institutions in the region are now enjoying Internet connectivity. The new information and communication technologies which make Internet connectivity possible could revolutionalize the way in which teaching, learning, production and distribution of knowledge take place in sub-Saharan Africa. Institutions of higher learning in sub-

Saharan Africa may take advantage of the new information and communication technologies to collaboratively produce and distribute knowledge.

Challenges facing sub-Saharan Africa-based institutions of higher education in producing and distributing knowledge

Institutions of higher education in sub-Saharan Africa face a number of challenges in effectively producing and distributing new knowledge.

Institutions of higher education as social institutions

Universities and other institutions in sub-Saharan Africa operate as any other social institutions. Many public institutions of higher education in sub-Saharan Africa lack autonomy. Important decisions on recruitment of staff do not completely rest on university administrations. Such decisions are made elsewhere and in most cases by politicians who do not understand the intricacies of managing a university or an institution of higher education. A public university in sub-Saharan Africa is regarded as extensions of the civil services which are not known for superior delivery of services. A typical institution of higher education in sub-Saharan Africa is therefore not only expected to teach, conduct research and generate new knowledge, but also provide employment opportunities. In providing employment opportunities, institutions of higher education in sub-Saharan Africa do not necessarily give preference to knowledge producers. Some institutions have too many senior administrative staff who are not involved in teaching, research and/or knowledge production. This kind of staff imbalance compromises teaching, research and knowledge production and distribution by institutions of higher education in sub-Saharan Africa.

Africanization of curricula, teaching and knowledge production

In sub-Saharan Africa, there have been attempts to 'Africanize' curricula and institutions of higher learning. Kistner (2009) contends that in an effort to Africanize institutions of higher education in some sub-Saharan African countries, highly acclaimed educational researchers have been publishing prolifically on 'Africanization in education', broaching a 'fundamental question' – 'What do Africans mean and understand when they say they know something?' – and explaining 'how the African thinks'. This means that knowledge production in institutions of higher education in sub-Saharan Africa should be aligned with what an African means when he says he knows something and how an African thinks. In South Africa for instance, there has been an attempt to introduce indigenous knowledge and indigenous knowledge systems in higher education curricular. Kistner (2009) reports that the South African government's former department of arts, culture, science and technology was at one time mandated to draft a policy on indigenous knowledge systems (IKS). The theme of IKS, likewise, features prominently as one of the research focus areas of the South African National Research Foundation (NRF). It comprises:

- Indigenous technologies,

- Traditional medicine and health,
- Indigenous food systems,
- Socio-cultural systems,
- Arts, crafts and materials, and
- Cross-cutting and supportive systems in IK, IKS and IT as subcategories.

The question remains as to what it is – in this plenitude and among all the plenipotentiaries of Africanisation by decree or policy or strategic plans or recurriculation – that evokes the sense of loss increasingly articulated by African intellectuals in the middle of these transformation processes. The thinking here is that of decolonizing the African university and decolonizing the way of producing and distributing knowledge in the African university. Africanization of the African university is a challenge to teaching, research and knowledge production and distribution by sub-Saharan Africa institutions of higher education as learning the knowledge society requires appreciating a broad range of disciplines, and understanding the inter-relationships between basic knowledge and research that is more directly relevant to users' needs. Furthermore, institutions of higher education need to find ways of organizing learning that promote networking, both inside and outside academic institutions, and both locally and internationally. Africanizing curricular, teaching research and knowledge production and distribution by institutions of higher education in sub-Saharan Africa may be seen as inward looking, contrary to the principles of producing knowledge collaboratively.

Competition from other players in knowledge production and distribution

Institutions of higher education in sub-Saharan Africa like elsewhere in the world may no longer claim a monopoly in knowledge production and distribution. Research hospitals, government laboratories, nongovernmental organizations and think-tanks are increasingly becoming producers and distributors of knowledge in sub-Saharan Africa competing with institutions of higher education. In addition to this, learning is no longer concentrated at a single location. True, much of it still takes place in universities, particularly research universities – higher education institutions at which knowledge production is one of the primary activities. However, in sub-Saharan Africa, just like in some other regions elsewhere in the world, scientifically and technologically related learning also takes place outside universities, for example in business settings. Additionally, new knowledge is increasingly being produced and applied in 'hybrid' settings that may involve groups of people from different disciplines and institutions coming together to tackle specific problems (Zutz 2005). As knowledge is being recognized as a primary factor of production, profit and non-profit organizations are becoming more and more reliant on knowledge and skills to acquire and retain competitiveness. Some of the organizations, particularly the multinational ones have attempted to create their own learning centres to try and

meet demand for new knowledge and skills, hence competing with institutions of higher education in producing and distributing new knowledge.

Poor infrastructure and declining public expenditure

Institutions of higher education in sub-Saharan Africa suffer from poor infrastructure as a result of steadily declining public expenditure. Many are times when investment in infrastructure is a once off venture which is never backed up by maintenance and upgrading budgetary plans. Poor infrastructure compromises sub-Saharan Africa's institutions of higher education ability to conduct research and produce and distribute knowledge. The institutions find it hard to train students in-state-of techniques. Consequently, employers of graduates from institutions of higher education in sub-Saharan Africa complain that the graduates are not equipped with the necessary knowledge and skills to perform. In a developing region like sub-Saharan Africa, students can't afford to go through university for the sake of acquiring knowledge. Students go through institutions of higher education to acquire knowledge and skills which may enable them to compete favorably in the competitive job market.

Brain drain

Sub-Saharan Africa suffers a great deal of brain drain. Very many could be knowledge producers who originate from the region live and work elsewhere in the world. Macfarlane (2007) gives rather depressing statistics of Africa's brain drain. If the statistics Macfarlane gives are anything to go by, there is no doubt that brain drain of scholars and other highly qualified professionals from sub-Saharan Africa will continue into the 21st century for so long as conditions in the region do not improve. In what he calls measuring the brain drain, Macfarlane gives the following statistics on brain drain:

- Nearly 235 000 professionals left South Africa between 1987 and 1997. Since 1997, the brain drain has cost South Africa $7.8 billion, according to the Paris-based Institute for Research and Development.
- Arabic African countries annually lose 50 per cent of their doctors, 23 per cent of engineers and 15 per cent of scientists. Of all Arabic African students abroad, only 4.5 per cent return home after completing studies
- About 80 per cent of Ghana's doctors leave the country within five years of graduating; and about 25 per cent of all doctors trained in Africa work abroad.
- About 20 000 professionals leave Africa every year according to the International Organisation of Migration.
- A recent study of 10 sub-Saharan African countries showed an average loss of 40 per cent of their university graduates, with massive drains from Cape Verde (67%), The Gambia (63%), Seychelles (59%), Sierra Leone (53%).

Macfarlane refers to causes of brain drain as 'push and pull factors'. Among the push factors he identifies are:

- Low and eroding salaries.
- Social unrest and political conflict, including wars.
- Unsatisfactory living conditions, such as lack of housing and transport.
- Discrimination in academic appointments and promotions.

The pull factors, mostly perceived as being offered in the West are the opposite: higher wages, political stability, intellectual freedom and better career opportunities among others. These statistics of brain drain from sub-Saharan Africa and the whole of Africa are disturbingly high. The statistics show how sub-Saharan Africa has been losing and will continue losing knowledge workers into the 21st century. Darchen and Tremblay (2010) are of the opinion that factors considered to attract knowledge workers to a city include: cultural diversity, a friendly welcoming environment' open minded views, safety, quality of life, life style, pace of work on the social or more subjective side, and cost of housing, density/urban form, green spaces, natural features, public transportation, cleanliness, weather and location (proximity to the us or Europe). Many of these factors may not be present in most sub-Saharan African institutions of higher education.

Little use of locally produced knowledge

Not much of the little knowledge produced in sub-Saharan Africa is put to use or applied by those in charge of formulating and implementing public policy. According to the Netherlands Development Assistance Research Council (RAWOO) (2005), 'it is increasingly recognized that the linear model of science-society relationships that prevailed in the past has failed because it was based on the false assumption that the findings of basic research would more or less automatically find their way into new applications, innovations and development interventions'. RAWOO further argues that because of the linear mode of thinking; more emphasis has been placed on basic upstream research and less on applied downstream research and development activities aimed at translating the fruits of basic research into new applications, interventions and development action. This phenomenon has recently been described as the 'know-do' gap, that is, the gulf between what we know and what we do in practice. In Sub-Saharan Africa, those in charge of formulating and implementing public policy hardly consult researchers based at the local institutions of higher learning and research institutions.

Governments, public corporations and institutions in sub-Saharan Africa should be encouraged to utilize knowledge that is generated as a result of research conducted within the region. Juma and Clark (1995) contend that in sub-Saharan Africa, the practice of linking research and policy-making is rare. Think thanks, most of which are government-sponsored in sub-Saharan Africa should act as links between

research, policy and practice and to absorb, process and synthesize the results of research for policy making, interventions and action. Such a bridging mechanism plays an important role in translating knowledge into policy options and in using existing knowledge more effectively for innovation in policy and practice.

CONCLUDING REMARKS

Institutions of higher education in sub-Saharan Africa face a number of challenges in producing and distributing new knowledge. Some of the challenges include poor infrastructure, external pressures, declining budgetary allocation, imposed Africanization of curricula, competition from other producers and distributors of new knowledge and brain drain among other challenges. However, the institutions have a number of opportunities to produce and distribute knowledge and contribute to the development of the region. Zutz (2005) suggests two of addressing the problems faced by sub-Saharan Africa institutions of higher education in producing and distributing knowledge. First, knowledge must be actively recognized as a vital issue for development. Second, a range of organizations – not only institutions of higher education – must work together to meet the goals. This means that, in order to transform institutions of higher education into better producers and diffusers of knowledge, business firms and institutions will need to be transformed as well, to stimulate a more challenging demand.

Changes must not be forced on institutions of higher education in sub-Saharan Africa as they are unlikely to be successful in achieving this, and may even be damaging. Governments in the sub-Saharan Africa region therefore have a central role in devising policies that foster the demand for knowledge, and helping other parties to use knowledge effectively. In any knowledge economy, the demand for and use of knowledge is usually very high. Local businesses that that are competent knowledge-users must become strong drivers of both the production and the distribution of knowledge. All businesses should be encouraged to produce, use and distribute knowledge. Institutions of higher education in sub-Saharan Africa could, if linked to developmental universities with a sound research agenda of their own, provide assistance.

NOTES

1 MRC – Medical Research Council of South Africa.

2 CSIR – Council for Scientific and Industrial Research (South African).

REFERENCES

Andriessen, D. 2004. *Making sense of Intellectual Capital – Designing a method for the evaluation of intangibles*. Boston: Elsevier Butterworth-Heinemann.

Castells, M. 1994. The university system: Engine of development in the New World Economy. In *Revitalizing higher education,* eds. J. Salmi and A. Verspoor. London: Pergamon.

Darchen, S. and D. G. Tremblay. 2010. What attracts and retains knowledge workers/ students: The quality of place or career opportunities? The cases of Montreal and Ottawa. *Cities* 27(2010): 225–233.

Dasgupta, P. and P. A. David. 1994. Towards a new economics of science. *Research Policy* 23(25): 487–521.

Davenport, T. and L. Prusak. 1998. *Working knowledge: How organizations manage what they know.* Boston: Harvard Business School Press.

Delanty, G. 2001. The university in the knowledge society. *Organization* 8(2): 149–153.

Etzkowitz, H. 1997. *The entrepreneurial university and the emergence of democratic corporatism*. In L. Leydesdorff and H. Etzkowitz, 1997, 141–152.

Etzkowitz, H. and L. Leydesdorff. (Eds.). 2000. *Universities and the global knowledge economy: A triple helix of university-industry-government relations.* London: Pinter.

Friedman, T. 2004. *The world is flat: A brief history of the twenty-first century*. New York: Farrar, Straus and Giroux.

Gibbons, M. et al. 1994. *The new production of knowledge.* London: Sage.

Godin, B. and Y. Gingras. 2000. The place of universities in the system of knowledge production. *Research Policy* 29:273–278.

Gurteen, D. 2006. The Gurteen Perspective. Available at: http://www.ikmagazine.com/display.asp?articleid=AE03F1CA-F94B-4BD5-9BE9-0CB68079CB6F. (Accessed on 10 April 2011).

Graham, L. 1998. *What have we learned about science and technology from the Russian experience*? Palo Alto: Stanford University Press.

Juma, C. and N. Clark. 1995. Policy research in sub-Saharan Africa: An exploration. *Public Administration and Development* 15:121–137. Available at: http://www.ksg.harvard.edu/sed/docs/k4dev/juma_pubadmin1995.pdf. (Accessed on 5 February 2011).

Kistner, U. 2009. Recolonising the mind: The rise of African national education. *Mail and Guardian*. Available at: http://www.mg.co.za/article/2009-02-06-recolonising-the-mind-rise-of-african-national-education. (Accessed on 4 March 2011).

Levy, M. and R. J. Murnane. 2004. Education and the changing job market: An educational centered on complex thinking and communicating is a graduate's passport to prosperity. *Education Leadership* October 2004.

Maiese, M. 2005. Theories of knowledge. Beyond Intractability. Available at: http://www.beyondintractability.org/essay/knowledge_theories/?nid=6574. (Accessed on 19 January 2011).

Macfarlane, D. 2007. Africa staffs the West. *Mail and Guardian* October 26 to November 1.

Martin, B. R. and H. Etzkowitz. 2000. The origin of the university species. Paper presented at the 'Organisation of Mode 2/Triple Helix Knowledge Production' Workshop held at Goteborg University, Goteborg, Sweden, 20 October 2000.

Mbali, C. 2011. Publish or be damned: The criteria of 'accredited' academic publications sideline other kinds of knowledge production. *Mail & Guardian* February 25 to March 3, 2011.

Morrow, N. M. 2001. Knowledge management: An introduction. In *Annual Review of Information Science and Technology (ARIST)*, ed. M. E. Williams, 35:381–422.

Myers, P. S. 1996. *Knowledge management and organizational design*. Newton, MA: Butterworth-Heinemann.

Netherlands Development Assistance Research Council (RAWOO). 2005. Mobilizing knowledge to achieve the millennium development goals, Publication No. 27, The Hague. Available at: http://www.rawoo.nl/pdf/Rawoo27.pdf. (Accessed 26 February 2011).

OECD. 2009. *Higher Education to 2030. Volume 2: Globalization*. Available at: http://www.ukafricapartnerships.org/OneStopCMS/Core/CrawlerResourceServer.aspx?resource=f40f2191-73cd-43fd-9362-4081143dc3fd&mode=link&guid=2245b559c07742e992c56865bb6a61dc. (Accessed on 3 March 2011).

Ondari-Okemwa, E. 2010. Open access as an alternative mode of scholarly publishing and enhancement of knowledge production in sub-Saharan Africa. In *Scholarly publishing in Africa*: *Opportunities and impediments,* ed. S. Ngobeni, 199–219.

Premus, R. 2003. University knowledge production and industrial innovation: The evidence. *International Journal of Technology Transfer and Commercialisation* 2(3): 263–273.

Stehr, N. 1994. *Knowledge societies*. London: Sage.

Stockton, W. L. 2004. A philosophy of the idea of Christian liberal arts education: Why is it important? Dallas Baptist University Friday Symposium. September 24, 2004. Available at: http://www3.dbu.edu/naugle/pdf/FridaySymposiumFa04/Philosophy_Christian_Liberal_Arts_Edu.pdf. (Accessed on 14 February 2011).

Tissen, R., D. Andriessen and F. L. Deprezz. 1998. *Value-based knowledge management*. Amsterdam: Addison Wesley Longman.

UNESCO Institute for Statistics. 2001. The state of Science and Technology in the world 1996–1997. Available at: http://unesdoc.unesco.org/images/0013/001318/131841e.pdf. (Accessed on 11 March 2011).

UNESCO. 2008. Education for all monitoring report. Available at: http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/efareport/reports/2008-mid-term-review/. (Accessed on 28 January 2011).

Zutz, J. 2005. The role of Universities in knowledge production. Science and Development Network. Available at: http://www.scidev.net/en/policy-briefs/the-role-of-universities-in-knowledge-production-.html. (Accessed on 23 February 2011).