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Review

The role of research and education to the sustainable development and food security in Sub Saharan Africa

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The paper examines the role of research and education for sustainable development and food security in SSA. The paper applied different case study literature review and trend analysis. In SSA research organizations are not well aligned with the needs and priorities of poverty alleviation strategies. For example farmers have difficulties in accessing new technologies and innovations, furthermore they it lacks organised networking. There is gap or disconnection between research and extension systems, between researchers and policy make; researches in SSA mainly under-funded as a research outputs are not adequately responding to the fast changing external environments in SSA. Therefore, the study suggested that it is time to introduce new model that can forest Sustainable economic growth in SSA that includes strategic way of reaching different target groups effectively.

Keywords: Research, education and sustainable development

INTRODUCTION

The importance of higher education for growth and development of a nation is confirmed by Kofi Annan who asserts that “the university must become a primary tool for Africa’s development in the new century. Universities can help develop African expertise; they can enhance the analysis of African problems; strengthen domestic institutions; serve as a model environment for the practice of good governance, conflict resolution and respect for human rights, and enable African academics to play an active part in the global community of scholars”(UN, 2008).

UNESCO, in responding to the need for higher education to contribute to the growth and development of the continent state that “at no time in history has it been more important to invest in higher education as a major force in building an inclusive and diverse knowledge society and to advance research, innovation and creativity (UN, 2008).

The youth population in Sub-Saharan Africa is more than four times its 1950 level and this trend is projected to continue for a foreseeable future (World Bank, 2008). However, this demographically young population lacks sufficient opportunities for both educational advancement and for full utilization of its talents. This paper describes a strategy for development of scientific research in higher education that promises to initiate a process that will provide Africa the indigenous and internationally engaged experts to solve local.

Sub-Saharan Africa faces many developmental challenges and is ranked the lowest of the world’s regions in most development measures. The continent is failing to attain the Millennium Development Goals. The failure to meet these development goals is due to the countries’ inability to effectively utilize their resources and implement policies that encourage development. In most cases, institutions are not equipped and struct-ured in a way to address the challenges related to health,

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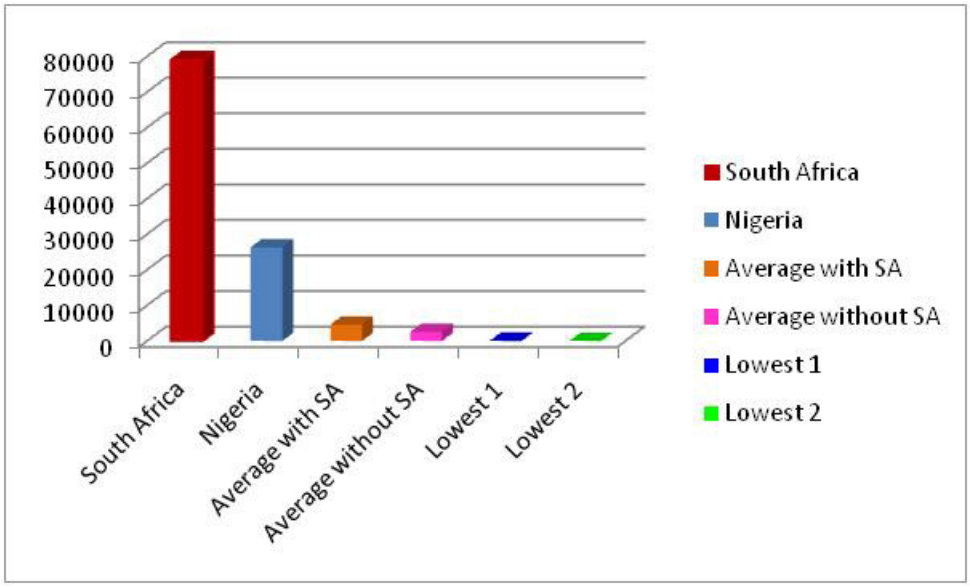

Figure 1. Research output in Africa from 1999 to 2009
Source: Tise ER (2011)

education or poverty further to food security. Only with strong scientific research capabilities can a nation address its developmental challenges.

Enhancing university research, in addition can improve the quality of scientists educated in African universities, will also stem to the problem of brain drain. Improved material conditions for researchers, modernized equipment, and access to information on global scientific developments in their field will encourage experts to stay in their home countries, utilizing their talents and expertise in Africa. As relevant opportunities emerge for conducting scientific research in their home countries, scientists that might otherwise have emigrated will choose to remain, while those who have already left many of whom are underemployed may be lured back to contribute to the development of their homelands.

Research in Africa

According to Tise (2011) the research output of Sub-Saharan Africa is about 0.7% of the world's output. Compounding this low output is poor access to this output. Lor (2000) and Swindell (2007) point out that the combination of these two negatives has contributed to Africa's growing unemployment and widespread poverty and backlogs in social services such as education and health. They go on to state that this lack of access to relevant information has contributed to Africa's isolation from the global economy.

In the period 1999-2009, Africa has produce just over 170 000 items and as can be seen from the graph, South Africa produces 66% followed by Nigeria. However, the more significant issue is what percentage of this research output is to researchers on the African continent. How much of this is locked away in exorbitant subscription costs. Libraries, as significant contributors to the generation of new knowledge, have an obligation to strengthening the African higher education space by developing forums that will improve access to information for researchers to manipulate in generation of new knowledge (Tise, 2011).

However, as asserted by Cullen (2004), Kavulya (2006) and Raju (2009), Africa's university libraries are under resourced and underutilized, they are facing a crisis that, though seemingly quiet, has the potential to affect the continent's intellectual capital for decades to come. The libraries, in the main, are characterised by low numbers of books per student, inadequate journals subscriptions and limited access to electronic information, which has led to libraries being unable to adequately support teaching, learning and research activities in universities.

This trend is exacerbated by continuously declining budget levels adding to the inability of university libraries to satisfy the growing demand for education.

It can be inferred from the Figure 1 that those countries that are high producers of research are the ones that have greater access to scientific output as there is a direct and positive correlation between access to old knowledge and the generation of new knowledge. It is beyond debate that access to authentic and trusted information is critical for the generation of new knowledge; therefore, it is absolutely imperative that

Table 1. R and D expenditure as percentage of GDP (2009)

South Africa	0.925229
Gabon	0.638217
Lesotho	0.02945
Kenya	0.417867
Gambia	0.021481
Zambia	0.340334
Madagascar	0.147905
Burkina Faso	0.205666

Source: World Bank (2009)
Source: UN Comtrade (2011)

academic institutions invest in developing good libraries to ensure that their libraries are empowered to contribute to the growth of new knowledge

Science-led development in Africa

Sub-Saharan Africa contributes about 2.3 percent of world gross domestic product but is responsible for only 0.4 percent of global expenditure in research and development. With 13.4 percent of the world's population, the continent is home to only 1.1 percent of the world's scientific researchers. This is about one scientist or engineer per 10,000 people, compared with 20-50 in industrial nations. Over the years, the science and technology gap between Africa and the rest of the world has grown. Economists feel that this widening gap is partly responsible for the continent's underdevelopment. As Rwandan president Paul Kagame stated, the question now facing many African countries is where are we headed, and what needs to be done to give science and technology their due weight in our development process? (Pifer and Demissie, updated)

Economic thinking about growth and development has evolved in the past decades. "Post-war growth theory stressed the need to accumulate factors of production capital, and unskilled and skilled labor and to increase the productivity with which these factors are used"(Johnson, et al., 2007). To succeed in knowledge based economy, a country should be able to adopt policies to strengthen its science and technology capabilities. Most importantly, young graduates in the natural sciences must be capable both to address local problems and to compete internationally.

In order to solve technological challenges locally, a country or region needs several things to do:

1. A cadre of scientists and engineers who understand local problems and are trained to address them,
2. The capability to carry out scientific research and generate technological solutions to problems,
3. Ties to the developed world's scientific expertise to tap into prior advances, capabilities, and ideas.

Fortunately, in recent years there appears to be hope for policy changes in most African countries. Since the start of the new millennium, economic growth in the region, measured by gross domestic product, has increased from 2.0 percent in the 1990s to 6.0 percent between 2002 and 2008 (World Bank, 2008). This change is mainly due to increased macroeconomic stability. During the same period the importance of higher education has increased. Development experts and international donors have focused on primary and secondary education for decades, and certainly the problem of early education remains acute in many places in Africa. But higher education and research has been identified as a critical component to development and at the time is right to emphasize scientific training at the tertiary level. The African Development Bank has observed that "in a knowledge economy, higher education can help economies gain ground on more technologically advanced societies, as graduates are likely to be more aware of and better able to use new technologies." One way of meeting this challenge is to integrate scientific research into traditional universities, which aids in training a skilled workforce while reducing brain drain.

As brain drain has hindered many African universities from building strong master's and doctoral programs, "nurturing good scientists through merit based selection systems to create and maintain strong, quality institutions must become one of the highest priorities of [African] governments" (Inter Academy Council (IAC), 2004).

The challenge is how to successfully create research-intensive institutions of higher learning. Fortunately, various programs have already been implemented throughout the world to address this challenge.

Africa expenditure to research and education

Table 1 presents African countries those allocated research and development expenditure in 2009 , in the

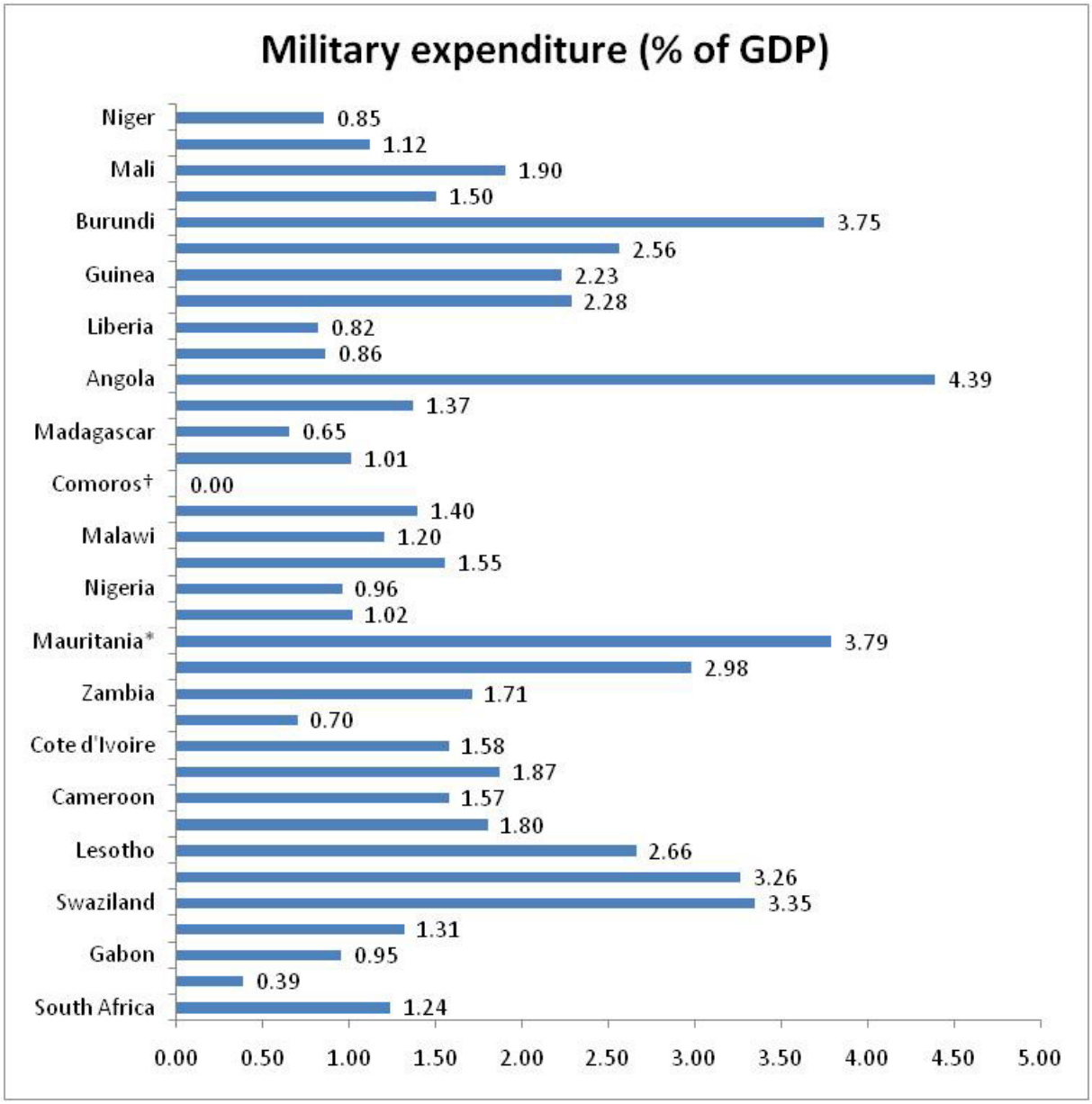

Figure 2. Military expenditure (% of GDP) in 2009
Source: UN Comtrade (2011)

World Bank data base shows that only few countries listed in Table 1 allocated budget for R and D, even it is not significant figure to impact the economic growth of the nation. For example South Africa only spent 0.92% of GDP to Research and Development, and followed by Gabon 0.63%.

Measures of educational attainment reflect the knowledge and skills, or human capital, of the population. Recent research shows that the impact of human capital and education on economic growth in World Education Indicators (WEI) countries may be even stronger than in OECD countries (OECD/UIS, 2003). Overall, the WEI (OECD/UIS, 2003) study results indicate that for every single year that the average level of schooling of the adult population is raised there is a corresponding increase of 3.7 percent in long-term economic growth.

Figure 2 to 4 presents the percentage of military expenditure, External Debt ratio to GNI, and education expenditure as percentage of GNI respectively. For example, Burundi, Angola and Mauritania accounted for more than 3.5%, which is equivalent the Agriculture gross production contribution to some of the nation GPD.

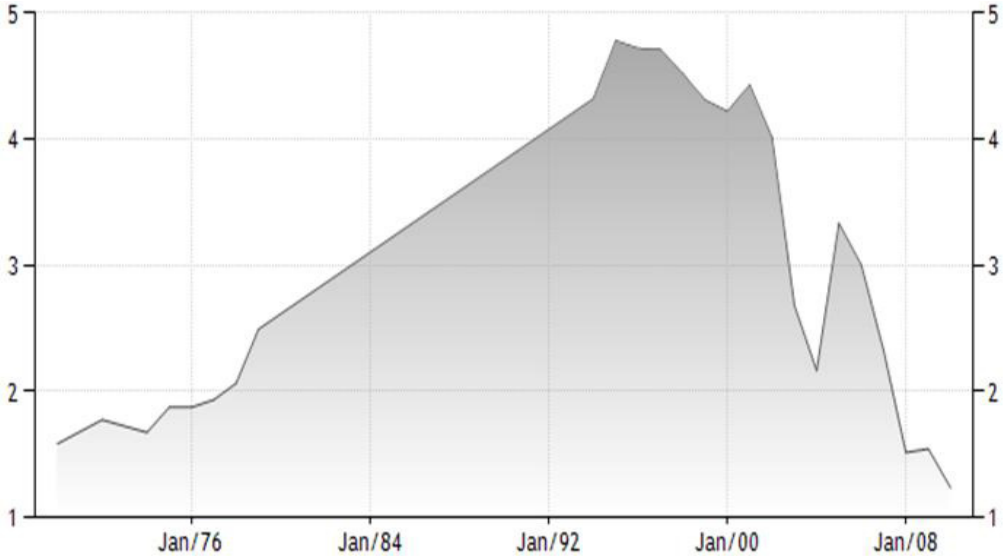

Figure 3. Total debt service (% of GNI) in Sub Saharan Africa
Source: Trading Economics (202)

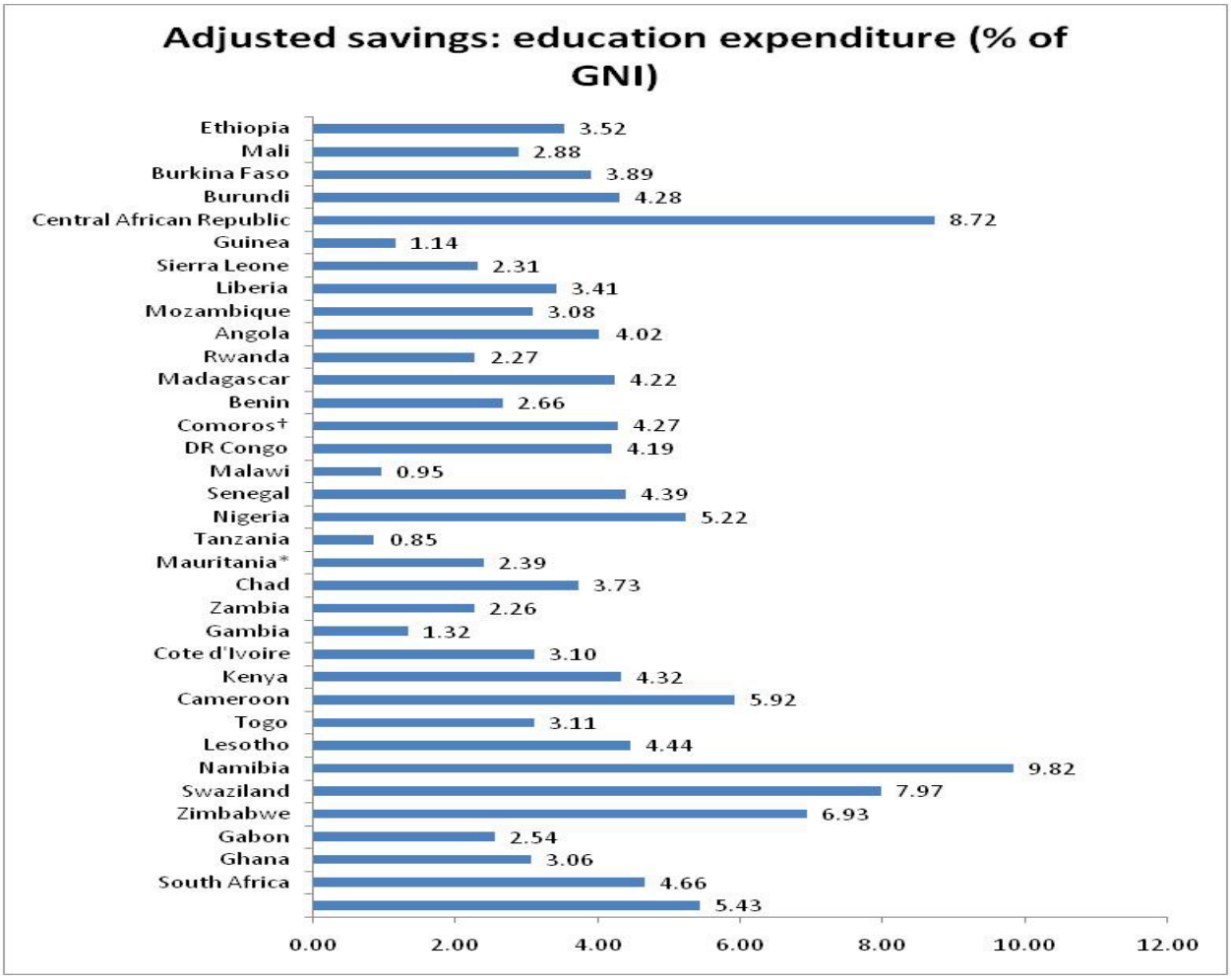

Figure 4. Education expenditure as percentage of GNI 2009
Source: UN Comtrade (2011)

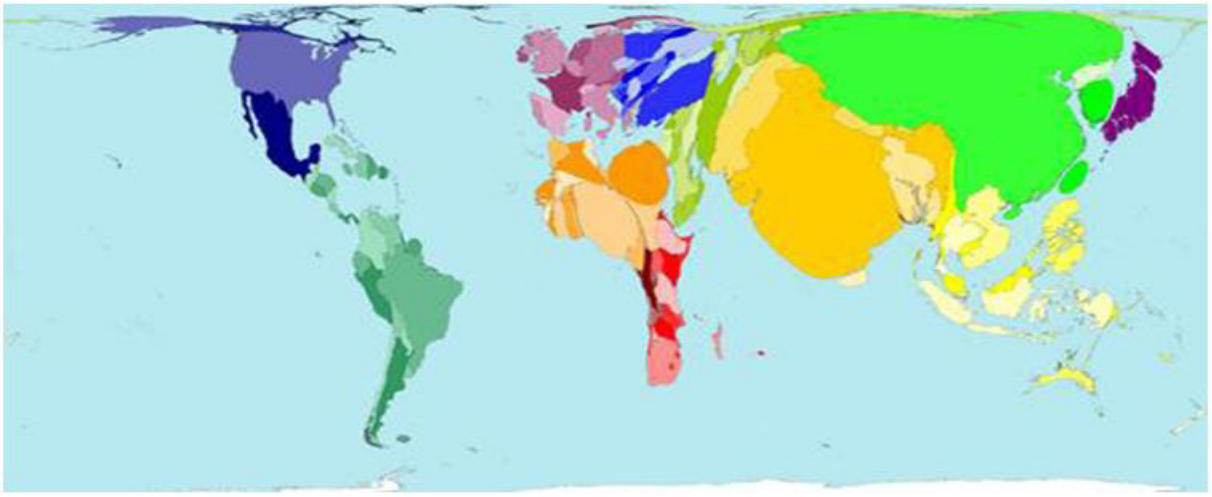

Figure 5. Secondary education enrollment
Source: World mapper (2012)

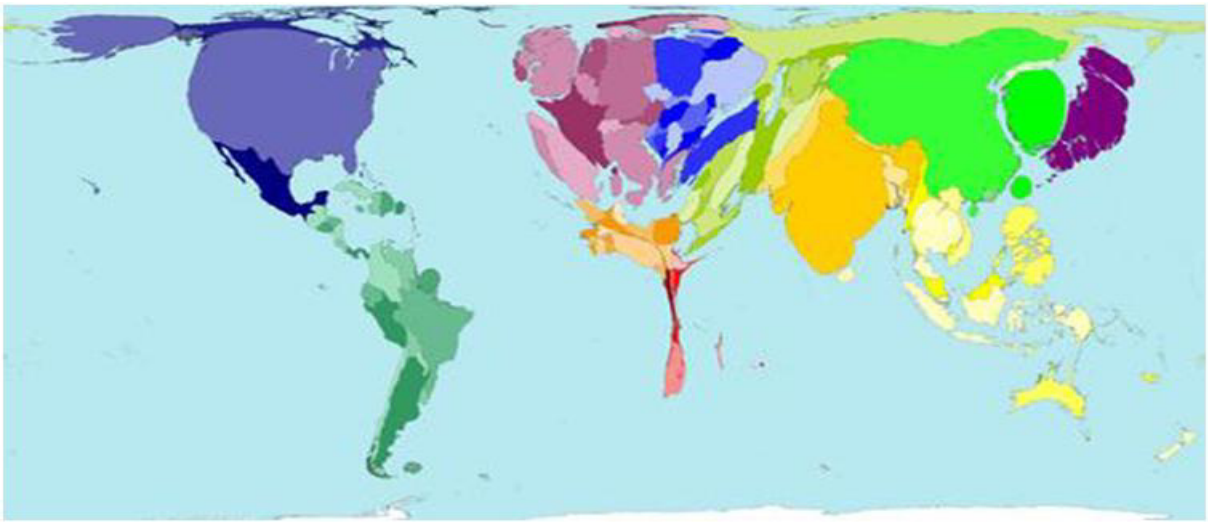

Figure 6. Tertiary Education
Source: World mapper (2012)

Surprising, External debt in 2009 in Zimbabwe accounted for 241% of the GDP and in majority of SSA accounted for more that 50%, which as an implication annual debt servicing (interest alone) range between 3% to 5%.

Study from Teweldemedhin (2012) shows that External Debt ratio to GDP (EXDGDP) was found to positive relationship to Multi Poverty Index in SSA, thus once percent increase in debt leads to 9.6% number of people increase to Multi Poverty in SSA. The long-term debt crisis with the other multitude of problems has left the SSA economic growth crippled and unable to grow fast enough. Moreover, the World Bank report (2011) shows some good news with debt servicing showing a significant improvement, amounting to 4.6 % of GNI in 1996/1997. This is due to substantial external debt relief, which has liberated fiscal space in SSA (see Figure 3). The IMF (2011) shows that deficits have been increased beyond sustainable medium-term paths; these should be revisited so that policy buffers can be restored. Whereas output remains well below potential, there remains a strong case for fiscal policy to help sustain demand in the near term, subject to financing availability.

Figure 4 shows that only Central African Republic and Namibia education expenditure in 2009 shows between 8 to 10% of their GDP; whereas as Zimbabwe and Swaziland between 6 to 7% of their GDP allocated to education. The rest of SSA nation's expenditure to education record shows below 5%. This implies still the

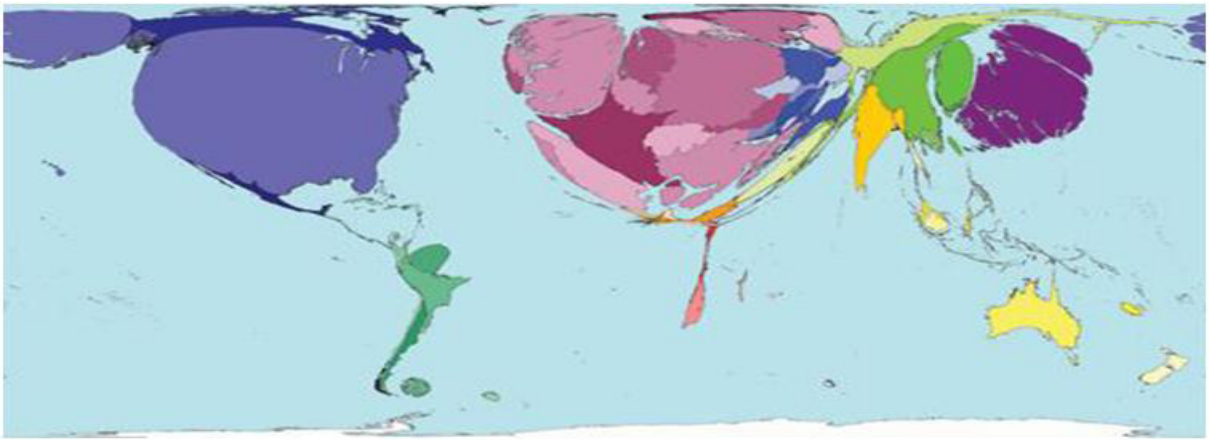

Figure 7. Research distribution
Source: World mapper (2012)

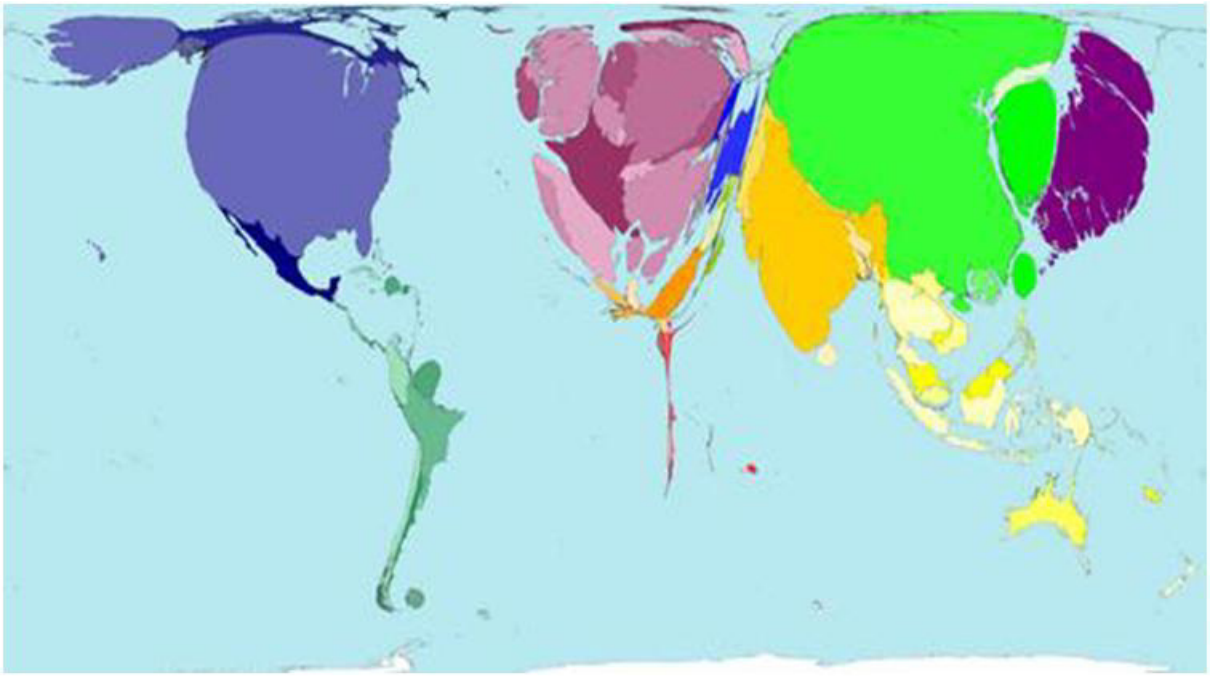

Figure 8. Wealth distribution
Source: World mapper (2012)

commitment of budget not yet considering to education, which mean SSA nations not yet recognizing the role of education to the economic growth.

For example, in China on average 89% get a secondary education, but in India it is only 49%. Figures in Africa are even lower than 45% in Northern Africa, 25% in Southeastern Africa and 13% in Central Africa. The lowest is 5% in Niger. What is compulsory in some territories is a rarity in others (see Figure 5)

The highest percentage of the student aged population enrolled is in Finland is 3.6 times the world average, with 140 times the chance of a tertiary education than in Mozambique. Figure 6 shows how Africa tertiary education is skewed.

Scientific papers cover physics, biology, chemistry, mathematics, clinical medicine, arch, agriculture.

Health expenditure

As Bloom et al (2005) have shown, healthier individuals can contribute to the economy in four ways:

Figure 9. HIV distribution
Source: Unicef (2012).

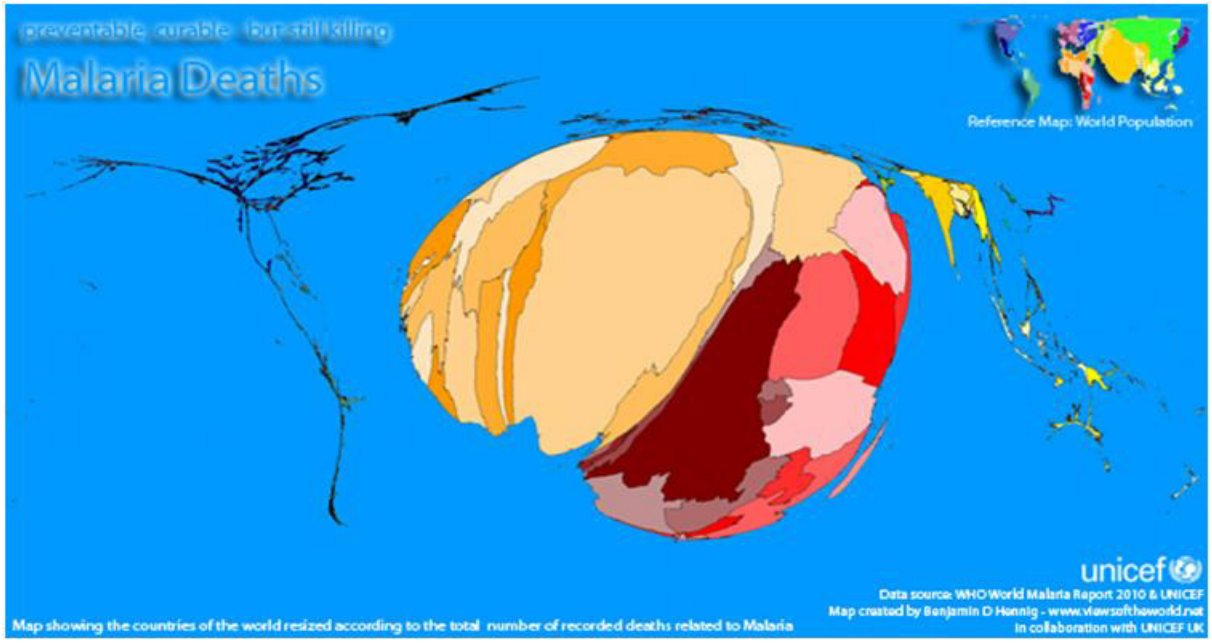

Figure 10. Malaria distribution
Source: Unicef (2012).

a) They might be more productive at work and so earn higher incomes;
b) They may spend more time in the labor force, as less healthy people take sickness absence or retire early;
c) They may invest more in their own education, which will increase their productivity; and
d) They may save more in expectation of a longer life for example, for retirement increasing the funds available

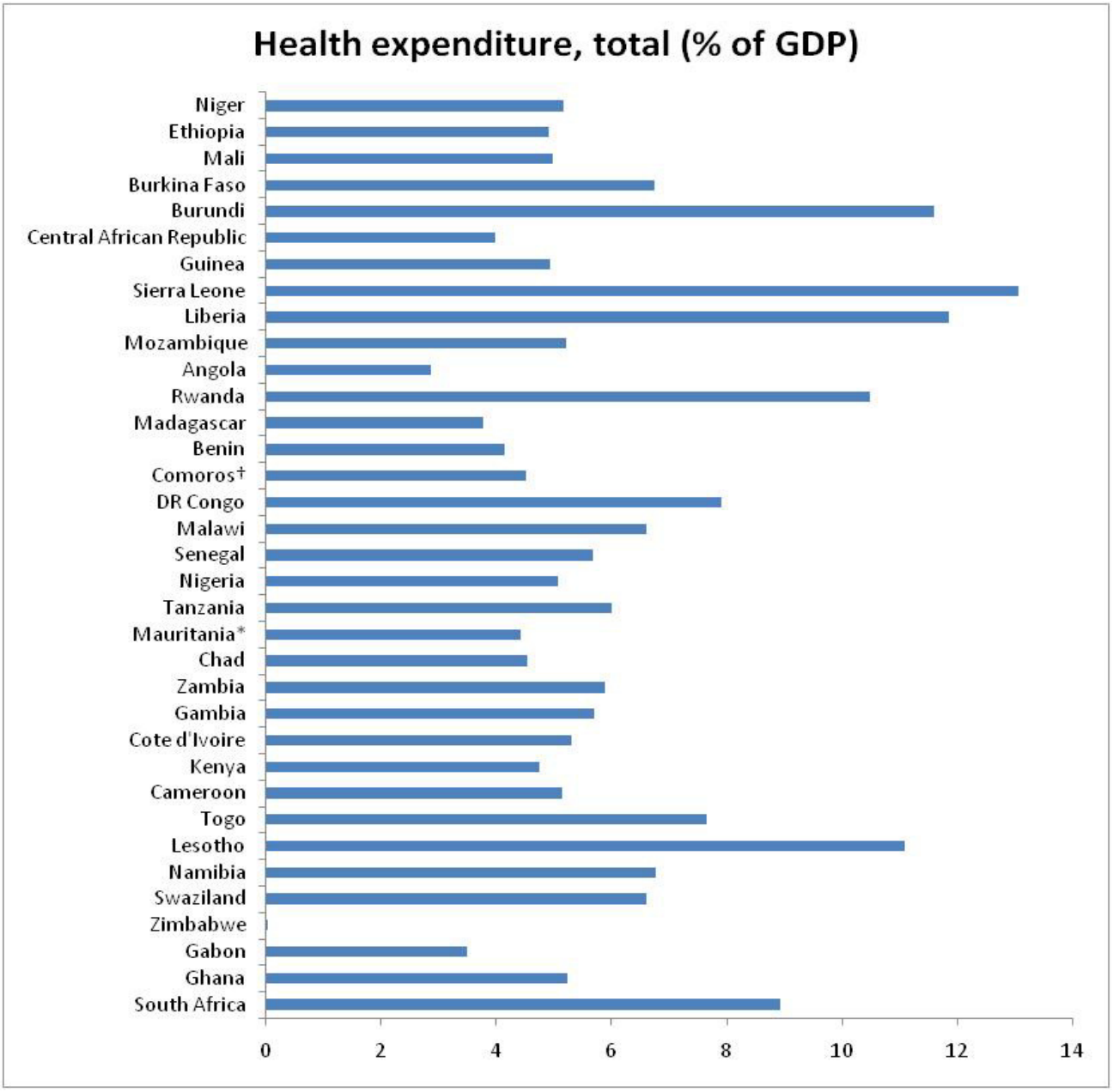

Figure 11. Health expenditure as percentage of GDP in 2009
Source: UN Comtrade (2011)

for investment in the economy. Health is indeed closely intertwined with economic growth and sustainable development.

There is evidence that investing in health brings substantial benefits for the economy. According to the WHO report that can increase life expectancy at birth by 10% and that can lead to economic growth increase by 0.35% a year. On the other hand, ill health is a heavy financial burden. 50% of the growth differential between rich and poor countries is due to ill-health and life expectancy (see Commission on Macroeconomics and Health, 2001). The UN Millennium Declaration was agreed to in 2000 by 189 countries to improve the health status of their nations so that can achieve the Millennium Development goals, exemplifying an unprecedented commitment on the part of both rich and poor countries to attain improvements in human development by the year 2015. This commitment is summarized in the eight Millennium Development Goals (MDGs) that set targets in areas of poverty reduction, health improvements,

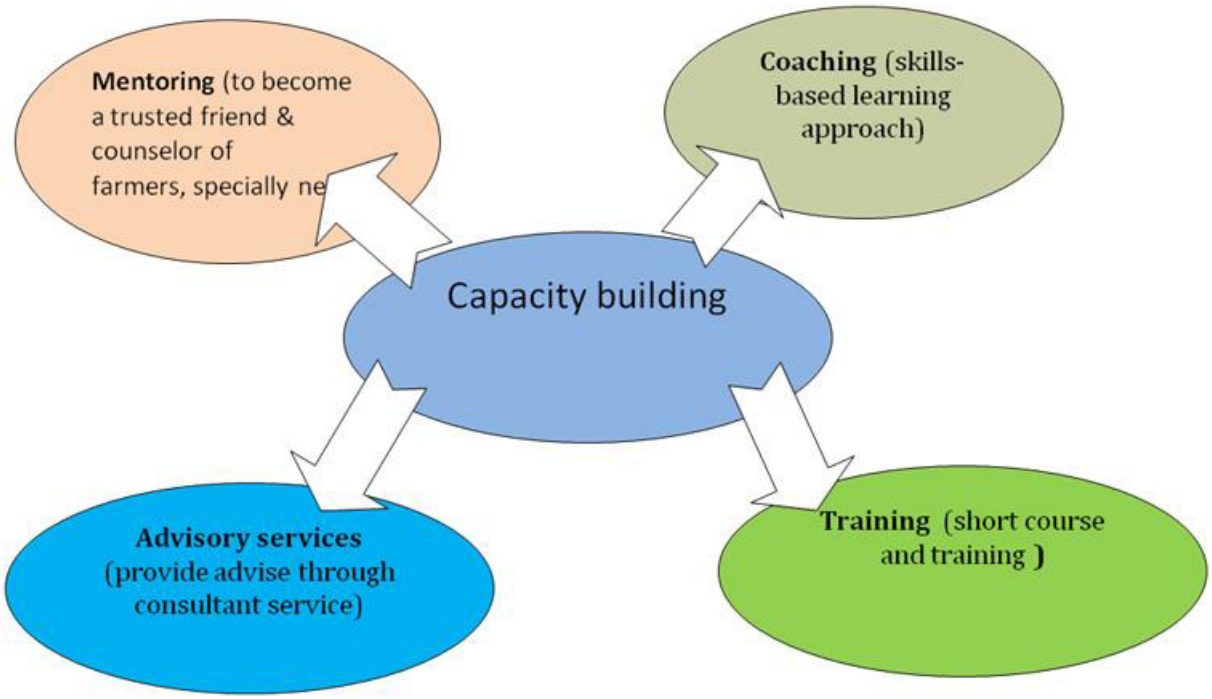

Figure 12. Capacity development
Source: Own representation

education attainment, gender equality, environmental sustainability, and fostering global partnerships (UNDP, 2003).

While the majority of countries have reduced child mortality since 1990, however the progress has been insufficient to reach the MDG target Progress has been particularly slow in Sub-Saharan Africa, where rates of infant and child mortality are increasing in some countries. Indeed, the gap between goal and reality is greatest in Sub-Saharan Africa where under-five mortality was 185 in 1990 and 163 in 2005 far short of the target of 62 in 2015. Based on estimates through 2005, only 33 out of 147 countries (22 percent) in the developing world are on track to achieve a two-thirds reduction in the mortality rate. Unfortunately, every country in Sub-Saharan Africa is off track, and in some countries mortality rates have actually increased since 1990 (World Bank, 2006).

Figure 11 shows that only Burundi, Sierra Leon, Liberia, Rwanda and Lesotho expenditure for health shows between 10 to 13% of their GDP, whereas the rest of SSA health expenditure is below 10%.

Indeed, the role of human capital in fostering economic development is well recognized in the literature. Thus, the justification for higher government expenditure on education is often based on its impact on:

a) Individuals' lifetime incomes (i.e., the social rate of return) (see, for example, World Bank, 2008 and);
b) Economic growth and food security (Durlauf and Temple , 2005 Commission for Africa,2005); and
c) Fostering economic development and poverty reduction in general (Sen, 1999; and Schultz, 1999).

Way forward

- Research and Development
- Agriculture is considered to be the engine for economic growth in SSA
- More than 32 per cent of SSA's GDP, provides a livelihood to about 80% labour force, accounts for about 65 % foreign exchange earnings and contributes more than 50 % of raw materials to the industrial sector.

Therefore, research can provide information at country and regional level to raise awareness of on-going challenges and guide policy makers towards informed decisions on fund allocation polices

- Provide information on trade negotiation, and agricultural development planning.
- Research provides information to farmers on production, distribution and consumption.
- Generate market information: drivers of supply and demand.
- Serving as a source of reliable evidence-based information to policy audience and general public.

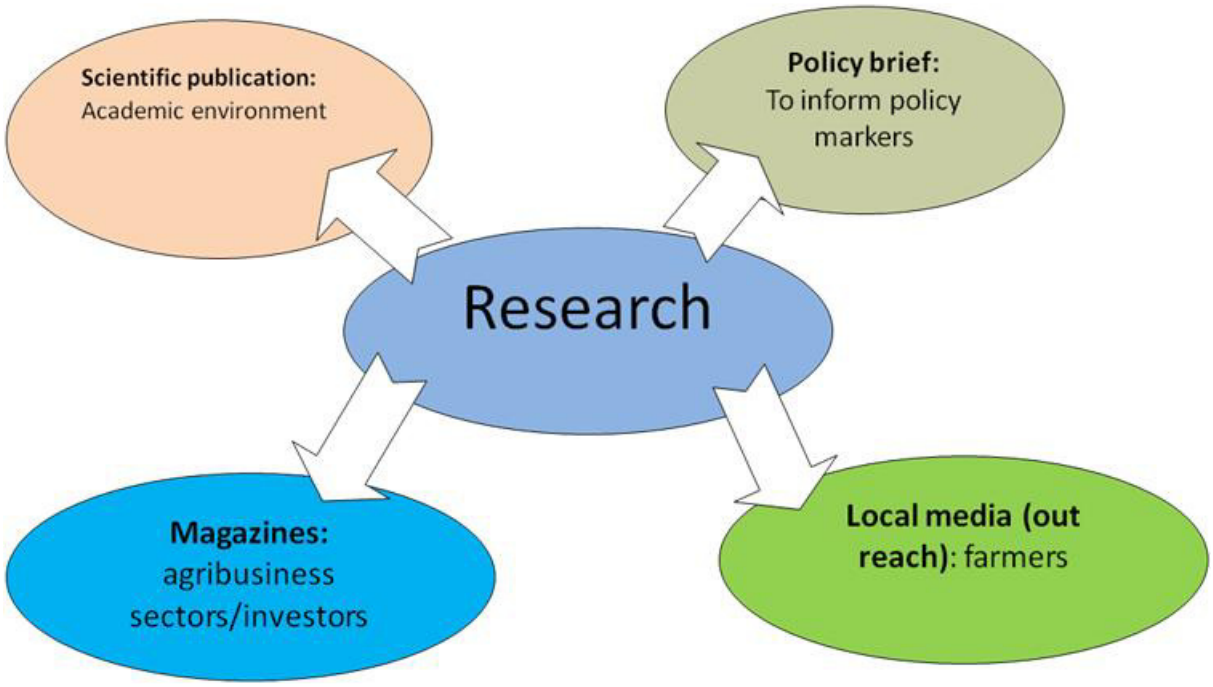

Figure 13. Model to forest Sustainable economic growth in Africa
Source: Own representation

- Capacity development (Training, mentoring, coaching, advisory service); as skilled human capital is critical for the success of agribusiness development and culture farming community.
- Further, improved knowledge of farmers on recent available technology is very important for poverty alleviation
- Experienced and Knowledgeable agricultural economist can help to produce young scientist and skilled people to drive the economy.
- Further we can provide appropriate training to farmers to do better business (example EFSP experience in Namibia)
- Guide policy dialogue: during adoption of new policy in attaining economic growth:

In SSA research organizations are not properly aligned with the needs and priorities of countries poverty alleviation strategies .Farmers have difficulties in accessing new technologies and innovations and lack organised networks. There is a disconnection between research and extension systems, and between researchers and policy makers. Many research systems are under-resourced. Research outputs are not adequately responding to the fast changing external environments in SSA.

Education has also been found to play a crucial role in the adoption of new agricultural technologies. In addition, education is seen as a means to improve health and reduce fertility (Schultz, 1999 and 2002; Strauss and Thomas, 1995), being an intrinsic good in itself (Sen, 1999).

This support for education among economists is matched by equal or greater enthusiasm among development policymakers (UNDP, 2003; World Bank, 2001). One example demonstrating the focus policymakers have placed on education is that two of the eight

Millennium Development Goals (MDGs) adopted at the United Nations Millennium

Summit in September 2000 focus on education: first, for all children to complete primary school by 2015, and second, to achieve gender equality at all levels of education by 2015.

The Millennium Declaration also stressed the special needs of Africa, and called upon

African governments to promote gender equality and the empowerment of women as effective ways to combat poverty, hunger and disease and to stimulate development that is truly sustainable and to develop and implement strategies that give young people everywhere a real chance to find decent and productive work. Further, they called on nations to support the consolidation of democracy in Africa and assist Africans in their struggle for lasting peace, poverty eradication and sustainable development, thereby bringing Africa into the mainstream of the world economy

The following two Figures A and B, should be used as model for capacity development and research in Africa.

Research Africa offers comprehensive, global coverage of news about science, technology and innovation policies, and the use of research to provide solutions to Africa's development needs. It is also the definitive source of information about sponsors of African science and development research funding programmes, and brings details of all proposal applications for funding.

Research Africa exists to inform senior researchers, research managers, administrators and everyone interested in the science and innovation research strategy of their institution, their country, and the international agencies (research Professional, 2012).

Africa is a large and rapidly growing market for research, as seen in the numbers of funding opportunities that are open to researchers. The most frequent sponsors of research in Africa include the National Research Foundation and Medical Research Council in South Africa, the UK Department for International Development, the World Health Organization, the World Bank and various national development organisations, such as USAID, NZAID, AUSAID and DAAD. Subject matter varies, but much of the funding is for agricultural programmes and healthcare research, especially work on diseases such as tuberculosis and HIV/Aids, climate change adoptability and land use planning (research professional, 2012).

Africa is very different from the other areas, as the majority of funding here comes from outside the continent and r*esearch Africa* has a much wider scope of funding opportunities that are relevant to the African problems.

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