

# Creating jobs from Science, Technology and Innovation: What's needed?

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# 9 million Africans enter the labour force each year

(One whole Sweden or one whole Rwanda!)

- How are they prepared?
- Which are their (scarce) opportunities?
- How are opportunities linked to levels of preparation?
- How could opportunities be increased?

# How are opportunities linked to levels of preparation? (1)

- Work in the family farm is the most common source of work for those who have only little education.
- For those who have achieved a little more education there are opportunities to look for agricultural wage labour in the neighbouring areas, mainly of seasonal character.
- The agrarian sector is still by far the biggest employer in Africa today.

# How are opportunities linked to levels of preparation? (2)

- For those who have completed primary education or made achievements in secondary education it is work in the informal sector that is available. Job opportunities are mainly available in the informal service sector, while the informal manufacturing sector is relatively small.
- The informal service sector is counted by ILO as the second biggest employer in Africa today, despite various efforts to change the situation.

# How are opportunities linked to levels of preparation? (3)

- The public sector is no longer a major employer,
- Public sector reforms have in many cases put educational restrictions so that only those with secondary schooling stand a chance to get employment.
- At the same time there are serious human resource constraints in key sectors such as health and education.

# How are opportunities linked to levels of preparation? (4)

- Work opportunities in the formal service and manufacturing sectors are limited for those without secondary or vocational training.
- Vocational training takes place within the enterprise, as the national vocational training systems have drastically declined in quality.
- To get a better paid job in a foreign firm requires that even better standards of education are met.
- Today there are very low rates of Foreign Direct Investments, FDI in most sub-Saharan countries, partly due to the difficulties in finding an appropriate labour force.

# How are opportunities linked to levels of preparation? (5)

- Better education  $\approx$  better jobs
- Catch 22
- The poor are excluded!
- Challenge 1: high technology and multinational enterprises exist side by side with a large and growing informal sector, and small holder agriculture
- Challenge 2: deficiencies in education and training systems, migration of qualified staff to industrialized countries and the HIV/Aids pandemic

# How to increase opportunities? (1)

The ILO Decent Work Agenda for Africa 2007-2015 recommends:

- create better job opportunities by promoting entrepreneurship
- formalise enterprises that are currently in the informal sector.
- close the skills gap – African states should ensure that half of the population in Africa has obtained new or improved skills by 2015.

# How to increase opportunities? (2)

- Upgrading of the African labour force to secondary schooling and vocational training is necessary but insufficient to make Africa competitive.
- There is a huge need for technical training at a tertiary level, particularly in the newer technology sectors like ICT, bio-technology etc.
- A real take-off for domestic firms that could become employers furthermore requires training of engineers, in business management and other entrepreneurial skills.

# How to increase opportunities? (3)

- A number of African Governments are currently reviewing policies for higher education and research,
- Stronger attention to HE and STI given by the Blair commission, the NEPAD and the 8th Summit of the African Union.
- Balancing, sequencing and timing in the design of educational systems are of outmost importance to meet the actual demand from the labour markets without overburdening education budgets.

# How to increase opportunities? (4)

Building on Lundwalls insights (1):

- The role of knowledge for development and for poor countries to catch up is increasingly recognised.
- Claims that knowledge existing in the global public domain could be exploited by anybody are now contested
- To succeed in exploiting the global pool of knowledge, LCDs need their own capabilities
- The conclusion that higher education should be financed by the individuals rather than publicly financed has finally been challenged in PRSPs
- ***Another approach than Technology transfer and Technical Assistance is proclaimed in the Paris Declaration but not yet realized in development cooperation practice***

# How to increase opportunities? (5)

Building on Lundwalls insights (2):

- People with higher education contribute to economic development through two mechanisms:
  - they could pursue regular activities more efficiently than average workers and
  - they are more competent to exploit new technical opportunities in the economy.
- The social rate of return to higher education will be positively correlated with the rate of technical progress.
- Higher education policy must be coordinated with a wider set of innovation policies

# How to increase opportunities? (6)

Lessons to learn from the BRICS by Zuccoloto and Cassiolato, and Kaplan:

- As a result of investments in HE and STI, China and India have been able to capture knowledge and technology from Foreign Direct Investments
- Brazil made fewer efforts to build up HE and STI and has been less economically successful
- South Africa has a small but good research base with a huge number of possible innovations to explore, but the higher education system is simply too small to provide the necessary competence to do so.

# How to increase opportunities? (7)

Fagerberg and Srolecs study:

- Capacity-building relating to the national innovation system to a large extent explain differences in GDP between different countries.
- Correlations between GDP and good governance, political systems or openness to the global economy are **less significant than the relation between innovation systems and GDP**
- National Innovation Systems are measured by: R&D, scientific publications and patents, ISO certifications, use of telephone, Internet and computers, education levels.
- ***The close connection between deficits in these areas and the difficulties for African countries to catch up is a major challenge that African governments and development cooperation must respond to.***

# How to increase opportunities? (8)

Watu Wamae's study:

- The links between higher education and domestic research are crucial points for coordination.
- Imported text books tend to be out of context, and external education providers would be less able to select the intrinsic themes of the local realities.
- Research focussed on domestic problems may be helpful to develop more relevant teaching materials.
- Domestic knowledge generation could be capable of sparking off an effective feedback mechanism between knowledge creation and interactive learning.
- This would eventually trigger the cumulative and interactive processes that create an interface between domestic knowledge and foreign knowledge

# Obstacles

- To sustain the development prospects of Africa the continent would need at least one million scientists and engineers (Hoebink and van der Zanden)
- EU calculate the need to expand European scientific institutions with 700 000 researchers to be able to compete with US and Asia
- Every year 70 000 highly qualified Africans leave the continent, and already more than 30 000 Africans with a Ph.D. live and work outside Africa. (Hoebink and van der Zanden)
- Only South Africa and Nigeria have a gross enrolment ratio in tertiary education that is more than ten percent. South Africa stagnated and Nigeria has expanded since 1995.
- The only ones in Africa with a number of higher education staff that exceeds 10 000 people and research staff (full time equivalents), beyond 1000 persons.
- No other African country claim to have more than 600 full time researchers.
- Sweden has 54 000 full time equivalents staff members engaged in research

# Overcoming obstacles (1)

Some remarkable steps forward:

- Ethiopia, Ghana and Rwanda have quadrupled the gross-enrolment ratio in HE during the last ten years.
- Mozambique and Tanzania have tripled their ratio, and
- Burkina Faso, Mali, Uganda, Kenya and Senegal have doubled the ratio
- Zambia has had a steady growth for the last twenty years and has recently taken a loan from the ADB to further expand tertiary education.
- In January 2007, at the 8th AU summit, African heads of state pledged to dedicate 1 percent of GDP for Science and Technology and research by 2010
- AMCOST: Africa's Science and Technology Consolidated Plan of Action
- REC's create STI-structures
- STI in PRSPs

# Overcoming obstacles (2)

Thus the scene for research cooperation and development cooperation in the education sector is rapidly changing.

- With strategies emerging at regional as well as national levels there are greater opportunities for national governments and regional bodies to execute their ownership of African education and research.
- There will be good opportunities for alignment of the various contributions that development partners will bring, and
- the processes around these contributions could be coordinated and harmonised.
- ***But are the donors prepared for such a shift?***

# Overcoming obstacles (3)

Other small steps known to Swedish research cooperation:

- Addis Ababa University preparing a major shift in graduate training – 5000 Ph.Ds
- The cluster initiatives in Tanzania and Uganda
- Various research projects at national universities with great potential for innovation: Enzymes from mushrooms, fiber composites, business and management studies, renewable energy, vaccine candidates etc.
- Research findings in regional research organisations being exploited or waiting to become innovations: AforNet, BioEARN, VicRes, Wiomsa
- Major African research programs planned, like:
  - NEPAD OST networks of excellence
  - ICSUs four programs on energy, climate, wellbeing, and natural hazards

# Expectations on science and practice: Max Planck and the Blacksmiths

A blacksmith's most important tool is his eyes, which allows him to determine the color of the heated iron rod. He knows that each color resembles a specific temperature. He also knows that temperature modifies the plasticity and formability of the iron rod. His experience tells him what color the rod should have to form the rod to a particular item.

# Expectations on science and practice:

## Max Planck and the Blacksmiths

Physicists in the late 19th century studied the same phenomena of colors and temperature, but they failed to establish mathematical models to describe the relationship. Max Planck's experiments with black body radiation in 1900 led him to conclude that the light resembled quantized energy emissions.

# Expectations on science and practice:

## Max Planck and the Blacksmiths

Max Planck's discovery gave birth to the elaboration of more probable models of the atom and its constituent particles, and to quantum mechanics. 40-50 years later it led to a large number of innovations: nuclear power, the transistor and computers, lasers, models for explaining the mechanisms of the greenhouse effects etc. Many of these came about through strategic research programs in the US military/space industry complex

Expectations on science and  
practice:  
Max Planck and the Blacksmiths

**Did the blacksmiths get anything  
back from Max Planck's discovery?**

Expectations on science and  
practice:

Max Planck and the Blacksmiths

**Not until almost a century later!**

Now metalworkers can cut, drill, weld,  
bend and form metals with the  
assistance of high precision lasers,  
controlled by computers and robotics.

Very expensive high tech, but so was  
dvd-players fifteen years ago.

# Expectations on science and practice:

## Max Planck and the Blacksmiths

### **Lessons learned:**

- Don't overemphasise practical use and results-orientation of research
- Combine academically oriented theoretical research with politically strategic research and with demand driven research
- Create a mutual understanding of the relationship between theory and practice between researchers and practitioners

## Overcoming obstacles (4)

- 9 million new workers
- PACF ?
- International cooperation/competition