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***Industrial Engineering Education in
North and Sub-Saharan Africa***
Facts & Trends

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Introduction

- High positive correlation between economical growth and high education development.
- Higher education has been proven
 - to facilitate economic growth,
 - to encourage innovation,
 - social mobility, and
 - democracy.
- Having higher education credentials alone, however, is not enough
- The **labor market** must have the flexibility to expand and adapt to accommodate the strengths of the work force.

High Education in Africa: Historical Development

- The [University of Al-Karaouine](#) is considered the [oldest continuously operating academic degree-granting university in the world](#), by the [Guinness Book of Records](#). (859)
- Pre-colonial period (before Mid 17th century)
- Colonial (Mid 17th - Mid 18th century)
- Post-colonial period (Mid 18th century-present)



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High Education in Africa: Historical Development

- **Pre-colonial period:**

- There was indigenous education at all levels before the colonization of Africa (Ajayiet al., 1996):

- 2 informal HEIs in Egypt in the last two or three centuries BC

- In 859 AD, a Moroccan Islamic HEI at Karaouine (1st univ in the world)

- In 970 AD, Al-Azhar of Cairo established

- In the 12th C, Sankorein Timbukutu established Ethiopian Orthodox Church provided education since 304 AD (Saint, 2004)

- Pre-colonial education was similar to modern education , however it was highly elitist.



Education in Africa: Historical Development

- **Colonial period:**

- Colonizers established institutions at all levels (Assie-Lumumba, 2006)

- To transmit their own culture and to gain the human capital

- Also to assist colonial administration with local skilled workers

- Structure of educational systems became more and more elaborated as time passed



Education in Africa: Historical Development

Post-colonial period:

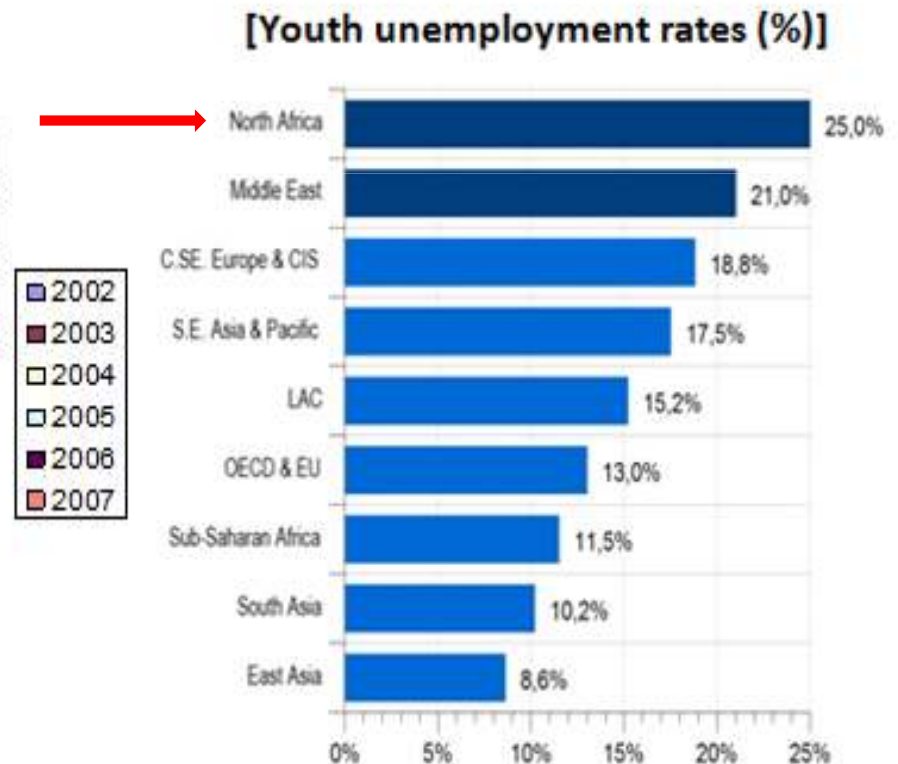
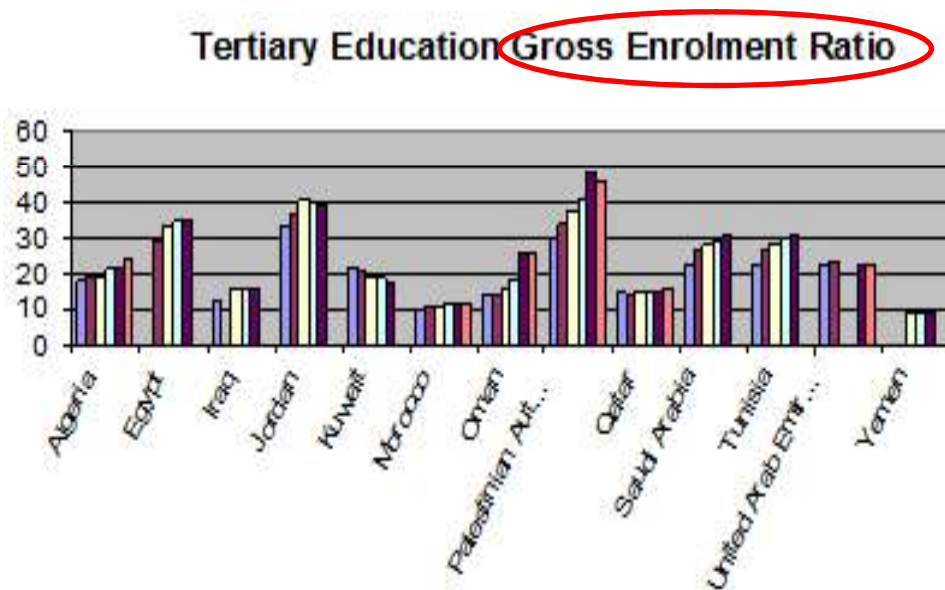
- The 1950s/60s reforms focused on making HEIs independent and relevant (Assie-Lumumba, 2006)
- Most universities were created after 1960 (Assie-Lumumba, 2006)
- Common reforms included: widening of access, inclusion of new fields and streams (Akin Aina 1994)
- Reform also considered education relevance to African needs e.g. Nyerere (1972)
- Pre-HE opened for the masses

Analytical Methodology

- Analysis is focused on patterns or trends across the selected themes
- One model (Morocco & Tunisia) to be analyzed representing countries having the same trends in educational development and programs
- Based on information supplied, some conclusions are drawn and recommendations are identified

Industrial Engineering Education in North Africa

- **MENA** region (Middle East & North Africa):



- Source CMI



MENA: Tradeoff between Employment and Higher Education

- In recent years, enrollment in higher education in MENA has increased significantly. Average enrollment across the region increased from 2000 up to now. However, although student enrollment numbers are increasing, there is still a gap compared to other, developed countries. In OECD countries, the proportion of the adult population with at least a HEI degree is 14.5%, with countries like Ireland as high as 20 %.
- In MENA, however, despite the availability of more skilled workers, the **job market** has remained **limited**, and graduates from higher education institutions constitute a larger proportion of the **unemployed population** than those of faster-growing economies.
- Youth unemployment rates in MENA are higher than any other region in the world – 21 % in the Middle East and 25 % in North Africa – and university graduates with at least an associate's degree make up nearly 30% of the unemployed.
- The MENA regional program on higher education recognizes these disparities and seeks to improve post-basic education and related institutions in the region.

MENA HE Development Initiatives

- Several projects established for higher education development in MENA region
- Starting with : **“Classifying Higher Education Institutions in the MENA Region: A pilot project”**
- The mission of the projects is to improve employability of tertiary education graduates
- Facilitate mobility of students, teachers and graduates across the region
- Develop analytical tools to improve the management and quality of tertiary education
- Promote knowledge sharing on quality, governance, and financing issues



MENA HE Development Initiatives

- A World Bank team based in Marseille, at the [Center for Mediterranean Integration](#), is developing a system for measuring the quality of university management against a combination of desired outcomes and international standards.
- This has been at the request of several MENA governments, keen on using the establishment of performance benchmarks to build momentum for the difficult process of university governance reform.

MENA: Big Moves and Impacts on HE

- Emergence Plan 2010
- 10 000 engineers in 2010
- Renewable Energy investments
- Offshoring
- Free zones

Morocco

Tunisia

Development Plan over the period 2002-2006
 Development Plan over the period 2007-2011
 Development Plan over the period 2012-2014

HE/GER:
 2001 23.2 %
 2006 34.3%
 2011: 45.5%

2013 –
 The International Monetary Fund commended Egypt's plan to boost public spending by \$3 billion to create jobs and stimulate economic growth

Egypt

1982/83 : HR/GER=16 %
 2002/03 : HR/GER=24 %
 2.2 million students enrolled in HEI
 2006/07 : HR/GER= 27.3 %.
 this number rose to 2.5 million students



MENA: Economical Development Driving Engineering Education & Ind.Eng.

- Morocco has emerged as one of the **top 10 countries in the world in the offshoring services**, despite only entering the field a handful of years ago.
- "Mega-investors demand to invest in heavy sectors calls for optimism, and can attract other globally reputable investors." (Foreign Trade Minister Abdellatif Maazouz).
- Offshoring activities are also expected to significantly **boost the Moroccan job market**.
- Morocco opened its doors to offshoring in July 2006, as one component of the **development initiative "Plan Emergence"**. It is viewed to be one of the most promising sectors in spurring economic growth.
- the key criteria multinational companies look at when they choose Morocco as a destination for offshoring:
 - Morocco's **geographical and cultural location** as well as **economic dynamism**.
 - **Political stability** and compared to the other MENA countries.
 - **low-cost labour** compared to Europe.
 - **Low resources cost and highly skilled** labor force.

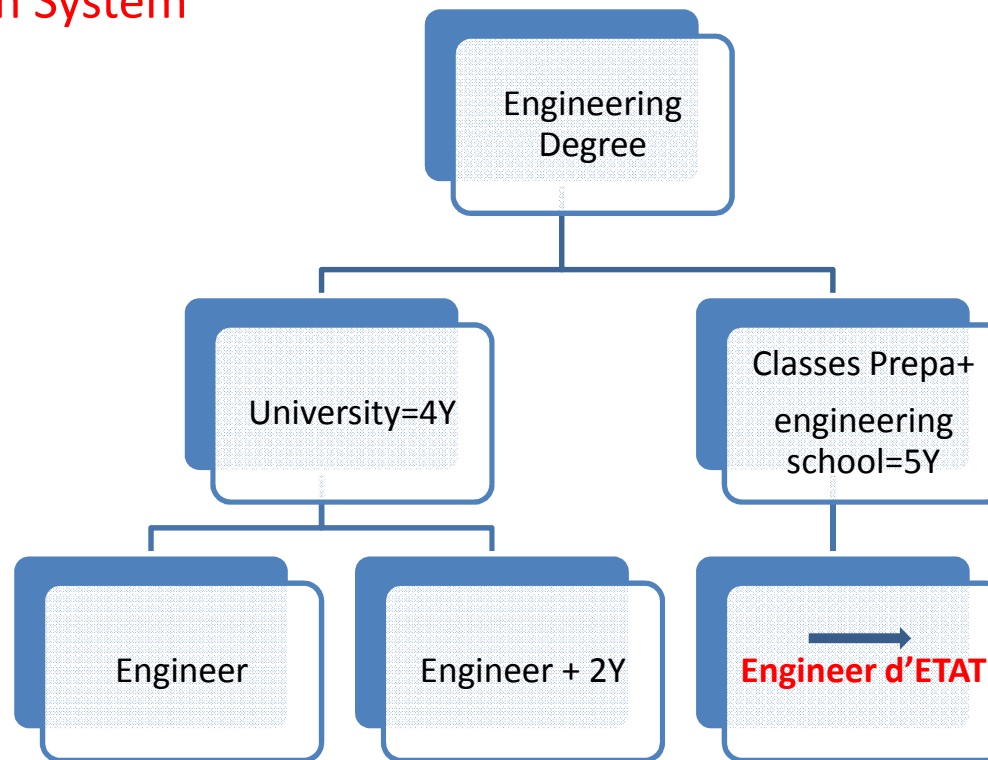


MENA: Economical Development Driving Engineering Education & Ind.Eng.

- In the next 10 years, the demand for offshoring is expected to rise.
- Two special areas in Casablanca and Rabat have been equipped to accommodate offshoring. The first offices, in "Casanearshore", were operational in December 2007. "Rabat Technopolis" followed soon after, in July 2008.
- Now, more than 35 companies have signed lease contracts at the two locations.
- The Ministry of Industry and Trade confirmed that the offshoring sector could boost GDP by nearly 15 billion dirhams by 2015, in addition to creating some 100,000 new jobs.
- New sites are to begin operation in Tangier and Fez in 2013.
- Mohamed Lasri, Director-General of Casanearshore, said the urgent offshoring demand from European clients who want to strengthen their presence in Morocco will require an increased work force and greater expertise.
- Morocco's higher education system is making the field a priority. Under a partnership between the office for professional training and work promotion, the National Agency for the Promotion of Work and Skills (ANAPEC) and universities, a national offshoring training program was created, offering 12 different professions and specialties.
- The plan is to train 22,000 graduates by the end of 2009.

Engineering Education in NA

- The engineering educational system in three nations of the Maghreb- the former French colonies of North Africa : **French System**
- The remainder of MENA region, the engineering educational system : **American System**





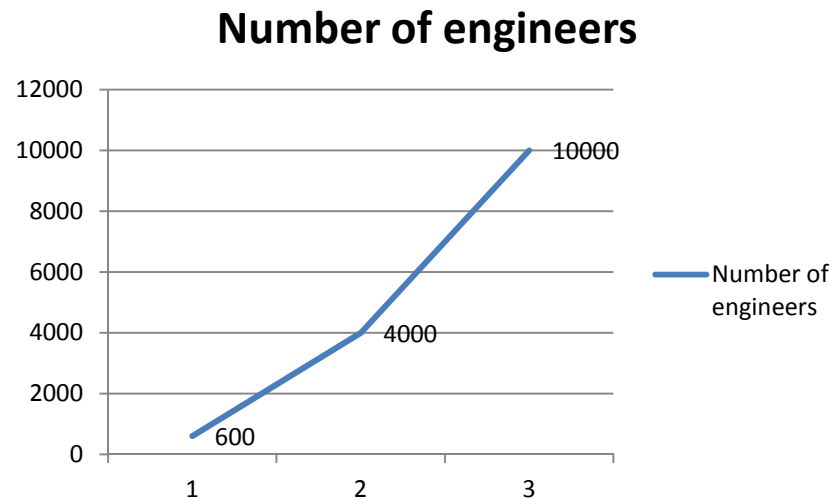
Engineering Schools in Morocco

- Morocco delivers 10 000 engineers yearly (histogram)
- Engineering public schools are now at a number of 25 (11 vocational training), 5 within public higher education (university) , plus private engineering schools:
 - L'Ecole Mohammedia d'ingénieurs (EMI),
 - L'Ecole nationale supérieure d'électricité et de mécanique (ENSEM)
 - L'Ecole nationale supérieure d'informatique et d'analyse des systèmes (ENSIAS)
 - L'Ecole nationale des sciences appliquées (ENSA) 11
 - L'Académie internationale Mohammed VI de l'aviation civile (AIAC),
 - L'Ecole Hassania des travaux publics (EHTP),
 - L'Ecole nationale de l'industrie minérale (ENIM),
 - L'Institut national des postes et télécommunications (INPT)
 - L'Institut national de statistique et d'économie appliquée (INSEA).
 - L'Ecole royale de l'air (ERA)
 - L'Ecole royale navale (ERN),
 - L'Ecole nationale d'agriculture de Meknès (ENAM),
 - L'Ecole nationale forestière d'ingénieurs (ENFI)
 - L'Institut agronomique et vétérinaire (IAV).
- ESITH
- FST (5)

Industrial Engineering
(In red)

Engineering Schools in Tunisia

- Tunisia delivers 5000 engineers yearly (histogram) at an average rate of growth of 10% per year



Ecole Polytechnique de Tunisie
Ecole Nationale d'Ingénieurs de Tunis
Sup-Com
Ecole Nationale des Sciences de l'Informatique de Tunis
Faculté des Sciences de Tunis
Ecole Nationale d'Ingénieurs de Monastir
Ecole Nationale d'Ingénieurs de Sfax
Ecole Nationale d'Ingénieurs de Gabès
Institut National Agronomique de Tunis
Ecole Sup. des Industries Alimentaires de Tunis
Ecole Sup. d'Agriculture du Kef
Ecole Sup. d'Agriculture de Mateur
Ecole Sup. d'Agriculture de Mograne
Ecole Sup. de l'Equipeement Rural de Medjez El Bab
Ecole Sup. d'Horticulture et d'Elevage de Chott-Meriam

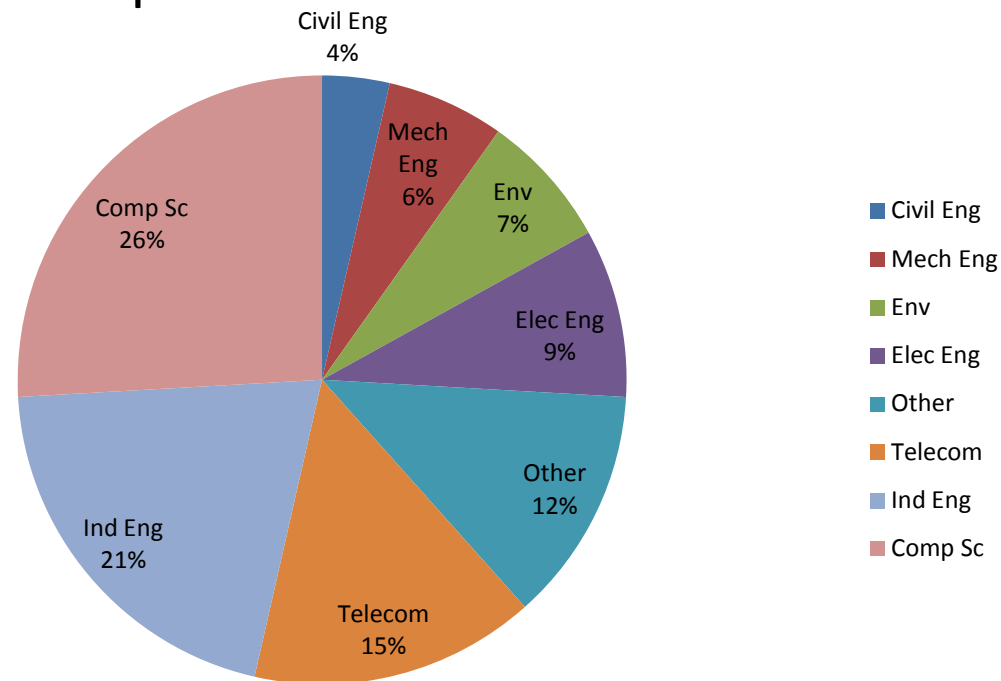


Eng. Enrolment Rate Comparison

- In 2006 Morocco Launched the “Emergence Plan” program, at that time Morocco formed an average of 4,000 per year
- The enrolment rate was **1.4 engineers** per 10000 population = **0.014%**
- This rate is much lower than that one observed in countries with the same level of development rate like Tunisia which has an average of **2.5 engineers** to the same proportion of population = **0.025%**
- the countries of Eastern Europe with 6 = **0.06%**.
- USA delivers 2M engineers over a population of 200M = **1%**

Industrial Engineering Programs in Morocco

- <http://www.enssup.gov.ma/index.php/enseignement-superieur/offres-formation/201-diplomeing>
- Engineering fields partition:

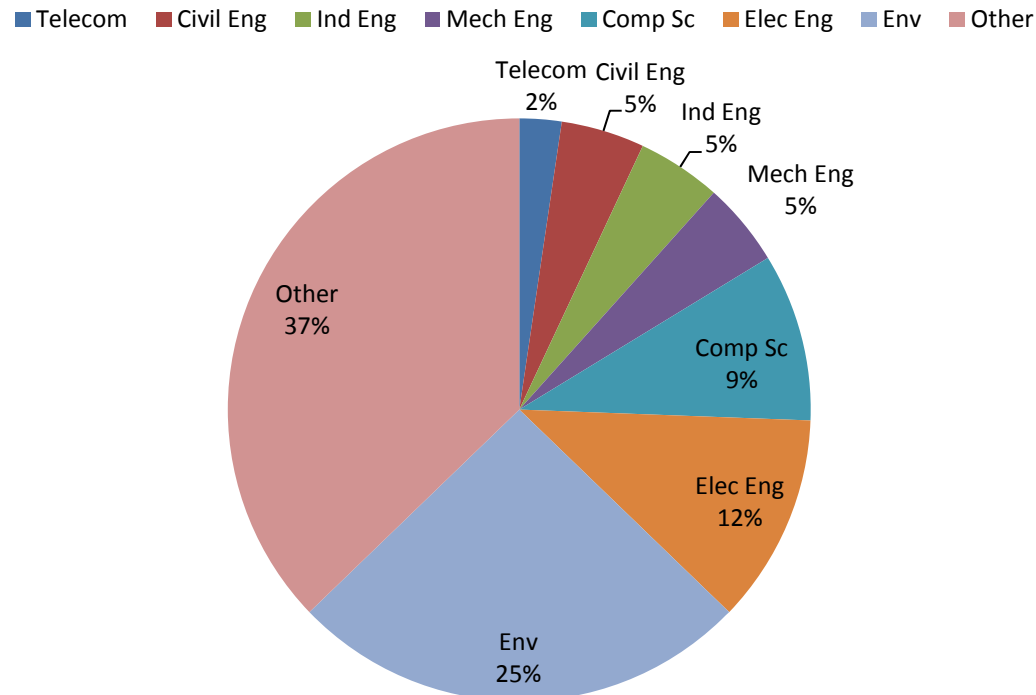




Industrial Engineering Programs in Tunisia

- Engineering fields partition:

Engineering Fileds



- http://www.mes.tn/francais/formation/p_for_ing.htm



Actions Towards HE improvement

- There are major efforts underway to reverse the decline in research output through, basically, scholarships for postgraduate students and greater funding for research.
- In 2005, South Africa launched its first **6 Research Centers of Excellence**, which pull together existing resources to enable researchers to collaborate across disciplines and institutions on long-term projects that are locally relevant and internationally competitive.
- In 2009 , Morocco creates **3 big research institutes CNRST, IRESEN, AH2.**



Research Grants Allocation

Field	Organization	Sample Projects
	Académie Hassan II des Sciences et Techniques	
-Renewable energies -Water treatment	ERESEN	Ouarzazate Solar Installation (first in Africa) Aeolian
-Water -Aerospace -Mechatronics and electronics -Health -Biotechnology and plant breeding environment -Energy and energy efficiency -Materials and Nanomaterial -Humanities and Social Sciences -Urban mobility	CRNST	

Sub-Saharan Africa (SSA)





Analytical Methodology

- Analysis is focused on patterns or trends across the selected themes
- Focus is on education systems of Ethiopia, Kenya, Uganda, Tanzania, the Sudan, and Nigeria
- Where possible and appropriate, country specific examples are provided
- Based on information supplied, some conclusions are drawn and recommendations are identified

Key Statistics on HE in SSA

- Though enrolment has doubled and tripled in many HEIs, Africa has the lowest enrollment rate in the world (Mohamedbhai, 2007; World Bank, 2002; UNESCO 2003)
- According to the UNESCO (2008):
 - GER for SSA was 5% in 2006
 - GER for Ethiopia 2%
 - GER for Kenya 3%
 - GER for Uganda 3%
 - GER for South Africa 15 %

Key Statistics on HE in SSA

- HE is less accessible to disadvantaged groups and women (Mohamedbhai; 2007; World Bank, 2002; UNESCO, 2003)
- Limited resource allocation (World Bank, 2002; Mohamedbhai, 2007):
- Ethiopia's spending for education was 17.5% of GDP of which 17% to HE
- Kenya 17.9% of GDP, 16% for HE
- Uganda 18.3% of GDP, 12% to HE
- Tanzania 11.4% of GDP
- Sudan 2.8% of GDP (UNESCO, 2008)

South Africa Ranking in Engineering

- The number of graduates produced annually by South African universities has been steadily growing, from 74,000 in 1994 to more than 127,000 in 2007.
- There have been successful efforts to produce more of the kind of graduates the economy needs, in the fields of science, engineering and technology; which now enroll more than a quarter of all students.
 - 36,637 (29%) graduates in Science, Engineering and Technology;
 - 31,104 (25%) in Business and Management;
 - 28,332 (22%) in Education;
 - 30,814 (24%) in Humanities and Social Sciences in the same year.
- South Africa has the highest tertiary education enrollment rate in SSA.



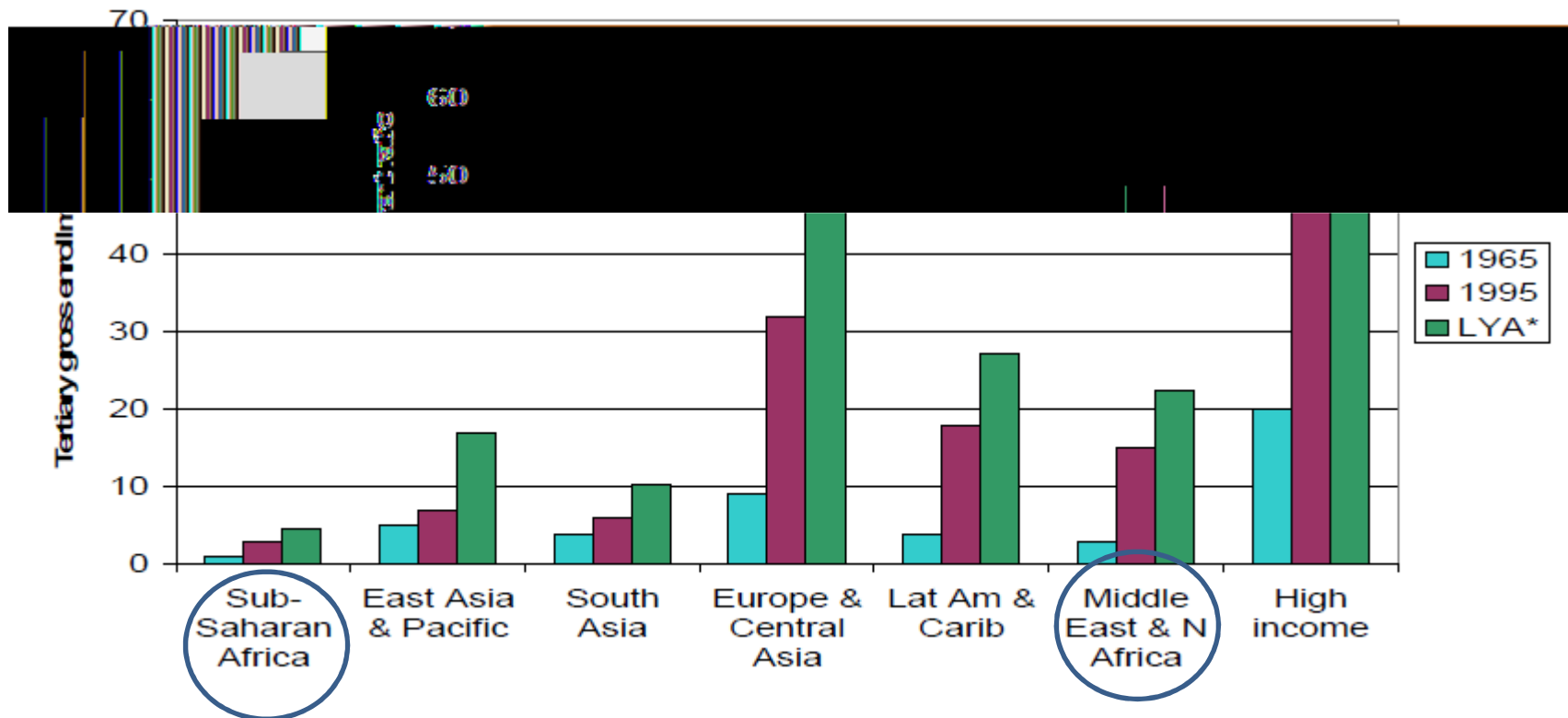
Private Higher Education in SA

- There are 99 private higher education institutions operating legally in South Africa, according to the register of institutions, including 75 that are fully registered and 24 with provisional status.
- Although there are far more private than public higher education institutions, the private sector is dwarfed by public universities in terms of student numbers.
- Present estimates place the number of students in the private sector at slightly over 30,000 students.
- Most private colleges offer advanced certificates and diplomas with a vocational focus, responding to **the high demand for market-oriented qualifications and producing drastically needed skills.**

Enrollment Ratio in HE in SSA

- Enrollment rates in HE in SSA are by far the lowest in the world.
- Although the gross enrollment ratio has increased in the past 40 years – it was just 1% in 1965– it still stands at around 6 %.
- Enrollment rate growth has been slow in SSA , and the absolute gap by which it lags behind other regions has increased rapidly.
- The region's present enrollment ratio is in the same range as that of other developing regions 40 years ago.
- Moreover, gender disparities have traditionally been wide and remain so.

Enrollment Ratio in HE in SSA & MENA





Challenges

- Funding Universities
- For many years university funding declined in terms of the proportion of total finance committed to higher education.
- Mismanagement, student numbers grew while staff numbers remained static.
- Skills that match market needs.



?????

If all the barriers could be overcome,
what would it cost to bring the rest of
Africa up to developed countries level?



Literature sources

The databases of the following organizations were visited:

- Association of African Universities (AAU)
- The World Bank: www.worldbank.org
- The UN and The UNESCO
- European Commission
- Council for the development of Social Science Research in Africa
- Association for the Development of Education in Africa Center of International Higher Education, the Boston College
- Enseignement superieur au Maroc: www.enssup.gov.ma
- Center for Mediterranean Integration: <http://cmimarseille.org>
- MENA: www.worldbank.org/en/region/mena
- <http://ent.arp.harvard.edu/AfricaHigherEducation/Reports/BloomAndCanning.pdf>
- Enseignement superieur en Tunisie:
http://www.mes.tn/francais/formation/p_for_ing.htm