HIGHER EDUCATION INSTITUTIONS AND INNOVATION IN TANZANIA

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THIRD STIPRO RESEARCH WORKSHOP

INNOVATION AND EDUCATION IN POOR DEVELOPING COUNTRIES: THE ROLE OF TECHNICAL EDUCATION AND IINSTITUTIONS OF HIGHER LEARNING IN TANZANIA

3rd - 4th July 2013

Background

- In 6th September 1943 the Hon. Winston Churchil (1884 – 1965), British conservative statesman and Prime Minister (1940 1945 and 1951 – 1955) delivered a morning speech at Havard University and in his speech he said ***"The Emperor of the future are the Emperor of Minds" he continued saying that "those who will invest in education, especially in Science and Technology will rule the World"***

Background (Cont..)

- **What are the roles of higher education learning institutions (HEIs) ?**
  - Teaching (for knowledge circulation),
  - Research (for knowledge creation),
  - Professional service (in pursuit of public service).
- Important to note is that higher education institutions are not supposed to be in the business of innovation as they are essentially in the business of teaching and research—they are producers of **knowledge for innovation** as well as **human resources** who are the main carriers of knowledge to industries ready for translation into innovations.

Background (Cont..)

- Without HEIs, companies would be starved of the highly skilled and the new ideas that they contribute to innovation as the business of innovation is with the industries.
- Innovation should not be confused with research although research may lead to innovation but it is not by itself innovation

Background (Cont..)

- **Previous studies have shown that Innovation in Tanzanian industry is scarce**
  - Available engineering and technical human resources in industries are few and probably they lack skills and knowledge to innovate
  - There are no new economic activities that exists in the country i.e. No new products, processes and services being produced in the country
  - The country continues to import cheap goods from other countries as most of the manufacturing industries have been wiped out – could not compete
  - Tanzania like many African countries continues with its colonial era legacy of exporting natural resources

Background (Cont..)

- In conclusion it can be said that may be **HEIs have not done enough** as far as in intellectual training for purposes of producing enlightened, creative and STI productive individuals as human resources.
- The knowledge produced through researches is either not in line with the market demand or it cannot be translated into new economic activities

Challenges faced by HEIs

- **An STI-deficient Education and Training System**
- The country's education system suffers from a severe lack of capacity to lay a solid foundation for teaching and learning of science and technology.
- This is occasioned by several factors, such as:,
  - Low enrolment in science-related fields,
  - Meagre science training facilities, to ineffectual teaching-learning methods.
  - Science teachers
  - Funding

Challenges faced by HEIs (Cont..)

- Engineering Graduate Output per year

Country	**Graduate Engineers per year**	**Country Population**
China	250,000	1.5 billion
India	350,000	1.2 billion
USA	60,000	311 million
Brazil	25,000	190 million
S. Africa	1,500	50.5 million
Australia	5,000	22.5 million
Kenya	700	40 million
Tanzania	700	45 million

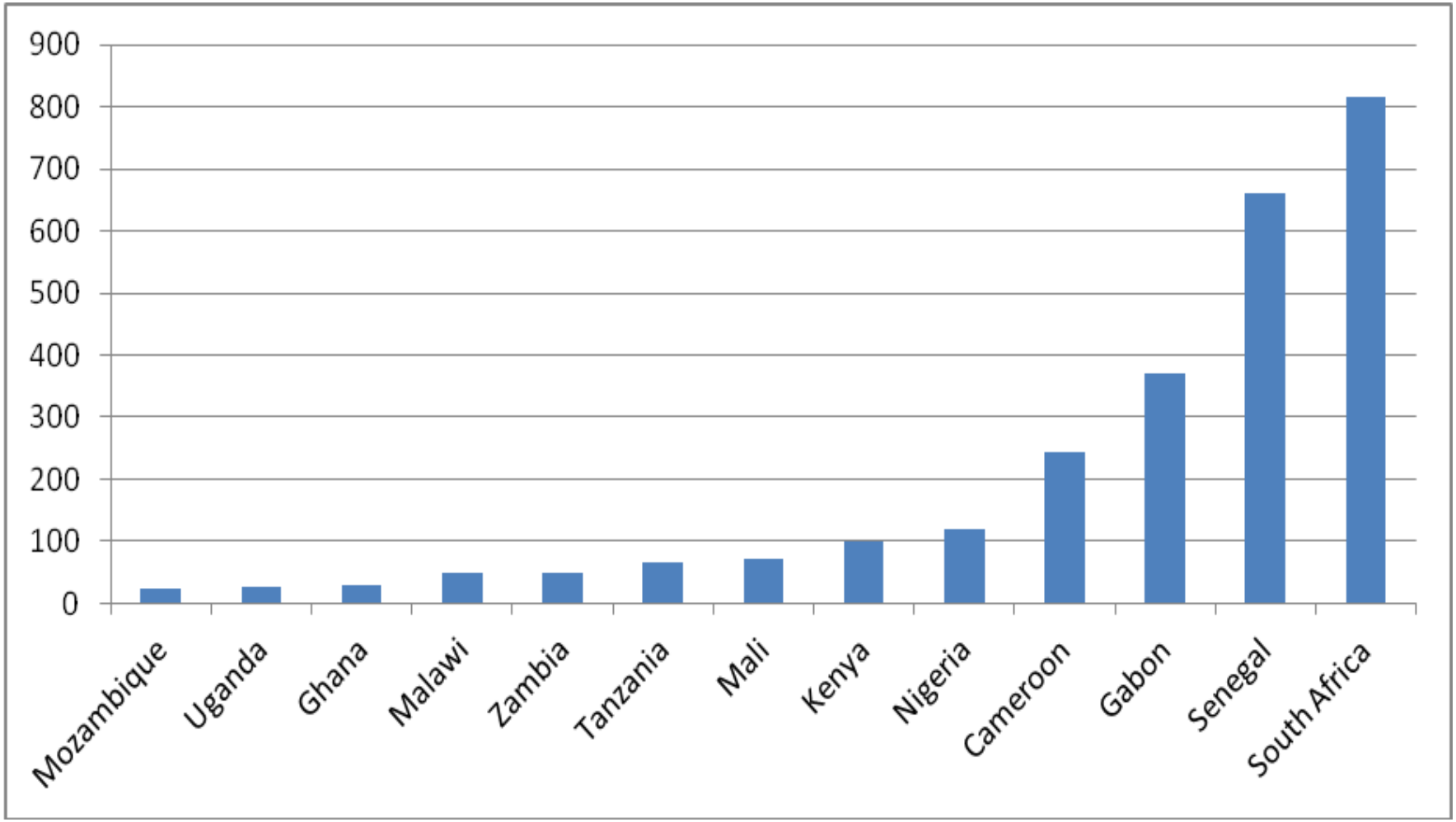
Challenges faced by HEIs (Cont..)

- Numbers of engineers available

S/No	Country's Name	No. of persons/Engineer
1.	China	130
2.	India	157
3.	Brazil	227
4.	United Kingdom	311
6.	Malaysia	534
7.	South Africa	3,166
8.	Tanzania	5,930
10.	Kenya	6,300

Challenges faced by HEIs (Cont..)

- **Number of Researchers /million inhabitants (2009)**



Challenges faced by HEIs (Cont..)

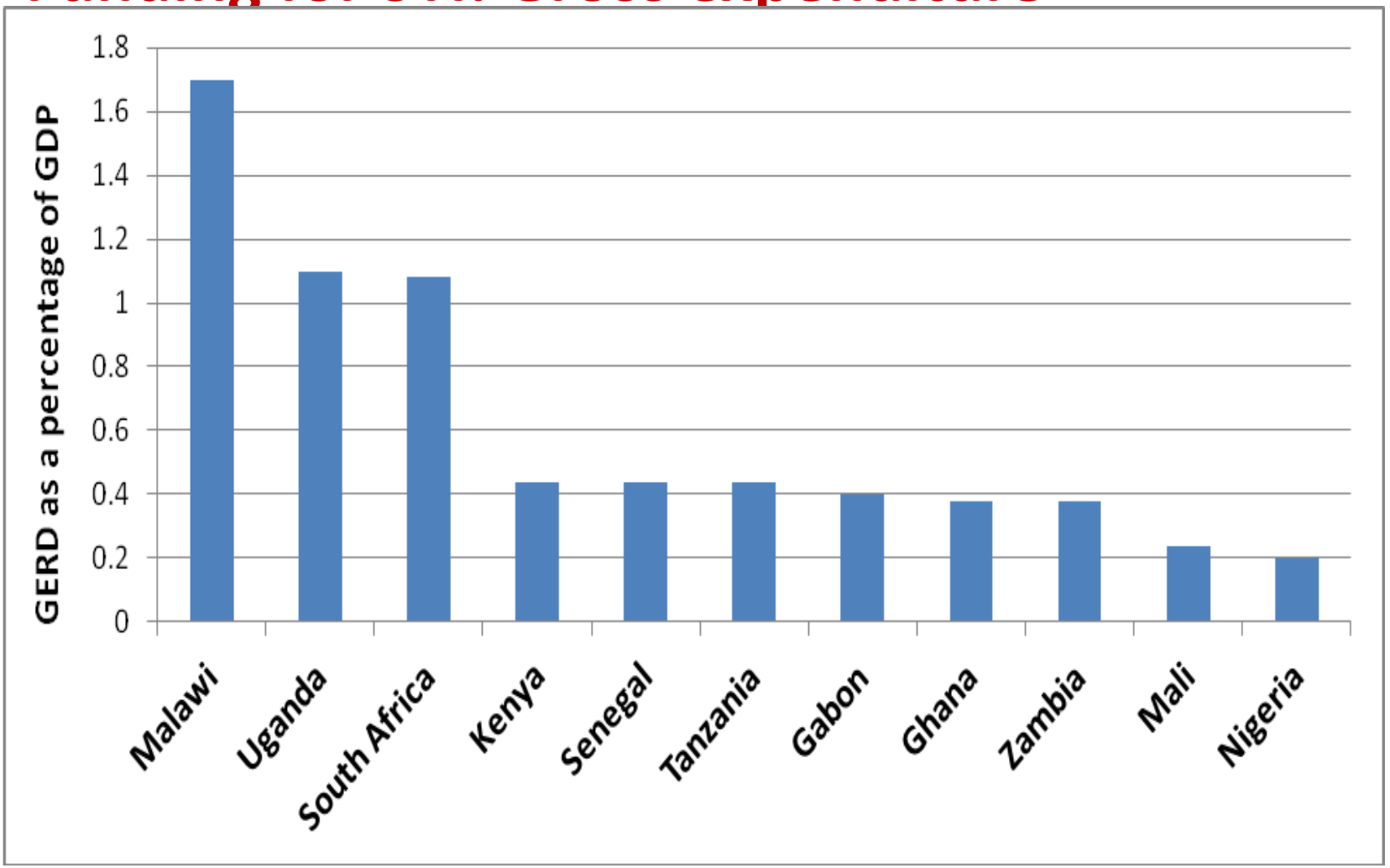
- **Inadequate Physical Infrastructure required by HEIs in imparting Innovation culture**
- Currently, laboratory resources are many students share few if any laboratory facilities. This leads to students to conduct superficial fact-finding, survey-type and non-innovative research, as opposed to targeted, mission-oriented research.
- Limited access to journal materials, which are available at unaffordable subscription rates.
- **The culture of reading/analysing issues: a problem!**

Challenges faced by HEIs (Cont..)

- **Mismatch of curricula content and labour market demands**
- The content delivered by HEIs has often **not** provided skills that are more responsive to market demands,
- Curriculum developed does exploit indigenous knowledge and technology for innovations, creative sufficient level of production and of guarantee of intellectual property ownership and rights.

Challenges faced by HEIs (Cont..)

- **Funding for STI: Gross expenditure**

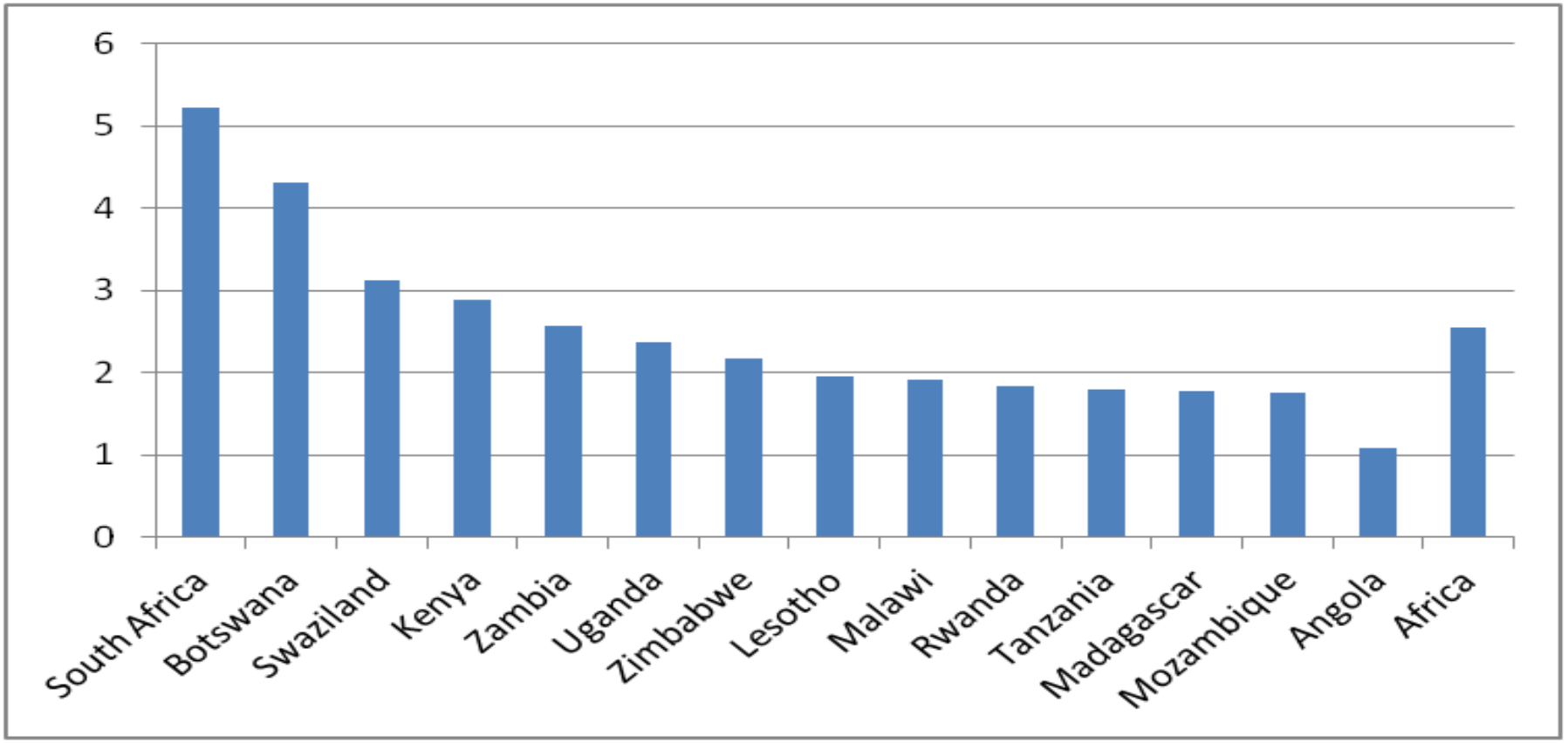


Challenges faced by HEIs (Cont..)

- **Knowledge economy index**
- This is a measure of the following core indicators of the knowledge depth of Innovation systems:
  - Education &training,
  - Information infrastructure,
  - Economic incentive and instructional regime,
  - Innovation system
- **Tanzania and Rwanda are not doing well**

Challenges faced by HEIs (Cont..)

- **Knowledge economy index**



Challenges faced by HEIs (Cont..)

- **The myth of Innovation/development – Oswald de Rivero (2001)**
- **Under-developed countries**:
  - Constitute **75 percent** of humanity
  - Posses **7 percent** of the world's total scientists and engineers
  - Spend less than **2 percent** of the total investment in scientific research and development : *Technological destitution*
- **50 percent of S&T** concentrates in Singapore, Korea, Malaysia, China, India and Brazil. **Devel. Countries** such as USA, UK & Canada the centre of global economy

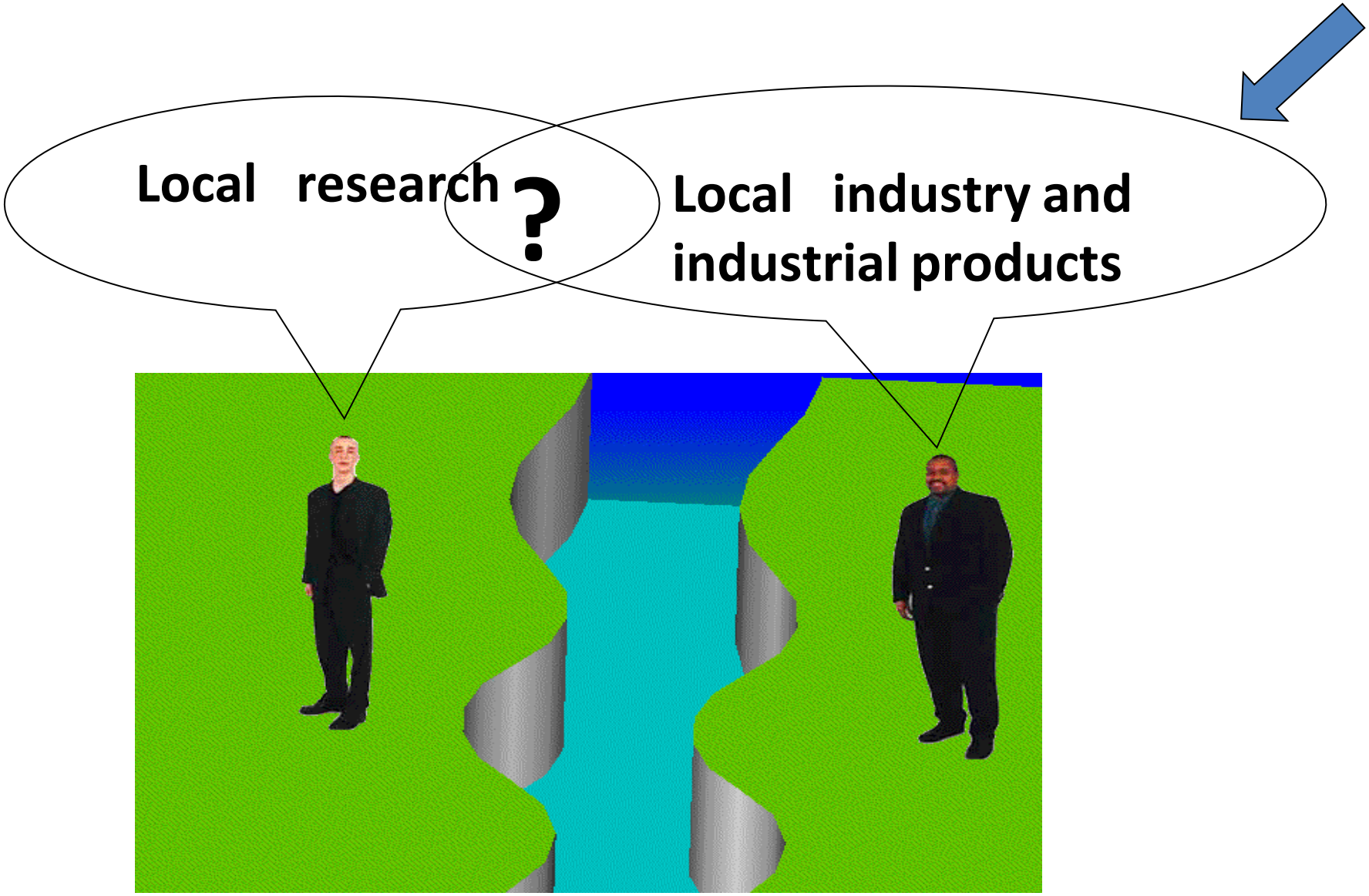
Challenges faced by HEIs (Cont..)

- **Linkage between the Productive Sector and Academia**
- There exists very low level of linkage between industrial firms and knowledge organizations: This could also be the reason for the poor uptake of research outputs from HEIs and sponsoring of R&D
- The Private Sector is less export oriented and has low level of competitiveness and is rather resistant to invest in R&D initiatives.

Challenges faced by HEIs (Cont..)

- No proper systems for the protection of IPR that could effectively enhance commercialization of research results or innovations,
- Inadequate mechanisms for identifying and linking existing knowledge with innovation
- limited capability and experience in converting research results into useful processes, products and services – technology incubators

Technology Transfer-University to Industry



Experiences from other Countries

- East Asian "Tigers" including Korea, Singapore and now China, Concentrated on **building labour force skills** through education at all levels focusing on innovation and technology applications.
- The above went hand in hand with intensification of Government-Academia-Industry partnership for manpower and industry development

Innovation Development Phases –case for Singapore

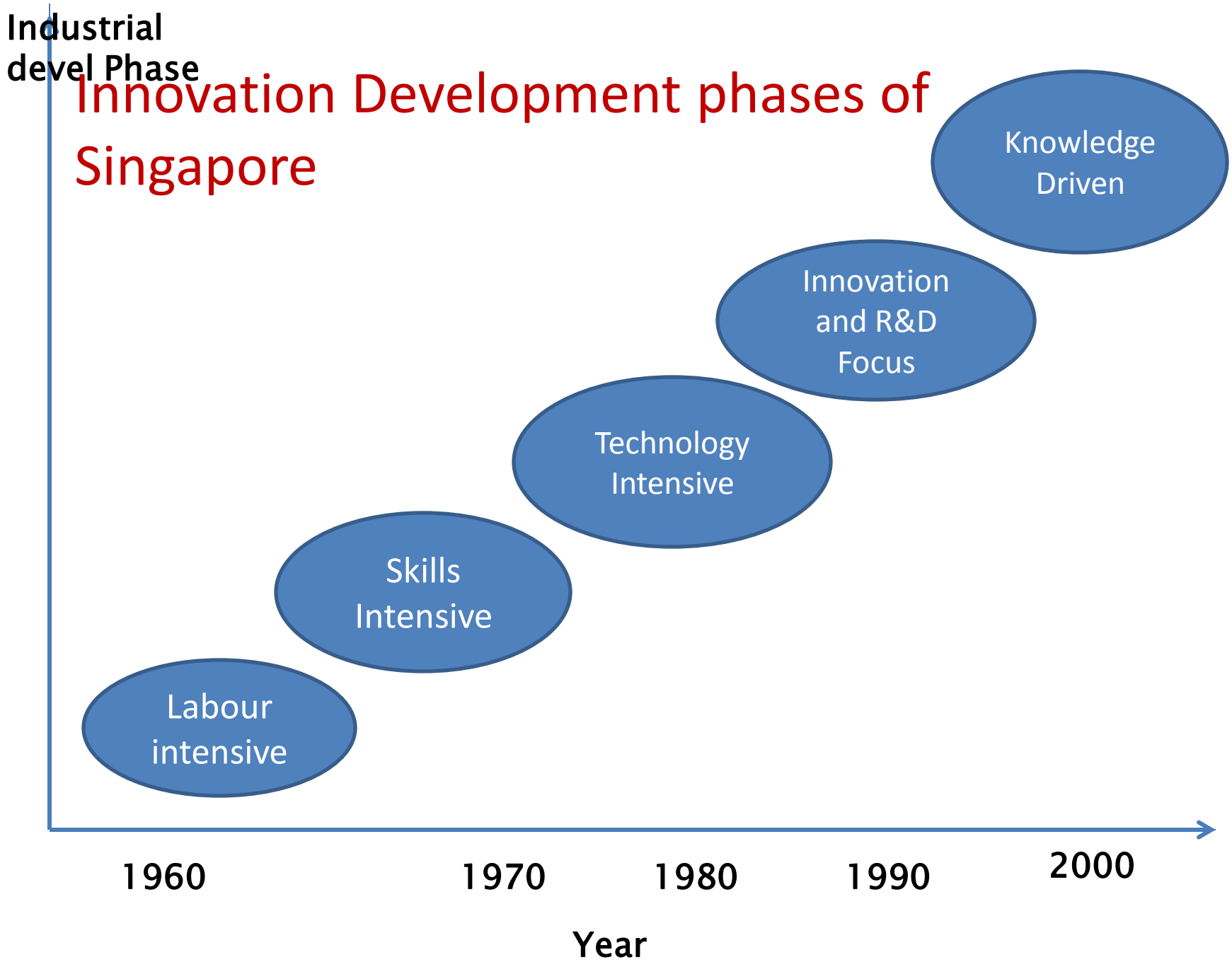
1990

- **Innovation and R&D Focus**
- Intensification of Govt-Academia-industry partnership for manpower and industry development
- Development of strong foundation for innovation and technology applications (Reverse engineering)

2000

- **Knowledge Driven**
- Application of new technologies and new ideas—both in the form of new inventions and new applications of existing knowledge
- Ability to access, adapt, and utilize knowledge for development

Innovation Development phases of Singapore



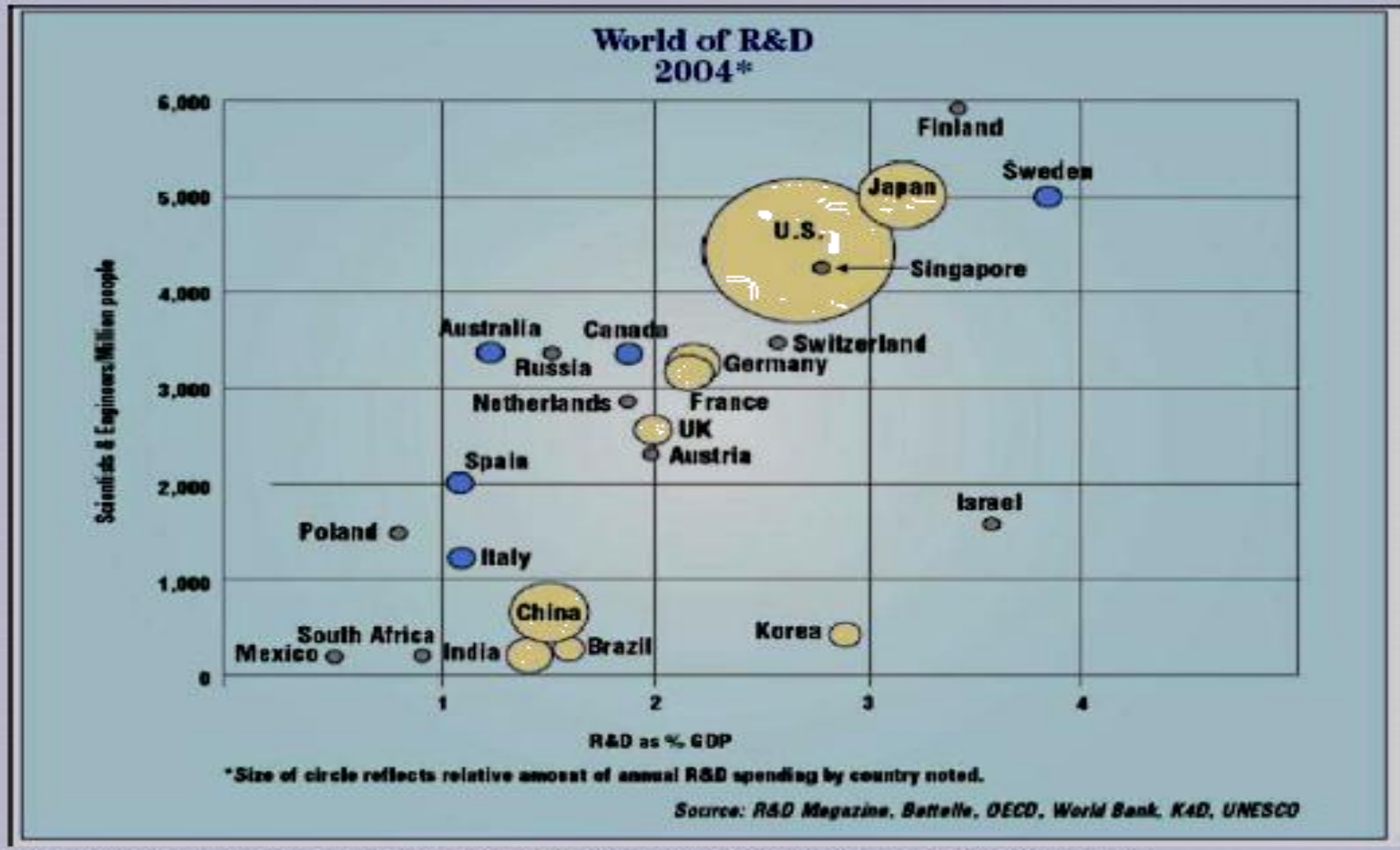
Experience from other Countries (Cont..)

- During the Knowledge economy phase, the Singapore Govt focus was concentrated on the application of new technologies and new ideas—both in the form of new inventions and new applications of existing knowledge.
- The above also went hand in hand with developing STI manpower that have the ability to access, adapt, and utilize knowledge for development

Experience from other Countries (Cont..)

- **Funding**

Chart 1: World R&D, 2004.



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Experience from other Countries (Cont..)

- **Linkages between HEIs and Industry**
- **Technology Incubators in UK:** Most of the incubators are in UK. are supported in form of grant by either the Government, Trusts or some other organizations to put the workspaces
- Aims at creating wealth and employment by providing facilities for the establishment and rapid growth of knowledge-based companies. The Park accommodates start-up businesses, which are referred as incubators

Experience from other Countries (Cont..)

- **IIT Mumbai Incubator**
- Provides staff members and students with infrastructure (office, internet, and telephone). Business mentoring, support in finance and setting up of a company are provided
- The facilities and services are subsidized and not free. The incubation cycle is 2-3 years (3 year maximum)
- Staff are allowed to take time off from the University so as to support their spin-off firms from their research results

Future Outlook for Enhanced Innovation

- **Education and Training**
- The teaching of science subjects at ordinary level secondary schools (Form I – IV) should be made mandatory with adequate numbers of science teachers and the provision of adequately equipped laboratory facilities
- HEIs institutions should be provided with modern laboratories with state-of-art facilities so as to be able to effectively carry out researches in the areas of new and emerging technologies.

Future Outlook for Enhanced Innovation (Cont..)

- Establishing continuous interaction with international research and other knowledge-based (Open Innovation)
- HEIs education and training curricula should be focussed on emerging of new sectors: with many of them based on the use of ICT products and services; extractive/mining industries as well as oil and gas. Others include: Bio-technology, material science, nanotechnology (NT) and nuclear science
- *NT is the **third** and, perhaps, the biggest of the three technological revolutions : the first is the **industrial revolution** and the second is the Si/IC/**digital revolution**19th and 20th centuries*

Future Outlook for Enhanced Innovation (Cont..)

- **Strengthening linkages between academia and industry**
  - Public-private partnerships should be encouraged in order to fully utilize physical resources available in industries as well as between different HEIs
  - There is need to establish local capacity for conducting periodic "technology audits and forecasts" through the envisaged technology foresight fora, based on developments taking place within and outside the country.

Future Outlook for Enhanced Innovation (Cont..)

- Scholars, academics and researchers should be sensitized and trained to improve their IPR management skills as well as on the use of patents in research and in the productive sectors
- **Technology Incubators** are likely to assist in accelerating diffusion of technologies or of R&D results: whether these are indigenous or foreign.
- They also assist academic staff and graduates to establish spin-off firm from potential R&D results.

Future Outlook for Enhanced Innovation (Cont..)

- **Funding**
  - The country needs to diversity its sources for funding its education and training: the private sector, Diaspora, *international research and other knowledge-based institutions,* including individuals, business entities, trade unions and community organizations.
  - Strengthening the available "innovation fund" for supporting end-stage research processes, new or high-risk products, processes and services;

Future Outlook for Enhanced Innovation (Cont..)

- Building internal capacity for research teams to compete for research funds;
- Providing incentives to exemplary research institutions (private and public) by giving more research funds to institutions that would excel in STI so as to motivate and encourage an innovative spirit.
- The Government to abide to a 1% to GDP funding of R&D activities

Future Outlook for Enhanced Innovation (Cont..)

- Like the Indian Institute of Technology, Mumbai, HEIs in Tanzania need to put in place policies of allowing academic staff to take time off so as to support spin-off firms from their research results
- **STI Agenda**: STI should be given distinctive prominence in government structures.
- **S&T advisory committees** should be established at their highest level of government.

Conclusion

- The success of innovation system in Tanzania requires the capability of higher education learning institutions to produce graduates of high quality with skills, knowledge and attitude capable of conducting innovative research nationally and internationally.

The End

- *Do not tell me what you value; show me your budget, and I will tell you what you value –* **Joe Biden**

- **Thank you for listening**