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African Higher Education Leadership in Advancing Inclusive Innovation for Development / AHEAD

585919-EPP-1-2017-1-RO-EPPKA2-CBHE-JP

Analysis of the National Innovation System in Tanzania



Dar es Salaam Institute of Technology
The State University of Zanzibar



AHEAD

Inclusive Innovation
for Development

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Capacity Building in Higher Education

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Authors:

Dar es Salaam Institute of Technology

Dr Joseph Matiko
Mr Daudi Mboma
Dr Paul Mmbaga
Mr Ombeni Mnzava

Contributors:

The State University of Zanzibar

Umayra M. Said El Nabahany
Yahya H. Sheikh
Abdulrahim H. Ali
Ramadhan A. Rai

Editor:

Dr Joseph Matiko

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Contact:

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Foreword

The Erasmus+ project “African Higher Education Leadership in Advancing Inclusive Innovation for Development / AHEAD” is implemented by a consortium of 15 institutions from Europe and East Africa, including:

- ▶ 4 Universities from Europe:
 - University of Medicine, Pharmacy, Sciences and Technology of Tîrgu Mures, Romania
 - Birmingham City University, the United Kingdom
 - University of Molise, Italy
 - University of Social Sciences, Polandjoined by the consultancy company European Center for Quality, Bulgaria

- ▶ 2 Universities from Tanzania:
 - Dar es Salaam Institute of Technology
 - The State University of Zanzibar

- ▶ 3 Universities from Uganda:
 - Kyambogo University
 - Lira University
 - Makerere University

- ▶ 5 Universities from Kenya:
 - Kenyatta University
 - Kibabii University
 - Kisii University
 - Mount Kenya University
 - The Catholic University of Eastern Africa

The project seeks to initiate a long-term partnership to mobilize EU expertise in support of building capacities of Kenyan, Tanzanian and Ugandan universities to lead and manage innovation that best fits their countries’ inclusive and sustainable development needs.

As part of the project work plan, partner universities from Kenya, Tanzania and Uganda carry out the analysis of the National Innovation System (NIS) in their countries. The implementation of this activity is based on the AHEAD Guidance and Benchmarking Tool for NIS analysis (WP 1.1). It aims to:

- ▶ help partner universities identify areas where National Innovation Systems in Kenya, Tanzania and Uganda are well-developed and where they are underperforming;
- ▶ assess the gaps in the performance between Kenya, Tanzania, Uganda and EU countries;
- ▶ develop recommendations for action and improvement;
- ▶ guide the planning of the upcoming project activities at partner universities.

The report on the Analysis of the National Innovation System in Tanzania provides the necessary background knowledge of the context, in which the project capacity-building activities in Tanzania will take place.



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Introduction

The United Republic of Tanzania is a nation in East Africa bordered by Kenya and Uganda to the north, Rwanda, Burundi and the Democratic Republic of the Congo to the west, and Zambia, Malawi and Mozambique to the south. The country's eastern borders lie on the Indian Ocean.

The United Republic of Tanzania is a unitary republic composed of 30 regions. The Capital City is Dodoma and the major commercial city is Dar es Salaam. Official currency is Tanzanian Shilling and the National language is Kiswahili whilst English is widely used in official communication.

The name Tanzania is a portmanteau of Tanganyika and Zanzibar. The two states united in 1964 to form the United Republic of Tanganyika and Zanzibar, which later the same year was renamed the United Republic of Tanzania.

Tanzania is aspiring to become a middle-income country by 2025 through industrialisation as stated in the Tanzania Development Vision 2025 ("TDV 2025"). Research and Development in strategic areas will promote innovation for economic development and technology transfer and therefore help realize the industrialisation vision. The government of Tanzania is aware of the significant contribution of the research and development to the economic transformation. Therefore, through the Tanzania Commission for Science and Technology ("COSTECH"), the government has set the direction and priority areas for research in Science, Technology and Innovation (STI) which will serve the purposes of development dynamics to propel the drive of socio-economic transformation over the next five years up to 2020. These priority areas are grouped into 15 sectors and 5 subsectors. The pertinent sectors include health, education, food quality, safety and nutrition, water and sanitation, land management and human settlements, energy, industry and manufacturing, mining, transport and logistics, agriculture, national heritage, tourism, climate change and ecosystem, forestry, and wildlife¹. The sectors are the major contributors of Tanzania GDP.

The government has also set a number of policies related to research and development. Such policies are the National Research and Development Policy of 2010 that clearly recognises that the scientific and technological knowledge generated by research institutions is relevant and responsive to the socio-economic needs of the country². It aims to develop a competitive knowledge economy which is skill-based, knowledge and innovation driven, and thus capable of generating and sustaining dynamic development.

Innovation ecosystem in Tanzania is currently coordinated by the Ministry of Education, Science and Technology under the Directorate of Science, Technology and Innovation. The main functions of this directorate are³:

- ▶ To formulate and review science, technology, innovation and research policies, guidelines and standards and monitor their implementation;
- ▶ To promote innovations and application of science and technology in the country;
- ▶ To create conducive environment for science, technology and innovation research in the country;

¹ Tanzania Research Priorities 2015-2020. COSTECH. URL: <http://www.costech.or.tz/wp-content/uploads/2016/09/TANZANIA-RESEARCH-PRIORITIES-2015-2020.compressed.pdf>.

² The National Research and Development Policy. (2010). Ministry of Communication, Science and Technology.

³ Ministry of Education, Science and Technology (MoEST). URL: <http://moe.go.tz/en/structure/division/science-technology-and-innovation.html> (Last visited on 02/02/2019).



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- ▶ To develop professional staff on science and technology in liaison with relevant ministries/ sectors;
- ▶ To establish and oversee the institutes of science and technology in the country;
- ▶ To formulate and coordinate the implementation of national innovation system;
- ▶ To stimulate industry and private sectors to increase its investment in S&T development and Innovation and;
- ▶ To establish and operationalize the National Research fund management;

This report aims to show key statistics contributing to the innovation ecosystem in Tanzania. The data presented in this report were gathered from various sources divided into three main categories. The first category of data is from the Tanzania government agencies and ministries, such as Tanzania National Bureau of Statistics (TNBS)⁴, Ministries and other authentic government bodies. The second category of data source includes data collected from international agencies or agencies affiliated with internationally recognized agencies such as the World Bank, UNESCO, organisations affiliated with these international agencies and research findings sponsored by these international agencies. The third category of data is from various manuscripts published by various researchers and scientific community.

It is worth noting that authors used the most recent statistical data that could be obtained from various sources as stated in the above paragraph. However, in some cases, where most recent statistics could not be found, the statistical data published 3 to 10 years ago were used and this may not reflect the current situation.

Disclaimer

Authors have given source of every data used in this report and should not be held liable or held accountable if the data from the given source was not correct.

⁴ Tanzania National Bureau of Statistics. URL: <https://www.nbs.go.tz>.



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I. Performance of the National Innovation System

1. Gross domestic expenditure on R&D

- ▶ Gross domestic expenditure on R&D (as percentage of GDP): **0.5% (2013 data)**

For Tanzania the domestic expenditure on R&D (as a percentage of GDP) is 0.5% as per 2013 data. In Sub-Saharan countries, South Africa has accounted for 46% of sub-Saharan Africa's publications in 2014 with 0.8% of domestic expenditure on R&D (as percentage of GDP). Kenya recorded 0.8% of domestic expenditure on R&D (as percentage of GDP) and Ethiopia had 0.61%.

Sources:

<http://uis.unesco.org/en/country/tz?theme=science-technology-and-innovation>
https://en.unesco.org/unesco_science_report/africa

2. Business enterprise expenditure on R&D (BERD) and Government Sector expenditure on R&D (GERD)

- ▶ BERD as a percentage of GDP: **no data available**
- ▶ GERD as a percentage of GDP: **0.5% (2013 data)**

Tanzania recorded a 0.5% GERD as a percentage of GDP in 2013, while there is no data on BERD available. Malawi has the highest GERD among the countries of the sub-Saharan Africa with 1.06%. For comparison, South Africa has 0.73% and Kenya - 0.79%. Among the East African countries, Uganda has 0.48% and Burundi has 0.12%.

Sources:

<http://uis.unesco.org/en/country/tz?theme=science-technology-and-innovation>
https://en.unesco.org/sites/default/files/usc_19-7_5_researchers_gers_ssafrica_en.pdf

3. Patents and licenses

- ▶ Royalty and license fees payments (per capita): **1,402,980 USD (2016 data)**

In the year of 2017, there were almost 3.17 Million patent applications around the world, of which only 0.5% were from Africa. Tanzania reported a total of 1,402,980 USD as Royalty and license fees payments (per capita) in the year 2016.

Sources:

<https://tradingeconomics.com/tanzania/royalty-and-license-fees-payments-bop-us-dollar-wb-data.html>
https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2018.pdf

- ▶ Royalty and license fees receipts (per capita): **256,978 USD (2016 data)**

The Royalty and license fees receipts (per capita) were 256,978 USD in Tanzania in 2016.

Source:

<https://tradingeconomics.com/tanzania/royalty-and-license-fees-receipts-bop-us-dollar-wb-data.html>

- ▶ IP filing activity originating in the country:



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In 2017 the country office reported a total of **20 patent applications** and a total of **446 trademarks**.

- ▶ Success rate of IP applications from locally-based individuals / companies (ratio of IP grants to the number of applications): **no data available**

4. Scientific production

- ▶ Number of publications included in Scopus and Web of Science databases: **15,388**

Tanzania is ranked number nine in Africa with 15,388 publications included in Scopus and Web of Science database and ranked number 87 worldwide.

- ▶ Scientific publications rated among the top 10% most cited: **142**
- ▶ Number of scientific and technical journal articles: **539**

Source: <https://www.scimagojr.com/countryrank.php>

5. Research capacity

- ▶ Number of researchers per million of inhabitants: **69**

Tanzania has 69 researchers per million inhabitants (Head Count) according to 2010 UNESCO statistics, while Kenya has 328 and South Africa, which is leading in Sub Saharan Africa is having 818 researchers per million inhabitants.

Source:

https://en.unesco.org/sites/default/files/usc_19-7_5_researchers_gers_ssafrica_en.pdf

II. Context and structure of the National Innovation System

Business Environment

1. Business structure and business financing system

1.1. Industrial structure

- ▶ Share of large firms and mature SMEs in the total number of enterprises: **no data available**
- ▶ Share of technology-based high-growth companies in the total number of enterprises: **no data available**
- ▶ Size of the informal sector in the economy

Indicator	Tanzania	Sub-Saharan Africa	All Countries
Percent of firms competing against unregistered or informal firms	72.6	68.3	54.3
Percent of firms formally registered when they started operations in the country	75.0	83.8	88.7
Number of years firm operated without formal registration	0.8	0.7	0.7



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Percent of firms identifying practices of competitors in the informal sector as a major constraint	45.0	39.2	28.3
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Source: <http://www.enterprisesurveys.org/data/exploreeconomies/2013/tanzania#informality>

1.2. Level of development of banking and venture capital

- ▶ Availability of financing through the local equity market
Medium

According to the World Economic Forum Competitive Index, on a scale of 1-7, Tanzania averaged medium (3.63) on the availability of financing through local equity market.

Source:

https://tcddata360.worldbank.org/indicators/haf3e424e?country=BRA&indicator=525&viz=line_chart&years=2007,2017#table-link

- ▶ Availability of venture capital
Low

According to the World Economic Forum Global Information Technology Report, on a scale of 1-7, Tanzania averaged low (2.4) on availability of venture capital.

Source:

https://tcddata360.worldbank.org/indicators/hf1e4e8a4?country=BRA&indicator=3385&countries=TZA&viz=line_chart&years=2012,2016

- ▶ Ease of access to loans
Medium

According to the World Economic Forum Global Competitive Index, Tanzania averaged 3.29 on a scale of 1-7 on the easiness of access to loans.

Source:

https://tcddata360.worldbank.org/indicators/inv.acc.loan?country=BRA&indicator=527&viz=line_chart&years=2007,2017

- ▶ Share of low-interest loans for SMEs within the total number of loans for SMEs
Medium

According to the World Economic Forum Global Competitive Index, in 2018 Tanzania averaged 3.84 out of 7 on the easiness of SMEs to obtain loans for their business. However, the report does not clearly show the interest rate subjected to SMEs.

Source:

https://tcddata360.worldbank.org/indicators/h2d0b9184?country=BRA&indicator=41434&viz=line_chart&years=2017,2018



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Firm behaviour

2.1. Managerial Talent (2014-2015 data)

- Share of higher education students studying in areas of business, administration and law

According to Tanzania Commission for University statistics of 2014, the share of higher education students studying in areas of business, administration and law is **42.7%**.

Field of study	Number of students		
	Total	Female	Male
Business management and administration	32,818	11,865	20,953
Law and sociology	60,752	23,217	37,535
Total (Business + Law)	93,570	35,082	58,488
Total (All study areas)	218,959	78,874	140,085
Share of HE students studying business, administration and law	42.7%		

Source: Students Enrolled in Universities and University Colleges by Program Categories 2004/2005 – 2010/2011

2.2. Adoption of ICT in firms

- Corporate investment spending in hardware, software, and telecommunications as share of overall capital investment:

The usage of telecommunication services is steadily increasing in Tanzania. This has increased from 27,607,882 (61%) subscribers in 2013 to 43,621,499 (81%) subscribers in 2018. This suggest that ICT hardware and software systems are being invested to expand to Telecom infrastructure and services to meet the demand

Source:

https://www.tcra.go.tz/images/documents/telecommunication/TelCom_Statistics_December_2018.pdf

Cultural factors

3.1. Demand for innovation

- Final consumption expenditure of households: **64.61% (data 2016)**

The household final consumption expenditure as a percentage of GDP in Tanzania was 64.61 in 2016. The highest reported value was in 1997 which was 86.29% in 1997 while the lowest was 61.36% in 2007. For comparison, the household final consumption expenditure as a % of GDP in Kenya was 77.94 as of 2016. Its highest value over the past 52 years was 81.48 in 2011, while its lowest value was 55.71 in 1977.

Sources:

<https://www.indexmundi.com/facts/tanzania/indicator/NE.CON.PETC.ZS>

<https://www.indexmundi.com/facts/kenya/indicator/NE.CON.PETC.ZS>



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- ▶ Secondary education enrolment rate and tertiary education enrolment rate (as proxies to receptiveness to innovative products and services): **85.26% (data 2017)**

In Tanzania, the secondary school enrolment rate in 2017 was 85.26%. Male enrolment was 84.34% while female was 86.18%.

Source:

<http://uis.unesco.org/country/TZ>

III. Trade, Tax, and Regulatory Environment

Long-term structural economic factors influencing the innovation system

1.1. Specialization of industry

- ▶ Contribution of high-tech, medium-tech and low-tech sectors to the trade balance: **no data available**
- ▶ Manufacturing trade as percentage of GDP: **5.5% (data 2016)**

Manufacturing trade as percentage of GDP in Tanzania was reported at 5.5% in 2016 according to World Bank collection of development indicators.

Source:

<https://tradingeconomics.com/tanzania/manufacturing-value-added-percent-of-gdp-wb-data.html>

- ▶ High-technology exports as percentage of manufacturing exports: **no data available**
- ▶ Capital goods imports as share of overall imports: **27.7%**

Total imports (Year 2016): USD 23,600,255,600

Capital good import (Year 2016): USD 6,542,103,950

Percentage: 27.7%

- ▶ Capital goods exports as share of overall exports: **1.57%**

Total exports (Year 2016): USD 14,215,329,010

Capital good import (Year 2016): USD 223,866,920

Percentage: 1.57%

Source:

<https://wits.worldbank.org/CountryProfile/en/Country/TZA/Year/2016/TradeFlow/Import/Partner/all/Product/UNCTAD-SoP4#>

Tanzania industrial structure has evolved through various stages since country's independence back in 1961 from undiversified state-led industrial economy to subsequently private sector involvement through various structural adjustment programmes and policy. The current development agenda (Nurturing Industrialization for Economic Transformation and Human Development) has fuelled more development of industry as one of the top priorities in the country. Tanzania's industrial sector contributes around 25% to the country's GDP and experienced an average annual growth of 8% over the past 5 years. The general industrial structure of Tanzania is comprised of manufacturing (53%), processing (43%), and assembling industries (4%). Agriculture is the mainstay of the Tanzanian economy; the manufacturing



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industry is centred around the processing of local agricultural goods. Currently, value-added products in Tanzania include cotton yarn, manufactured coffee and tobacco, sisal products (yarn and twine), and wheat flour.

With the overall dependency on agriculture and majority of industries falling under medium and low technology sectors, opportunities for innovation infusion is huge in Tanzania. Supported by the emphasis of the current government in developing industrial economy the opportunity for innovation will ever increase. Overall innovation is much dependant on high learning institutions with most companies investing low in R&D.

1.2. Foreign Direct Investment (FDI)

- ▶ FDI outflow as percentage of GDP: **0% (data 2014)**

The Foreign direct investment, net outflows in Tanzania was \$0.000 as of 2014.

Source:

<https://www.indexmundi.com/facts/tanzania/foreign-direct-investment>

- ▶ FDI inflow as percentage of GDP: **2.88% (data 2016)**

Foreign direct investment, net inflows as a percentage of GDP in Tanzania was 2.88% as of 2016. Its highest value over the past 28 years was 5.77 in 2010, while its lowest value was 0.00 in 1991. Kenya reported a 0.56% FDI inflows and 0.224% FDI outflows as percentage of GDP. For Uganda the FDI inflow was reported to be 2.17% and 0.001%.

Source:

<https://www.indexmundi.com/facts/tanzania>

1.3. Knowledge intensity of the economy

- ▶ Share of knowledge-intensive industries and services in the value added in the business sector (GDP-by-industry)

Tanzania GDP by industry is as follows:

- Agriculture: 23.4%
- Industries: 28.6%
- Services: 47.6%

Source:

https://www.indexmundi.com/tanzania/gdp_composition_by_sector.html

Agriculture includes fishing, farming and forestry, while industries include mining, manufacturing, energy production and construction. Services include but not limited to government activities, communications, transportation, finance, and all other private economic activities that do not produce material goods.



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Source:

https://www.indexmundi.com/tanzania/gdp_composition_by_sector.html

- ▶ Knowledge-intensive services exports as share of overall exports

The knowledge-intensive services sector is underdeveloped in Tanzania. According to World Intellectual Property Organization, Global Innovation Index of 2018, knowledge intensive employment in Tanzania scored 3.4%.

Source:

https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018-profile48.pdf

1.4. Hotspots in key technologies

- ▶ There are key technology sectors or regions specializing in technological industries that emerge as hotbeds of innovation: **No**

1.5. Ongoing structural change / reforms in the economy

- ▶ There are ongoing reforms to upgrade the manufacturing sectors through research and technologies: **No**
- ▶ There are ongoing reforms to upgrade the non-manufacturing sectors through research and technologies: **No**

1.6. Communication and ICT infrastructure

- ▶ Internet subscribers per 100 inhabitants: **40 (data 2017)**

For the year 2017, a total of 23 Million Tanzanians was reported to use the Internet. This is equivalent to 40% of the population.

Source:

<https://www.internetworldstats.com/stats1.htm>

- ▶ Share of households with Internet access at home: **40% (data 2017)**

For the year 2017, a total of 3,468,188 people accessed the Internet using fixed wireless service, 19,006,223 people accessed the Internet through mobile wireless and 520, 698 people accessed the Internet using fixed wired. A total of 22, 995,109 people accessed internet overall which is equivalent to 40% of the whole population.

Source:

https://www.tcra.go.tz/images/documents/telecommunication/TelCom_Statistics_December_2018.pdf

- ▶ Computers per 100 inhabitants: **2.958 (data 2004)**

Computers per 1000 inhabitants was reported at 29.58 in 2004, which makes up to 2.958 per 100 inhabitants in 2004. In the same year, Kenya was reported at 26.35, while Uganda report shows it was at 17.35 per 1000 inhabitants.



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Source:

<https://tradingeconomics.com/tanzania/personal-computers-per-1000-people-wb-data.html>

- ▶ Fixed-broadband internet penetration (subscribers per 100 inhabitants): **3.3257 (data 2016)**

Fixed broadband Internet subscribers per 100 inhabitants in Tanzania was reported at 3.3257 in 2016. In the same year, Kenya was reported at 0.32578, while Uganda report shows it was at 0.26106 per 1000 inhabitants.

Source:

<https://tradingeconomics.com/tanzania/fixed-broadband-internet-subscribers-per-100-people-wb-data.html>

- ▶ Internet access tariffs (20 hours per month), as percentage of per capita income: **29.68% (data 2008)**

Fixed broadband Internet access tariff (US\$ per month) in Tanzania was reported at 204 in 2008. According to the World Bank data, in the same year GDP per capita in Tanzania was 687.39 US\$ per month. Hence, the internet access tariffs as percentage of per capita income constituted 29.68%.

For comparison, in Kenya the Internet access tariff (US\$ per month) was reported to be 503, while in Uganda it was reported to be 510 in the same year.

Sources:

<https://tradingeconomics.com/tanzania/fixed-broadband-internet-access-tariff-us-dollar-per-month-wb-data.html>

<https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=TZ>

- ▶ Percentage of localities with public Internet access centres by number of inhabitants (rural/urban): **no data available**

Regulatory Environment

2.1. Ease of starting a business and ease of doing business

- ▶ Ease of starting business: **Low** (ranks 163 out of 190)
- ▶ Ease of doing business: **Low** (ranks 144 out of 190)

Source:

<http://www.doingbusiness.org/rankings>

2.2. Ease of closing business, resolving insolvency and laying off workers

- ▶ Entrepreneurs do not have to struggle with excessive bureaucratic requirements when downsizing or closing business: **Yes**
- ▶ Investors can obtain reasonable capital recovery rates when a business goes bankrupt: **No**
- ▶ The insolvency regime allows for companies facing temporary distress to restructure in order to avoid liquidation: **No**

Source: <https://breakthroughattorneys.com/company-voluntary-winding-up/>



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2.4. Tax policies

- ▶ Tax support for business R&D (allowances, credits or other forms) is available in the country: **No**
- ▶ Rate of corporate tax in the country: **High** (compared to world-wide average)

The corporate tax rate in Tanzania is relatively high. It stands at 30%, which is higher than the world average rate of 22.5% across 188 countries.

Source:

<https://tradingeconomics.com/country-list/corporate-tax-rate>

2.6. Intellectual property protection regime

- ▶ There are laws on patents: **Yes**
- ▶ There are laws on utility models: **Yes**
- ▶ There are laws on industrial design: **Yes**
- ▶ There are laws on trademarks: **Yes**
- ▶ There are laws on copyright and related rights: **Yes**
- ▶ There are laws on trade secrets: **Yes**
- ▶ There are laws on plant varieties: **Yes**
- ▶ The national IP office has an independent legal status and enjoys autonomy from the government: **Yes**
- ▶ The national IP office has regional coverage (i.e. is not operating only in the capital): **No**
- ▶ The national IP office is appropriately staffed in terms of number of staff and qualifications of staff: **Yes**
- ▶ The national IP office can perform both formal and substantive examination of patent applications: **Yes**
- ▶ The work of the national IP office is automated and modernized (i.e. there is no reliance on manual processing): **Yes**
- ▶ The mandate of the national IP office supports the enforcement of IP: **Yes**
- ▶ The mandate of the national IP office includes promotion of innovation: **No**
- ▶ There is a national body competent to deal with the prosecution and management of IP rights (e.g. an IP Tribunal): **Yes**

The Business Registrations and Licensing Agency (BRELA) is an Executive Agency under the Ministry of Industry and Trade responsible for business administration and regulation of laws such as Business Names Registration, Trade and Service Marks Registration, granting Patents and issuing of industrial licenses. BRELA was established under the government Executive Agencies Act No. 30 of 1997 and formally launched on 3rd December. The main aim of BRELA is to ensure that businesses operate in accordance with the laid down regulations and sound commercial principles. The national IP office is equipped with right staff with required capacity however it does not have full mandate to foster innovation among industries and general public. BRELA is committed to continuous improvement of business environment in Tanzania. By doing so they have fully automated the business registration process to make it more efficient for business. Furthermore, the agency utilizes IPAS system for administration of Intellectual Property, the system is used for registration of Trade/Service Marks, Patents, Banjul Marks



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and Process Post Registration. IP Office has also started the process to verify and validate IP data which is currently underway. Up to now, all registrations and post registrations since 2013 are validated and verified.

In Tanzania, the copyrights are regulated by the Copyright and Neighbouring Act Rights Act. The Copyright Society of Tanzania (COSOTA) is an institution that administers the registration of copyrights.

Copyright

The copyright protection is available for products of Tanzanian authors or residents in the country. The copyright duration is the life of author or fifty years after his/her death.

Trademarks

Trademarks are governed by the Trade and Service Marks Act.¹³ In Tanzania the registration of trademarks and patents are administered by the Business Registration and Licensing Agency (BRELA). Registration of a trademark is for a period of seven years and may be renewed for further periods of ten years in perpetuity.

Patents

Patents are under the Patent (Registration) Act. A patent may be registered for inventions (other than a discovery, scientific theory, mathematical method, aesthetic creation, computer program or presentation of information) after meeting specified requirements relating to novelty, utility and inventiveness. Registered patents endure for twenty years, subject to the payment of annual fees. The duration of protection is 20 years for patent of invention and 7 years for utility models. Absolute novelty is required for patents of inventions.

Industrial Design

Currently there is no local system for registration of industrial designs in Tanzania. However, Tanzania has ratified the Agreement on the Creation of the African Regional Industrial Property Organization, 1979 (effective for Tanzania as from 12 October 1983); and the Protocol on Patent and Industrial Designs within the Framework of African Region Industrial Property Organization (the Harare Protocol), 1982 (effective for Tanzania as from 01 September 1999).

2.7. Public procurement rules

- ▶ According to the applicable legislation, public procurement can be used strategically as a means of promoting innovation as a secondary objective: **No**

IV. Innovation policy environment

R&D and Technology

1.1. Government support for R&D

- ▶ Government funding for R&D in Universities and public research organizations (PROs): **Yes**

The Government is providing research and development fund to Universities and public institutions through Commission for Science and Technology (COSTECH). COSTECH always invites calls for



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research proposal from various higher learning institutions and also allocates fund to support various innovations activities.

- ▶ Direct government funding for Business R&D: **Yes**

The government provides research and innovation fund to Tanzania Industrial Research and Development Organization (TIRDO) and Small Industries Development Organisation (SIDO) for supporting small and medium-sized enterprises (SMEs). They usually invite calls for research and innovation proposal from various stakeholders for fund. Other government organisations are the National Economic Empowerment Council (NEEC) and the Centre for Agricultural Mechanization and Rural Technology (CAMARTEC).

Source:

<http://anza.co.com/wp-content/uploads/2016/08/the-innovation-ecosystem-of-tanzania-compressed.pdf>

1.2. Technology transfer policy

- ▶ There are legislative acts, policies or public agencies enabling or supporting the commercialization of research or technology transfer from universities or PROs to industry and the marketplace: **Yes**

The Centre for the Development and Transfer of Technology (CDTT), established under Part IV of Act No.7 of 1986 of the Tanzania Commission for Science and Technology (COSTECH) is the principal organ of the Commission responsible for matters related to the transfer, adaptation and development of technology including choice and assessment of technology.

CDTT is creating an enabling environment for technology autonomy, for making independent and correct decisions on the choice of technology, its evaluation, and internalization, generation of endogenous capacity for adaptation, innovation and development of sustainable technologies. The mandate of the CDTT is to coordinate and promote the development and transfer of technology in the Country.

Source:

http://www.costech.or.tz/?page_id=1657#

Knowledge Flows

2.1. University-industry collaboration

- ▶ Number of world-class research-intensive universities in the country: 4
- Sokoine University of Agriculture (SUA)
- University of Dar es Salaam (UDSM)
- The Nelson Mandela African Institution of Science and Technology (NM-AIST)
- Muhimbili University of Health and Allied Sciences (MUHAS)
- ▶ Are public universities encouraged and supported by the national or regional/ local governments to cooperate with industry: **Yes**
- ▶ Capacity building activities for knowledge transfer are organized: **No**



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- ▶ Level of development of university-industry cooperation: **Low**

Tanzania has a number of research-intensive universities. Some of them are Sokoine University of Agriculture, University of Dar es Salaam, Nelson Mandela African Institute of Science and Technology and Muhimbili University of Health and Allied Sciences. Most of the universities collaborate with the industry to conduct industrial based research. However, the level of cooperation varies from one university to another. Some universities have very good links with the industry, while in the others the university-business cooperation is not so developed. The collaboration between the universities and the industry is not regulated by the government, instead every university makes its own initiatives to establish and strengthen industrial linkage.

2.2. Technology Diffusion and Adoption Systems

- ▶ Are there programs for firms encouraging them to adopt certain technologies?
No

Human Capital

3.1. Research capacity in the innovation system

- ▶ Total R&D personnel as a percentage of total employment: **0.1%** (1000 Personnel UNESCO 2013)
- ▶ Quality of scientific research institutions

The quality of scientific research institution is reflected in their ranking among other higher education institutions in Africa:

University	Rank (as of 2018)
National Institute for Medical Research (NIMR)	17
University of Dar es Salaam (UDSM)	79
Muhimbili University of Health and Allied Sciences (MUHAS)	85
Sokoine University of Agriculture (SUA)	117

Source:

<https://www.scimagoir.com/index.php?display=chart&country=Africa>

- ▶ Science, Technology, Mathematics and Engineering enrolment ratio in higher education (i.e. share of higher education students enrolling in STEM subjects)

According to the data from Tanzania Commission for Universities (TCU), the STEM enrolment ratio is as follows:

STEM enrolment (TCU)				Overall enrolment (TCU)			
Year	Male	Female	Total	Year	Male	Female	Total
2012/13	33727	15481	49208	2012/13	128586	72400	200986
2013/14	36743	16865	53608	2013/14	140085	78874	218959
Year 2012/13 STEM Enrolment ratio: $(49208 / 200986) \times 100 = 25\%$							



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Year 2013/14 STEM Enrolment ratio: $(53608 / 218959) \times 100 = 25\%$

Source:

http://www.tcu.go.tz/images/documents/Enrollment_by_category.pdf

Apart from TCU, the National Council for Technical Education (NACTE) is also enrolling students in technical education studies. The following are the statistics for the students enrolled in STEM programmes through NACTE.

STEM enrolment (NACTE)		
Year	Male	Female
2013/14	52.29%	66%
Average	$(52.29\% + 66\%) / 2 = 60\%$	

Hence, the average percentage of the **National STEM enrolment in Year 2013/14** equals: $(60\% + 25\%) / 2 = 42.5\%$. This is a clear indication that the enrolment in STEM subjects is averagely good as the percentage of enrolment is approaching a half of the entire enrolment.

3.2. Education and training

- ▶ Enrolment rate in secondary education: **31.67% (data 2013)**
- ▶ Funding per pupil/ student: **12,500 Tsh for secondary & 6,000 Tsh for primary per year**

Source: http://hakielimu.org/files/home/EDUCATION%20REPORT_EMAIL.pdf

- ▶ School drop-outs (early school leavers) as a share of the student population

The available data are from 2000 to 2005:

Year	Drop-out rate	Year	Drop-out rate
2000	5.90 %	2003	6.57 %
2001	7.60 %	2004	7.20 %
2002	8.77 %	2005	7.30 %

Source:

<http://tanzania.opendataforafrica.org/TZSOECD2016/social-economics-of-tanzania-2016?region=1000010-mainland&indicator=1004660-secondary-school-drop-out-rate-percent>

- ▶ Share of schools with internet access

In 2016 one of the biggest cellular operators in Tanzania - TIGO Tanzania - signed a MOU with the Ministry of Communications, Works and Infrastructure for 700 school internet connectivity. During the time of MOU, the total number of secondary schools covered by the programme was 4,753. Since the MOU had to last for two years, it was expected that in 2018 15% of schools would be connected to the internet.

Source:

<https://www.tanzaniainvest.com/telecoms/schools-internet-connectivity-tigo>



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- ▶ Quality of STEM education

Currently, there is no accredited body which is responsible for availing such data. However, there is high sensitization of STEM education in Tanzania Universities. For example, in Dar es salaam Institute of Technology all the programs include mathematics, engineering and science subjects.

3.3. Skills training

- ▶ Private sector investment in skills training as a share of GDP: **No data available**

Private sector companies provide internships and industrial training to students at higher institutions of learning.

- ▶ Tax credits for company investments in workforce development are available: **No**
- ▶ Specialized training services are available at local level: **Yes**

3.5. Lifelong learning

- ▶ Share of the population aged 25 to 64 participating in education and training: **No data available**
- ▶ Diverse opportunities for lifelong learning are available: **No**

Structure and specificity of the higher education system

4.1. Participation in Higher Education

- ▶ Enrolment rate in tertiary education: **3.92% (data 2015)**
- ▶ Share of the population with tertiary education: **4% (data 2015)**

For comparison, Tanzania, Kenya, Rwanda and Uganda have the following tertiary education enrolment rates.

Country	Tertiary education enrolment rate (2015)
Tanzania	3.92%
Kenya	9.4%
Rwanda	7.9%
Uganda	5%

In the 2015 statistics, it is clearly seen from the data for the four East African countries (Tanzania, Kenya Uganda and Rwanda) that Tanzania is behind in tertiary education enrolment rate compared to all other countries mentioned. This indicator signifies low participation in Higher Education, the gap which needs to be addressed.

Sources:

<https://data.worldbank.org/indicator/SE.TER.ENRR?locations=TZ>

<https://tradingeconomics.com/rwanda/school-enrollment-tertiary-percent-gross-wb-data.html>



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<http://uis.unesco.org>

4.2. Diversity, concentration and specialization in the Higher Education sector

- ▶ Private HEIs exist: **Yes**
- ▶ Enrolment is divided between many universities (as opposed to concentrated in one major university while the others serve much smaller percentages of enrolled students): **Yes**
- ▶ Share of universities performing excellent research: **4 (as indicated in indicator 2.1)**
- ▶ There are universities focused primarily on teaching rather than research, while other universities typically characterized as research-intensive: **Yes**
- ▶ Research funding is concentrated into those HEIs that perform research (as opposed to being thinly spread among many or all universities): **No**

4.3. Funding of HEI

- ▶ Public investment in Higher Education (as percentage of GDP)

There is indirect public investment in higher education through revenue collection. The share of the collected tax from individuals is used to run the ministry of education which is responsible for overseeing all coordination of education activities.

- ▶ Funding for Higher Education is performance-based: **No**

The funding is based on needs and government capacity.

- ▶ Performance contracts/ agreements are used to monitor university performance: **No**

All the higher learning institutions need accreditation by their respective bodies based on the outlined qualifications. If those qualifications are not maintained, the institution may lose its accreditation. So, the performance contracts are used to monitor university performance.

- ▶ Performance contracts/agreements are linked to funding: **No**

The government subsidizes fund regardless of the university performance. The government believes that the existence of the university signifies adherence of conditions set by the governing authority.

- ▶ Industry funding for universities is allowed by law: **Yes**

Any stakeholder who is willing to fund the university is allowed to do so. Stakeholders consume some of the products of the university (e.g. skilled labour, innovation and finished goods), so their contributions to education is encouraged

- ▶ Industry funding represents a substantial part of university funding: **No**
- ▶ Students pay enrolment fees: **Yes**
- ▶ International funding represents a substantial part of university funding: **No**



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4.4. Integration of knowledge transfer with core university missions

- ▶ Knowledge transfer is part of the mission and core strategy of public universities: **Yes**
- ▶ There is public funding dedicated to knowledge exchange and knowledge transfer: **Yes**

The collaboration portfolio with industry on education activities is growing. It spans from short-term internships to fully-fledged dual education programs. Particularly in certain disciplines, students are benefitting from the possibility to work with equipment, which was partly sponsored by firms.

- ▶ Applied sciences degrees are offered: **No**

4.5. University governance

- ▶ Universities have autonomy from the state in academic matters: **Yes**

Universities are established by law of the United Republic of Tanzania and given autonomy from the state to control its academic matters.

- ▶ Universities have autonomy from the state in financial matters: **Yes**

Universities have autonomy from the state in financial matter. However, the government monitors the expenditure. The government may intervene if fraud or any misuse of fund is found.

- ▶ Universities have organizational autonomy from the state: **Yes**

The organisational structure of universities is established internally.

- ▶ Universities have autonomy with regard to staffing decisions: **No**

The staffing matters depend on the government budget.

- ▶ Universities in the country are accountable to a variety of stakeholders other than the government (civil society, students, etc.) with regard to their:

- a) academic output: **No**
- b) social impact: **No**
- c) financial management: **No**

The institute is only accountable to the government.

- ▶ Stakeholders other than the government have a say in university governance: **No**

Only Government has a say on the university governance.

4.6. Strength of entrepreneurship education

- ▶ Share of universities that offer courses on entrepreneurship or creativity: **No data available**

Structure of the National Innovation System

5.1. Quality of public research organizations (PROs)



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- ▶ PROs have substantial publishing activity: **Yes**
- ▶ PROs regularly engage with industry: **Yes**
- ▶ Financing of PROs is adequate: **No**

In Tanzania, most researches are conducted by public research institutions, higher learning institutions and private research institutions. The public research institutions in the country include sixteen (16) agricultural research institutions and stations; six (6) in animal sciences and animal diseases; nine (9) in human health, nutrition and medical sciences; six (6) in natural resources; and seven (7) in industry. All the public institutions operate under their respective ministerial administrations. With the exceptions of the agriculture and livestock research institutions, most research institutions are administratively organized under an umbrella body that have a level of autonomy from the parent ministries. Such bodies include the Tanzania Wildlife Research Institute (TAWIRI), the National Institute for Medical Research (NIMR), the Tanzania Fisheries Research Institute (TAFIRI), and the Tanzania Forestry Research Institute (TAFORI).

Source:

http://www.tzonline.org/pdf/National_Research&DevPolicy.pdf

5.2. Links between universities, PROs and industry

- ▶ Clusters exist in which research organization and universities take part: **Yes**

Research clusters exist in Tanzania Commission for Science and Technology (COSTECH), which is a parastatal organization with the responsibility of coordinating and promoting research, innovation and technology development activities in the country. Also, COSTECH works closely with universities which are recognized by the Tanzania Commission for Universities (TCU) as Institutions where tertiary education programmes are offered. E.g. Mbeya University of Science and Technology, Ardhi University, Nelson Mandela African Institute of Science and Technology, State University of Zanzibar, Muhimbili University of Health and Allied Sciences etc.

5.3. Research funding

- ▶ There is an independent and professional research funding agency in the country: **Yes**

Tanzania Commission for Science and Technology (COSTECH) is a parastatal organization affiliated with the government of Tanzania. COSTECH was created by an Act of the National Assembly of Tanzania in 1986 as a successor to the Tanzania National Scientific Research Council. The function of COSTECH is that of "co-ordinating and promoting research and technology development activities in the country. COSTECH is the "chief advisor to the Government on all matters pertaining to science and technology and their application to the socio-economic development of the country. Government-funded science activity in the country is governed by the commission, and its duties include the administration of research grants, maintenance of research registry and science information services, setting research policy, and creating incentives for invention and innovation. Areas of activity include the Internet, biotechnology, energy, telecommunications, the development of multimedia teaching material, and more. COSTECH works with corporations, universities, and other parastatal, including the Tanzania Industrial Research and Development Organization and the Tanzania Traditional Energy Development and Environment Organization.



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Source:

https://en.wikipedia.org/wiki/Tanzania_Commission_for_Science_and_Technology

REPOA was formed in 1994 in Tanzania with the mandate to contribute to the alleviation of poverty in its multiple dimensions through research and capacity building. Over time, REPOA's mandate has expanded beyond alleviating poverty to encompass growth and socio-economic transformation for poverty reduction. REPOA is an independent research institution which creates and utilizes knowledge to facilitate socio-economic development and produces high quality research, provides training, facilitates knowledge sharing and promotes the use of accurate information in policy development.

Source:

<http://www.repoa.or.tz/about-us/>

The Economic and Social Research Foundation (ESRF) was established in 1994 as an independent, not-for-profit institution for research and policy analysis. The formation of ESRF was based on the assumption that there was need and demand for an improved understanding of policy options and development management issues, and that the capacity for this was lacking in the Tanzania civil service. ESRF addressed this gap by putting into place qualified Professional Staff, modest resources and a favourable research environment for the analysis and discussion of economic and social policy. The primary objectives of the Foundation are to strengthen capabilities in policy analysis and development management and to enhance the understanding of policy options in the government, the public sector, civil society, the donor community and the growing private sector.

Source:

<http://www.esrftz.org/intro.php>

- ▶ The process of evaluation and funding of scientific and scholarly proposals is transparent and peer-review based: **Yes**

All proposals evaluations are carried out transparently. Here is an example of evaluation process criteria from COSTECH on one of their call for proposals:

"EVALUATION CRITERIA

Applications received before the deadline Friday, January 12, 2018 23:59 (EAT) and considered by COSTECH to be compliant with the requirements set out in this Call will be evaluated in accordance with the following criteria:

- Scientific and technical merit
- Focus to industrialization policy of the Country
- Novelty and originality
- Quality and clarity of project presentation
- Clear Methodology
- Relevance and feasibility
- Multidisciplinary and gender aspect inclusion
- Capacity building on supporting research components for Masters and/or PhD students enrolled in local Universities and/or R&D Institutions
- Potential for commercialization and up-scaling"

Source:





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<http://www.costech.or.tz/wp-content/uploads/2017/12/Research-CALL-FINAL-13.pdf>

5.4. Existence of innovation bridging institutions and boundary spanning organisations

- ▶ Incubators: **Yes**
- ▶ Accelerators: **No**
- ▶ Technology and science parks: **No**
- ▶ Technology transfer offices: **No**
- ▶ Networks of companies: **Yes**
- ▶ Regional development agencies: **Yes**
- ▶ R&D units within universities: **Yes**

5.5. Involvement of stakeholders in the innovation system – users, grant making agencies, civil society organizations

- ▶ Channels, initiatives or innovation platforms/ networks exist for stakeholders and stakeholder organizations to become involved in innovation activities at the grassroots: **Yes**

In Tanzania there are several initiatives, innovation platform or networks that work closely with the stakeholders for development and improvement of socio-economic processes. The following are some of the existing structures in the country.

Sustainable Agriculture Tanzania (SAT) creates linkages between farmers, educators, researchers and government to generate and inspire locally-relevant knowledge in agroecology. Since 2011, SAT has brought only in Morogoro over 2000 small-scale farmers working together into the agroecological farming movement by demonstrating and practicing agroecological principles in 70 groups from 50 villages using farmer field schools.

Source:

<http://kilimo.org/WordPress/sats-innovation-platform/>

Buni is a technology Hub, which fosters innovation and technology entrepreneurship through capacity building, mentoring programs and community empowerment. Founded in 2011, Buni Innovation Hub's focus is to discover, nurture and mentor youths with innovative technological solutions to problems facing Tanzania.

Source:

<https://www.gogla.org/buni-innovation-hub>

The Dar Teknohama Business Incubator (DTBi) is an independent autonomous entity of COSTECH with its own Board that promotes the growth of ICT technology-based emerging companies contributing to job creation and enhanced economic health of the nation. DTBi nurtures start-ups and small initiatives into independent, self-sustaining and mature wealth-creating businesses.

Source:

<http://teknohama.or.tz/>



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Science & Technology Innovation Centre and Laboratories (STICLab) is the first Tanzanian makerspace, equipped with passionate and experienced innovators who come up with products and solutions to tackle community challenges in Tanzania and beyond. It provides technical, scientific and engineering solutions to both social and industrial problems/challenges through utilizing locally available resources as much as possible.

Source:

<https://sticlab.co.tz/about>

5.6 International linkages and collaboration

- ▶ Share of PhD students from the country relocating for a period of study to a different country:
No data available
- ▶ Share of foreign PhD students among all PhD students
No data available
- ▶ Share of universities involved in international research or capacity building projects
No data available

Currently, authorities do not collect these data, since every university keeps its own records for the PhD students.

Policies and measures in support of innovation

6.1. Coordination of education, research and innovation policies

- ▶ An up-to-date government strategy/ overall policy on research and innovation exists: **Yes**
- ▶ There are policies, strategies and reform plans of international/ supranational institutions that affect research and innovation in the country: **Yes**
- ▶ An up-to-date government strategy/ overall policy on higher education exists: **Yes**

Science, technology and innovation (STI) in Tanzania describes developments and trends in higher education and science, technology and innovation policy and governance, whereas Research and Development (R&D) activities are necessary in order to inform, lead and guide all that needs to be done to achieve the desired transformation of the socio-economic status of a nation. The government of Tanzania through Tanzania Commission for Science and Technology (COSTECH) together with Council on Health Research for Development (COHRED – an international partner) initiated the development of National Research Priorities in collaboration with the relevant national stakeholders. This is an effort to consolidate and coordinate research activities within the National Science, Technology and Innovation Ecosystem to realize the Tanzania Development Vision (TDV) 2025 and that of Zanzibar 2020.

Source:

<http://www.costech.or.tz/wp-content/uploads/2016/09/TANZANIA-RESEARCH-PRIORITIES-2015-2020.compressed.pdf>



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Conclusion

The report has analysed the National Innovation System in Tanzania. Performance of the national innovation system, context and structure of the national innovation system, trade, tax and regulatory environment, and innovation policy environment are all studied.

The report shows Tanzania still has to make significant step in realizing the potential of research and innovation. Although there are structure and policies for fostering the STI activities in the country, still implementation of the same is a challenge. As a nation, Tanzania is undergoing major transformations coupled with the commitment of fifth phase government to reach middle income country by 2025 through development of industrial economy. The government has made significant tax reforms, among few is the establishment of "The Office of the Tax Ombudsman" responsible for receiving complaints from taxpayers in regard to tax administration, including corruption and unfair closures of businesses by tax officials. This will enhance transparency in tax administration and reduce complaints among taxpayers.

Furthermore, the government has proposed a six-month relief from tax payments for investors and businessmen after obtaining the Tax Identification Number (TIN) to enable the businesses to undertake the necessary preparations. Furthermore the government through Ministry of Industry, Trade and Investment published a **Blueprint for Regulatory Reforms to Improve the Business Environment**. The blueprint provides the Government's main framework for enabling a holistic review of business environment in the country. The blueprint highlights key challenges in business operations across various sectors and a recommendation on how to rectify to improve the operation of businesses. This is another commendable step by the government towards improving the business environment in the country.

The innovation and entrepreneurship education has not been emphasized much in most Higher Learning Institutions as it is still being considered as a cross-curricular course rather than a separate course by itself. Education will always be a major factor in fostering innovation, so emphasis has to be put on the innovation and entrepreneurship education in curriculum.



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Capacity Building in Higher Education

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A graphic consisting of several overlapping triangles in various colors (red, green, blue, yellow, orange, purple) forming a larger triangular shape.

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