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African Technological Development Index (ATDI)

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The African Technological Development Index (ATDI) indicator is the country's ability to take advantage of the evolution of science and technology to boost economic growth and create jobs.

The speed of economic progress for a modern country is linked to its ability to embrace technology and harness the opportunities that it presents effectively.

The control of science and technology are the main keys that will open the doors of progress. To become prosperous, some requirements need to be fulfilled:

- Strong and well-equipped universities;
- Platforms for engineers, scientists, and inventors need to be created, to enable them to demonstrate and to share their know-how;
- Existing industries should develop research activities to improve the quality of their products in order to become more competitive;
- Research sector need to be fully supported by African governments, through various funding agencies;
- Governments should develop strategies that enable the implementation of the outcomes of the results of research on the ground to support their economies.

The African Technological Development Index (ADTI) indicator is a tool that will provide to each African country hints on the real situation about the state of technology control. It's a preventive guide whose aim is to help each country to better equip itself to support its economic growth by developing incentive policies that promote the conquest of scientific and technological knowledge.

Ranking indicators:

The African Technological Development Index (ATDI) ranks African countries according to their capacity, into 7 groups of indicators: Higher education infrastructure, Research & Development, Technology Innovation & start-ups, Platforms of exchange & conference, Human capital, Entrepreneurial investment, vocational training.

HIGHLIGHT OF CONTENT

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I - HIGHER EDUCATION INFRASTRUCTURE

Background

The role of higher education in any nation-building is paramount of importance. Countries thrives when they invest in their populations to enable them to obtain quality education. In fact, education is the most powerful weapon to be used to move forward. Good infrastructure and equipment are core structure of any university system. Theoretical knowledge learned from books need to be strongly supported with the practice, which will prepare students for successful knowledge transfer for the benefit of the society. Therefore, improving higher education infrastructure in African countries is the essential precondition to achieving economic growth of the continent**.**

Indicators

I-1: Number of well-equipped departments of Mathematics & Natural Sciences

Mathematics & Natural Sciences are keys that open the doors for understanding and transforming the human environment, in order to boost progress.
Internet access, Libraries, Laboratories, Research staff are essential component for evaluation.

I-2: Number of well-equipped universities of applied science

Scientific knowledge precedes the development of practical solutions. Therefore, well-equipped universities of applied science are the driven forces that transform the scientific knowledge to enhance industries capacities. Applied Physics, Applied Mathematics, Architectural Science, Automotive engineering, Biological engineering, Biochemical engineering, Chemical engineering, Civil engineering, Computer science, Computer engineering, Electronic Engineering, Electrical engineering, Geological engineering , Industrial engineering, Information Management, Integrated engineering, Information Systems, Mechanical engineering, Mechatronics engineering, Mining engineering, Sound engineering.

I-3: Number of well-equipped technical universities

Engineering is a specific part of technology and science that focuses on the design of engines, machines, structures and electrical systems. Here we will particularly pay attention to Mechanical Engineering, Chemical Engineering, Civil Engineering, Foundry Engineering, Metals Engineering.

II - RESEARCH & DEVELOPMENT

Background

African countries should provide themselves with a new self-confidence, which should work as a motivation that create and maintain the atmosphere necessary to turn the idea of knowledge transfer into reality, thereby stimulating the desire to reach success and achievements. In this regard, the necessity to invest in the research activities is more than ever needed. Research drives industrial innovation and enables the development of new products for the market.

Indicators:

II-1: Number of academic research institutions

In academia, research is conducted with the aim of generating knowledge. People have freedom to do curiosity-driven-research.

II-2: Number of non – academic research institutions

Research carried out in non-academic institutions is highly driven by constraints factors: market demands, profit, products.

II-3: Industrial research and development (R & D)

The objective of Research and Development (R&D) is to provide new and efficient solutions. Industries will therefore introduce competitive products to the marketplace. R&D department helps industries to innovate.

II-4: Number of published articles in the field of natural science & engineering/ registered patents

Publication output in peer-reviewed science and engineering (S&E) journals, books, and conference proceedings serves as an indicator of scientific research activity. The quantity of publication reflects the vitality of research activities of a country.

The quantity of patents registered shows the research ability of countries. The technology innovation capability of the country.

II-5: Number of national research funding agencies

Funding research agencies are essential support for researchers. Their number could reflect the importance given to research activities in each country.

III- INNOVATION & TECHNOLOGY ORIENTED START-UPS OR HIGH-TECH START-UPS

Background

The technology innovation can be measured by the number of **High-tech start-ups** or technology-oriented **start-ups**. In the African context where technology still needs to be developed in most of fields, it´s necessary to distinguish between **high-tech start-ups** and **technology-oriented start-ups**. It is essential for African nations to simultaneously develop strategies to boost the creation of **High-tech start-ups** and **technology-oriented start-ups**. The **Technology oriented start-ups** will boost the control of technology while **High-tech start-ups** will help to move as much as possible to the forefront of the current technology era. The creation of **high-tech start-ups** or **technology-oriented start-ups** will stimulate economic activity and boost the creation of more jobs.

Indicators

III-1: Number of innovators with engineering or science background

Technology as a human action on physical objects or as a set of physical objects whose characteristics are to serve human purposes. Number of high-tech start-ups or start-ups created by engineers and scientists are a clear demonstration of their capacity to transform their knowledge into business activities.

III-2: Number of innovators without engineering or science degrees (skilled technicians)

The contribution of innovators with no university degree needed to be quantified. It has been noticed that some innovators have been to university for less than 3 years or never. They are skilled technicians.

III-3: Number of start-up academy

Start-ups created by universities to transform their know-how into products are indications showing the direct contributions of universities in technology transfer. Indeed, African universities are invited to develop strategies that enables researchers to transform the results of their research activities into practical application.

III-4: Policy of knowledge & technology transfer

Work done by scientists and engineers need to be transformed through industries or services to generate effects throughout the economy. Therefore, a good policy that will encourage scientists and engineers to turn their knowledge into practical application should be developed.

III-5: Follow-up of innovators and start-uppers by governments

The impact of innovators in economic growth is relied on strategies put into place by governments to support innovators and start-uppers.

IV- PLATFORMS OF EXCHANGE & CONFERENCE

Background

Platforms of exchange to enhance activities of African scientists, engineers and researchers are an important component to be taken into consideration. In Africa, conference for scientists, researchers, engineers are limited due to the lack of availability of travel funding. It´s a serious handicap for the development of science & technology. Exchanges between researchers need to be boosted via such platforms. Such platforms are opened to financial institutions and industrialists as well. Ph.D. students need to be encouraged through the development of many platforms to allow them to share the results of their works and develop their networks which are important for their research activities. Therefore, it´s essential to quantify the existence and functionality of such platforms in African countries.

Indicators

IV-1: Number of platforms of exchange

There are numerous fields in natural science & engineering. Platforms of exchange are rooms where actors of different sectors need to meet and network. As an essential component for progress, the industrial sector is priority partner for all platforms. People working in R&D department of industries are invited to be members of different platforms.

IV-2: Number of annual conferences related to natural science topics

Scientific conferences are important meetings where researchers and Ph.D. students have opportunities to share their research activities. It´s also the place to seek out collaborations and new horizons. They also learn from others, improve their knowledge about their own works through discussions with other participants.

IV-3: Number of annual conferences related to engineering topics

For a continent where the control of technology is not yet won, organising conferences to give opportunities to engineers to get together is paramount of importance. Such conference should be opened to non-academic with strong interested in technology.

V- ENTREPRENEURIAL INVESTMENT

Background

Entrepreneurs are key principal actors of the development in any country. Their impact on the living conditions of citizens is tremendous. They develop business, crate jobs, bring new opportunities in countries. Of course, one should differentiate an entrepreneur to someone who runs a business. An entrepreneur is a leader, a driver and the ultimate responsible for the project. An entrepreneur is someone who always take risk to tackle issues. Entrepreneurial need good rules of laws, good environment for businesses. Countries move forward when investment opportunities are available for entrepreneurs. We are mainly interested about the entrepreneurship in the field of technology since it is our challenge. A culture of entrepreneurship enables creation of new companies. They need to transform the results of research into products.

Indicators

V-1: Business-incubator for technology-oriented start-ups

Incubators for scientific spin-offs, for technology companies should offer facility and favourable conditions. Business-tech incubators are key ingredient to economic growth and recovery. In general, the investment cost is lower compare to the return on investment which is higher. Therefore, encouraging the creation of Business-Tech incubator in African countries is our priority. The role of incubators is to provide expertise and tools necessary for successful start-ups. Space & infrastructure need to be provided.

V-2: Funding for technology-oriented start-ups

Numerous funding agencies to support the creation of technology-oriented start-ups constitute the key support that transform Ideas, project, know-how into reality.

V-3: Rules of law for investors

Rules of law need to be well known and well applied to attract internal and external investment.

VI- HUMAN CAPITAL

Background

Investment in human capital is the key ingredient for a better future. In general, countries invest in their people through quality education and training. Good educational system will provide good results while bad educational system will lead to catastrophe. Therefore, countries need to build their educational system in accordance with what they desire to achieve in the short, mean or long term. Companies need well trained employees to maintain and increase continuously their productivity. As key driver for economic growth, productivity needs to be innovated by people with good skills. How do African countries invest in their people? This will be the important question to raise. Also, what are policies developed by African countries to attract their own people?

Indicators

VI-1: Number of bachelor's degrees in natural science or engineering topics

As an undergraduate degree, Bachelors is the first level of degree study at university in many countries. A Bachelor could be considered as more critical piece of human capacity development. It shows people´s ability to significantly contribute to the interpretation of the nature. It shows their ability to contribute to the economic growth and social stability.

VI-2: Number of master's or Postgraduate degrees in natural science or engineering topics

Master or Postgraduate degrees allow students to deepen knowledge gained in their undergraduate course by more advanced studies. Earning a master's degree means, acquire the ability to solve complex problems and think rigorously and independently.

VI-3: Number of Ph.D./ doctorate degrees in natural science or engineering topics

A Ph.D. (Doctor of Philosophy) is awarded to people who complete an original thesis offering a significant new contribution to knowledge in their subject. Therefore, the number of people earning Ph.D. should be reflected on countries development.

VI-4: Number of inventors without science or engineering degrees (Do-it-yourself scientists or engineers)

Do-it-yourself scientists or engineers are citizens who design and build complex structures. They use their personal knowledge to learn about their natural environment and create new solution to solve problems

VI-5: Brain drain & Brain gain of scientists, engineers, inventors and innovators

Brain drain is particularly acute in sub-Saharan Africa. The migration of young and educated workers takes a large toll on a region whose human capital is already scarce. **Brain gain:** to attract and retain highly qualified African nationals who travelled abroad for studies and what could be their input for the economic growth.

VII- VOCATIONAL TRAINING

Background

Vocational training is an important component which should be taken into consideration to boost the economy growth of African countries. People into this category can be divided into two groups. The first group are those who are enrolled for vocational training after completing secondary education. The second group are those who are enrolled without having completed secondary education. Their contribution into technology relevant sector is very important. Their number should be increased because they used technology to solve daily life problems of citizens. It seems that this category is neglected, while their role is crucial. In fact, they are technology carriers towards population. They move the work done by people who develop technology into the hands of people who use technology. Therefore, they assume maintenance and solve problems.

VII-1: Vocational training sectors

Vocational training helps people to be prepared for day-to-day duties. People are equipped with real skills as opposed to theoretical knowledge only. There are numerous sectors for vocational training. However, we will focus our attention only on few which are considered relevant for the daily life: Chemical technician, Civil technician, Computer technician, Electrical technician, Mechanical technician, Mining technician, Foundry Engineering, Metals Engineering, chemical engineering.

VII-2: Contribution of local companies

What is the contribution of local companies into the vocational training sector? In fact, the vocational training sector should be done in cooperation with local companies. Vocational training is also seeing as dual training system. The combination of theory and training embedded in a real work environment. Therefore, local companies are important actors of vocational training.

VII-3: Activities of people at the end of vocational training

Normally, people with vocational training are considered as one of the most important workforces to boost the technological maintenance of countries. What are their daily activities after their vocational training?