IATT Policy Brief on Science, Technology and Innovation for the SDGs Roadmaps --- #3

Assessment of Human Capital Needs for STI R&D and Other STI Skills

SUMMARY

This policy brief presents research evidence for effective human capital formation to drive the STI4SDGs agenda in Ghana, as revealed by the situational analysis conducted by CSIR-Science and Technology Policy Research Institute in collaboration with Ministry of Environment, Science, Technology and Innovation, with technical support from UNESCO in line with the UN Inter-agency Task Team (UN-IATT). For the accelerated achievement of the selected Sustainable Development Goals (SDGs) using Science, Technology and Innovation (STI), there must be a reform of the educational system with emphasis on stimulating curiosity, creativity and competence-building. At the tertiary level in particular, STI human resources must be equipped for the tertiary institutions to effectively deliver teaching and learning in Science, Technology, Engineering and Mathematics (STEM). Research and Development (R&D) institutions must be strengthened with adequate human resources and infrastructure needs in STI.

1. BACKGROUND

The 2030 Agenda, adopted at the United Nations Sustainable Development Summit in September 2015, positioned Science, Technology and Innovation (STI) as key means of implementation of the SDGs, and launched the UN Technology Facilitation Mechanism (TFM). The Annual Multi-Stakeholder Forum for Science, Technology and Innovation (STI Forum), supported by the Inter-Agency Task Team on Science, Technology and Innovation for the SDGs (IATT), has been the main fora for TFM to discuss topics of common interests of Member States and STI stakeholders in the context of the 2030 Agenda.

STI roadmaps and action plans to help realize the SDGs have been among the central topics through the first three STI Forums. In the Addis Ababa Action Agenda, Member States had committed to "adopt science, technology and innovation strategies as integral elements of our national sustainable development strategies" (para 119). In the 2017 STI Forum, participants highlighted that the STI roadmaps and action plans are needed at the subnational, national and global levels, and should include measures for tracking progress. These roadmaps incorporate processes that require feedback loops, evaluate what is working and not working, and produce continual revisions that create a real learning environment.

There is important knowledge and experience scattered across the 43 IATT members and other stakeholders. Therefore, this initiative is expected to add value through facilitating a common approach and developing a coherent framework to examine gaps, synergies and trade-offs, prioritize actions, strengthen national STI systems, and promote cross-sectoral collaborations and Goal-specific "deep dives" for the SDGs.

2. METHODS

A review of the existing human capital and the outlook for the future in relation to the STI4SDGs Roadmap were assessed in Ghana. Data from the universities and research system, their potential for collaborative work with the private sector and the emerging trends of youth exploiting their creativity in the innovation space were obtained through desk review studies, expert interviews and on-line survey.

3. KEY FINDINGS

The purpose of the IATT Policy Briefs is to provide a channel for interested stakeholders to discuss and review issues relevant to the UN Technology Facilitation Mechanism. For further information on this Brief, contact: Essegbey, O.G., Asafu-Adjaye N.Y., Quaye, W., Akon-Yamga, G., Addo-Yobo, F., Browne, L. (2020).

Science, Technology and Innovation (STI) and Higher Education (HE) are critical drivers of rapid economic growth and development in every country (Livingstone and Frimpong, 2020). According to Abuzyarova et al (2019), a key factor of human capital development is formal education at specialized educational organizations:

University of Ghana (UG) Legon, Kwame Nkrumah University of Science and Technology (KNUST), University of Cape Coast (UCC) and University for Development Studies (UDS) respectively have a better number of lecturers who possess Doctoral Degree (PhD) or its equivalent.

In recent years (2012/2013 to 2018/2019), there has been a 25.1 percent increase in student's enrolment at public universities, but a decrease of 2.13 percent at private universities within the same period.

Overall, there has been a 19.67 percent increase of Bachelor's enrolment in Ghana within the referenced time period.

At the Masters' level, there has been a decrease in student's enrolment both at the Master's research and non-research levels for some years.

At the non-research Master's level there is 0.12 percent decrease at public universities and 17.58 percent decrease at private universities. In total, from 2012/2013 to 2018/2019, there has been a 3.53 percent decrease.

At Master's level with research there has been a substantive decrease in student's enrolment at public universities by 27.14 percent. Private universities have also seen a decrease in enrolment by 23.68 percent. Overall, there has been a decrease of 25.34 percent in student's enrolment at the Master's (research) level.

Nevertheless, overall student enrolment at the PhD level has seen a 95.68 percent increase between 2012/2013 and 2018/2019 academic years. At public universities there has been a high increase of 82.64 percent in student's enrolment at the PhD level. Private universities have also seen an increase in enrolment by 27.94 percent.

Figure 1: Key STI Projects in Ghana

On the other hand, Research Institutions in Ghana are to conduct research for the provision knowledge-based information that contribute to the formulation and implementation of policies for socio-economic development on the basis of Science, Technology and Innovation (STI). National research institutions in Ghana include the Council for Scientific and Industrial Research and Ghana Atomic Energy Commission.

The Ghana Atomic Energy Commission (GAEC) is mandated to conduct research which would develop and promote the utilization of nuclear, bio, and other related technologies for socio-economic development through research, training and commercialization. The areas of research by the GAEC includes Medical Physics, Nuclear Science and Technology, Nuclear Engineering, Computational Nuclear Sciences and Engineering, Nuclear Technology Applications in Petroleum and Mining, Applied Nuclear Physics, Environmental Protection, Nuclear and Radiochemistry, Nuclear Earth Sciences, Radiation Protection, Radiation Processing and Nuclear Agriculture. Research institutes in the GAEC have less PhD scientists as compared to scientists with master's qualification. However, about 68% of the human resource scientists are in the field of natural science whilst the least can be found in medical and health sciences.

The CSIR is mandated to perform the following functions among others (Livingstone and Frimpong, 2020)

1. To pursue the implementation of government policies on scientific research and development;
2. To advise the sector Minister on scientific and technological advance likely to be of importance to national development;
3. To encourage a coordinated employment of scientific research for management, utilization and conservation of the natural resources of Ghana in the interest of development.

Human resource capacity analysis in CSIR indicates that most of the research institutes in the CSIR have less PhD scientists as compared to scientists with master's qualification. However, there are capacity building opportunities for scientists with masters to upgrade their knowledge and capacity to doctoral status.

Over the years, CSIR research institutions have partnered with various international development organizations and donors for implementation of projects and programmes in line with its mission. The council leadership and its research scientists have enjoyed collaborative support from development partners including Government of Ghana, World Bank, Bill and Melinda Gates, UNESCO, UNDP, UN, Foreign Governments (Japan, Demark, Canada, USA, Germany, UK etc) and European Union among others.

CAPACITY NEEDS REGARDING STI FRAMEWORK CONDITIONS AND GOVERNANCE SYSTEM FOR KNOWLEDGE EXCHANGE AND TRANSFER

Generally, STI human resource capacity needs assessment in relation to food and nutrition security as well as good health and wellbeing (SDGs 2 and 3) attracted fairly favorable scores of at least 60 percent for either "adequate" or "average" from the online survey conducted. The STI human resource capacity needs assessment scores for education at all levels, clean water and sanitation and industrialization (SDGs 4, 6 and 9) were rather unfavorable.

In the particular case of STI education at all levels, the point needs to be emphasized that, effective STI education begins from the basic level. Pre-school and basic education are very important for proper orientation of the individual to STI. There has to be inculcated scientific attitudes and mindsets and encouraging curiosity in the child at that early age which is very vital. The second-cycle education must be built on what has been achieved at the basic level and creativity must be stimulated in the child. At the tertiary level, the impartation of scientific knowledge then strengthens creativity and contributes to building skills and competences. For all this to happen, there is a need for creating the right teaching-and-learning environment, providing adequate infrastructures and maintaining qualified teaching staff. There must be laboratories for practical teaching and learning. There must be tools and audio-visual aids to make teaching and learning meaningful and relevant. Clearly, to produce the 21st Century human resource for STI, the emphasis must be on the three "C" s in the educational system across all the

longitudinal levels of basic, secondary and tertiary– *curiosity, creativity and competence*.

CAPACITY NEEDS REGARDING INFRUSTRUCTURE FOR STI-SDGs

Creating appropriate infrastructure for STI human resource development is vital particularly digitalization and e-infrastructure. The central government budgetary allocation to the educational sector should be adequate for maintaining the needed professionals and workers in the sector and ensuring continuous enrolment into the educational institutions at all levels. However, without the infrastructures and emphasis on practical teaching and learning, STEM education is unable to achieve the desired goal of building competences.

4. CONCLUSIONS AND POLICY RECOMMENDATIONS

Human capital is critical in sustainable development. Even before the attainment of political independence, Ghana recognized the urgency for creating formal educational institutions and empowering them as instruments for human capital formation. Currently, the diversity of tertiary educational institutions is an evidence of the efforts the country is making to ensure that it has the needed skills and competences to drive the national development agenda.

In the specific area of STI, the evidence of diverse tertiary institutions training STI human resources is strong. The public tertiary institutions are dominating the training of STI human resources. For example, an institution such as KNUST still addresses its fundamental mandate in STEM education even though it has extended into teaching-and-learning in non-STEM disciplines. Other tertiary institutions have also strengthened their efforts in STEM education.

Thus, the country is making good progress in producing the scientific and technological resources for national development. However, the challenge of the new technologies demands much more enhanced strategies in building skills and competences.

With the emergence of the new technologies, the strategies for human capital formation have become even more crucial. These are knowledge-intensive technologies that require more adequate infrastructure and expertise in producing the requisite skills and competences. In this regard, Ghana needs to enhance its educational strategies in STEM.

The SDGs have also raised the bar in STEM education. The priorities include producing human resources to address the agenda in achieving no poverty in the society, good health and well-being, ending hunger and malnutrition, providing clean water and sanitation to everyone everywhere and educating people living in Ghana to be well-informed and capable of engaging in decent and sustainable jobs for the collective good of the society.

For this to be realized it implies a transformation of the educational strategies from the basic to the tertiary, emphasizing on inculcating curiosity, creativity and competence (3Cs) in everyone who passes through the educational system. This is very crucial for the 21st Century person living in Ghana.

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