THE USEFULNESS OF SCIENCE, TECHNOLOGY, ENGINEERING, ARTS AND MATHEMATICS (STEAM) EDUCATION AS INSTRUMENT FOR MEDIUM-TERM REVENUE STRATEGY (MTRS) IN SUSTAINABLE DEVELOPMENT GOALS (SDGs) IN NIGERIA

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Abstract
STEAM (Science, Technology, Engineering, Arts, and Mathematics) education has emerged as a dynamic educational approach that equips students with interdisciplinary skills, fostering creativity, critical thinking, and innovations. This paper explores the use of STEAM education as an instrument for a Medium-Term Revenue Strategy (MTRS) aimed at achieving Sustainable Development Goals (SDGs). By leveraging STEAM education, countries can cultivate a workforce adept at addressing complex global challenges, promoting economic growth, and ensuring long-term sustainability. The paper presents a comprehensive analysis of how STEAM education aligns with key SDGs, emphasizing its roles in enhancing human capital and fostering innovations, critical for a sustainable future. The potential for revenue generation through STEAM education-driven initiatives was discussed, with a focus on developing countries seeking to strengthen their economies and meet international commitments for sustainability. In conclusion, this paper recommended among others that, government should support research and development in STEAM fields, encourage entrepreneurship and innovation, align STEAM education with local and global economic needs, and raise public awareness about the importance of STEAM.

Keywords: ***STEAM, SDGs, Medium-Term Revenue and Economic Growth***

INTRODUCTION

Education is the key to sustainable national growth, development and productivity globally. Qualitative functional (STEAM) Education aim at preparing citizens for a balanced development and also assist them to attain a level of advancement that meets the needs of the society. (Usman, 2011).

Science, Technology, Engineering, Arts and Mathematics (STEAM) Education had played an indispensable role in shaping economic realities of any society. For any

nation to attain any sustainable development there is need to recognize Science, Technology, Engineering, Arts and Mathematics Education of her citizens (Orukotan, 2007).

STEAM is an acronym, standing for Science, Technology, Engineering, Arts and Mathematics. Science is the systematic study of the structure and behaviour of the physical and natural world through observation, experimentation, and the testing of theories against the evidence obtained. Technology is the application of scientific knowledge for practical purposes. Technology uses scientific principles, which can be applied to change the environment in which humans live. Engineering is a branch of science and technology that deals with designs, buildings, use of engines, machines, and structures while Arts refers to an area of study that encompasses various disciplines that explore human culture, expressions and creativity. Mathematics is the science of numbers and their operations, interrelations, combinations, generalizations, abstractions, space, configurations and their structure, measurement, transformations, and generalizations, while Mathematics Education is the pedagogy of mathematics, otherwise is the practice of teaching, learning, and carrying out scholarly research into the transfer of mathematical knowledge (Wikipedia, 2024).

An investigation into the activities of MTNDP (Medium-Term National Development Plan) on SDGs was considered to increase domestic revenue sources through primary taxation, as the means to fund national development as identified in its 2021-2026 MTNDP. SDGs are phased into three periods namely: building on existing foundations lay under the MDGs (2016-2020); Scale-up (2021-2025); these are the period bedeviled by so many factor such as COVID -19 pandemic, National Economic decline due to insecurity especially Boko Haram era) and leave no one behind (2026-2030). However, looking at the progress made so far in meeting the SDGs, Nigeria ranked 160th out of 165 Countries, coming ahead of only five countries: Liberia, Somalia, Chad, South Sudan and the Central Africa Republic. The SDG score for Nigeria was put at 48.93%, this is an indication of slow progress (NINFF, 2024).

The status of progress on SDGs in Nigeria so far is considered unfavorable especially when it recorded a score of 47.85% in 2021. The Nigeria Government is committed to achieving the 17 sustainable development goals (SDGs) set under the agenda before 2030. SDGs blue print has 169 objectives targeted at eradicating all forms of poverty, thereby transiting the world into a pathway of resilience and sustainability for development. The effort is targeted towards ensuring that all unresolved issues and newly identified challenges are tackled and making sure that no one is left behind because development should be an enduring process (MTRS, 2022)

An Overview of the Medium-Term Revenue Strategy (MTRS) is a combined arrangement of four major international Organizations for Economic Co-operation and Development (OECD), the United Nation (UN), the International Monetary Fund (IMF) and the World Bank Group (WBG) birthed the MTRS. The goal of the MTRS is to lay a solid foundation for a resourceful tax system through collaborative effort to achieve successful and robust tax reform for revenue generating funds for SDGs (OECD, 2020). MTRS is a holistic approach for achieving effectiveness in tax systems reform which can last for five years 2022-2026 as projected on the roadmap.
The Usefulness of Science, Technology, Engineering and Mathematics Education as an Instrument for Medium - Term Revenue Strategy (MTRS) in Sustainable Development Goals (SDGS) in Nigeria has become a global imperative, with the United Nations' Sustainable Development Goals (SDGs) offering a blueprint for addressing critical challenges such as poverty, inequality, climate change, and environmental degradation. Achieving these goals requires innovative approaches that combine education, technological advancement, and policy frameworks. STEAM education, which integrated arts subjects into STEM fields (Science, Technology, Engineering, and Mathematics), provides a holistic framework for cultivating skills that are essential for achieving the SDGs. This paper explores how STEAM education can serve as a vital instrument for a Medium-Term Revenue Strategy (MTRS) in countries pursuing sustainable development objectives.

Objectives of the Study

The main objective of the study is to discuss, the usefulness of Science, Technology, Engineering, Arts and Mathematics (STEAM) Education as instrument for Medium-Term Revenue Strategy (MTRS) in Sustainable Development Goals (SDGS) in Nigeria. Specifically, the study sought to discuss:

i. STEAM Education and Sustainable Development Goals
ii. Medium-Term Revenue Strategy (MTRS) and Human Capital Development
iii. Enhancing Human Capital for Economic Growth
iv. Promoting Innovation through STEAM Education
v. Revenue Generation through STEAM Initiatives
vi. Developing Technological Solutions for Sustainability
vii. Entrepreneurship and Startups.

STEAM Education and Sustainable Development Goals

STEAM education is well-positioned to address a wide range of SDGs. The integration of arts into STEM broadens the scope of inquiry, encouraging creativity and innovation, which are essential for problem-solving in complex global issues. The following SDGs are particularly aligned with the goals of STEAM education:

- **Goal 4: Quality Education:** STEAM education promotes inclusive, equitable, and quality education by fostering skills in critical thinking, creativity, and interdisciplinary collaboration. These skills are essential for addressing global challenges and creating a more sustainable world (UNESCO, 2017).

- **Goal 8: Decent Work and Economic Growth:** By providing students with the skills necessary for innovation and entrepreneurship, STEAM education contributes to economic growth and job creation. This is particularly important in industries related to sustainability, such as renewable energy, environmental engineering, and sustainable agriculture (World Economic Forum, 2020).
- **Goal 9: Industry, Innovation, and Infrastructure:** STEAM education enhances technological and scientific research capacities, promoting the development of sustainable industries and resilient infrastructure (Hynes & Hynes, 2018). This goal is critical for driving revenue growth through innovation-driven sectors.
- **Goal 13: Climate Action:** STEAM education equips learners with the skills necessary to develop and implement solutions to mitigate and adapt to climate change. Innovation in technology and engineering is crucial for addressing environmental challenges, such as renewable energy development and waste management (Wals, 2015).

Medium-Term Revenue Strategy (MTRS) and Human Capital Development

The concept of a Medium-Term Revenue Strategy (MTRS) involves designing fiscal policies that enhance a country's ability to generate revenue in a sustainable manner over the medium term, typically a 3-5-year period. STEAM education plays a pivotal role in this strategy by enhancing human capital, which in turn drives economic growth and revenue generation.

Tax revenue, has been adversely affected by various challenges over time. This has led to poor tax - to -GDP ratio in Nigeria, averaging around 5.7% since 2015, compared to an African average of 16.6% (OECD Report, 2020). Uncertainty, in the oil market has been reflected in the declining trend of oil tax revenues. However, non oil tax has continue to grow at a relatively low rate moving from ?2,150 billion in 2016 to ?3,435 billion in 2020 (Tax Statistics Report - FIRS, 2020) as can be seen in the table below:

YEAR	OIL TAX ₦ BILLION	NON - OIL TAX ₦ BILLION	TOTAL TAX ₦ BILLION	TOTAL TAX REVENUE TO GDP RATIO
2020	1,517	3,435	4,952	6%
2019	2,114	3,148	5,262	6%
2018	2,468	2,853	5,321	6.3%
2017	1,520	2,507	4,027	5.7%
2016	1,158	2,150	3,308	5.3%

For 2021, as of November 2021, FGN's aggregate revenues were N5.51 trillion, or 74% of target. FGN's share of oil revenue was N970.3 billion, which represents 53% of the prorated target in the 2021 budget. FGN's share of non- oil tax revenue totaled N1.62 trillion (118.8% above target). Company's income tax (CIT) collections were

?718, 58 billion, representing 115% of the pro rata target for the period. Value added tax (VAT) collections were ?360, 56 billion, and representing 165% of the pro rata target for the period. Customs collections were ?542, 11 billion or 104% of the target (NINFF, 2024). This showed that STEAM serves as instrument for human capital development in MTRS.

Enhancing Human Capital for Economic Growth

Hanushek & Woessmann (2020) opined that countries that invest in education, particularly in Science, Technology, Engineering and Mathematics (STEM) education experience higher levels of innovation and productivity. By incorporating Arts into STEM education, STEAM fosters creativity and collaboration, which are essential for driving innovations that contribute to sustainable development. The result is an educated workforce capable of generating solutions to global challenges which in turn, contribute to economic growth and provide a sustainable revenue base for government (Mazzucato, 2018).

The economic situation in Nigeria has become more challenging since the sharp fall in oil prices in 2015-2016, due to the combination of heavy dependence on the oil sector, limited progress in economic diversification, and an array of policy shortcomings that inevitably inhibit economic growth potential. The collapse in oil prices and decline in output shrank by 1.6% in 2016 and Nigeria was also hit hard by the COVID -19 pandemic in 2020, with real GDP estimated to have contracted by 1.92% (NBS, 2020). This sharp contraction has further complicated the environment for economic development. Economic growth is projected to recover only modestly in 2021, as evidenced in the table below:

Nigeria Selected Economic and Financial Indicators, 2017 - 2021

Gross Domestics Product(GDP) Description	2017	2018	2019	2020	2021
Change in real GDP (2010 market prices)	0.8	1.9	2.2	-1.8	3.6
Change in oil and gas GDP	4.7	1.0	4.6	-8.9	-8.3
Change of non oil GDP	0.5	2.0	2.0	-1.1	4.7
Production of crude oil	1.89	1.93	2.0	1.83	1.63
Consumer price Index	16.5	12.1	11.4	13.2	17.0
Gross national saving share on GDP	18.1	20.5	21.4	24.7	23.5
Investment share on GDP	14.7	19.0	24.6	28.6	24.4

Source: IMF 2022 April World Economic Outlook (WEO)

To address these deep-rooted developmental challenges, Nigeria will need to reduce its reliance on oil, diversify its economy and revenue sources, address inadequate infrastructure, build stronger and more effective institutions, and enhance governance and public financial management. Without more growth-oriented policies and greater emphasis on diversification, the recovering could be weak and drawn out, plateauing at around 2- 2.5% annually (IMF, 2020). Similarly,

without a commitment to broaden the public sector revenue base and improve fiscal management, fiscal deficits and debt- servicing risks are projected to stay elevated. Therefore, with STEAM education in place, policy reforms and addressing structural issues will be required for economic performance and create a more welcoming environment for mobilizing Sustainable Development Goals (SDGs) financing.

Promoting Innovation through STEAM Education

The intersection of arts and science in STEAM education encourages students to approach problems from multiple perspectives and fostering innovation. This is particularly important in sectors critical to sustainable development, such as clean energy, education, agriculture and technology. Innovation in these fields not only addresses pressing global challenges but also creates opportunities for economic growth and revenue generation (Fagerberg, 2018).

For instance, advancements in green technology and renewable energy have the potential to generate significant economic returns. By training students in STEAM disciplines, countries can cultivate a workforce that is prepared to drive innovation in these high-growth sectors (Smith, 2020). Governments that implement STEAM-focused educational reforms as part of their MTRS are likely to see long-term benefits in terms of revenue growth and economic sustainability.

Revenue Generation through STEAM Initiatives

In addition to enhancing human capital, STEAM education provides opportunities for direct revenue generation through the development of innovative products and services. The table below illustrates STEAM education contributions towards the Nigeria States' internally generated revenue.

NIGERIA STATES' INTERNALLY GENERATED REVENUE 2021

S/No	State	Internally Generated Revenue ?
1	Abia	14,376,871,322.30
2	Adamawa	8,329,870,706.65
3	Akwa-Ibom	30,696,770,278.06
4	Anambra	28,009,906,580.48
5	Bauchi	12,502,599,363.55
6	Bayelsa	12,180,775,243.00
7	Benue	10,463,674,280.73
8	Borno	11,578,518,120.67
9	Cross-River	16,183,341,456.32
10	Delta	59,732,882,662.97
11	Ebonyi	13,591,038,584.15
12	Edo	27,184,350,734.90

13	Ekiti	8,716,460,193.84
14	Enugu	23,650,723,357.00
15	Gombe	8,537,983,927.43
16	Imo	17,081,878,984.93
17	Jigawa	8,667,720,607.78
18	Kaduna	50,768,523,407.34
19	Kano	31,819,816,711.74
20	Katsina	11,399,650,509.67
21	Kebbi	13,778,260,800.14
22	Kogi	17,357,833,531,.99
23	Kwara	19,604,303,787.67
24	Lagos	418,988,587,897.11
25	Nassawa	12,476,738,650.15
26	Niger	10,524,281,921.17
27	Ogun	50,749,595,850.07
28	Ondo	24,848,466,192.88
29	Osun	19,668,371,916.01
30	Oyo	38,042,733,036.47
31	Plateau	19,122,375,801.59
32	Rivers	117,189,729,245.29
33	Sokoto	11,796,827,128.19
34	Taraba	8,114,973,143.14
35	Yobe	7,779,631,175.54
36	Zamfara	18,499,252,091.61
37	FCT	92,059,700,897.42
	TOTAL	**1,306,075,020,099.95**

Source: Nigeria Integrated National Financing Framework (NINFF, 2024)

Developing Technological Solutions for Sustainability

The global shift towards sustainability has created significant demand for technologies that reduce environmental impact. STEAM education equips students with the skills to develop such technologies, from renewable energy solutions to sustainable agriculture practices. Governments and private enterprises that invest in STEAM education are better positioned to capitalize on these opportunities, generating revenue through innovation (McCowan, 2019).

Entrepreneurship and Startups

STEAM education fosters an entrepreneurial mindset by encouraging students to develop creative solutions to real-world problems. This mindset is critical for the development of startups and small businesses, particularly in sectors related to sustainability. Governments can support these enterprises through policies that incentivize innovation, creating a revenue stream through business development and job creation (Acs et al., 2020).

CONCLUSION

STEAM education offers a powerful tool for advancing sustainable development while contributing to a Medium-Term Revenue Strategy. By investing in STEAM education, countries can enhance human capital, promote innovation, and stimulate economic growth in industries critical to sustainability. The interdisciplinary nature of STEAM equips students with the skills necessary to address complex global challenges, while also generating economic returns through technological advancement and entrepreneurship. As the global economy transitions towards sustainability, countries that prioritize STEAM education will be better positioned to achieve their Sustainable Development Goals and foster long-term economic resilience.

RECOMMENDATIONS

1. Support Research and Development in STEAM Fields: Allocate funding for research initiatives that explore innovative STEAM education practices and their impact on student outcomes. This will provide valuable data to inform policy decisions and improve educational strategies.
2. Encourage Entrepreneurship and Innovation: Create incubators and innovation hubs within educational institutions to foster entrepreneurship among students. Programs that encourage students to develop their own projects can stimulate creative thinking and lead to the creation of startups that contribute to economic growth.
3. Align STEAM Education with Local and Global Economic Needs: Tailor STEAM education programs to address the specific economic needs and environmental challenges of local communities. This ensures that education is relevant and contributes directly to local development goals.
4. Implement Assessment Metrics for STEAM Programs: Develop clear metrics to assess the effectiveness of STEAM education initiatives in terms of student engagement, skill acquisition, and economic outcomes. This data can guide continuous improvement and demonstrate the value of STEAM education to stakeholders.
5. Promote Lifelong Learning: Encourage lifelong learning opportunities in STEAM fields through community programs, online courses, and adult education initiatives. This will ensure that individuals can adapt to evolving job markets and contribute to sustainable development throughout their lives.
6. Raise Public Awareness about the Importance of STEAM: Launch campaigns to highlight the benefits of STEAM education for economic development and sustainability. Engaging the public can increase support for policies that prioritize STEAM initiatives.
7. Foster Global Collaboration: Participate in international networks that promote STEAM education and sustainable development. Sharing best

practices and resources can enhance the effectiveness of national strategies and contribute to the global knowledge base.

8. Promote Partnerships between Educational Institutions and Industries: Encourage collaboration between schools, universities, and local industries to create programs that link STEAM education with real-world applications. This partnership can facilitate internships, mentorships, and project-based learning that prepare students for the workforce while fostering innovation.

By implementing these recommendations, countries can harness the power of STEAM education to not only enhances human capital but also to drive innovation and economic growth, ultimately contributing to the achievement of Sustainable Development Goals.

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