Review on Need for Humanitarian Engineering Approaches in Agricultural Technology Innovations: Implication for Agriculture Education Programme in Nigeria

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ABSTRACT

The farmers' struggle for the mass production of food is undermined by the low level of agricultural technology and the use of crude implements. The word "humanitarian" has been defined as being "concerned with or seeking to promote human welfare". There is a necessity for human intervention in agricultural development and food security to ease the affected populace. New ways of doing things to boost the sustainability of food sufficiency are pertinent. This paper was made to confer a theoretical analysis in order to establish the significance of humanitarian engineering applications and operations in agricultural technology innovation development to boost the welfare of the developing world. It highlighted the role of agriculture in the provision of food, shelter, and clothing as basic human needs and emphasised the necessity of directing humanitarian-driven scientific innovations towards the sustainability of agriculture. Based on the philosophy of building a superstructure on a well-built foundation, it was considered vital to equip the "budding" (future) agriculturists and engineers on humanitarian innovations and approaches. The discourse also explored the relevance of inclusion and implication of HE in agriculture education programmes. The paper recommended the integration of HE approaches into the agricultural education curriculum of higher education programmes in Nigeria.

KEYWORDS: Humanitarian Engineering Approaches, Agricultural Technology Innovations, Agriculture Education Programme and Nigeria

Introduction

Consideration of the potentials of Humanitarian Engineering (HE), its application in Agricultural Technology innovations for benefit of the human race, and much more to the African society, is pertinent. All humans eat food to survive. Despite all efforts to increase food production, the prevalence of hunger and food insecurity in the developing world is alarming. Similar situations occur with regard to clothing and shelter for the under-developed population. Humanitarian Engineering (HE) is the application of engineering to improve the well-being of marginalised people and disadvantaged communities, usually in the developing world. It typically focuses on programmes that are affordable, sustainable, and based on local resources (Brittanica, Encyclopedia, 2016). According to Mazzurco and Daniel (2020), humanitarian engineering (HE) is an engineering specialisation that focuses on the design of products, systems, or services to support the sustainable development of resource-constrained communities. Engineering can be defined as the use of science and mathematics to invent, create, design, develop, improve,

modify, or apply technologies; or, more simply, engineering advances technology (Passino, 2016). Engineering plays a significant role in providing fundamental human needs by improving livelihoods and creating opportunities for sustainable growth at a local, national, regional, and global level. He also affirms that HE advances technology for sustainable development and has been recognised by several authors as having valuable potential for creating a new and meaningful approach to engineering education.

He also noted that Technology is often thought of as "a tool that extends human capability," or more generally, "anything that extends human capability." The New Oxford American Dictionary defines technology as "the application of scientific knowledge for practical purposes." Some view technology as a systematic study of techniques in making and doing things, while another group views it as an application of scientific or organised knowledge to practical tasks. Some other schools of thought go a little further to regard technology as the use of products of creativity, innovations, and scientific research in the service of man.

The objective of technology is to provide more output for a fixed amount of production input. It is vital in economizing processes and improving ways of completing a specific task. Within the context of this write-up, Agricultural Technology refers to the application of scientific and organised knowledge to practice tasks in agricultural production, marketing, information dissemination, and understanding agricultural environments. Osula (1996) asserted that agricultural technology involves the acquisition and application of practical skills based on scientific knowledge, relating to various agricultural occupations and development.

According to Passino (2016), innovation is the process of making changes to something established by introducing something new. As such, it can be radical or incremental, and it can be applied to products, processes, or services in any organization. It can happen at all levels in an organization, from management teams to departments and even at the level of the individual. For purposes of sustainability, it is also vital for such applications or approaches in HE to be profoundly initiated through the educational system. Lucena et al. (2007) opined that HE is an important dimension of engineering practise that deserves clearer ethical articulation and curriculum development.

The objective of this paper is to determine the need for humanitarian engineering approaches in agricultural innovations and practices and its implication in education in Nigeria.

Need for Applications of Humanitarian Engineering in Agricultural Technology Innovations and Developments

A significant percentage of the people in the world are poor, and most of the world's poor people earn their living from agriculture. The practise of agriculture and its education in the developing world is still naive, crude, and not growing in tangent with scientific and technological discoveries. Sustaining growth in agricultural productivity is crucial, and farmers need a steady stream of new farm practises that enable them to raise yields, manage inputs more efficiently, adopt new crops and production systems, improve the quality of their products, and conserve natural resources. Therefore, there is an urgent necessity for scientists, academics,

researchers, and politicians to engineer their efforts toward the timely provision of solutions for basic human needs such as food, clothing, and shelter. There is a need for more humanitarian approaches and efforts in innovation to achieve agricultural sustainability in developing countries. Nigeria seems to be lacking behind in this humanitarian service.

Innovation is any constant change in the forms of behaviour of members of an identifiable social group. It is a novel departure from a customary practise that cannot be sustained to a more sustainable one that is situational and relevant to a group in time and place, and when widely adopted, it becomes a reform. Agricultural practises and processing requirements necessitate such innovative reforms in order to meet the most recent societal development and agricultural technology.

In the developed environment, agriculture is undergoing a technological revolution supported by policymakers around the world to achieve increased productivity. Deliberate humanitarian engineering and intervention offer radical changes in agricultural development through innovations such as the adoption of Smart Agriculture or e-agriculture, the application of Internet of Things (IoT) technology in the agricultural process, increased eco-efficiency, effective use of electronic systems and data transmission, precision agriculture, Minichromosomal Technology, Real-Time Kinematic (RTK), etc. (Croptracker 2006).

Of specific note is the introduction of information and communication technology (ICT) into agriculture. The Industrial Revolution is gradually taking over the agricultural world. Smart Agriculture innovation involving software engineering and computing technology, Precision technology, Internet of Things (IoT), Sensor technology, Geo-positioning systems, Big Data, Autonomous and robotic labour, etc. The listed innovations, and much more, are all current engineering specialty areas that are applicable to various agricultural practices, processing, and designs for facilitation of production and replacing human labour in agriculture.

Moisture sensor technology is used to measure moisture, temperature, and electrical conductivity of the soil, while livestock sensors are wireless IoT sensors that gather data regarding the health and well-being of livestock. Soil sensors can alert farmers to conditions such as high acidity, monitoring plants and soil conditions that are useful to them (Xiaohui and Nannan 2014). Precision agriculture is a crop and livestock production management system that uses a global positioning system (GPS) to monitor equipment field positions, collect information, and apply inputs as required at each location.

Precision Technology is run by people who are passionate about delivering professional products and services that are constantly enhanced based upon feedback from owners and operators. Precision technology is used in agricultural engineering operations such as visual guidance and autosteer, land levelling and earthworks, tree planting and fencing, planting and variable rates, spray control and auto-section, irrigator steering, mapping, and record keeping.

Biotechnology in agriculture involves the use of technology to make advances in crop production and in animals. Through biotechnology and genetic engineering innovations, crops are able to withstand harsh weather conditions such as drought and flooding, which serves as a strategy to combat the effect of climate change on

crop production. Farmers are able to provide a variety of crops, products, and food to the market. Environmental standards, which are rules for protecting the environment through scientific innovations, have improved towards better use of natural resources. Through the use of engineering technologies, farmers are able to provide extra care for the land, its management, and its utilization. Waste recycling and nutrient management are applied to increase food production. As a result of increased use of HE, farming would improve in terms of seize, efficiency, and quality.

Implication for Agriculture Education

Education is a powerful agent of change, and it improves health and livelihoods, contributes to social stability, and drives long-term economic growth. Education is also essential to the success of every one of the 17 sustainable development goals (GPE, 2021). It is the pivot of societal development. To access a country's development matrix in this technological age, quality education is one of the significant variables to be considered. Therefore, when our leaders, policymakers, academic professionals, and the generality of the populace, in all fields of human endeavour, maximise the use of this crucial variable (education), economic development and overall societal growth will be heightened. Innovations in educational curriculum and content are a prerequisite to the advancement of society. This fact is essential for assisting the developing environment, African society, and Nigeria in particular.

Agricultural education has been a vital factor in the success of agricultural progression. At present, many programmes in higher education institutions in the country have failed to keep pace with global emerging innovations in agriculture by not adopting prevailing technologies into the curriculum for the purpose of initiating and sustaining agricultural innovations. Based on the philosophy of building a "super structure" on a firm foundation, the education system must be fully utilised to cross the bridge of ignorance to awareness and readiness for a future generation of humanitarian engineers and agriculturalists. There is a fundamental need for the introduction of humanitarian engineering approaches to agriculture education, in order to lay an effective foundation in the learners for future initiation and future survival of HE utilization in agricultural development (Bunmi and Okon, 2021).

Innovations in educational systems contribute to reforming tertiary level education programmes. Agriculture education needs to produce professionals who make use of the opportunities provided by ICT to increase agricultural productivity for the populace. Sustainability requires developing an infrastructure that allows the rapid building of multiple IoT applications, which need more people with technical skills. The technical skills acquired in school are transferable to real-life situations in the future to boost sustainable agriculture.

Conclusion

Humanitarian-driven innovation offers a pathway to sustainable agriculture through diversification of technologies, adoption of new methodologies in crop and livestock production systems, and networking across all actors in the agriculture sector. To ensure sustainability in agriculture education, the application of data-driven approach to farming can be developed, making it possible for farming to optimise their crop yields and promote livestock health through remote monitoring and data-driven

decision making (Floreano and Wood 2015). These innovations, initiated by humanitarian engineers, are ways of assisting agricultural production and making quality food, affordable shelter, and clothing available to people in need, as well as improving their livelihood.

Recommendations

1. It is recommended that the 'Budding Scientists' being the future Humanitarian Engineers in relevant disciples should be trained on directing scientific and engineering efforts toward agricultural development and sustainability of the environment for the human race.

2. Humanitarian approaches to agricultural technology should be integrated into the tertiary education curriculum of Agriculture Education Programmes in Nigeria.

3. There's is a need to create more awareness through seminars and training on the emerging humanitarian engineering approaches in the developing world to boost agricultural developments.

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