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Agricultural and Rural Development

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Abstract **Original Research Article**

Agriculture is a sustainable sector of many countries economy. It is undisputable that it supports food, shelter and revenue provision. Its importance has generated topics of discuss among the global bodies such as FAO, AATF, UNO and ECOWAS amongst others) on starvation, food security and climate change among others. This research addresses agricultural and rural development and how its adoption could foster technological advancements, effective management, good market access and trade, famers and stakeholders' capacity building, rural infrastructure provision to increase food supply, efficiency and economic sustainability through informed government decisions, policies and regulations on agriculture. It concludes by examining the mutual benefits of agricultural and rural development towards having sustainable economy and development as it proffers solutions ensuring sustainable food supply and security on the globe.

Keywords: Food Security, Agricultural development, Market access, Infrastructure, Sustainable Economy.

Introduction

Agricultural development could be defined as the techniques of improving on agricultural practices, systems, and infrastructure in order to increase food productivity, food supply and efficiency, and overall performance of the agricultural sector. It explains ways and methods of increasing the crop yields on the farm, improving the livestock productivity, and reducing environmental impact in the society. Agricultural development seeks to enhance both rural and urban dwellers livelihoods, incomes, and access to services through modern technologies. It helps in ensuring food security by encouraging food surplus and its availability in the society as well as enhancing rural and urban dwellers livelihoods and incomes. It ensures improved nutritional outcomes and foster economic growth through poverty reduction in the society and equally promotes friendly environmental achievement.

Agricultural development gives room for technological advancements. Unlike the primitive agriculture that involves the use of obsolete tools and machineries; agricultural development facilitates the adoption and use of modern tools, machineries, and techniques to enhance agricultural efficiency, food productivity and security. It seeks modern techniques of improving on agricultural crops and seeds in order to achieve high-yielding, disease-resistant, and climate-tolerant seeds and crops. It explains the acceptable methods of soil conservation and management in order to preserve the soil fertility, health and water-retention through acceptable practices.

Furthermore, agricultural development ensures efficient water management on the farm through

the efficient provision and usage of advanced irrigation systems practices and water management on the farm. It ensures adequate watering of the farm and equally prevents soil and nutrient erosion on the agricultural farm. It facilitates the use and adoption of drones and other related advanced method of farm irrigation system on the farm. In addition to the afore-stated, It promotes efficient farm management and organization y the farmers and farm professionals to have improved farm planning, update records of farm activities, and improved agricultural decision-making. It equally enhances farmers' access to the markets thereby improving food supply chains and promoting local and foreign trade transactions between the farmers and potential buyers of their farm products.

In addendum to the above, agricultural development promotes rural development through provision of lacking infrastructures such as provision of good feeder rural roads, storage facilities for rural dwellers and other essentials that are of mutual benefits and development to the farmers, their customers and the village as well. It also encourages capacity building and training of the farmers y educating the farmers, the extension officers, and stakeholders that invested in agricultural business on the best practices and new technologies on agriculture. Asides the above, it also assists the farmers in making informed policies and regulations on their business by embarking on the policies and regulations that will foster the growth and development of their agricultural business. The practice of agricultural development in no small amount helps in promoting agricultural practices that minimize environmental pollution which may result in climate change. These practices may equally result in conservation of the natural resources in the societies.

Research Problems / Objectives

This research addresses insufficient food supply and security, lack of sustainable agricultural practices and climate control, inadequate rural infrastructure development and access to markets, improper agricultural practices and low efficiency in agricultural products, inadequate engagement of the rural dwellers in commercial agriculture and practices, weak Inter-dependence between agricultural and rural development, inappropriate agricultural policies and governance in the society and challenges faced by agricultural and rural development sectors. It seeks to proffer solutions to the challenges of agricultural and rural development sector and improved and data-governed methods of agricultural practices for bountiful crops yield, efficiency, drought resistance crops, eco-friendly agricultural farming and sustainable food supply and security.

Significance of the Study

Agricultural Development can improved food security in the society:

Agricultural Development can help make informed agricultural policies.

Agricultural Development can help to empower rural communities and enhance rural dwellers livelihoods:

Agricultural Development can help to mitigate climate change and reduce environmental impact.

Agricultural Development can bring about more technological innovations:

Agricultural Development can enhance Economic Growth

Agricultural Development can help gain Global Relevance

Methodology

This research methodology will help the farmers, researchers, agricultural professionals, stakeholders and government to understand the need for introduction and adoption of technological tools and methods in agriculture in order to make informed policies and regulations on agricultural practices, sustainable food supply and security and adaption to climate change. It helps to explain some underlying causes and relationships that could drive agricultural activities between the cities and rural communities. It answers why and how informed decisions and policies are made in agriculture through modern technologies. It equally explains how rural farmers, government, stakeholders, agricultural extension officers as well as the rural youths could appreciate and cultivate the benefits

of agriculture and its practices to achieve improve access to technology, improved food security, crop yields, zero Hunger, reduction in poverty, automate tasks, improve efficiency, employment opportunities, enhance youth involvement and optimize supply chain management in agricultural operations.

Materials used in Agricultural Development

The materials used in agricultural development include: Drones, Farm Management Information System, Weather stations, Sensors, Autonomous farming equipment, Robotics, GPS and GIS technology, IoT devices, Automation systems, Data analytics software, Advanced materials for greenhouses, quality crops and precision irrigation systems.

Modern Tools and Materials used for Agricultural and Rural Development

Drones: This is Equipped with cameras, sensors, and GPS for crop monitoring and analysis.

Farm Management Information System: Integrated software for farm planning, monitoring, and analysis.

Weather Station and Forecasting: Weather Stations and Forecasting: Real-time

weather data and predictive analytics

Automated Farming Equipment: Tractors, planters, and harvesters with automation and guidance systems

Block-chains: Secure, transparent, and tamper-proof record-keeping for supply chains.

Sensor: Soil moisture, temperature, humidity, and crop health sensors

Variable Rate Application: Precision application of inputs like seeds, fertilizers, and pesticides

Robotic and Automation: Autonomous systems for farming, pruning, and harvesting

Mobile Apps and Platforms: For farmer engagement, data access, and advisory services.

Cloud Computing: Cloud Computing: Scalable infrastructure for data storage, processing, and analysis

Big Data: Big Data Analytics: Handling large datasets for insights, trends, and patterns

Artificial Intelligence ad Machine Learning: For predictive analytics, decision support, and automation.

Internet of Things (IoT): Connecting devices, sensors, and systems for data exchange and analysis.

GPS and GIP: GPS and GIS: For precision farming, mapping, and spatial analysis

Satellite Imaging: High-resolution images for crop monitoring, yield prediction, and soil analysis.

Method

The methods used in agricultural development that help the farmers, researchers, policymakers, and stakeholders in agriculture to develop and implement effective agricultural development strategies include: Experimental Research, Survey Research, Participatory Action Research (PAR), On-Farm Trials, Demonstration Plots, Farmer Field Schools (FFS), Technology Transfer, Monitoring and Evaluation (M&E), Geographic Information Systems (GIS) and Remote Sensing, Statistical Analysis and Modelling, Case Studies, Ethnographic Research, Agricultural Economics, Soil and Water Conservation, Integrated Pest Management (IPM), Precision Agriculture, Agro-forestry and Conservation Agriculture.

Experimental Research

Experimental Research in agricultural development refers to how experimental analysis are designed and conducted to know how effective and the impact of newly introduced agricultural technologies, practices and innovations are. Experimental research helps the farmers, agricultural professionals as well as the stakeholders in agriculture to give solutions to questions, such as the impact of a new fertilizer on crop yield, how a newly installed irrigation system could affect the water usage and crop growth as well as the effect of pest management on crop damage among other questions. Furthermore, experimental research in agricultural development could involve formulation and testing of hypothesis by actualising it on crops and farming vegetations, setting out a control group and comparing the results between treatment and control crops, analyzing of agricultural data to arrive at informed logical data-driven recommendations and conclusion. However, experimental research such as field experiments, pot experiments, laboratory experiments (CIMMYT, 2019) and on-farm trials (IFAD, 2018) are conducted to evaluate new technologies and practices, identify best practices in agriculture, to make inform policy and decisions in agricultural practices, to make improved production and sustainable agricultural practices as well as to enhance farmers' livelihoods and food security in agricultural practices. Experimental research could contribute to agricultural development by helping in evaluating how effective new agricultural technologies are doing, how to improve crop yields, how to enhance resource efficiency, how to develop climate-resilient agriculture, how to make informed policy and decision, how to reduce post-harvest losses, how to improved soil health, how to develop integrated pest management (IPM) strategies, how to enhance agricultural productivity and how to build capacity and expertise in agriculture.

Survey Research

Survey research in agricultural development is the collection and analyzing of data which may include the use of questionnaires, interviews, or observations in order to understand agricultural practices, attitudes, and behaviours. This research method helps farmers, agricultural professionals and stakeholders in agriculture to assess agricultural knowledge and adoption (IFAD, 2018), identify constraints and opportunities, evaluate program impact (World Bank, 2019), inform policy and decision-making and understand farmer needs and preferences. However, survey research in agricultural development may include *c*ross-sectional surveys, longitudinal surveys, panel surveys, household surveys and farm-level surveys. In addition to the above statements, survey research in agricultural development may help to understand agricultural practices and systems, identify areas for improvement, develop targeted interventions and evaluate program effectiveness and to make informed policy and decisions in agriculture. Some of examples of survey researches that could e made on farms include agricultural census, farm-level surveys, household surveys, and impact evaluations and needs assessments. Furthermore, survey research may contribute to agricultural development by making farmers to understand their needs, assess agricultural practices and identify areas for improvement and opportunities for innovation, to carryout program impact making farmers to carryout informed policy and decisions, identify knowledge gaps and areas for further research, develop effective extension programs, enhance

farmer livelihoods (IFAD, 2018), support agricultural planning, facilitate technology adoption that could help to develop effective strategies for promoting new technologies and build capacity for agricultural research.

Participatory Action Research (PAR)

This involves active participation of farmers, agricultural professionals, and other stakeholders in the research process. It is termed Participatory because the farmers, agricultural professionals and the stakeholders are directly involved in the research. Participatory research could help to empower farmers to take ownership of research and development (FAO, 2019), address local agricultural challenges and priorities, develop context-specific solutions, build capacity and knowledge among farmers and researchers and foster collaboration and networking. It involves identifying local priorities, co-designing research by the researchers and farmers and joint collection and analyzing of data by the farmers and researchers. However, agricultural participatory action research may be profitable by increasing relevance and adoption, building trust and skills of the farmers and agricultural professionals, encouraging creativity and innovation (IFAD, 2018) and promoting sustainability in agricultural activities.

On-Farm Trials

(OFTs) is an acronym of ***On-farm trials*** in agricultural development. It involves testing of new agricultural technologies, practices or innovations on the farmers' fields under the concerned farmers management and participation. The purpose of on-farm trials is to measure the effectiveness of the new technologies or practices on the farmers' fields (FAO, 2019). It assess how the newly introduced technologies or practices have been adapted and adopted in the agricultural field, OFT equally helps the farmers' to build their confidence and identify and address the their challenges and limitations of the newly introduced technologies. It helps the farmers to have and develop informed research and policy decisions through documented information (CIMMYT, 2020). OFT also helps to promote technology transfer and adoption of new technology among the farmers (World Bank, 2019) and agricultural professionals as it enhances collaboration and feedback between the farmers and the researchers. However, aside the creation of collaborative planning between farmers and the researchers, on farm trials helps in selection of farms that are used for representation purpose. It equally allows testing of the new technologies or practices with already existing farmers' practices and ensures data collection and monitoring. On farm trials also facilitates joint analysis and interpretation of results by the farmers and the researchers and transfer of the findings obtained on the farms and recommendations to other farmers.

Demonstration Plots

Demonstration plot is the farm land that is used for the new agricultural technologies, practices, or innovations to demonstrate to the farmers, agricultural professionals and other stakeholders. The reason for this is to demonstrate how effective the newly introduced technologies and practices are (FAO, 2019). Demonstration plot is also required to provide training to the farmers (IFAD, 2018) and extension agents and to facilitate adoption of any new technology.

Farmer Field Schools (FFS)

Farmer Field School (FFS) ensures participatory and interactive approach to agricultural development. It helps in bringing farmers, researchers and extension officers together for the purpose of learning and experimenting on the new agricultural technologies and practices (IFAD, 2018). However, FFS helps in empowering farmers' ownership of their learning and decision (FAO, 2019). It equally promotes sustainable agricultural practices and technologies (World Bank, 2019) as well as enhancing farmers' knowledge, skills and innovation (IFAD, 2018). Furthermore, it encourages the farmers, researchers, and extension officers to collaborate and address local agricultural problems.

Technology Transfer

Technology transfer is the method of sharing new agricultural technologies, innovations or practices from research centres, farmers, extension officers, and stakeholders. This method improves agricultural productivity and

efficiency (FAO, 2019), farmers' knowledge and skills, adoption of innovative practices, sustainable agriculture (World Bank, 2019) and solves local agricultural problems.

Monitoring and Evaluation (M&E)

M&E is the acronym of Monitoring and Evaluation. It is the logical collection and analyzing as well as using of data to assess the performance, impact, and effectiveness of agricultural projects, programs, and policies in agricultural development (FAO, 2019). This method helps in tracking progress and achievements, areas for improvement and helps in decision and policy formulation. It equally enhances accountability and transparency (World Bank, 2019), program design and implementation, impact and effectiveness and learning (IPCC, 2019) and knowledge sharing in agriculture.

Geographic Information Systems (GIS) and Remote Sensing

Farmers that want to succeed will need Geographic Information System (GIS) and Remote Sensing (RS). The above mentioned devices will help them in analyzing ad interpreting, monitoring and assessing the crop health, growth and yield (FAO, 2019). It will equally helps to identify and manage the agricultural pests, diseases, and nutrient deficiencies as well as helping to optimize irrigation, fertilizer and pesticide application on their farms. GIS and RS will equally help to predict and prepare for climate and natural disasters and to evaluate and improve on their agricultural policies (CIMMYT, 2020). More importantly, the devices enable them to practice sustainable agriculture and natural resource management on their farms.

Statistical Analysis and Modelling

Statistical analysis and modelling is one of the methods used in agricultural development to help the farmers, researchers, policymakers and stakeholders develop and implement effective agricultural development strategies. This method is used because it helps the farmers to develop data-driven statistical analysis that provides insights for informed decision-making (IPCC, 2019). It also facilitates improved crop yields (FAO, 2019), resource optimization (optimization of resource allocation and reduction of waste) (World Bank, 2019), risk management, food security and policy formulation aside other addendum benefits.

Methods Used in Rural Agricultural Development

I earlier stated in this research that development of Agriculture will lead to rural development. Therefore, there should be ways through which rural dwellers could be involved in agricultural development for their personal growth, community growth, income realization, sustainable agriculture and for the purpose food security in the country. Methods through which rural areas could be developed through agricultural development include Irrigation System Development, Crop Improvement, Agricultural Mechanization, Farmers' Training programme, Market Access, Rural Infrastructure Development, Agro-Tourism, Cooperatives and Collective Action, Digital Agriculture, Agricultural Financing, Soil Conservation, Water Harvesting, Livestock Development, Agro-forestry, Rural Entrepreneurship, Women Empowerment, Youth Engagement, Climate-Smart Agriculture and Agricultural Policy Support.

Irrigation Development

Irrigation development plays an important role in rural agricultural development. Provision of good irrigation systems in the rural settlement could help ensure reliable water supply to the farms which will accord the farmers in such a settlement opportunity to grow more crops and variety of crops (FAO, 2017) which will reduce dependence on a single crop and equally increase resilience and food security (World Food Programme, 2020) as well as increasing the income of the farmers in such a place (International Fund for Agricultural Development, 2018) Provision of irrigation systems in the rural area will help reduce water waste (International Water Management Institute, 2019) and ensure availability of water for the livestock and livestock production in the rural areas. It could also help in reduction of poverty through job creation in the agricultural field thereby reducing the mad rush for the cities

in search of job. Good irrigation systems could further help improve food availability, access to food and utilization as well as reducing hunger and malnutrition in the society. In addendum to the above advantages, good irrigation systems in the rural areas could help support sustainable agricultural practices, food security and sustainable agriculture as well as reducing environmental degradation.

Crop Improvement

Crop improvement can contribute to rural agricultural development through provision of improved crop varieties which could lead to higher yields (FAO, 2017), increased food availability and drought-tolerant crops (IFAD, 2018) that could help the rural farmers adapt to climate change (IPCC, 2019) and reduce crop failures due to pests and diseases. Provision of improved crops could help improve the soil health which could enhance the soil fertility and structure. It could also help to increase market access and enhance farmers competition in the market as well as improving the farmers' skills and decision-making.

Agricultural Mechanization

Agricultural mechanization could contribute to rural agricultural development in many ways. It could help in reduction of labour time and effort expended on the farm (IFAD, 2018) and equally increasing productivity and efficiency (FAO 2019). Agricultural Mechanization enables timely planting, harvesting, reduction in crop losses and improving crop management. Furthermore, it helps in reduction of waste and environmental impact and equally enables farmers to cultivate larger areas of land. In addition to the afore-stated, it facilitates increased production and income as well as reduction of labour costs (IFAD, 2018) thereby increasing the profitability for farmers in the rural areas. Moreover, it could improve crop quality, marketability and create jobs in manufacturing (World Bank, 2019), maintenance, and operation of agricultural machineries aside preventing reduction in post-harvest losses (FAO 2019). It is of no doubt that agricultural mechanization will help in enhancing food production increase and equally reduce hunger and malnutrition in rural areas.

Farmer Training

Training of farmers in the rural areas could contribute to rural agricultural development by enhancing farmers' knowledge and skills (FAO 2019) which could lead to better farming practices and increase in productivity (IFAD, 2018). Same training could facilitate adoption of new technologies adoption (CIMMYT, 2016) thought by researchers thereby improving efficiency and productivity as well. Training of farmers on the best farm practices and new techniques could increase crop yields and improved quality. Furthermore, the training could empower farmers to make informed decisions on farming practices and ability to manage their farms as businesses, It could also help to increase farmers income through improved productivity and market access, In addition to the afore-stated, it could improve nutrition and food security for rural settlement, promote environmental sustainability (FAO 2019), conservation, capacity building and social capital among farmers in the rural areas.

Market Access

Market access can contribute to rural agricultural development enables farmers to sell their products at better prices which will increase their income (IFAD, 2018) and make informed decisions on production and marketing. This equally enables them to compete with other producers (FAO 2019) which will improve their productivity and efficiency (World Bank, 2019). Access to different markets will reduce farmers' dependence on a single market, improving farmers' resilience and reduce post-harvest losses. It will equally improve the quality and quantity of sold products, increase production and improve food availability and security in the country. Furthermore, access to market will help to improve the bargaining power and livelihoods of rural farmers. In addendum to the previous advantages, it will help in creating of jobs, stimulating local economies; promote adoption of quality standards, quality of products and competitiveness as well as contributing to reduce poverty in the rural areas (World Bank, 2019).

Rural Infrastructure Development

Rural infrastructure development will contribute to rural agricultural development through

construction of roads, bridges, and transportation systems which will facilitate farmers' easy access to the markets at reduced transportation costs. Irrigation systems, Warehouses and Storage facilities are equally parts of infrastructures which will enhance crop growth, food security and reduce post-harvest losses and improve the quality and quantity of products from the rural areas (IFAD, 2018). Provision of communication networks and rural electrification will also enable farmers to access market information, weather updates and extension services easily and supports irrigation, farm products processing as well as storage in the rural areas. It equally facilitates access to clean water for livestock production, human consumption and soil conservation. Housing, schools, and healthcare facilities are also infrastructures that will help stimulate rural economies, jobs creation and economic opportunities as well as enhancing the quality of life for rural areas (World Bank, 2019).

Agro-tourism

Agro-tourism is another way of contributing to rural agricultural development through provision of additional income for farmers, reducing dependence on single crops (IFAD, 2018). It creates jobs (FAO 2019) in hospitality, and management and promotes agricultural products and rural areas thereby increasing awareness and demand by the tourists. It equally adds values to agricultural products, such as farm-to-table experiences, stimulates rural development and improving infrastructure and amenities and equally preserves rural cultural heritage, traditions, and practices (UNESCO, 2019). It is no doubt that agro-tourism will promote environmental conservation, support sustainable agriculture, fosters community engagement, enhancing social capital and community development. Furthermore, it will provide opportunities for skills development and promotes local food production by increasing food security and reducing reliance on external or foreign products.

Cooperatives and Collective Action

Cooperatives and collective action will contribute to rural agricultural development by enabling the farmers to pool resources together to increase their bargaining power (FAO 2019) and reduce costs (World Bank, 2019). This will also make the farmers to negotiate better prices to improve the market access for their members (IFAD, 2018) and equally share knowledge, skills and practices as well as improving productivity and efficiency (CIMMYT, 2019). It provides risk management facilities like insurance and credit, quality standards and empowers small-scale farmers by improving their participation in decision-making. Cooperatives and collective action further contributes to rural development by promoting sustainable agriculture, conserving natural resources and protecting the environment.

Digital Agriculture

Digital agriculture can equally contribute to rural agricultural development by enabling precise management of crops (FAO 2019), soil, and water, increasing efficiency and productivity. It allows farmers to make informed decisions (CIMMYT, 2019) thereby reducing risks and improving yields as well as creating online platforms to the farmers to improve on their farm business.

Agricultural Financing

Provision of finance by the government, financial institutions, NGOs' or cooperate bodies will enable the rural farmers to overcome financial barriers to invest in their farms (IFAD, 2018) and contribute to rural agricultural development. Through helping hands, farmers can adopt new technologies to improve efficiency and productivity (FAO 2019), expand production, improve food security and income and create employment opportunities in the rural areas (World Bank, 2019). Furthermore, agricultural financing will reduce poverty by increasing farmers' income, increase food security and stimulate rural economic growth.

Rural Entrepreneurship

Rural entrepreneurship can contribute to rural agricultural development by creating employment opportunities in rural areas thereby reducing migration to urban centres (IFAD, 2018) and creates innovations to solve agricultural challenges and equally promotes diversification of income by reducing

dependence on single crops. It further stimulates rural economic growth, increase income and reduce poverty as well as improve food security (World Bank, 2019).

Youth Engagement in Agriculture

Youth engagement is another way of contributing to rural agricultural development. Through youth engagement, new ideas and technology as well as continuity and knowledge transfer could be achieved (World Bank, 2019). New jobs can be created to stimulate local economies (IFAD, 2018). It could help farmers' access new markets and diversify their products, increasing income (IFAD, 2018). Youth involvement could help bridge rural-urban gaps by connecting farmers to urban markets and services, improve agricultural skills and knowledge, influence agricultural policies and programs as well as improving agricultural products and sales (FAO 2019).

Results

It could clearly seen from the research that agricultural development will Increase the crop yields, productivity, food availability and access to Improved food which in variable will enhance the food security of the country. It could also be seen that agricultural development will also lead to reduction in poverty level because people in the rural communities will be gainfully employed which will prevent the mad rush of their youths to the cities in search of the white collar job which is not available. Furthermore, agricultural development will facilitate economic growth and transformation of the rural areas of any country through provision and availability of infrastructures and modern equipment which are required and must be used for agriculture in the rural areas. This will equally improve rural livelihoods and reducing migration to the cities. Furthermore, agricultural development will reduce environmental degradation, improve natural resource management and enhance resilience to climate change impacts. In addition to the afore-stated statements, it will improve nutrition and health outcomes as well as strengthening rural-urban linkages, promote economic growth and development aside promoting sustainable agriculture and ensuring long-term environmental sustainability.

Recommendation and Conclusion

This research shows that that agricultural development has greater positive impacts on the rural communities in many ways. However the following under-listed recommendations are made through my research. Small scale farmers, youths, and women should be included in the agricultural policies implementation and development for their betterment, acquisition of skills and contribution toward agricultural and rural development. Furthermore, the government, stakeholders, institutions, entrepreneurs as well as agricultural lovers should be encouraged to invest in agricultural research and development in order to improve productivity, efficiency, and sustainable agriculture. Infrastructures (such as roads, storage, electricity, and irrigation systems among others) in the rural areas must be improved to develop the rural communities in order to enhance food security and sustainable agriculture in the country. In addendum to the afore-stated, sustainable agricultural practices (such as organic farming, perma-culture, and agro-forestry among others) must be promoted in the rural areas to enhance agricultural development. Also, rural entrepreneurship (such as trainings, mentorship and access to finance) and innovation must be supported for enhancement of livelihoods in the rural communities. There should also be collaborations and partnership among the government, private sectors, civil society and institutions of research for the purpose of agricultural and rural development. Moreover, there should be easy access to both the local and online market for the rural farmers to improve their opportunities, income realization, addition of values and competitions with other countries and international farmers. Furthermore, the climate change and environmental degradation issues should be addressed through sustainable agriculture and natural resource management. Rural social services such as the healthcare, education, and social protection should be enhanced for the purpose of the rural community development. Finally, agricultural and rural development programmes to ensure impact and

effectiveness should be continuously monitored and evaluated for the progress of rural livelihoods.

Agricultural and rural developments are essential for achievement of sustainable development, reduction of poverty, and improvement food security in any country. If the governments, private sector and civil society can work together and the above-stated are recommendations and implemented, the rural areas can be transformed into effervescent and wealthy communities. To achieve the said purpose, there should be a total commitment to inclusive, sustainable, and equitable agricultural and rural development that will benefit all stakeholders. In conclusion, every country can create a more food secure, prosperous and sustainable future for the present and the generation yet unborn by prioritizing agricultural and rural development.

References

African Agricultural Finance Facility (2020). Digital Agriculture in Africa.

African Agricultural Research Network (2020). Monitoring and Evaluation

Asian Development Bank (2020). Digital Agriculture in Asia.

Borlaug, N. (2007). Feeding a Hungry World.

CIMMYT (2019). Agricultural Knowledge Sharing Platforms.

CIMMYT (2020). Digital GIS for Agriculture.

CIMMYT (2016). Mechanization for Sustainable Agriculture.

European Union (2020). Digital Agriculture in Europe.

European Union (2020). Technological Transfer.

FAO (2019). Agricultural Mechanization: A Key Driver of Sustainable Agriculture.

FAO (2019). Rural Entrepreneurship for Sustainable Agriculture.

FAO (2017). The Future of Food and Agriculture: Trends and Challenges.

FAO (2019). Youth Engagement in Agriculture.

Gebbers R., Adamchuk V. I., & Hummel, J. W (2017). Precision agriculture and food security. *Journal of*

Experimental Botany, 68(16), 3289-3299.

GEN (2020). Rural Entrepreneurship and Innovation.

Goyal, M. K., Bharti, B., & Gupta, P. K. (2016). Precision Irrigation Management uusing Remote Sensing

and GIS. *Journal Of Irrigation And Drainage Engineering*, 142(4), 04015019.

GYIN (2020). Youth Innovation in Agriculture.

Harvest-Plus (2020). Bio-fortification: A Game-Changer for Nutrition.

IFAD (2018). Digital Agriculture and Rural Development.

IFAD (2018). Rural Development and Agricultural Growth.

ILO (2020). Rural Entrepreneurship and Employment.

ILO (2020). Youth Employment in Agriculture.

Inter-American Development Bank (2020). Agricultural Financing in Latin America.

International Institute of Tropical Agriculture (2020). Monitoring and Evaluation.

International Telecommunication Union (2020). E-Agriculture.

IPCC (2019). Climate Change and Land: *an IPCC special report*.

IPCC (2019). Technological Transfer for Climate Change Adaptation.

Kamilaris, A., Kartakoullis, A., & Prenafeta-Boldú, F. X. (2019). A Review on the Practice of Big Data

Analysis in Agriculture. *Computers and Electronics in Agriculture*, 156, 427-443.

Klerkx, L., Jakku, E., & Labarthe, P. (2019). The Role of Digital Extension Services in Agriculture.

Journal of Agricultural Education and Extension, 25(2), 147-162.

Kumar, P., Kumar, V., & Mahapatra, S. K. (2019). Hyper-local weather forecasting using IoT and

machine learning. *Journal of Intelligent Information Systems*, 54(2), 257-273.

Liakos, K. G., et al. (2018). Machine learning in agriculture: A review. Sustainability, 10 (11), 4226.

National Agricultural Research Institute (2020). Monitoring and Evaluation.

National Agricultural Technology Project (2020). Digital Agriculture in India.

OECD (2018). Rural Development Policy.

Sladojevic, S., et al. (2016). Deep Neural Networks for Plant Disease Detection. *Journal of Intelligent*

Information Systems, 47(3), 541-554.

Troxel, A. B., et al. (2019). Market Intelligence for Farmers: A Review. *Journal of Agricultural and*

Applied Economics, 51(2), 249-265.

United Nations Development Programme (UNDP). (2019). Sustainable Development Goals.

Wang, X., et al. (2019). Soil Analysis and Nutrient Management using Machine Learning. *Journal of*

Environmental Quality, 48(5), 931-938.

World Bank (2019). Agricultural Mechanization in Africa.

World Bank (2019). Rural Development and Poverty Reduction.

World Bank (2019). Rural Entrepreneurship and Agricultural Productivity.

World Bank (2019). Youth and Agricultural Innovation.

Xinhua News Agency (2020). South-North Water Transfer Project.

Zhang, J., et al. (2019). Crop Monitoring using Drones and Machine Learning. *Journal of Field Robotics*,

36(5), 851-863.