

# Exploring Youth Participation in Food Production through Smart Agriculture: The Cool Factor

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## **Abstract**

Africa has highest percentage of arable land and high percentage of its total population is a youthful population, yet it is faced with food deficit. At the same time Africa's unemployment records an all-time high. This disconnect point to underutilization of one or more factors of production to facilitate food security, This paper explores various ways in which youth can be engaged in food production by changing the perception of agriculture to be a cool profitable career engagement thus increasing food security and employment. The engagement by the youth in agriculture need not be perceived in the traditional farming but an involved in all aspects of food security chain. This can be achieved through engaging the youth in the development and application of modern technology especially in ICT, focused on food production chain.

**Keywords:** Food Security, Farming, Youth, ICT, Agribusiness, employment Agropreneurship

African food insecurity remains high. About 21% of total African population was facing hunger by 2020 (ref). On the other hand Africa records the highest percentage of arable land with 70% percent of its total population being a youthful population of below 35 years. This point to underutilization of one or more factors of production to facilitate food security. According to Donkor (2021), Africa on paper presents the lowest unemployment rate globally among youth aged 15 to 24 (10.6 percent in 2021, according to the International Labor Organization). However, the majority of Africa's youth work informally, and many are underemployed or remain in poverty despite working due to low wages and the lack of a social safety net, making it difficult to compare African countries to more advanced economies.

This study aims at exploring how ICT innovations applied in the agriculture sector of Africa can draw the youth's interest in not only farming, but in food production process and supply chain. Various technologies can be used in enhancing positive perceptions of agriculture by the youth. The paper adopts systematic review of literature. The literature search included peer reviewed research articles including several online databases and search engines such as Google scholar, Science direct, Web of science and this was based on studies on youth in agriculture in Africa published between 2010 and 2022. Relevant policy documents were also consulted, obtained from various websites of organizations involved in Agriculture in Africa.

### ***Why Youth and Agriculture?***

Youth in a country exhibits the most active part of the population and the most important area of its productivity. This is why integrating this group of the population into the socio economic and political agenda or program is considered crucial for development initiative anywhere in the world (Adigun, Bamiro and Oyetoki, 2017). Ahaibwe, Mbowa, & Lwanga, (2013), points out that agriculture remains a key sector where majority of the youthful and unemployed labour-force can be employed in Africa. The term youth refers to the period of adolescence during which young people make the transition from childhood to adulthood, become sexually mature and experience increasing social and economic autonomy. It is a transition period from the parent's dependency to economic independence as well as social maturity. It can also be seen as a social category that is historically and culturally constructed (Maina, & Maina, 2012). This group also entails millennials that are technologically savvy and mostly connected to the internet albeit the infrastructural limitations in Africa. In line with the African Youth Charter (Trivelli & Morel 2020), Botswana and Kenya similarly define youth as people from the ages of 15 – 35 years (Government of Kenya, National Youth Policy 2002, Botswana National Youth Policy 2010). However, for the employment and contracting purposes the youth is defined as people from the ages of 18 – 35 years (The Youth Enterprise Development Fund (YEDF) 2011).

Geza et al (2021) emphasizes the need to define youth participation so as to understand the link between the youth and agricultural development. They define youth participation as the active engagement and influence of young people who are not only passively present but impact decisions, processes and resultant output. Several challenges have been ascribed to the

lack of youth participation including poor or limited infrastructure, lack of access to finance, production inputs and resources, markets, extension services and training (Geza et al, 2021). It has also been noted that non-participation and/or withdrawal of the youth in agriculture is higher than that of the older cohorts although a significant proportion of the youth still derive their livelihood from agriculture. The shift from agriculture is also aggravated by the growth of the services sector hence a bias towards the services sector especially among the educated youth. Apparently, the agriculture sector is not looked at as a viable sector of employment, and remains highly unattractive to the youth due to associated risks, labour intensity and low profitability (FAO, 2012). Geza et al (2021) also notes that Africa acknowledges agriculture as a sector that could drive socio-economic transformation and allow for broader participation of marginalized groups including women and youth, however, they also note that the extent to which the intent has translated to desired outcomes remains a mystery.

Despite the shortcomings and negative perceptions associated with agriculture, opportunities exist with some yet to be explored especially with the advent of technology. This conceptual review therefore, aims at exploring various ways in which youth can be actively engaged in farming and food production as well as how youth perceptions towards agriculture can be altered for them not perceive agriculture as the last resort but a cool and profitable career that contributes immensely to food security. The primary hypothesis is that lack of an integrated and technology enthused focus in agriculture influences the non-participation of youth. Specifically the paper addresses the following objectives;

- Identify the effect of technology on youth participation,
- Explore how ICT innovations applied in the agriculture sector of Africa can draw the youth's interest in not only farming but in food production process and supply chain,
- Identify neglected and undersold areas in the food production value chain that youth align with and could participate in.

According to Maina, & Maina, (2010), African farmers are ageing and the implications are negatively staggering; not only for food security but also for transfer of necessary knowledge, skills, expertise and techniques and for employment and economic development. While the average age of farmers in Brazil is 52, it is 57 in the USA and 60 in Africa. In fact, agriculture is perceived to be post retirement engagement. Maina, & Maina, (2015) noted that this is made worse in Africa by the non-attractiveness of agriculture to the youth who prefer migrating to the cities than work in the rural farms. Akpan (2010), noted that there is no conscious succession planning, thus the old farmers in Africa as majority of the youth do not see the value in following their parent's footsteps. This is as a result of the poor profitability and glamour that goes with farming in Africa and while this trend is not limited to small-holder farmers, it permeate to the agricultural research institutions which report a disproportionately large number of staff close to retirement age. According to Ashford, (2007), this short-sightedness is presently impacting the agricultural sector, with increasingly fewer qualified mentees to pass on knowledge and skills to the new generation.

The engagement of youth in agriculture would go a long way in creating youth employment to attain economic sustainable livelihoods; offer one on one job opportunities, support those still looking for jobs and establishing youth public works and labour intensive programmes, which would be meeting Botswana national youth policy strategies 5.1 (Vi, Vii and xi). As an example, according to World Bank Data (2022) the Botswana youth employment is estimated to be 45.5% while Kenya is 13.6. This is not much different in other sub-Saharan Africa. According to Farah, & Ali, (2018), Employment is major problem not only in Kenya and Botswana but the whole of Africa. It has made young university graduate to be demoralized. Unemployment rate has raised to about 40% of youth with requisite skills and qualification. This effect of unemployment and the relationship between creation of opportunities and the growth of the economy.

The youth with a rural background cope easily with professional and technical work in agriculture (Aphunu and Atoma, 2010). While many still view formal job creation in the formal wage sector as the solution to youth unemployment, prospects of finding this kind of employment is limited as the number of people entering the labor force far outweighs the number of jobs available in the formal wage sector.

While youth participation is deemed a contributory factor to the growth of any nation's economy, several factors inhibit or facilitate their involvement that needs the attention of policy makers, scholars and practitioners. These include:-

### ***Perception***

According to Ojha, et, al., (2017), Davies, (2008), perception of limited economic and social opportunities in rural areas compared to the metropolitan areas drive youth from rural areas where agriculture is the main economic activity. It was noted that the association of rural social opportunities with terms such as 'hot hard work', 'long suffering farmers' and 'isolation' were also common, and were frequently associated with negative comments about rural social issues such as youth suicide and rural decline. According to Elias, Mudege, Lopez, Najjar, Kandiwa, Luis, & Bentaibi, 2018), agriculture was perceived to be a stop gap between the aspiration achievement of goals promised by their education for securing the formal employment which seek yet unfulfilled, and thus they continue to farm in their family's production. They also noted that gender disparity exist, with more young women engaged than men. However, while some young men aspired to engage in knowledge-intensive or 'modern' agriculture, young women did not express any such interest.

### ***Social structural changes***

Doitchinova, (2019) noted that structure affected agriculture in Europe. More demands were placed on Agriculture products, resulting in the reduction of land under-cultivation as most farmers were not able to profitably meet those requirements. Doitchinova, (2019) and Vogel (1994) noted that most countries had to adjust simultaneously to both a market-oriented economy in a pluralistic society as well as a supranational framework regulating many policy-making processes, particularly with regard to agriculture. Ojha, et

al (2017), noted that socio-cultural changes has favoured out-migration; evolving economic opportunities that make farming less profitable; and a policy context in which the gravity of the land subdivision to uneconomical portions as well as abandonment of land challenges goes unrecognized. This makes farming or food production to seem as unattractive venture to youth.

### ***Dearth of infrastructure:***

According to Ng'atigwa, Hepelwa, Yami, & Manyong, (2020) small-scale agriculture is the developing world's single biggest source of employment, and with the necessary support it can offer a sustainable and productive alternative to the expansion of large-scale, capital-intensive, labour-displacing corporate farming. However, rural areas are notably more deficient in physical and social infrastructure than urban areas, leading to rural-urban migration with the attendant removal of youths from the rural areas where agriculture is mostly practiced. Pelzom, & Katel, (2018) and Ng'atigwa, Hepelwa, Yami, & Manyong, (2020), Giuliani, Mengel, Paisley, Perkins, Flink, Oliveros, & Wongtschowski, (2017) also noted that the availability or lack thereof of facilities during harvesting, handling, and storage, ICT and other infrastructure needed in agriculture affect the perception of youth on farming as un –or- profitable.

### ***Lack of research base***

According to Pardey, Chan-Kang, Dahmer, Beddow, Hurley, Rao, & Alston, (2014) agricultural R&D is a crucial determinant of agricultural productivity and production. However there is an inherent lag, between when R&D investment takes place and when it comes to fruition, as well as where the research is carried since this gives a substantial innovative edge to the higher income countries where most of this R&D takes place. Youth in Africa seldom engage in agriculture or agriculture research. According to Kruijssen, (2009) the involvement of youth in agriculture research is limited. It was noted that 56 percent workers in Senegal is older than 50 years while in Ghana and Kenya, 35 percent of staff is older than 50 years. There is frighteningly thin research about situations in which particular groups of young people engage or do not engage in agriculture or agriculture research. According to Sharma, (2007), Maina & Maina, (2015) the demography of agriculture is changing fast. There are clear signs of young people fast moving out of agriculture.

### ***Lack of information on agribusiness opportunities***

According to Maina & Maina, (2015) a lot of young people struggle to access information on agriculture and agribusiness. They are not even aware of the enormous range of opportunities obtainable in the sector. Most perceive agriculture from the production perspective. Muthomi, (2017) noted that, apart from poor infrastructure, lack of access to capital, lack of information on agricultural opportunities, a futile career guidance is one of the change that hinder youth engagement into agriculture. Massive emphasis need to be invested in making information easily accessible in schools, libraries and local municipalities. Negi, & Anand, (2015) Das, Mandal, & Mohanty, (2021) also highlighted the lack of information regarding the prices in the market, demand, food processing units as one of the

challenges that hinder youth into agriculture. Availability of business opportunities through the cycle of agribusiness can drive the desire for engagement of in agriculture among the youth. In addition there is also a need to look into new policies to ensure availability of information on opportunities in agriculture that best reflect the current economic, social and political climate. Equal focus needs to be invested in the implement of these policies as in some instances a lot of policies have not seen the light of the day. Maina & Maina, (2015) also noted that there is a general lack of information and data on numbers of and types of farms, on agricultural and rural households and their characteristics, agricultural activities that youth engage in as well as weak capacity to link the welfare and income of the different types of rural and agricultural households with agricultural production.

### ***Disconnect between agricultural education and practice***

According to Maina & Maina, (2015) young people are being educated on the local and global agricultural systems. Wingenbach, Boyd, Lindner, Dick, , Arispe, & Haba, (2003), and Gill, Ricciardi, Bates, & James, (2017) noted that the disinterest in farming among the youth may stem from a disconnect between “real world” events and the government policies. The availability of farm inputs, extension services as well as market information, are usually scarce in most Africa markets while the government policies though attractive in paper rarely translate to reality on the ground especially in view of the global events that may and usually impact agricultural practices worldwide. A good example is in where Cambodia only 2.3% of all bachelor's' students are studying the agricultural sciences. The disconnect between the supply and workforce needed in agriculture and the disconnect between agriculture and agriculture education, seems not to be bridging the gap between theory and practice necessary for farming labour. It is worth noting that only 20% of graduating secondary seniors base their decision on what to study on the labor market, while 70% followed their parents advise who after toiling in the farms with little or no income to show, encourage their children to venture into other franchise other than agriculture. Higher unemployment levels, especially among the youth, suggest that work and education are failing as key routes by which people move out of poverty, and as crucial mechanisms linking economic growth to poverty reduction. This is true for agriculture sector skills as any other. African agricultural graduates often lack practical skills, will and competences required for successful engagement in agropreneurship.

### **Types of agriculture youth engage in**

In their Research on young people's engagement with agriculture in Malawi, Ethiopia, and Kenya, Ascitti, Pont,& Sumberg, (2016) noted that although there are trends of youth turning away from agriculture, the absolute numbers of youth who are dependent on farming or livestock production is likely to increase because of population growth. They also noted a strong evidence for research, use of technology, and need of high productivity and access to land as determinants for youth engagement in agriculture. The use of Information and communication technologies (ICTs) is already bringing new vibrancy and potential to agricultural practices around the world. Young people are more ready and eager to master these new technologies and apply them to agriculture to increase productivity and solve



challenges. At the same time, these technologies can help demonstrate to youth that agriculture can be a viable and profitable business opportunity, increasing the desirability of agriculture related career paths (Chipfupa, & Tagwi, 2021).

Chipfupa, & Tagwi, (2021) noted that though, the traditional indicators are critical to youth engagement in farming, the psychological traits of the youths themselves are equally important. There is a need to understand the youth's endowment to better explain their decision-making behavior as well as recognizing heterogeneity in the youth groups. This calls for policy makers not to ignore the contextual, gender, talents, and interest as other non-cognitive differences of the youth in order to ensure appropriate utilization youth as resource-base in agriculture and food production

Chipfupa, & Tagwi, (2021) identified ten different types of youth based on cognitive and non cognitive differences which call for a different approach while employing youth in agriculture and food productivity. This would ensure that they fit in to the role of either directly engaging in agriculture or completing the farmers so as lead to an increased food production; the identification is possible from schools or home and talents channeled towards productive contribution in agriculture.

- In the first dimension are youth who are the beneficiaries of agricultural support programmes and can easily access to agricultural training and extension services.
- In the second dimension were older youths, experienced in farming with access to land.
- In the third were self-confident young people who exhibit some leadership qualities.
- The fourth represented youths who believe that agriculture is not for the educated and have no faith in the potential of farming providing a livelihood to young people.
- In the fifth were educated youth who are well endowed with assets.
- The sixth represented youth whose networks have a negative attitude towards agriculture and have no or limited access to credit.
- In the seventh were male youths who are members of agriculture cooperatives.
- In the eighth are optimistic young people who believe that agriculture could be operated as a business.
- The ninth represents youths who have not seen the benefit of engaging in agriculture; these youths are also more independent and enjoy working alone.
- In the tenth are youths who lack financial skills

While these typology is not sufficient, it may provide direction in the youth engagement. However a more thorough and localized analysis of youth is needed for better engagement in agriculture and food production.

According to Ayim, Kassahun, Addison, & Tekinerdogan, (2022), the traditional approaches of agriculture has numerous challenges in terms of productivity as well as marketing. This

has led to the adoption of social media in agriculture. The use of mobile phone especially in Africa is growing rapidly. Countries like Botswana and Kenya have 150% and 109% connectivity respectively with high percentage being smart phones capable of 4G networking. Lathiya, Rathod, & Choudhary, (2015) and Balkrishna, & Deshmukh, (2017) found that social media is very useful tool in agricultural marketing. The people both in rural and urban areas are now much more connected to sources of information and each other. Utilizing these channel to promote agriculture and educate young people has started to bear fruits as young people use the mobile connectivity to get the market information, product sourcing as well access advise on the challenges faced in farming including access to finance and agricultural extension services howbeit limited. This has resulted in adoption of precision agriculture (Ofori, & El-Gayar, 2021).

Another area that youth has potential is the utilization of their Strengthen higher education in agriculture. Linking advance in technology, to facilitate research and innovation that has greater relevance to a diverse and evolving agricultural sector, can not only facilitate interest in agriculture and food production, but can be a catalyst in high food productivity. A focus on agribusiness and agripreneurship need to shift from the mere farming to incorporate all aspect of agribusiness, supply chain upstream and downstream. This calls for education and research in all spheres of agriculture from farming, marketing, mechanization, climate & geosystems, deceases control, logistics and post-harvest preservation, value additions, among other areas. In all these research and education spheres, youth can get involved in, without necessarily engaging in cultivation but participating in other areas. Beyond technical skills, building capacity for management, decision-making, communication and leadership, this will go a long way in getting youth involved in food production and generating employment for the youth.

According Sushanth, & Sujatha, (2018), smart farming is an emerging concept especially the use of evolving Information and Communication Technologies (ICT) in agriculture. The use of IoT sensors capable of providing information about the agriculture fields as well as Monitoring environmental factors is a major factor in improving the yield crops (Gupta, Khosravy, Gupta, Dey, & Crespo, 2020). Smart agriculture makes greater use of Information and Communication Technologies (ICT) especially the evolving technology (Prathibha, Hongal, & Jyothi, 2017). Smart farming is an emerging concept, because of application of IoT sensors in agriculture fields. The role of light mobile phone equipped with evolving technology can go a long way in enabling the farmers to scan the field using geosystems as well as enable them better anticipate changes in the farms and scan for diseases (Mishra, 2021). Not only can ICT be used to educate and train those unable to attend higher education institutions but it can also be used as a tool to help young people spread knowledge, build networks, as well as find employment. Catering adequately addressing the needs of a technologically savvy generation will require technological solutions in the agricultural sector.



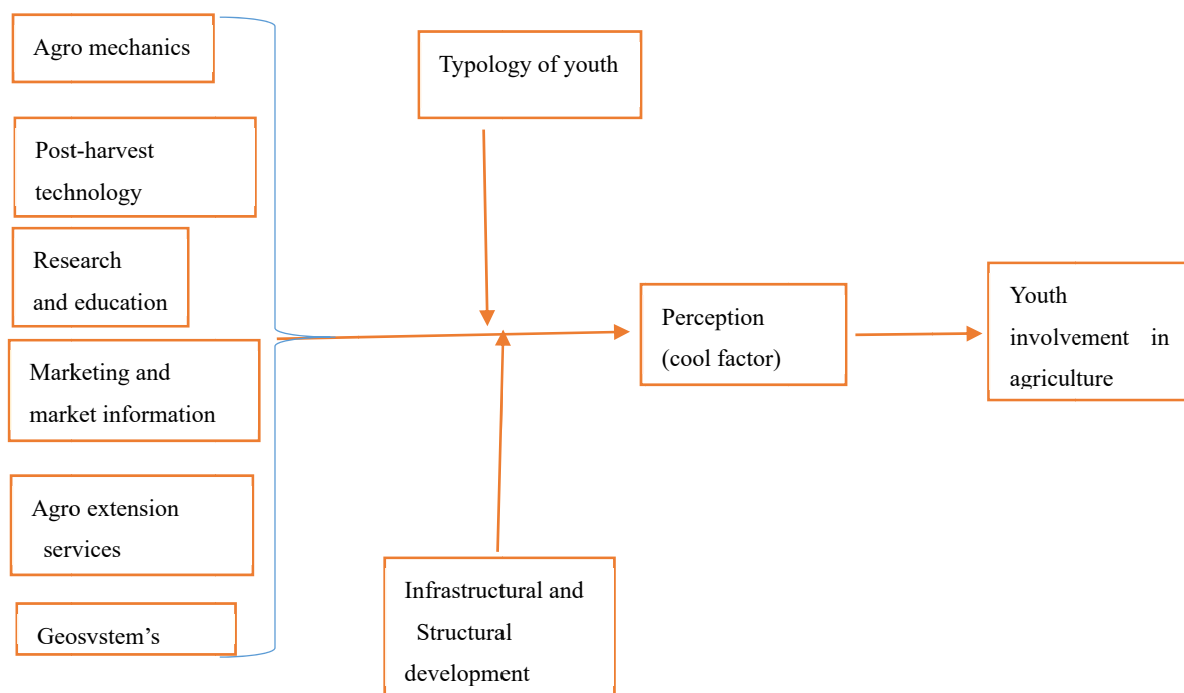
## **Bridging the youth to Agriculture with ICT the cool factor**

In countries such as Botswana and Kenya agriculture employs 75% (Moreki, Koloka, Nthoyiwa, Moloi, & Palai, 2011, Onyalo, 2019,) of the rural population. According Ayim, Kassahun, Tekinerdogan, & Addison, (2020), about 70% of the African population depends on agriculture for their livelihood, which makes agriculture the most critical sector within the economies of the African countries. Diao, Hazell, & Thurlow, (2010) noted that although there has been some skepticism, drawing on economy-wide modeling, these case studies contrast the effectiveness of alternative growth strategies in reducing poverty, the conventional wisdom about agriculture's contribution to the development process can still be applied to Africa today. Allen, Heinrigs, & Heo, (2018) noted that agriculture and related food industry the biggest employer in West Africa accounting for 66% of total employment, with the majority of food economy jobs are in agriculture, off-farm employment in food-related manufacturing and service activities. Nonetheless, agricultural productivity is low and food insecurity is still a challenge (Ayim, Kassahun, Tekinerdogan, & Addison, 2020). Moreki, Koloka, Nthoyiwa, Moloi, & Palai, 2011 noted that the contribution of agriculture to the GDP in Botswana has fallen from 40% at independence to 1.7% in 2011 and 2% in 2017 irrespective of it employing about 70% of the rural population. According to David, & Grobler, (2019). Innovative agricultural practices requires the farmers to be provided with factors of production which include land for agricultural production, agricultural skills, farm implements and (Information Communication Technology) ICT gargets for information dissemination for effective food production

In recent years, several initiatives in using ICT to improve agriculture productivity has been introduced (Ayim, Kassahun, Addison, & Tekinerdogan, 2022). The traditional approaches of agriculture being adapted, has numerous challenges in terms of production, marketing, profit etc. The challenges of the traditional agriculture are addressed significantly by using Information and Communication Technologies (ICT) (Allen, Heinrigs, & Heo, 2018). Due to the nature of agriculture in Africa, it has become indispensable to explore various ways to keep our farmers updated on relevant information and the available modern technologies. According to Singh, Ahlawat, & Sanwal, (2017), the development and timely dissemination of better personalized technologies specific to different agro-climatic conditions, size of land holding, soil type, type of crops and related pests/diseases is the real issue to brazen out ahead for the agricultural scientists/experts. The timely availability of right information and its proper utilization is indispensable for agriculture. Ayim, et al, (2022) noted that the growth and development of the agriculture sector can be achieved through the effective deployment of Information Communication Technology (ICT) in Africa since ICT has been a significant contributor to the growth and socio-economic development in countries, where ICT is deployed effectively. Ayim, et al, (2022) and Singh, et al, (2017) notes that innovative ICT solutions ranging from computers, radio, television, and mobile phones to advanced technologies such as blockchain, artificial intelligence, cloud computing, Internet of Things (IoT) and big data analytics are among the current trends required to be applied in agriculture. These disruptive ICT trends hold the potential to contribute to sustainability transitions in agriculture by increasing efficiency, enhancing transparency, and traceability. In marketing

study by Nwafor, Ogundeji, & van der Westhuizen, (2020) noted that the use of ICT was significantly related to the age, additional income, membership of a cooperative of the farmers, which had a bearing in the market participation. ICT has revolutionized the world with an increasing number of activities replaced by ICTs. The youth have also been found to easily assimilate technology. This study aims at exploring how ICT innovations applied in the agriculture sector of Africa can draw the youth’s interest in not only farming but in food production process and supply chain. Various technologies can be used in enhancing positive perceptions of agriculture by the youth. These technologies would ensure that young people are engaged in agriculture, by doing what they love from the location they enjoy residing and not necessarily being in the rural farms cultivation.

Smart Agriculture involves several human capital inputs that youth can deliver using the technology and thus getting involved in agriculture.



### Technologies application in smart farming of interest to youth

#### ***The smart agro machines and technology***

According to Daum, & Birner, (2020), agricultural mechanization has largely been neglected following the earlier failures of state-led mechanization programs as well as myths that mechanization leads to unemployment. Most governments in Africa, development practitioners and private companies have rediscovered agricultural mechanization as a top priority in ensuring high food productivity. Pingali, (2007) noted that over the past half a century developing regions, developing countries have seen labor-saving technologies adopted at unprecedented levels. This includes in areas such as land preparation, harvesting and threshing operations among other. However the African region has lagged behind this

development, adopting more labour intensive production methods. Adoption of climate smart farming has also been on the rise as sensitivity to the environmental demands increases. However, farmers in Botswana still lag behind in adopting climate smart farming methods such as hydro and aqua phonics systems. Although farmers in Botswana are aware of climate change and the adverse effects therefrom, they still adopt conventional agricultural practices (Mugari, Masundire and Bolaane, 2020). An increasing number of youth farmers have adopted smart farming practices. In order to increase productivity, the adoption of mechanical technologies could help enhance agricultural productivity and lowered the unit cost of crop production. Countries like Kenya and Botswana that have high a percentage of youth ratio and highly educated and unemployed youth rate, can use this in creating jobs for the youth in machine innovations, machines production as well as in the application of these machines in farming.

### *Post-harvest technologies*

According to Rugumamu, (2009) Major post-harvest processes in developing countries includes farm field; products en-route; homestead and storage. All activities are usually carried out by both men and women at varying participation levels using unimproved technologies. Losses at each process are varied yet farmers perceived the greatest loss occur during storage. Baributsa, et al (2014) noted that addressing post-harvest losses requires cost-effective technologies with effective strategies to disseminate them. A Large-scale extension activities substantially increase the demand for the technology and help establish the supply chain, thus increasing youth employment. Adom, (2018) noted that the sorry state of the agricultural economy as a result of postharvest losses is not only in the Ghanaian household but in other developing and developed countries. Unfortunately, only 5% of resource allocated for agricultural research is assigned to post-harvest research by governments in developing countries. A an increase in research would stem out the losses as well as provide well needed job for the youth , both in the innovation of post-harvest technology as well as their applications.

A study undertaken to evaluate the knowledge level of farmwomen and rural youth towards training programmes on post-harvest technology noted a marginal involvement in India. It was found that the large proportion of young female farmers aged (26–35), belonging to medium socio-economic status and had medium state of modernization. Enough gain in knowledge regarding post-harvest technology was recorded as well as preservation technique, preservative, post-harvest machinery equipment, selection of raw material and packaging knowledge. The training indicated significant increased knowledge level of trainees effectiveness from 13.33% to 86.66%. This proves that if youth are well trained in the well-motivated on, would benefits of post-harvest technology, post-harvest handling methods and packaging materials to be used by farmers and other actors in developing countries in Africa can gradually replace local methods and adopt new innovative technologies to avoid post-harvest loses

### *Research/ education*

While social, health and wellbeing benefits of agriculture and food production are well documented, there is a major knowledge gap in terms food production and its accessibility by the city population as well as the processes of production. According to Lockeretz, & Anderson, (1990) involvement of farmers in sustainable agricultural research can have important benefits as farmers originated many sustainable agriculture ideas and innovations. This can contribute a valuable perspective different from that of other researchers in institutions. This is why it necessary for the youth to be involved in agricultural research. Moreover, although farmers can bring valuable insights to research, these alone will not be enough to ensure that a sustainable agriculture research program. Current and smart farming would require an appropriate mix of applied versus basic, short-term versus long-term, and component-level versus system-level studies. The mix need to include the citizen science. Local farmers have great wealth of knowledge in production, types of suitable crop as well as post-harvest preservation methods. This is known as citizen science or indigenous knowledge. Ryan, Adamson, Aktipis, Andersen, Austin, Barnes, & Dunn, (2018) noted that citizen science, which we define broadly to include research in which non-scientists play a role in project development, data collection, or discovery and is subject to the same system of peer review as conventional science, has been around for centuries. This indigenous knowledge has received renewed attention in the last decade. Several future challenges in agriculture (like those facing society more generally) relate to education. On the one hand, major opportunities exist for linking teachings on agriculture methods through citizen science to the youth and incorporating the current scientific innovation and knowledge into the agricultural research.

### *Logistics and Geosystems*

Zhang and Li (2012) and Kramar, Topolšek, & Lipičnik, (2015) defined agri-food supply chain as a network of business enterprises that are related to food production. It is a network through which the food is “moving” from production to consumption, including the activities of pre-production and consumption. They also define agricultural logistics as a discipline which analyses and models the economic systems, time-based agricultural objects, location-based flows of agricultural objects as well as the agricultural networks. Logistics in agriculture tries to configure, organize, control or regulate different agricultural networks and flows with the aim of paving the way for progress in the balanced achievement of economic, ecological and social objectives.

Modern agriculture needs to use technology in all aspect including the logistics. Technology use especially of geographical positioning systems in the management of the objects of agricultural transport systems and the availability of terminal complexes should be an integral part of modern agriculture. In transportation of agricultural produce, especially airports, and road network, choosing convenient routes requires modern technology. The use of GIS in

agriculture is similar to property management of enterprises with developed territorial infrastructure, the analysis of climatic changes, population movements, among others, and can be an integral part of farming activities. It also addresses issues related to land management, management of a fleet of vehicles with a goal of minimizing cost of transportation, it also helps in accelerating fulfilment of contractual obligations to customers, as well as improving the quality of customer service. Incorporating the modern technology can assist farmers accessing information and communications, with customers and the logistic staff, traffic management, traffic analysis, accident analysis. These calculations allow you to calculate how long it is possible to deliver agricultural products to the consumer. This information will be useful to small-scale agricultural producers. Developed logistics industry and market system are the important guarantee of modern agriculture. The research on agricultural logistics is of great significance to speeding up the process of agriculture modernization and improving the competition ability of agriculture

### ***Marketing and market information***

According to Awasthi, (2007), market information is an important facilitating function in a agricultural marketing system. It facilitates marketing decisions, regulates the competitive market processes and facilitates marketing mechanisms. To increase consumption, it is necessary to develop marketing channels. An application of marketing information system would serves as a platform for movement of agricultural products from the farms directly to the consumers or retailers. It would facilitate both farmers and consumers or retailers to buy and sell the required farm products without the involvement of a middleman at its right profitable price (Abishek, Bharathwaj, & Bhagyalakshmi, 2016). Rural or urban farming and city population works on symbiosis relationship. Youth not inclined to cultivation or animal husbandry and are city oriented would find this an attractive venture to assist in food production by facilitating the tail end of agriculture at the comfort of their offices in the city.

### ***Agro- extension services***

The extension officers act as the farmer's private advisors. In the pas past this could only be afforded by the by wealthier, more prosperous farmers and by corporate farms. Therefore, various extension and advisory services need new capacities in order to address the current challenges which will enable them to contribute meaningfully to better the agricultural innovation. With the trend towards privatization, the roles of public and private (commercial) extension have had to be redefined. With modern technology, knowledge being communicated is embedded in, or closely associated with, market goods (e.g. tractors, hybrid seeds, fertilizers etc.), the delivery of relevant advice can be left to the private sector, within an appropriate regulatory framework (Sushanth, & Sujatha, (2018),it also includes toll good (such as farm management or marketing information), the delivery of extension advice is best handled by a judicious combination of public and private entities (Sarker, & Itohara, 2009). Youth equipped with modern technology provides a common-pool good (such as soil, water

and air resources, community forests, fisheries, common pastures etc.) would be highly beneficial to the farmers. This would connect the advisory activities closely with cooperative or voluntary action. Extension workers with their extension services are doing this noble work. However, its expansive African rural regions has remained far behind the expected level that raised the issue about the effectiveness of the extension services due to the lag in infrastructure and structural developments which hinders the access of the services by the smallholder farmers. This creates opportunity for youth involvements.

### ***Crop production facilities and ICT systems***

According to Beriya, (2021) inefficiencies in the post-harvest value chain in agriculture stifle farmer incomes and are a barrier to the realization of the full potential of farmers. These inefficiencies arise from losses during harvesting, threshing, drying, poor storage facilities. Beriya, (2021), suggest that using Information and Communication Technologies (ICTs) in post-harvest management like geotagging of agri-warehouses, grain storage management, vehicles tracking and cold storages are a step-in mitigating these loses. The youth can be involved in the development of these ICT systems as well as the innovation in the storage drying, and other post-harvest activities to stem out the losses and improve the framing profitability

According to Geza, et a.l., (2021), a growing body of knowledge suggests that part of the solution for promoting youth participation in agriculture includes supportive policies and frameworks that promote capacity building, stakeholder investment and creation of innovative spaces in agriculture that incorporates youth aspirations. Without the requisite resources and capabilities, youth participation and the intent to increase the same remains but a fallacy. This study is anchored on both the resource based view and network theories. Resource-based theory posits that resources that are valuable, rare, difficult to imitate, and non-substitutable are best positioned at a firm for long-term success. General network theory tells us that we are all nodes in a network of relationships in which we interact. Some nodes are more influential than others and become hubs to which many connect. Individuals form clusters and some clusters become formal organization and corporations. Food supply chain involves a network of farmers, marketers, information technologist logistic among others, these strategic resources and networks can provide the foundation to develop firm capabilities that can lead to superior performance over time.

### **Conclusion**

The engagement of the youth in agriculture need not only be seen as youth in farming but youth involved in all aspects of food production chain. This can be achieved by engaging the youth in agriculture through change in perception. The perception can be altered by the development of modern technology especially in ICT and its application in the farming activities, thereby increasing the food production and eliminating both production and post-production losses in the farm. As a result, farming can be not only profitable, but youth



can be able engaged from the comfort zones in cities and towns. As profitability of farmers improve, youth would view agriculture as a worthwhile and cool venture and cool.

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