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Role of Food Scientists in Agricultural Research, Innovation, Capacity Building for Food Security, Nutrition, Safety, Income and Sustainable Development in Nigeria

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Abstract

Food Science and Technology plays key roles in reducing postharvest losses, enhancing value through agricultural value addition and ensuring quality and safety in the value chain of food crops. The Sustainable Development Agenda are a set of 17 interlinked objectives that the world leaders have committed to since 2015 in closing various gaps by the year 2030. They are designed as shared 5Ps blueprint for Peace and Prosperity for People and the Planet, now and Partnership in the future. They are designed as shared blueprint for peace and prosperity for people and the planet, now and in the future. The objective of this paper is to highlight the roles food scientists play in Agricultural Research and Development through capacity building. This covers the efforts in ensuring food security which is becoming a pressing problem in the country, through product optimization. It also discusses Food Science and innovations, collaborative work in the agricultural value chain, donor agencies role in enhancing agricultural research, food scientists involvement in policy formulation, their activities in capacity building programmes through training, teaching, mentoring younger scientists and in role modelling events in encouraging the future generation and in advocacy and advisory roles for sustainability in the field. Their expertise is crucial in addressing the country's complex challenges related to food security, nutrition, addressing unemployment through entrepreneurship which contributes to national economic growth.

Introduction

Nigeria, Africa's most populous nation, has vast agricultural resources and a critical need for sustainable agricultural and food systems to ensure food security and economic growth. Despite the country's agricultural potential, post-harvest losses, poor food processing technologies, and limited value addition put constrains on productivity. Food scientists play a pivotal role in addressing these challenges by contributing to research, enhancing food systems, and promoting sustainability. This paper reviews the contributions of food scientists in Nigeria's agricultural landscape, their role in capacity building, and the pathways for achieving sustainable development through innovative food science practices. About nine (9) of the sustainable development goals are keys areas that Food Scientists can be engaged in closing societal to world gaps (Fig. 1).

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2. Food Science Field, Agricultural Research and Food and Nutrition Security

Any nation's ability to sustain its economic growth depends heavily on its ability to ensure food security. It guarantees that people have access to enough food that satisfies their nutritional demands and is safe and nourishing. Unfortunately, individuals in emerging nations have suffered as a result of food insecurity, especially in sub-Saharan Africa (Sisay, 2023). Millions of people are at risk of starvation and malnutrition as a result of factors like poverty, violence, and climate change.

Food science applies biology, chemistry, physics and engineering to study the nature of foods, causes of food deterioration and principles underlying food

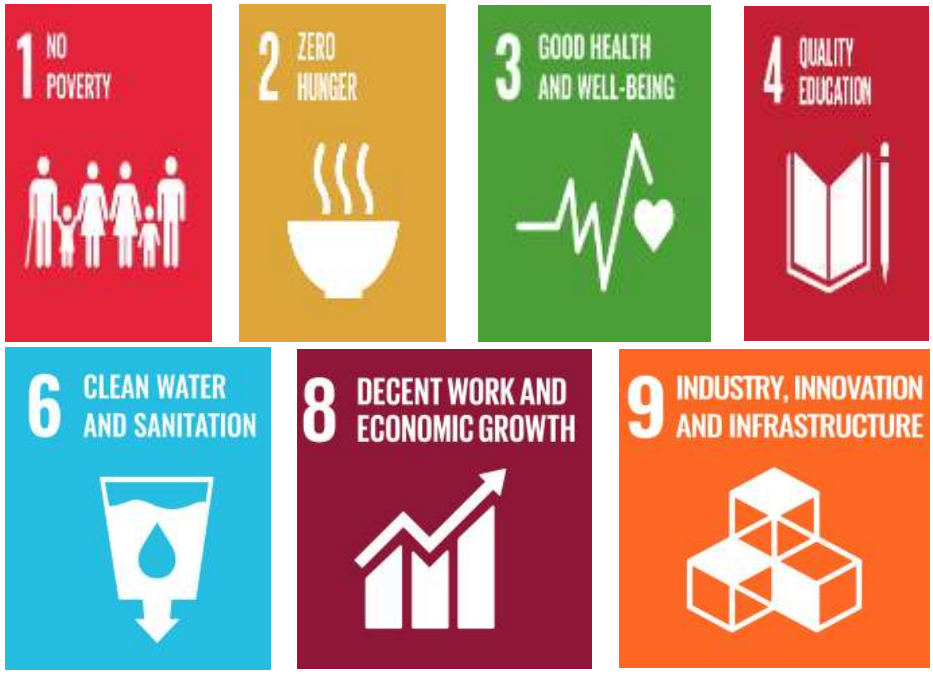


Fig. 1: Food scientists and the sustainable development goals (Fasoyiro, 2023)

processing. Agricultural research on the other hand focuses on improving farming practices, crop yields, animal husbandry and sustainability thus the two fields go hand in hand in ensuring food nutrition and security.

The discipline of Food Science and Technology is essential to improving the situation in these areas, where food insecurity is becoming an increasingly pressing problem. By utilizing advancements in food processing, preservation, and agricultural productivity, food scientists—who possess a wealth of scientific knowledge and expertise -can effectively tackle the issue of food poverty. The capacity of these experts to create technology and remedies can promote food security in underdeveloped nations. Food scientists play crucial role in improving productivity, reducing losses and promoting utilisation of agricultural resources. Some core areas of agricultural research where food scientists contribute include:

Developing improved crop varieties

Through genetic engineering, breeding, and other techniques, food scientists contribute to developing new crop varieties through sensory testing for quality and acceptability of desirable traits such as appearance, taste, colour, texture, flavour and overall acceptability (Edgar, 2019).

Post-harvest technology and food preservation

Nigeria suffers from significant post-harvest losses, primarily due to inadequate storage, preservation, and processing techniques. Food scientists research innovative preservation methods, such as refrigeration, dehydration, and food fortification, which can extend the shelf life of agricultural produce. Their work in developing technologies for minimizing nutrient loss and microbial contamination is crucial for maintaining the quality and safety of food products thus contributing to food security and waste reduction (Erine, 2024).

Value addition, food processing and income

Value addition is a vital aspect of agricultural development, especially in a country like Nigeria where raw agricultural products often fetch lower market prices. Food scientists contribute by developing new processing techniques to transform raw materials into value-added products such as flour, beverages, and snacks which are important to boosting national gross domestic products, income generation and economic growth Fasoyiro *et al.* (2009). This not only enhances the market value but also encourages the development of small- and medium-sized food enterprises, driving economic growth. In the Institute of Agricultural Research and Training, Ibadan, Nigeria, various value added food products were developed including soy milk, soy yoghurt, weaning food, soy ogi, soy iru, soy

garri, nutrient dense *garri*, pigeon pea *daddawa;* fresh, dried, cube, lima bean *daddawa*, pigeon pea flour, maize-fortified flours, cassava-pigeon pea fortified flours, lima bean flour, maize pigeon pea *tuwo*, pigeon pea akara, maize-pigeon pea chinchin, maize-pigeon pea biscuit, cassava-pigeon pea snacks: cake, biscuit, chinchin, baked lima beans, plantain –lima bean *momo*, lima bean veggie, lima bean *ekuru* muphin, enriched custard powder, roselle fruits drinks amongst others. Some of the products have also be improved in their packaging (Ashaye *et al.,* 2001, Farinde *et al*., 2020, 2023, Fasoyiro *et al*., 2005a, 2005b, 2009a, 2009b, 2013, 2025).

Food safety and quality control

Ensuring food safety is critical to public health, and food scientists play a key role in establishing standards for food safety and quality control. By conducting research on contaminants, pathogens, and toxins in food, food scientists help establish best practices in agricultural production and food processing, reducing the risk of foodborne illnesses (Erine, 2024).

Nutritional quality improvement

Malnutrition remains a challenge in Nigeria, with micronutrient deficiencies affecting millions. Food scientists analyse the nutritional composition of different crops and develop strategies to enhance their nutritional value especially through fortification, addressing malnutrition and promoting public health (Ashaye, 2001, Farinde, 2020, 2023, Fasoyiro, 2009a, 2009b, 2013). Figs. 2–3 show some of the value-added products and innovative products developed from some different research institutes in south-west, Nigeria. .

3. Food Science Research and Innovation

Food Scientists' function in agricultural research in various ways:

Innovative technology development

When it comes to creating innovative techniques for food production, processing, and preservation, food scientists play a critical role in the advancement of agricultural research. Post-harvest losses are a major issue in many developing nations, including Nigeria. They are mitigated by implementing scientific advances that extend the shelf life of perishable food products and improve food quality. Additionally, their research may result in the creation of bio-fortified crops that address the dietary inadequacies common in areas experiencing food insecurity. (Hellin *et al*, 2024). The use of Artificial intelligence (AI) and big data are recent innovative means of strengthening food safety, production and marketing (Ding *et al.,* 2023) and is receiving wide acceptance.

Technologies development and patenting

The 2030 Agenda for Sustainable Development, adopted in 2015 by the United Nations (2015), set the goals "to end hunger, achieve food security and improved nutrition, and promote sustainable agriculture" (Goal 2) and "to ensure healthy lives and promote well-being for all at all ages" (Goal 3) (Katzmarzyk *et al*., 2020). To achieve these two goals, food products for consumption must be available and accessible. Food Scientist promote this through technologies development and patenting for industrial uptake (Farinde *et al*., 2023).

Advancements in food preservation and processing:

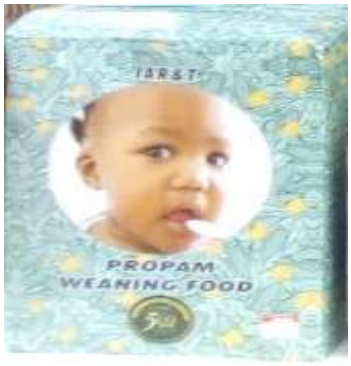
Innovative approaches that increase the shelf life of food goods, like cold chain technologies, smart packaging, and enhanced food preservation processes, can improve food security. These technologies, which ensure that food products retain their nutritional content over extended periods of time and reduce spoiling and loss, are developed and implemented by food scientists. (Hellin *et al*, 2024). Food scientists can also aid in the creation of environmentally friendly packaging materials that lessen the impact of food manufacturing on the environment. Innovations in food packaging that ensures it is both environmentally friendly and useful, such as edible films, biodegradable packaging, and recyclable materials, can help reduce the pollution caused by plastic (Ashaye 2018; Ese 2022).

Improving the yield and quality of crops:

Food scientists use genetic engineering, biotechnology, and other cutting-edge farming methods to enhance crop productivity and quality by collaborating with agricultural specialists. In addition to ensuring that the population's nutritional needs are satisfied, these technologies can assist Nigeria and other emerging nations satisfy their rising food demand. (Fan, 2024.

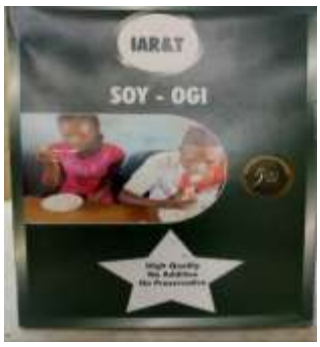
Soy milk

Soy yoghurt



Propam weaning food

Soy gari



Soy ogi

Maize pigeon tuo meal

Pigeon pea akara

Maize pigeon pea biscuit

Maize pigeon pea chinchin

Lima bean ekuru muphin

Plantain lima momo

Baked lima beans

Lima bean veggie

Fig. 2a: Value added food products from underutilized legumes; pigeon pea, lima bean and soybean

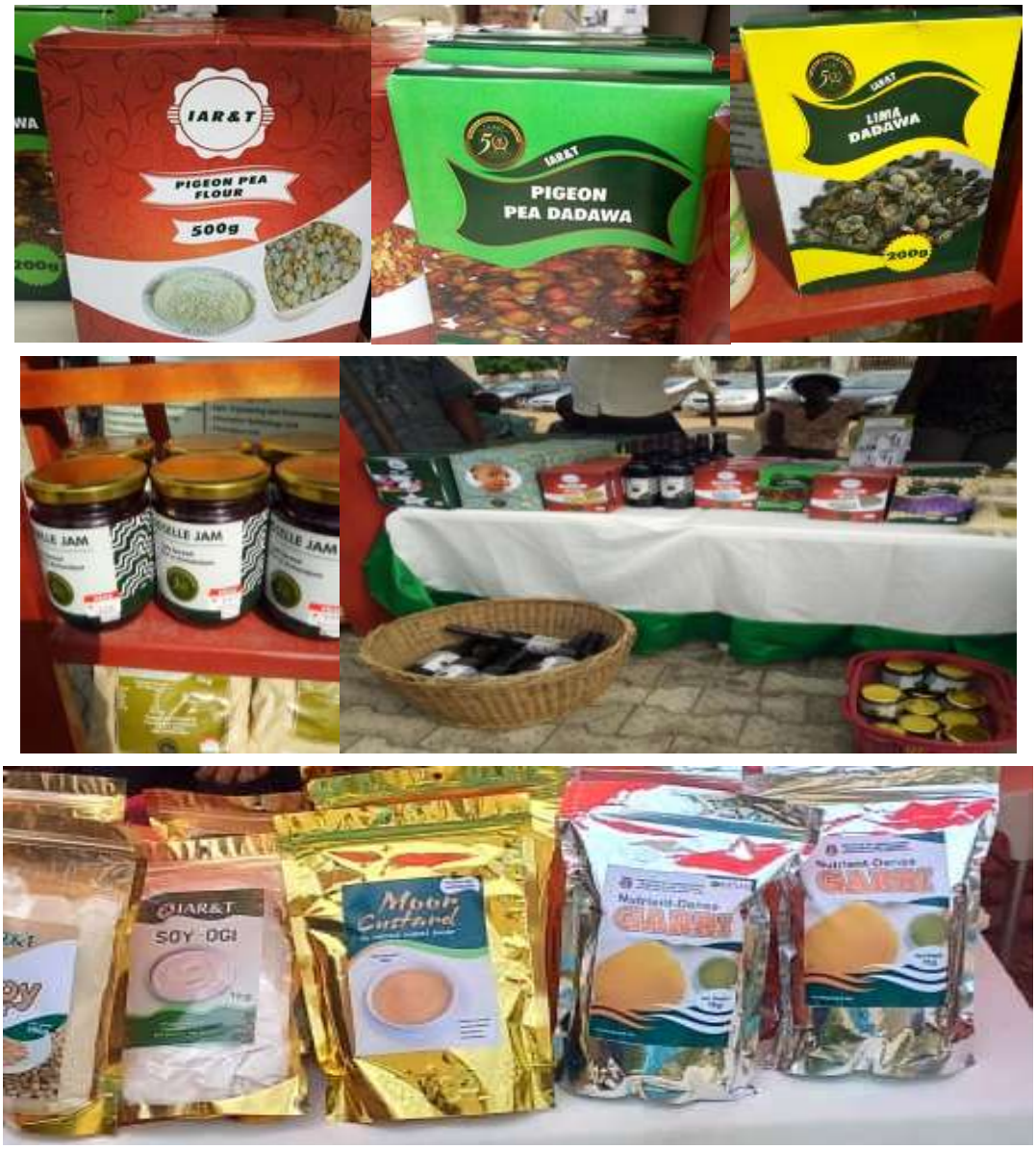


Fig. 2b: Innovative value added food products from underutilized legumes; pigeon pea, lima bean and roselle and other products from IAR&T with improved packaging

Fig. 2c: Value-added products produced by food scientists in Cocoa Research Institute of Nigeria

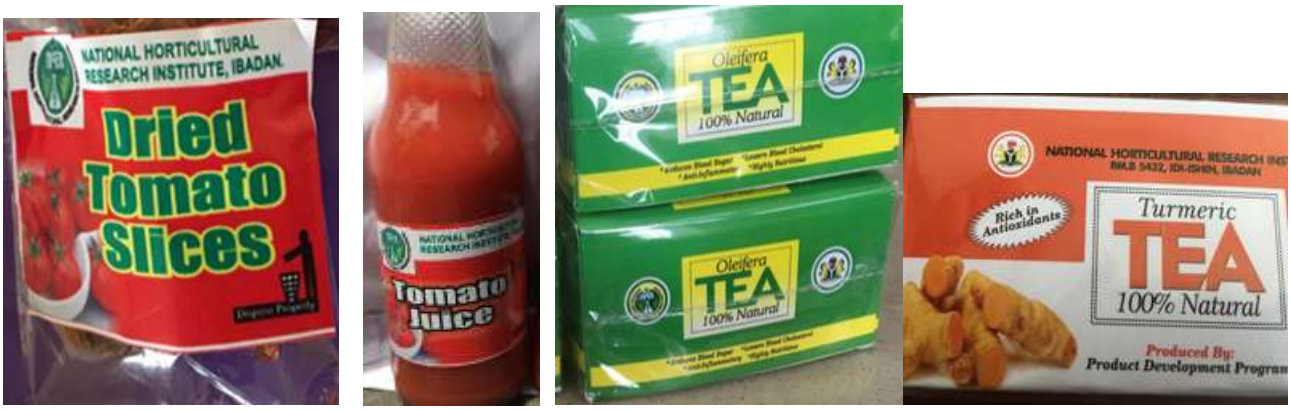


Fig. 2d: Innovative processed horticultural crops from tomato, telfaria and turmeric from NIHORT

Fig. 3: Food Scientist sharing the impact of innovative value added food products with stakeholders during an exhibition at IAR&T

Contributing to environmentally friendly farming practices:

Food scientists encourage the use of sustainable farming practices that reduce environmental effect and maximize resource use. Scientific knowledge is incorporated into farming systems to assist farmers increase output while protecting natural resources like water and soil for future generations. (Hellin *et al* 2024).

Systems for food safety and quality assurance:

One of the main responsibilities of food scientists is to ensure that food items meet safety regulations. To reduce contamination, spoilage, and foodborne illnesses and so enhance public health, they create quality control systems and food safety protocols. From farm to fork, their knowledge is essential to guaranteeing that food products fulfill regional and global safety regulations. (Dingqing *et al.*, 2024).

Effect on regional and international food supply chains:

Strengthening regional and international food supply chains is another important function of food scientists. They create methods and technologies that increase the effectiveness of food production and distribution networks, assisting in making sure that food items are delivered to customers on time and in good condition. Their efforts help build resilient food systems that can endure shocks like market disruptions, pandemics, and climate change. (Dingqing *et al.*, 2024)

4. Collaborative Efforts in the Agricultural Value Chain and Advocacy

Food Scientists work in partnership with other fields in achieving national and the global goals. Food Science itself has different area of specialization such as:

Food Microbiology: study microorganisms in food, ensuring safety and quality

Food Chemistry: analyze chemical composition, nutritional content, and interactions

Food Engineering: design and optimize food processing systems

Food Technology: develop innovative products and processes

Nutrition Sciences: study the impact of food on human health

Specialists in these various fields can come together to address issues on post-harvest, value-addition, processing, preservation, storage and safety and equipment designs towards better outcomes. Food Scientists are engaged in interdisciplinary research in the agricultural value chain of various crops working with other scientists in various fields. They work with agronomist, soil scientists, crop scientists, animal scientist, human nutritionists, nutritional biochemist, agricultural extensionist, agricultural economist and biometricians towards better use of different crops. Food Scientists through various professional bodies at national and international levels and networks such as Nigerian Institute of Food Science and Technology (NIFST), International Food Technologists (IFT), International Union of Food Science and Technology (IoUFST), Family Consumer Sciences of Nigeria (FACSON) can advocate for positive changes towards national development to global (SDG) goals such as on no poverty (Goa l 1), zero hunger (Goal 2), health and wellbeing (Goal 3), education (Goal 4), gender equality (Goal 5) fostered through partnerships (Goal 17). Partnerships can between research institutions, universities to industries.

Food scientist through their Associations can advocate for better national policies such as in food security and safety and at the global level (Fasoyiro, 2023). Different related fields can also work together to effect better changes. The efforts of other stakeholders are necessary to ensure success, even if the Food Scientist plays a critical role in ensuring food security. To establish an environment that is supportive of food security measures, cooperative collaborations between government agencies, research institutions, farmers, and private sector entities are required. The contributions of food scientists can be hampered in the absence of the required government policies, incentives, and support. Achieving food security in developed nations has relied heavily on cooperation between food scientists and other experts. Nigeria and other emerging countries ought to use this strategy as well (Idowu and Lawrence, 2014).

5. Impact of Donor Agencies in Agricultural Research

Donor agencies play vital role in agricultural development. They provide financial support for projects and programs. In Nigeria, Ministry of Agriculture supports Agricultural Institutes in funding, so also the Tertiary Education Trust Fund (TETFUND) in the higher institution such colleges and universities. Some donors provides technical assistance such as expertise and knowledge transfer, capacity building for local institutions and technology transfer and adoption. International Funding agencies support agricultural development through funding include International Foundation of Science , Sweden gives such support as training apart from funding, United State department of Agriculture (USDA), and Centre for Tropical Agriculture (CTA) which also supply agricultural books.

6. Capacity building Programs

In agricultural development in Nigeria, Food Scientists have been engaged in the following areas of capacity building:

Dissemination, extension services and training

Dissemination and extension services are vital roles of research institutes in showcasing their research outputs and in creating awareness of the potentials new technologies to the populace**.** Extension services also help in providing guidance and technical support to end users of the technologies. Training is a structured and systematic process aimed at enhancing knowledge, skills and performance and productivity. It involves sensitizing, crating awareness on research solutions and technologies to trainer of trainers, end users and various stakeholders to improve their lives (Ashaye *et al*, 2000; Fasoyiro, 2023). Providing Farmers with

Training and Education on Best Practices: In Nigeria and other developing countries, capacity building is crucial to ensuring food security. Food processing, preservation, and safety are taught to farmers by food scientists, who provide a valuable contribution to agriculture. In order to help farmers increase yields, lower post-harvest losses, and preserve food quality, they present innovative methods and innovations. Agricultural extension agencies and food experts collaborate to bring the most recent findings and advances to farmers in rural areas. Food scientists help bridge the gap between research and practical application by supplying extension agents with information on food preservation, safety, and quality control, enabling farmers to adopt sustainable methods.

It may involve a set on instructions, demonstration, giving the trainees the opportunity to experience by practicing to assessment. At the Institute of Agricultural Research and Training (IAR&T), one of the key roles as agricultural scientists is the training of different stakeholders such as Agricultural Development Specialists also called the trainer-of –trainers that also communicates the training to different communities. Food Scientists have been involved in training in food processing skills and food safety practices on institute mandate crops such as maize, soybean, roselle and underutilized legumes such as pigeon pea and lima beans to different stakeholders such as Agricultural Development Specialists as trainer-of-trainers to other communities within the institute Fasoyiro *et al.,* 2019; (Farinde *et al.,* 2020). Also, soybean, roselle, pigeon pea and lima bean products have been disseminated in outreach and extension services to women groups, farm families, local processors, unemployed youths, and students at IAR&T Adopted villages in Oyo and Ogun state, in other rural communities such as Erin Oke, Eruwa, Osun state, and Akufo Farm settlement in Oyo state (Fasoyiro *et al,* (2023). Product processing technologies for roselle drink and underutilized legumes; pigeon pea and limabeans have also been disseminated through a radio programme called "Agbe Asejere" at IAR&T to the broader communities. Some of these technologies have been by Oyo state ADP trainer- of-trainers to other communities beyond IAR&T reach. IAR&T Annual Report (2025) reported 99% adoption of IAR&T roselle drink technologies at Oyo and Ekiti states among communities the products were disseminated with income generation. Food scientists also play important advisory role as resource in household food security and career development such as IAR&T scientists in collaboration with Well 'n Virtue Advisory (NGO) towards overall wellbeing for all people. Nigerian Stored Product Research Institutes (NSPRI) has also been engaged in training on Cowpea Storage, processing of vegetables, cassava and bread fruit (Ajani *et al,* 2014; 2016). At Cocoa Research Institute of Nigeria (CRIN), food scientists have been engaged in training on Cocoa, Coffee, Cashew, Kolanut and Tea value added products. They have been engaged as Experts by GIZ / MOVE for new products development from cashew apple, nuts and by products. Also as Facilitators for training farmers on adding value to crops by the Nigerian Export Promotion Council (NEPC) (Jayeola, *et al,* 2020). Moreover, National Horticultural Research Institute (NIHORT) also trains on different spices, fruits and vegetables (Oduntan *et al,* 2018).

Teaching

In different public and private institutions offering Food Science and Technology as a course, you will find Food Scientists contributing to teaching, student project supervision and examination. Public Universities offering Food Science as a Course in Nigeria include Obafemi Awolowo University, University of Ibadan, Ladoke Akintola University, Federal University of Technology, Akure. Private Universities offering Food Science as a Course include BOWEN University. At the international level, you will find University of Ghana, Penn State University and Cornell University in the USA offering the course to mention a few. Teaching is also important in enlightening, passing on knowledge, values and skills to students for proper behavior and sustainability (Fasoyiro, 2023). Through writing and documentation of research, Food Scientists as authors allow updated information using in teaching and dissemination to spread abroad (Fasoyiro, 2023).

Entrepreneurship

Food Science offers the opportunity to build the capacity of students in food business, training of food

processing skills of different crops for self –reliance (Fasoyiro, 2023). Engagement in food business helps creates job opportunities where job is limited or no unemployment opportunities. It is important in contributing to gross domestic products and national economic growth.

Figs. 4 to 9 show some of the activities of food scientists in different institutions in training different groups of people in products developed from their institutes for nutritious healthy eating towards food security and entrepreneurship or income generation.

Fig. 4: Training of Farmers and Women Groups at Rural Communities in Oniyo and Akufo in Oyo state and Erin Oke in Osun State

Fig. 5: Training of ADPs at an empowerment programme organized by IAR&T and National Fadama Office

Fig. 6: IAR&T Training at adopted secondary schools, Oniyo, Ogbomosho, Oyo State

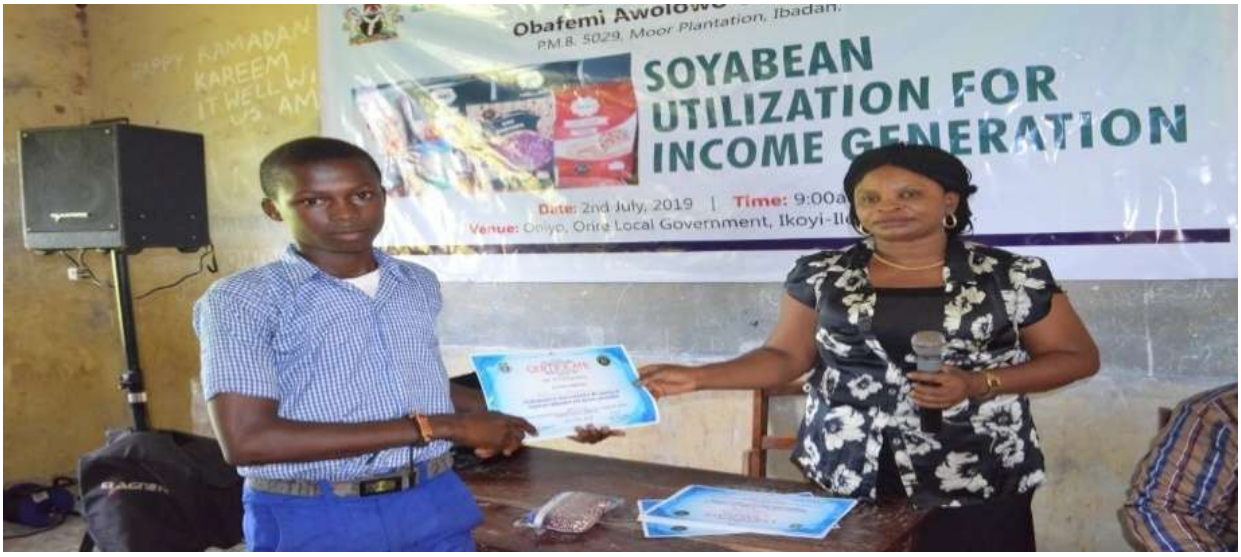


Fig. 7: A Professor of Food Science awarding certificate to a secondary school student at a training programmes

Fig.8: Training of women and youth in Ebonyi State on NIHORT value-added products

Fig. 9: Trained youth corps members on processing of value-added products of NSPRI at Onireke, Ibadan

Mentoring

Mentoring is the guidance -based relationship between an experienced individual and a mentee. It aims to support the mentee's personal growth and development. Food Scientists help build local expertise by providing mentorship and supervision to young researchers, fostering the development of the next generation of food scientists in Nigeria (Fasoyiro, 2023). The mentoring can be formal, informal, one-on-one, or group mentoring. The formal structure can be within an organization, the informal is usually outside the formal programs. E- Mentoring is usually on-line using digital platforms, while group mentoring can be more than one person mentored. African Women in Agricultural Research and Development (AWARD) is one of such formal mentoring program that has extensive network of mentors, fellows and mentees across Africa. Some of these mentors, fellows and mentees have also form associations within their countries to keep fighting the cause of poverty and hunger in the country and in Africa. Food Scientists form a key part of these network in sharing knowledge and experience. Mentoring is pivotal in achieving sustainability within institutions and in achieving global goals.

7. Sustainable Agricultural Development

Food scientists are instrumental in developing strategies that promote the sustainable use of resources while minimizing environmental impacts. Their work sustains agricultural development through:

Reducing food waste and losses

Food scientists contribute to sustainable development by devising strategies to reduce food waste at all levels of the value chain. Innovations in food packaging, processing, and preservation help in reducing post-harvest losses, which is a major issue in Nigeria. Reducing food waste not only ensures more efficient use of resources but also enhances food availability. Furthermore, food scientists can contribute to lowering the need for resource-intensive livestock production—a significant source of greenhouse gas emissions—by encouraging plant-based diets and the use of substitute protein sources (Ashaye 2018, Echendu, 2021, Fasoyiro, 2023).

Value addition:

They promote value addition to agricultural products through processing, packaging, and branding. This increases farmers' incomes and creates jobs in the food industry.

Sustainable farming practices:

Promoting practices such as crop rotation, organic farming and integrated pest management to maintain soil health and reduce environmental impact

Promoting eco-friendly food processing technologies

Food scientists are at the forefront of developing eco-friendly technologies for food processing and packaging. These include renewable energy sources, biodegradable packaging materials, and energy-efficient processing methods that minimize the carbon footprint of food production.

Enhancing food security

By improving agricultural productivity and reducing food losses, food scientists contribute to the overarching goal of food security. Their research in developing resilient crop varieties, sustainable preservation methods, and fortification practices ensures that more Nigerians have access to nutritious and affordable food.

Climate resilience

Nigeria is highly vulnerable to the effects of climate change, which impact agricultural production and food security. Food scientists play a role in researching and developing climate-resilient crops, alternative food sources, and sustainable agricultural practices that mitigate the effects of climate change on food systems.

8. Policy Formulation

Food Scientists' involvement in the formulation, development and application of policies for agricultural growth. The development of policies that support food security, quality, and safety must take their feedback into consideration. Food scientists can push for the changes that are required to make sustainable agriculture practices possible by collaborating with politicians and policy makers. These changes can include giving farmers financial incentives, market access, and infrastructure. (Adeyemi *et al*, 2024). Here are some key policies in Nigeria that support innovation and the adoption of new technologies in Food Science:

Agricultural promotion policy (APP) 2016-2020:

Also known as the Green Alternative, this policy focuses on improving agricultural productivity through the adoption of modern technologies and practices. It emphasizes the need for research and development in food science to enhance crop yields and food processing techniques (Truab, 2021).

National agricultural technology and innovation policy (NATIP) 2022-2027:

This policy aims to drive agricultural transformation by promoting the use of innovative technologies. It supports the development and dissemination of new agricultural technologies, including those related to food science, to improve food security and sustainability (NATIP, 2024).

Science, technology, and innovation (STI) policy:

This policy framework encourages the integration of science and technology into all sectors, including agriculture. It supports research and innovation in food science to develop new products and processes that can enhance food quality and safety (CGIAR, 2019).

National biotechnology policy:

This policy promotes the use of biotechnology in agriculture to improve crop varieties and food production. It supports research in genetic modification and other biotechnological innovations that can enhance food security and sustainability.

These policies collectively aim to foster an environment where innovation in food science can thrive, ultimately contributing to sustainable agricultural development and improved food security in Nigeria.

9. Encouragement of the Future Generation in Career Choices

One of the areas that the food Scientist can be engaged in making a difference concerning the future development is in the area of empowering the future generation in Food Science and Agricultural related fields. Fasoyiro *et al.* (2015) conducted a study among secondary school students in Oyo state to find out their interest in agriculture. It was reported that majority of the students were not interested in agriculture or the related fields. This study has led to sensitization and encouraging of students in career choices in Food Science and related field through Nigerian Institute of Food Science and Technology (Fasoyiro *et al.*, 2015). IAR&T has been working in encouraging students in agriculture. It has adopted rural schools in Ogun state and Oyo state where some of the training in the institute are carried out to encourage students in agriculture and entrepreneurship. Some food processing skills that have been disseminated to empower students include in

soybean and roselle processing technologies. NIFST, AWARD role-modelling event programmes through fellows and mentee and Organization of Women in Science in Developing World (OWSD) have been engaged in these area in the country in encouraging girls-in-science. Fig. 10 shows AWARD fellows role modelling event for secondary school students in Ibadan. Still more needs to be done in this area as agriculture as development in agriculture is fundamental to household food security and national food sufficiency. Conference and inaugural lecture have been used as platforms to advocate for Consumer Science which has food Science as a key component, skills such as leadership and entrepreneurship in tertiary institutions and mentor-mentee programs for youth development (Fasoyiro, 2021, Fasoyiro, 2023). Online platforms such as Facebook and Linkedin have also been used in reaching the broader communities with food information and creating awareness for nutritious foods and healthy eating (Fasoyiro, 2023). Food Scientists have worked with Non-government organization (NGO) such as Vision Shapers Treasure, Grace Reachfill Development Foundation, and Life Choice Foundation have also been engaged in empowering secondary school students in career choices as activities and women in skill empowerment such as roselle drink processing for income generation (Fasoyiro, 2023). Some of the activities is towards encouraging and empowering underprivileged women and youth in value, skills and start-up support for self-reliance and to make positive contributions also to the society.

Even with all these roles performed by Food Scientists in Nigeria, they are still faced with many challenges including:

Limited funding for research and innovation: Food science research is often underfunded, limiting the capacity for cutting-edge innovations.

Infrastructure gaps: Lack of adequate infrastructural facilities.

10. Challenges and Opportunities

Even with all these roles performed by Food Scientists in Nigeria, they are still faced with many challenges including:

Limited funding for research and innovation: Food science research is often underfunded, limiting the capacity for cutting-edge innovations.

Infrastructure gaps: Lack of adequate laboratories, processing facilities, and storage infrastructure hampers the effective application of research findings.

Fig. 10: Role modelling event of IAR&T AWARD Fellows for Secondary schools

Lack of skilled personnel: A shortage of qualified food scientists limits the capacity of research institutions and the food industry.

Policy constraints: Inconsistent policies on agriculture and food safety can hinder the implementation of scientific solutions in the food industry.

But despite these challenges, there are significant opportunities for food scientists to contribute to Nigeria's sustainable development, some of these are:

Expansion of agro-processing industries: With the growing demand for processed foods, there is a substantial opportunity for food scientists to lead the development of new value-added products.

International collaboration: Global partnerships in food science research offer avenues for capacity building, knowledge exchange, and technology transfer.

Sustainable food innovations: The increasing focus on sustainability opens up new avenues for research into eco-friendly and climate-resilient food systems.

Policy reforms: Policies that promote sustainable agriculture, food safety, and value addition should be implemented and enforced.

Conclusions

Food scientists have a crucial role in shaping Nigeria's agricultural future. Food Scientist are essential for achieving the SDGs, they drive economic growth by providing industrialization, ensuring a sustainable food future and improving the well-being of people and the planet. Through their contributions to agricultural research, capacity building, and sustainable development, they help address key challenges in food security, nutrition, and economic growth. \By investing in research, training, and sustainable technologies, Nigeria can harness the full potential of its agricultural sector, ensuring a more resilient and sustainable food system. This review emphasizes the essential role food scientists play in advancing Nigeria's agricultural sector and promoting sustainable development. Enhanced focus on research, capacity building, and the adoption of sustainable practices will be key to overcoming Nigeria's agricultural challenges. Future efforts should focus on strengthening research institutions, enhancing collaborations, and ensuring policy support for innovations that drive sustainability in food systems.

References

Adeyemi, O., Phorbee, O., Samuel, F., Sanusi, R., Afolabi, W., Covic, N., Onabolu, A. and Ajieroh, V. (2023). Training to build nutrition capacity in the Nigerian agricultural sector: initial assessment and future directions. *Food and Nutrition Bulletin*, 44(1): S85 - S91

Ashaye, O.A. (2018). Post-harvest handling of food crops in a changing climate: An outlook on Food Research in IAR&T. Lead paper presented at IAR&T 2018 In House Review p. 1-41.

Ashaye, O.A., Fasoyiro, S.B. and Kehinde, R.O. (2000). Effect of processing on the chemical and sensory quality of *ogi* fortified with full fat cowpea flour. *Moor Journal of Agricultural Research,* 1(1): 115-122.

Ashaye, O.A, Taiwo, L.B. Fasoyiro, S.B. and Akinnagbe, C.A. (2001). Compositional and shelf- life properties of soy-yoghurt using two starter cultures. *Nutrition and Food Science,* 31 (5): 247-250.

Ajani, A.O., Adegoke, G.O. and Fasoyiro, S.B. (2014). Chemical and sensory properties of breadfruit and pigeon pea custard. In: Proceeding of Alexander von Humboldt Conference, Federal University of Technology, Akure, Nigeria, 2014.

Ajani, A.O., Alade, O.A., Olagbaju, A.R., Fasoyiro, S.B., Arowora, K.A. and Oyelakin, M.O. (2016). Chemical and sensory qualities of stored gari fortified with soybean and groundnut. *Applied Trop. Agric.*, 21:1-5.

Bingqing, Z., Dingqing, Z, Qasim, H.H. and Hayati, H.A. (2024). Quality and food safety management review. *Cyta-Journal of Food*, 22 (1): 2405005.

Ding, H., Tian, J., Yu, W., Wilson, D. I., Young, B. R., Cui, X. and Li, W. (2023). The application of artificial intelligence and big data in the food industry. *Foods,* 12(24): 4511.

Echendu, A.J. (2021). Poverty and climate change, two important global policy issues of our generation. *Queens Policy Review*, 12:17-27.

Edgar, C. (2019). Analysis of sensory properties in foods: A special issue. *Foods,* 8(8):291.

Erine, A. (2024). Processing and food preservation: Ensuring quality, safety and longevity. *African Journal of Food Science and Technology* 15:1-3.

Ese, A.G. (2022). The Role of food and nutrition in achieving sustainable developmental goal 2030 through food security in Nigeria. *Alexandria Science Exchange Journal,* 43(2):33-38

Farinde, E.O., Oyedokun, A.O., Fasoyiro, S.B., and Adebayo, P.K. (2020). Sensory evaluation and acceptability of selected Lima bean products at Erin- Oke, Osun state, Nigeria. *Journal of Underutilized Legumes,* 2:7-14.

Farinde**,** E. O.**,** Obatolu, V. A., Dauda, T. O., Taiwo, O. M. and Ezugwu, B. N. (2023). Improving custard nutrients with blends of Quality Protein Maize (QPM), Pro-Vitamin A cassava (PVAC) and Lima Bean (LB). Certificate of Registration of Patent-RP: NG/P/2023/16

Fan, K. (2024). Metabolic Engineering in plants: Enhancing crop yield and quality https:// doi.org/10.20944/preprints 202407.1490.VI 18 July 2024. Assessed July18, 2024.

Fasoyiro, S.B., Babalola, S.O. and Owosibo, T. (2005). Chemical composition and sensory quality of fruit-flavoured roselle drink (*Hibiscus sabdariffa*). *World Journal of Agricultural Science,* 1: 161-164.

Fasoyiro, S.B., Ashaye, O.A., Adeola, A. and Samuel, F.O. (2005). Chemical and storability of fruit flavoured (*Hibiscus sabdariffa*) drink. *World Journal of Agricultural Science,* 1: 165-168.

Fasoyiro, S.B. and Arowora, K.A. (2013). Chemical, pasting and sensory properties of whole fermented (Ogi) fortified with pigeon pea flour. *WASET International Journal of Agricultural, Biosystems Science and Engineering,* 7: 32-34.

Fasoyiro, S. B., Farinde, E.O, Adiat, W.T., Zaka, K. O. and Ajani, A. O. (2013). Proximate composition and organoleptic properties of cassava snacks fortified with pigeon pea flour. *Science Focus*, 18:1-9.

Fasoyiro, S.B., Oyelakin, M.O., Alimi, P.J., Zaka, K.O., Ajani, A.O., Oduntan, A.O., Olapade, A.A., Farinde, E.O., Osunbitan, S.O., Ejigbo, E.A., Adeboyejo, F.O., Ilesanmi, F.F. and Afolabi, F.F. (2015). Gender response and sensitization of students in Oyo State on carreer choices in S and T (case study: Food Science and Technology). *International Journal of Development Research,* 5(2): 3508-3512.

Fasoyiro, S.B., Farinde, E.O., Chete, O.B. and Ajani, A.O. (2019). Knowledge assessment, training and consumer acceptability on cassava-pigeon pea processing at Akufo, Oyo state. *Greener Journal of Agricultural Research,* 9:32-26.

Fasoyiro, S.B., Farinde, E.O., Oyedokun, M.O. and Adebayo, A.O. (2019). Dissemination, training on pigeon pea utilization and evaluation of farmers' acceptability of the products at Erin-Oke, Osun state, Nigeria. *Greener Journal of Agricultural Research,* 9: 90-94.

Fasoyiro, S.B. (2021). The Role of Consumer Sciences in Contributing to National Development in Nigeria. *Int. Journal of Consumer Science,* 10:97-110.

Fasoyiro, S.B. (2023). The hidden treasures in plants: for food security, healthy and wealthy life. Inaugural lecture series. Obafemi Awolowo University Press Limited, Ile-Ife, Nigeria, p. 84.

Fasoyiro, S.B., Farinde, E. O., Arowora, K., A., Ajani A.O., Adeola A., Olanipekun, O.T., Ejigbo E., Oyedokun, M.O., Adebayo, A.K. and Ashaye, O.A. (2025). Pigeon pea Utilization: A Recipe book: Nutritious Healthy Foods for Wellness and Income- Home Use and Cottage Industries. Second Edition, Iny Publisher, Lagos, Nigeria. 61 pages.

Hellin, J., Fisher, E. and Bonatti, M. (2024). Transforming agricultural research and development systems to meet 21st century needs for climate actions. *Frontiers in Sustainable Food Systems*, 8: 1398079.

IAR&T Annual Report (2025). Adoption rate of IAR&T Roselle processing technology in Oyo and Ekiti states. p. 98-102.

Jayeola, C.O., Yahaya, L.E., Ogunwolu, S.O., Mokwunoye, F.V. and Olalekan-Adeniran, M.A (2020). Formulation and assessment of cashew kernel milk as an alternative to Cow's milk. *Food Processing and Nutrition Science*, 1:86-92.

Katzmarzyk, P. T., Salbaum, J. M., Heymsfield, S. B. (2020). Obesity, non-communicable diseases, and COVID-19: A perfect storm. *American Journal of Human Biology*, e23484.

Mayer, J. E., Pfeiffer, W. H. and Beyer, P. (2008). Biofortified crops to alleviate micronutrient malnutrition. *Current Opinion in Plant Biology*, 11: 166 – 170.

National Agricultural Technology and Innovation Policy for 2022-2027 (2024). National-Agricultural-Technology-and-Innovation-Policy-NATIP-2022-2027.pdf. Assessed June 6, 2024.

Oduntan, A.O., Fasoyiro, S.B., Akinfasoye, J.A., Adeboyejo, F.O. and Akintoye, H.A. (2018). Antioxidant and proximate properties of underutilized vegetables in western Nigeria. *Acta Horticulturae,* 1225: 255-260.

Olaoye, O.A., Idowu, O.A. and Lawrence, I.G. (2014). Certain roles of the Food scientist in ameliorating food insecurity in developing countries particularly Nigeria. *ISABB Journal of Agriculture Science* 4 (1) 13-19.

CGIAR (2019). Capacity building for Africa's future-agrifood system challenges and the way forward. https://www.cgiar.org/newsevents/news/capacity-building-for-africas-future-agrifood-system-challenges-and-the-way-forward/. Assessed Dec. 3, 2019

Sisaye, D.B. (2023). The impact of food insecurity on health outcomes: empirical evidence from sub-Saharan African countries. *BMC Public Health* 23:338.

Traub, L.N., Jayne, T and Shilobo W. (2021). Africa: Research and Development Are Key to Resilient Food Systems in Africa. allafrica.com/stories /202108020023.html#:~:text=Innovation%20at%20every%20level%20of,with%20them%20to%20share%20knowledge. Assessed August 1, 2021.

United Nations. (2015). Resolution adopted by the General Assembly on 25 September 2015, Transforming our world: the 2030 Agenda for Sustainable Development.