AGRICULTURAL ENGINEEFRING AND SOCIETY - THE CHALLENGES AND SUSTAINABILITY

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PROTOCOL

1. INTRODUCTION

I consider it a special honour to have been invited to address this august assembly of men and women in an academic community, especially in my area of call. I have had the privilege of modifying the topic to reflect the recent experience to which I have been exposed due to my contacts both local and international. These contacts keep reminding me of the need for us to see to it that Engineering and Technology are refocused to the original concept of Engineering and Technology being the prime movers of development in the modern society. It has been my view to broaden the scope of the topic in a holistic way as well as relating the proprietary nature of our usefulness to the larger society. I hope to try to accomplish both in this special lecture. We have always taught our students that they are a lucky breed of men and women who have been specially selected to serve the larger society. It is clear that the society itself appreciates the need for development. Infrastructural development has been receiving a lot of talk politically. We need to wonder how effective the politicians have been to really deliver on the development of society through proper application of Engineering and Technology.

I must, at this juncture, thank the Department of Agricultural and Biological Engineering of the University of Ilorin, and especially Professor K. C. Oni for thinking me fit to be invited for this lecture. Initially my commitments were such that I did not see how I could do this. However, a request from a Department where I took some students many years ago and for which I have served as an External Examiner to want me to come and talk to them and the University about

the role of Engineering to the society, then it would be both a pleasure and a challenge. I would not have been happy with myself if I did not make myself available. I am indeed grateful to those who have been involved and also the Head of the Department, Professor A. O. Ogunlela and Dr. J. O. Olaoye.

It seems that in our society, the focus of Agricultural Engineering is not much understood among aspiring students. Sometimes they do not understand what Agricultural Engineering is all about or have not been reading enough to know what Agricultural Engineering is expected to cover. It is indeed a career prospect that can be challenging if understood from the onset.

The plan is to go through the general origins of Engineering and the dynamics of Agricultural Engineering, historically and the emerging Biological Engineering concepts. The role of the developments on the global impact on society is highlighted with the Nigerian assessment from my perspective. What are we doing to create the needed awareness of our role as part of the general Engineering and Technology team in being an effective arm of the engine of development for our dear country? Hence, the need to identify the challenges and propose some options that can promote sustainability.

2. HISTORICAL BACKGROUND

Engineering as a concept is known to have been part of human practice since ancient times as fundamental and basic inventories were made. These included the lever, wheel and the pulley. These were the basis of very hand tool and contrivance.

As documented by Wikipedia:

> **The term engineering itself has a much more recent etymology, deriving from the word engineer, which itself dates back to 1325, when an engine 'or (literally, one who operates an engine) originally referred to "a constructor of military engines" In this context, now obsolete, an 'engine' referred to a military machine, i.e., a mechanical contraption used in wars (for example, a catapult). The word "engine" itself is of even older origin, ultimately deriving from the Latin *ingenium* (1250}. Meaning "innate quality, especially mental power, hence a clever invention"**

The overlapping four phases of engineering and technological development are:

Pre-scientific revolution:

The pre - history of modern engineering features ancient master builders and Renaissance engineers such as Leonardo da Vinci. The Acrioiucs in Greece, Roman aquadocts, the Great Wall of China, etc. are examples of works of ancient Civil and Military Engineers.

Industrial Revolution:

From the eighteenth through early nineteenth century, civil and mechanical engineers changed from practical artists to scientific professionals.

Second Industrial Revolution:

In the century before World War II, chemical, electrical, and other science-based engineering branches developed electricity, telecommunications, cars, airplanes, and mass production.

Information Revolution:

As engineering science matured after the war, micro electronics, computers, and telecommunications, jointly produced information technology.

Some of the very first projects were simply based on trial and error. Imaginative and creative individuals with good technical skills would try and design and put things together. Engineering Technology has transformed man as it was the basis of the industrial revolution. According to Dyson (1989):

> **"Next to the gift of life is technology, for it is the greatest of God's gifts as it offers the poor of the earth, a short cut to greatness and wealth, a way of getting rich by cleverness rather than a back-breaking labour"**

The 1852 Charter of the American Society of Civil Engineers defines engineering as:

> **"The art of the practical application of scientific and empirical knowledge to the design, production or accomplishment of various parts of construction projects, machines and materials of use or value to men"**

Today, engineering has become much more complex as clearly stated by Professor Hardy Cross of University of Illinois:

> **"It is customary to think of engineering as part of a trilogy, pure science, applied science and engineering. It needs emphasis that this trilogy is only one of a triad of trilogies into which engineering fits. The first is pure science, applied science,**

engineering; the second is economic theory, finance and engineering; and the third is social relation, industrial relation, and engineering. Many engineering problems are as closely allied to social problems as they are to pure science"

Agriculture has been defined as the production of food and goods through farming. Agriculture was the key development that led to the rise of human civilization, with the husbandry of domesticated animals and plants (i.e. crops), creating food surpluses that enabled the development of more densely populated and stratified societies.

Agriculture encompasses a wide variety of specialties and techniques, including ways to expand the lands suitable for plant raising by digging water-channels and other forms of irrigation. Cultivation of crops on arable land and the pastoral herding of livestock on rangeland remain at the foundation of agriculture

Since its development roughly 10,000 years ago, agriculture has expanded vastly in geographical coverage and yields. Throughout this expansion, new technologies and new crops were integrated;

Modern Agriculture with inputs such as pesticides and fertilizer, and technological improvements has sharply increased yields from cultivation, and at the same time have caused widespread ecological damage and negative human health effects;

Historians and anthropologists have long argued that the development of agriculture made civilization possible.

Engineering has clearly imparted on agriculture in modern times. Thus agricultural engineering can be defined (According to Makanjuola (1977)) as:

"Agricultural Engineering is that field of engineering in which the physical and biological sciences are utilized to find and apply better ways of exploiting natural resources for the production, handling, processing and storing of food and fodder. It is also concerned with finding better ways for carrying out such allied activities as rural housing and living. Agricultural Engineering consequently involves the design, development, testing, manufacturing, marketing, operation, maintenance, and repair of all agricultural tools, implements, machines and equipment which are used in mechanizing agricultural operations with the objective of raising the productivity of human labour and land in the face of prevailing economical, human and social realities of the time and place concerned."

Agricultural Engineering has a more recent history in comparison to the much older disciplines such as civil, mechanical and electrical. It took of in the United States of America in 1907. At that time males provided 75 per cent of the total horsepower used by American agriculture, according to Stewart. In the 1930s, agricultural engineering played a rather marginal role in Europe, with variations from country to country. China has a longest history of tools innovation and development for agriculture but became moribund between the Qing Dynasty and 1940s. Since the 1950s and more so since reform in the 1970s, agricultural engineering has made monumental achievements in China. It was known as agricultural mechanization up to 1978.

In Nigeria, the profession took off in late 1960s with a few foreign trained engineers. More will be provided in terms of experience, coverage acceptability over the years later in this presentation.

3. SOCIETY AND RURAL DEVELOPMENT

As stated earlier; agricultural engineering is much younger than the traditional engineering disciplines. As societies become more urbanized, the roles of agricultural engineers have become not so clear to policy makers who have limited knowledge of the overall inputs that promote efficient agribusiness of these modern times. What are the rural development strategies and where does technological input fit?

3.1 Rural Development Issues

In order to promote rural development and reduce the poverty level, especially in the underdeveloped world, the United Nations came up with the Millennium Development Goals (MDG). Millennium Development Goal's conception is based on the United Nations' Declaration which arose from the consensus of experts set up by the United Nation through IMP, OECD and the World Bank and Is based on a frame work to be adopted to achieve greater benefit for all human beings in the world in the current Millennium. The target date have been chosen to be between 1990-2015; thus, it has been a 25 Year Development Programme that had been foreseen to help governments all over the world, especially in the developing world, to start some planned process that will help them – 'a catch up concept'. The document was actually adopted by the United Nations Assembly as a way of expressing common worldwide priorities in development with a target date of 2015.

The United Nations Millennium Declaration, signed in September 2000, commits the states to:

1. **Eradicate extreme poverty and hunger**
    - Reduce by half the proportion of people living on less than one U.S. dollar a day.
    - Reduce by half the proportion of people who suffer from hunger.
    - Increase the amount of food for those who suffer from hunger.
2. **Achieve universal primary education**
    - Ensure that all boys and girls complete a full course of primary schooling.
    - Increased enrollment must be accompanied by efforts to ensure that all children remain in school and receive a high-quality education
3. **Promote gender equality and empower women**
    - Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015.
4. **Reduce child mortality**
    - Reduce the mortality rate among children under five by two thirds.
5. **Improve maternal health**
    - Reduce by three quarters the maternal mortality ratio.
6. **Combat HIV/AIDS, malaria, and other diseases**
    - Halt and begin to reverse the spread of HIV/AIDS.
    - Halt and begin to reverse the incidence of malaria and other major diseases.
7. **Ensure environmental sustainability**
    - Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources.
    - Reduce by half the proportion of people without sustainable access to safe drinking water (for more information see the entry on water supply).
    - Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020.
8. **Develop a global partnership for development**
    - Develop further an open trading and financial system that is rule-based, predictable and non-discriminatory. Includes a commitment to good governance, development and poverty reduction—nationally and internationally.
    - Address the least developed countries' special needs. This includes tariff- and quota-free access for their exports; enhanced debt relief for heavily indebted poor countries; cancellation of official bilateral debt; and more generous official development assistance for countries committed to poverty reduction.
    - Address the special needs of landlocked and small island developing States.
    - Deal comprehensively with developing countries' debt problems through national and international measures to make debt sustainable in the long term.
    - In cooperation with the developing countries, develop decent and productive work for youth.
    - In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.

- In cooperation with the private sector, make available the benefits of new technologies—especially information and communications technologies.

The professional concern for us are in item1, i.e. what we can do to eradicate extreme poverty and hunger?; item 7, can we also ensure environmental sustainability through the efficient use of land and other related resources; and item 8, the way to work with others both locally and internally to promote the much needed development.

3.2. Agriculture and Food Security

The most recent review as of 12th May, 2010 given by Dennis S. Jubane, is found as follows:

> About 70 percent of the MDGs' target groups live in rural areas, particularly in Asia and Africa, and for most of the rural poor agriculture is a critical component in the successful attainment of the MDGs. Even though structural transformations are important in the longer term, more immediate gains in poor households' welfare can be achieved through agriculture, which can help the poor overcome some of the critical constraints they now face in meeting their basic needs. Thus, a necessary component in meeting the MDGs by 2015 in many parts of the world is a more productive and profitable agricultural sector.
>
> While the relation with agriculture is particularly strong for the first MDG, or MDG 1—halving by 2015 the proportion of those suffering from extreme poverty and hunger—all MDGs have direct or indirect linkages with agriculture. Agriculture contributes to MDG 1 through agriculture-led economic growth and through improved nutrition. In low-income countries economic growth, which enables increased employment and rising wages, is the only means by which the poor will be able to satisfy their needs sustainably.

3.2.1 Role of Trade, Policy Making, and Governance Systems

> In addition to the targeted investments required to help agriculture achieve its potential contribution for the MDGs, policies and governance systems need to be supportive for agriculture to achieve maximum impact.
>
> Supportive systems and policies include trade and domestic support polices for agriculture in developed and developing countries, macroeconomic reform and public-sector infrastructure and other investments, the role of the private sector and public-private partnerships, and general good governance.
>
> Price support policies and border protection of wealthy Organization for Economic Co-operation and Development (OECD) countries, valued at hundreds of billions of dollars each year, cause harm to agriculture in developing countries. Removal of OECD protection could boost rural value added in low- and middle-income countries by $60 billion per year says the International Food Policy and Research Institute.

Food aid is another component of international transactions that directly and indirectly affects rural poverty in a globalized agricultural economy and therefore could have a significant impact in achieving the MDG targets. While the provision of aid in the form of food is not the optimal form for development assistance, donors would probably not provide equivalent cash development assistance in place of food if existing food-aid programs were terminated. Thus, attention needs to focus on how its effectiveness can be maximized and potential harms mitigated.

3.2.2 Private Sector Roles

Public intervention alone is not sufficient to deliver the services and investments required to achieve the MDGs. To alleviate rural poverty in developing countries, the private sector can contribute to economic growth through job creation both on and off farm. The private sector also has an important role in supporting timely and efficient credit availability to fuel agricultural development and growth. Finally, the private rural nonfarm sector is an important engine for rural development. In Asia, for example, the rural nonfarm economy accounts for 20-50 percent of total rural employment and 30-60 percent of total rural income.

Private financing of investment and MDGs may be explored as a general way to ensure availability of basic services, particularly as the official development assistance or aid for the water and other sectors has declined in recent years. Financing options should also include income redistribution and tax efforts in China, India, and other poor countries to co-finance the MDGs.

Ideally, the public and private sectors complement each other, with the government providing an appropriate enabling environment for private initiatives to develop. Public-private partnerships are an important way to increase financial, human, and social capital in rural areas. Partnerships can include publicly provided training for small- and medium-scale enterprises, partnerships in education, agricultural research, the provision of information and communication technologies, the expansion of rural infrastructure including roads, and the development of rural industrial clusters. Moreover, through partnerships, public research institutions can gain access to advanced scientific knowledge and technologies held by the private sector, mechanisms for developing, processing, marketing, and distributing final products to farmers and consumers, and financial resources that are increasingly difficult to obtain. In the area of agricultural research, however, a sustained public role in funding agricultural research will be essential, particularly for crops and regions that are unlikely to be served by the private sector, such as those in less favorable environments.

Good governance is typically defined under the terms of accountability, transparency, predictability, and participation. These principles are only meaningful and supportive of agricultural development toward achieving the MDGs if adequate institutional and social structures are available. Countries with a good governance structure and adequate institutions tend to ensure political and economic stability, possess reasonable state

capacity, enforce property rights and contracts, provide sufficient public goods, and limit government corruption and predation. Conversely, countries with poor governance and poor institutions typically have poor public services, including those for agricultural extension and research, and have particularly poor social services like water provision and education. Good governance can be built through the development of social capital, particularly in rural areas, where participation by individuals in social networks increases the availability of information and lowers its cost, helps enforce property rights, and reduces opportunistic behavior in natural resource use—thus supporting all MDGs.

3.3 Role of Engineering and Technology

The inputs for achieving the above goals require a holistic approach in which the role of engineering and latest technological developments must be appreciated and promoted. The practitioners must also be mobilized by their bodies for input into the implementation strategies. The effectiveness of this approach is part of what will be discussed under the challenges a little later.

4 RURAL DEVELOPMENT IN NIGERIA

Poverty in Nigeria has been getting worse in the last decade after the government has been making statements on "people getting the benefit of democracy"! The challenge to all, professional not excluded, is most difficult to imagine. Table 1 shows the available figure up to 1996 and if we are to project to what we see around, it will be a most disheartening scenario as people are suffering in the midst of plenty.

The vision statement for Nigeria's National Economic Empowerment and Development Strategy (NEEDS):

> **NEEDS is about people, their welfare, their health, education, employment, empowerment, security, and participation. It is about poverty-reduction, and its overarching ultimate goal is to lead to an enhancement of the life, livelihoods and good living or wellness of the people.**

TABLE 1: NIGERIA – POVERTY INCIDENCE INDICATORS, 1980-96

(The poor as a percentage of the total in the specified groups)

	1980	1985	1992	1996
National	28.1	46.3	42.7	65.6
Geo-Political Zones				
(i) North East	35.6	54.9	54	70.1
(ii) North West	37.7	52.1	36.5	77.2
(iii) North Central	32.2	50.8	46	64.3
(iv) South East	12.9	30.4	41	53.5
(v) South West	13.4	38.6	43.1	60.9
(vi) South South	13.2	45.7	40.8	58.2
Sector				
Urban	17.2	37.8	37.5	58.2
Rural	28.3	51.4	46	69.3

Source: Federal Office of Statistics. Note: A recent nation-wide household survey by FOS will provide up to date statistics on the state of poverty in Nigeria.

The specific details in regard to Agriculture are as follows:

Agriculture and Food Security

Despite the dominant role of the petroleum sector as the major foreign exchange earner, agriculture remains the mainstay of Nigeria's economy. In addition to contributing the largest share of GDP, it is the largest nonoil export earner, the largest employer of labour, and a key contributor to wealth creation and poverty alleviation, as a large percentage of the population derives its income from agriculture and related activities.

Over the years the rate of growth in agricultural production has stagnated and failed to keep pace with the needs of a rapidly growing population, resulting in a progressive increase in import bills for food and industrial raw materials.

The potential of the agri-business sector as a major employer of the growing labour force and an earner of foreign exchange has also been undermined. As a result, the large majority of Nigeria's population, many of whom live in rural areas, remain poor. Under the NEEDS programme, agricultural development will be vigorously pursued, with the aim of achieving food security and reducing poverty.

Major constraints inhibiting private sector participation in the transformation of agricultural production include the following:

• The rapid shift of the population from rural to urban areas and the shift in consumption patterns from local to imported food items

• Lack of funds, inadequate processing and storage facilities, and inefficiencies in input supply and distribution

• The oil boom, policy inconsistency, and the decline in political commitment to agricultural and rural development

• An inadequate incentive framework and pervasive distortions in the macro economy

• Absence of a price support mechanism and pervasive distortions in macroeconomic and sectoral policies, including misaligned exchange rates and heavy taxation of agricultural exports

• Continued dependence on rain-fed agriculture and the absence of economies of scale

• A land tenure system that inhibits the acquisition of land for mechanized farming

• Inadequate agricultural extension services and the lack of indigenous capacity or technologies responsive to local conditions

Agriculture remains the mainstay of Nigeria's economy

• A degraded environment that has reduced agricultural yields

Policy Thrust

Given the dominant role of agriculture in the economy, prospects for food security, the supply of industrial raw materials, and overall economic growth are critically

dependent on what happens in this sector. Accordingly, the government is committed to increasing investment in food and agricultural production. Its main policy thrusts include the following:

- **Provide the right policy environment and target incentives for private investment in the sector. Implement a new agricultural and rural development policy aimed at addressing the constraints in the sector.**
- **Foster effective linkages with industry to achieve maximum value-added and processing for export.**
- **Modernize production and create an agricultural sector that is responsive to the demands and realities of the Nigerian economy in order to create more agricultural and rural employment opportunities, which will increase the income of farmers and rural dwellers.**
- **Reverse the trend in the import of food (which stood at 14.5 percent of total imports at the end of 2001), through a progressive programme for agricultural expansion. The government is committed to reducing the growing food import bill to stem the rising trade imbalance as well as diversify the foreign exchange earning base.**
- **Strive towards food security and a food surplus that could be exported.**
- **Invest in improving the quality of the environment in order to increase crop yields.**

The assessment of the performance in implementation cannot be said to follow the expectations raised in the policy and the implementation statements. The strange thing has been that this programme went with the Obasanjo's regime and the 7 – Point Agenda has since taken over. The following are the statements in the new dispensation under FOOD SECURITY:

Agriculture contributes 42% of Nigeria's GDP and engages over 65% of the country's workforce. The sector is constrained by enormous challenges, and is characterised by low output, inefficient and antiquated production tools and infrastructure. Approximately 66% of the country's total land mass of 92.377 million hectares is suitable for agricultural production but about half of that is not cultivated. The technological inadequacies in standardisation and quality control have stunted our farm produce, rendering it uncompetitive in local and international markets.

Non-affordability of modern production inputs and equipment, low access to credit/finance and poor infrastructure all combine to make local production uncompetitive. Poor funding which led to total collapse of research and extension services in the sector shall be overcome through the effective deployment of the Natural Resources Fund. Ineffective regulatory framework for enforcing grades and standards for farm produce has made farm output growth difficult.

Government will ensure the optimal performance of agriculture. When left to market forces and pitched against the more efficient, and often highly subsidised external competition, as well as when faced with the vagaries of natural uncertainties, the average, resource-poor, small-holder Nigerian farmer will find it difficult to compete in local and international markets. Critical areas for intervention will include strengthening agribusiness through institution of a profitability and prices support mechanism, land tenure changes, aggressive development and supply of new land resources, technological empowerment of the sector, increased access to credit finance, strengthening of farmer support groups through commercial farmers, improvement of rural access infrastructure, and resuscitation of the River Basin Development Authorities (RBDAs).

Central to these mentioned strategies, is the urgent need for the introduction on the supply side, of the Commercial Farmer to professionalise agribusiness in Nigeria. Additional land for cultivation and idle irrigation facilities around our dammed water bodies provide excellent opportunities to increase farm output and employment prospects in rural areas.

On the demand side, the reintroduction of the Commodity Boards and its licensed Buying Agent will be undertaken to boost the marketing prospects of our farm produce. Also, the new National Policy on Agriculture launched by the previous administration shall be made to, among other things, strengthen national food security, increase production and local processing of agricultural raw materials, and increase employment generation opportunities in the food sector.

Government shall embark on the preparation of a comprehensive National Food Sector Plan (NFSP). The Plan, which must be detailed, implementable and result-oriented, will be the tool for realising the desirable goals of the interventions recommended above. The NFSP will be the product of collaboration between all significant stakeholders in the Food Sector. The Development Plan for the Food Sector will have definite implementation timelines classified as; short-term activities (2008 – 2010); medium-term activities (2010 – 2015); and long-term activities (2015 – 2020).

Faborode reported on comments and suggestions on the NEEDS proposal in 2005 which can equally apply today to the new policy thrust as enumerated in this part of 7 – Point Agenda, as some comments that could help with successful implementation. These include:

1. **That it could be helpful if the big picture is broken down i.e detailing activities to the lowest level of implementation;**
2. **The need for massive education/enlightenment. (Many Nigerians do not know much about these programmes, neither do even many elites, scholars and students/youths (tomorrows leaders!) have access to its guiding philosophy …, its documents. The degree of value re – orientation required to enshrine its new tenets in our psyche should not be underestimated);**
3. **Identifying our strengths (existing knowledge and capabilities) and comparative advantages and converting them into value;**
4. **Identifying weaknesses on our part and plugging them – a total SWOT analysis for real value; and**
5. **Creating an environment where new ideas can find expression, by designing incentives/rewards and protection for creativity and intellectual property.**

These can significantly help with the hope that this new programme be made more permanent until the desired goals have been achieved.

Funding has also been considered to have been too low for agricultural development that will meet the target development indices. Up till now, can we see the impact of the allocation in actually improving the quality of life of our people?

It is proper to now look at the challenges we have as professional.

5 THE CHALLENGES AND SUSTAINABILITY

The challenges we face as professionals will be discussed here as well as how we can sustain the practice as well as make significant impact on the future development of our country as well as be part of the global player in the very important task of improving the quality of life which essentially lead to real development. Some are internal to us in our practice and the need to get the larger society to understand as well as appreciate our role and its critical nature in propelling development. This is in addition to our trained ability to respond to the dynamics of societal needs as part of development.

5.1 Internal Reorientation – from Agricultural Engineering to Agricultural and Biological Engineering

Professor Otto Loewer (1997) has given us a vivid report as a follow – up on the work of Professor R. E. Stewart (1979) which chronicled the development in the USA of Agricultural Engineering between 1907 and 1977. It showed that the wave of the division had always been debated with the ASAE. "Are we part of agriculture or engineering?" That was the question. Incidentally at Obafemi Awolowo University, we were recently expelled from the Faculty of Agriculture for political reasons. It has thus always been clear that the role of our profession has been and confines to be a challenge. The challenge is a global factor which was also worked by CIGR (International Commission of Agricultural Engineering). The name change has also been motivated to refocus the profession to attract young bright prospective students who see a bright future not only in agriculture but in modern industrial set-up that are utilizing the products of biological nature. Faborode (2005) has clearly shown how this part of the challenge is overcome with name change:

> **Essentially, the agricultural and environmental/biosystems/bioresources engineering programme prepares men and women for careers requiring application of physical, biological, and engineering sciences to problems that involve living systems. Agricultural and biosystems engineers are uniquely qualified to solve problems involving engineering aspects of agricultural production, biomaterials handling and processing for food and non-food products, and environmental resources management. Preparation in agricultural and biosystems engineering can serve a broad range of career interests, providing opportunities for men and women from both urban and rural backgrounds. A careful balance has to be struck in order to allow agricultural production systems producing biological raw materials for non-food use to meet public demand in terms of quality, supply, sustainable land management and biodiversity preservation. In order to get the best possible yield from crops, storage and transport systems must be developed to ensure the preservation and recovery of valuable components. Consequently, a lot of effort is being made to ensure that these 'new' agricultural processes can work smoothly alongside traditional food production systems in rural communities with industrial and agricultural needs being considered in parallel. Product-oriented research focuses on the extraction of physical, chemical and biological elements from plants, animals and wastes, as well as the modification of oil, protein, starch, sugar and fibre material. This is then processed into bulk or fine chemicals or biopolymers.**

5.2 Acceptance of the Role of Agricultural Engineers as part of the Technology Team

Experience has shown that this discipline which came much later than the others has not always been given the pride of place. The fact that the profession combines almost all the disciplines of engineering as well as the biological sciences (as stated earlier in the definition) is not easily recognized by the society. As a practitioner in the farm structures and Environmental Design area many prospective clients have claimed that they did not see the need for a specialist for their facilities in the farm and for that matter in the ural environment. While some progress has been made, more needs to be done in general to get the public and more so the policymakers, to fully appreciate the unique capabilities of those trained in this area. The needed awareness must be created through appropriate mobilization.

I have compiled some pictures that depict the extent of the areas covered by the professional practice. They are included as an appendix (Figures 1 to 29). These are:

1. The Tractor, the traditional symbol of the profession;
2. Food and allied Factories;
3. Animal Production Facilities;
4. Dams and Related Structures;
5. Irrigation systems;
6. Rural roads; farm houses;
7. Green houses; etc.

5.3 National and Global Co-operation

In Nigeria, the first generation of Agricultural Engineers ensured the recognition of the profession right from the on-set of COREN (The Council for the Registration of Engineering in Nigeria) in 1970. The dynamics of the profession including diverse areas of practice were not fully covered. This must be corrected. It is neither new nor uncommon for the older, more established disciplines of the engineering profession to discriminate against the newer, not-so-well known ones. Thus, the discipline of Chemical Engineering which was a product of the 20th century, achieved full professional status in the United Kingdom with the granting of a Royal Charter only in 1922. For nearly half a century before this time, the institution of Mechanical

Engineers saw the skills of the chemical engineer as only one incidental specialization of the wider functions of the Mechanical Engineering Discipline. Mechanical Engineering evolved from civil as Electrical Engineering grew out of Mechanical. Each new discipline evolves through a grey period in its history during which it receives only token acceptance and even sometimes must confront outright opposition from the more established ones. This historical process, on the one hand, symbolizes a challenge for an evolving discipline to justify its professional uniqueness. On the other hand, it can be seen as one rational expression, on the part of the institutionalized disciplines, of an instinct for professional pride as well as self-preservation.

The challenge here for us is to reinforce our relationships with the national and international organizations through appropriate contacts. Most of our colleagues have lost their membership of international organizations due to the economic crunch. The situation has improved lately and we must make the priority and needed sacrifice to re-enroll and pay the dues. This can encourage the young ones who are the real beneficiaries of such an effort. This is a sure way to sustain the profession.

The other challenge has to do with continued professional development. This has been clearly shown to be critical in other professions and ours cannot be different. The rate of changes and obsolescence in the technological practice demands that we move on this platform.

Our products are already out there in the society. We must find ways through our local professional body, the Nigerian Institute of Agricultural Engineering (NIAE) to mobilize them as our ambassadors for our future sustainability and for Nigeria to gain from the uniqueness and comprehensiveness of our calling. They form a most important bedrock for us.

In 2006, Professor Otto Loewer wrote the following predictions:

> **"The next 100 years will be defined by three separate periods characterized primarily by chaos, reallocation and finally peace and stability. It is my opinion in a conceptual framework about how and why the interactions among technology, economics and societal values will create these periods.**
>
> **Furthermore, predictions are made about the critical role that agricultural and biological engineering will play by providing the engineering for life-sustaining necessities associated with human consumables, process, productivity and environmental health."**

This is not an unbalanced way of making some positive outlook for the profession in the next generation and beyond.

6. CONCLUDING REMARKS

I have taken this lecture as an assignment in the middle of a personal readjustment after official retirement. It has afforded me an opportunity to have a new look at my profession. I have been motivated by two things;

Firstly, to look at how our profession can continue to grow and impact positively on the society, especially as I come across evidence of increased poverty in the middle of plenty.

The second motivation came from the words of Olivier Wendell Holmes:

"The GREAT THING in this WORLD is not so much where we are,

but in what direction we are MOVING."

"A MIND once expanded by the NEW IDEA never

returns to its ORIGINAL dimensions."

It is my prayer that our leaders will rededicate themselves to work to prevent famine. if the oil wealth Is not properly used to empower the citizenry, the worst is yet to come. Nigeria does not deserve such a catastrophe.

I must again thank Professor K.C Oni and the leadership of the Department of Agricultural and Biological Engineering of the University of Ilorin for inviting me for this maiden lecture. Professor Oni showed class when he was the Director at the National Center for Agricultural Mechanization (NCAM). He remembered those of us who had one role or the other in the establishment of NCAM. The Vice Chancellor, Professor Ishaq Oloyede deserves a special mention as he promised to be here and contacted me on this. I am grateful to him for sparing the time with so much pressure from so much to do.

Thank you all for coming and may you all be blessed forever!!!

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APPENDIX

PICTORIAL PRESENTATION OF SOME THE TOOLS AND END PRODUCTS OF AGRICULTURAL AND BIOLOGICAL ENGINEERING:

Figure 1. A Modern Farm TRACTOR

Figure 2. Tractor in a field

Figure 3. Wheat harvest with a combine

Figure 4.Pivot irrigation of cotton

Figure 5.Grain silos at sunset

Figure 6. Grain silos in the port of Santos, Brazil

Figure 7. Grain Silos

Figure 8. Newly constructed grain silo and elevator

Figure 9. Bridge over a dam, Knowlton, Quebec

Figure 10. Canada Dam

Figure 11. Beaver Dam

Figure 12. Hoover Dam on Lake Mead,Las Vegas

Figure 13. Small power dam

Figure 14. Alqueva Dam

Figure 15. Ozarks Bagnell Dam

Home Factory Photos

Excel Homes shared these photos from inside one of their three modular home factories. Enjoy.

Here Excel Homes workers are performing work on the ceiling of a module. Trust me construction workers perform better and faster when they are in a comfortable environment.

Now they have started work on a hinged roof. The hinged roof allows modular homes to be transported on narrow roads and still have a steep roof pitch like stick-built homes. Also notice how the power nailer the builder is using is attached to the roof of the factory.

Figure 16. Home Factory Picture showing workers performing work on the ceiling and on a hinged roof of a module

Workers continue on the hinged roof. Here they are adding an overlapping protective layer to seal the roof after it is lifted into place at the building site.

Builders are placing piping trough the framework. You can also see some of the reinforcement that has been added to the framework.

Figure 17. Home Factory Picture showing workers adding an overlapping protective layer to seal the roof and placing piping trough the framework

Figure 18. Traditional Dutch farmhouse

#HF01

#HF02

#HF03

#HF04

#HF05

#HF06

#HF07

Figure 19. Piggery Facilities

Poultry Houses From Around The World

Figure 20. Broiler house in Ecuador

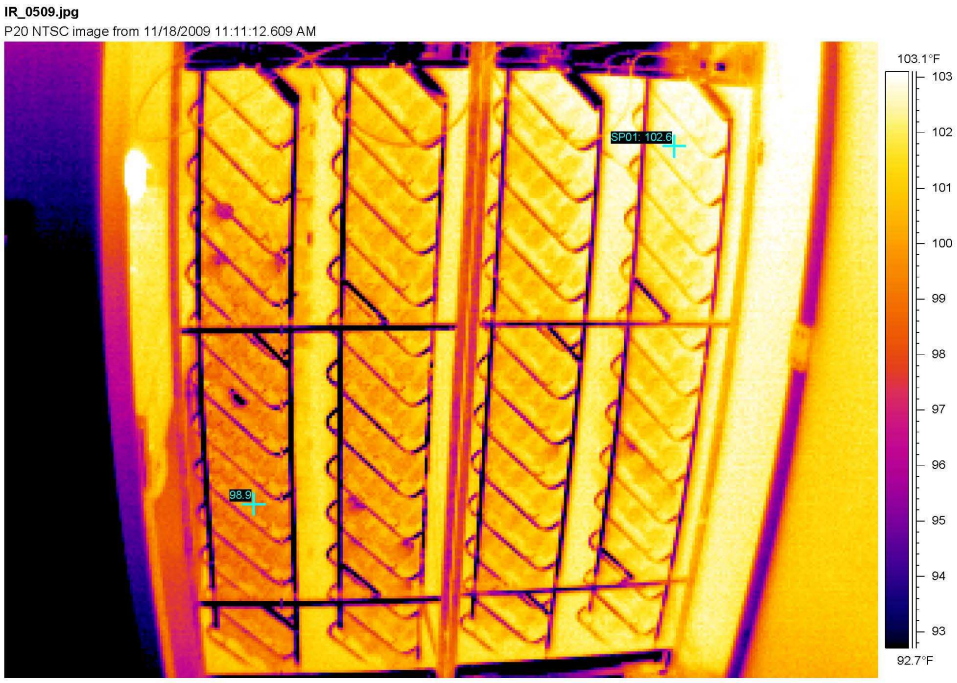

Figure 21. Egg temperature variations in hatchery setter.

Figure 22. Poultry House Structural Failure Analysis

Figure 23 ARM HOUSE in the RUGGED ENVIRONMENT

Figure 24. Historic Cottage style home

Figure 25. Historic Colonial Style home

Figure 26. A typical North American grain farm with farmstead in Ontario, Canada

Figure 27. Processing Machine

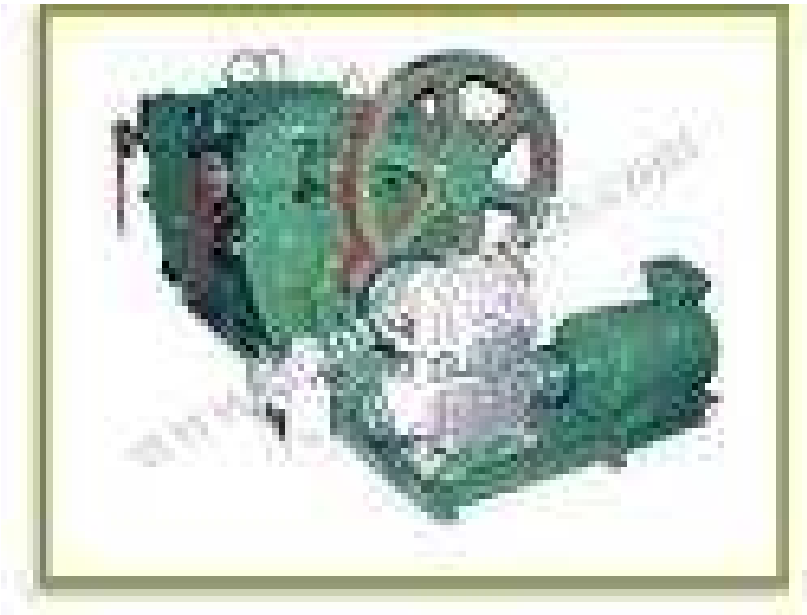

Figure 28. Farm Machinery

Figure 29. Plant Factory