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THE ROLE OF EXTENSION IN THE DEVELOPMENT OF AGRICULTURAL ENGINEERING PROFESSION IN NIGERIA

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Abstract
This paper discusses how extension methods could promote awareness for the needed advancement in agricultural engineering in Nigeria. This could be achieved by revealing the latest operations and giving feedback on farmers/users responses to such technologies. Performance of a number of labour saving devices developed by some of the Nigerian Research institutions and centers requiring commercial adoption are reported.

Keywords: Extension, Agricultural Engineering Research, agricultural technology

1. Introduction
It can be argued that no human being can survive without food and some form of shelter. Agriculture, the oldest profession, produces food and fibre for the sustenance of man on this earth. Through the various stages of human civilization the necessity for more food and fibre has been the motivating factor for technological development. The use of bare hand, by the ancient man, to till the land and the use of stone/wood before the Iron Age are evidences of this trend. The latest technologies in use in space/computer age also find applications in agriculture. Economic and environmental concerns increase interest in site-specific crop management (SSCM), which technical advances make feasible. Microprocessor-controlled, weed-detecting technology helps save money and the environment (Folton and McCloy, 1992). It has been shown that agricultural engineers can make significant contributions to our space programme.

Labour in the form of energy is required for the execution of any task, including agricultural operations. Energy availability as any other resource is not limitless and its use is usually associated with cost(s). The relative advantage of animal as a source of farm power over the other several sources especially for semi-arid regions has been documented elsewhere (Ahmed, 1999). Animal drown implements have been developed also to perform virtually all field operations and post harvest processing. The appropriateness of animal traction for the small-to medium scale farmers who produce about 75% of our food has been suggested (Ahmed, 1994). Agricultural mechanization aims at increasing the productivity of labour, increasing the land under cultivation, improving the quality of farming operations; reducing drudgery and hence making agriculture more attractive, and ensuring timely completion of certain key agricultural operations due to the limitations imposed by the weather.

While extension can assist the small and medium-scale farmers achieve production efficiencies, sustainability is the main problem needing attention in large-scale organised enterprises. Farmer's interest can be attracted by earmarking plots for demonstration to show the relative benefits of using improved equipment. The ease with which these improved technologies can be operated will be assessed by the farmers themselves. Also the interest of

local blacksmiths/artisans to reproduce the improved implements will complement the rate of adoption.

As at the year 2009 there were over twenty seven thousand corporate engineers, of different disciplines (including agricultural engineers) registered with the Nigeria Society of Engineers (NSE),with only one thousand four hundred (1,400) corporate Agricultural Engineers registered with the Nigerian Institution of Agricultural Engineers (NIAE). With the Nigerian economy still being considered agrarian (42% of GDP from Agriculture), more engineers with specialization in agricultural sector are required.

The aim of this work is to review some of the established challenges facing agricultural engineering professionals and show the need of extension in providing solutions to the enunciated problems.

2. Developed labour saving devices requiring adoption through extension

The thrust or objective in technologies for labour saving in the maximization of work output from limited and/or costly energy resource. The ultimate energy saving in performing any operation lies with the operator. However, designers of agricultural tools, equipment and processes are always striving to design unit with minimum input energy requirements and taking care of gender variations to match different tasks with appropriate subjects. It has been suggested that farm tools designed for women should not be excessively energy demanding. In a study of a foot operated maize shelter women's output was half that of men as the drive proved hard. Similarly, the tool or process should not include induced health hazards to women and children (Kaul, 1994).

Energy saving concepts consists of two broad strategies, making efficient tools available to farmers and ensuring that the operators of the tools are properly trained on how to handle them without getting exhausted. Through extension services the second strategy can be ensured. Trained subjects matter specialist can give solution to any problem concerning how to operate and make necessary adjustments in the field during operation. Also problems associated with the equipment as identified by the users can be documented and channelled as feedback. By so doing, the engineers in the field of agriculture will be under constant challenge to produce more improved devices.

Table 1 shows some of the on-going researches that developed labour saving devices in various research institutes and private organizations, with human, animals, internal combustion engines (ICE) and electric motors as prime movers. It is worthy to note that all the tools and equipment in Table 1 are presently in use at various locations in Nigeria and some other developing countries.

Table 1: Some of the on-going development labour devices available for adoption

S/N	Farm operation	Labour saving equipment	Prime mover	Capacity or efficiency	Developed by
1	Tillage/ fertilization	Animal traction equipment package (Emcot/Unibar/Arara, multipurpose toolbars plough, ridger, cultivators, groundnut lifter, weeder, fertilizer attachment and cart), manure spreader	Animals (ox, horse,donkey , camel)	Donkey tillage devices (14-30 hrs/ha)	IAR/ABU, John Holt and Local Blacksmiths, FUT-Minna (on-going)
2	Planting	Animal-drawn single row planter, jab planter pre-germinated drum seeder (rice/wheat), potato planter-cum fertilizer applicator, manually operated electrostatic planter, tri-cycled pulled broadcaster	Animals, manual		IAR/ABU (on-going)
3	Weeding	Knapsack sprayer, weeding hoes, cocoa plantation weeder	Animals, manual		IAR/ABU, NCAM (on-going)
4	Harvesting	Serated sickle, animal-drawn groundnut lifter, motorized reaper, animal-drawn/engine – operated reaper	Animals, manual and I.C.E.		IAR/ABU (on-going)
5	Processing	Vortex rice fan thresher, cone and turn wheel sheller, plate and hammer mill, treadle-operated rice/wheat thresher (rice, wheat, cowpea, soyabean) g/nut oil extraction machine, milk churner, butter cocoanut grater, butter leaf processing machine, bicycle-pedal operated grain mill, sugarcane crusher		Milk churner (75%), donkey power crusher (204kg/hr)	UNIMAID, ATBU-Bauchi, IITA, NAERLS/ABU/ MCC/ITDG, Local artisans
6	spraying	Shrouded-disc herbicide applicator	Manual, animals	Manual (0.64ha/hr) Animal-drawn (1.89ha/hr)	ABU (on-going)
7	Transport	Bicycle trailer		200 litres of water	ABU, ITDG

As a mark of achievement the milk churner developed at the institute of Agricultural Research (I.A.R) Zaria was able to extract butter in one-fourth of the time needed by traditional method and even yielded about 9% more butter (Ali and Kaul, 1993). The Ground metered shrouded-dice herbicide sprayer eliminates the occurrence of over or under-dosage commonly associated with spinning-dice sprayers (Suleiman and Ahmad, 1987). Also a bicycle trailer constructed in Bangladesh is capable of carrying a drum of water.

The history of man is filled with evidences of his effort, both successful and unsuccessful, to create tools and equipment that satisfactorily serve his purposes and to control more adequately the environment within which he lives and works. During most of the centuries of man's history, the development of tools and equipment depended largely on the process of evaluation, the trial and error. Through the use of a particular device, it is possible to identify its deficiencies and to modify it accordingly, so that the next "Generation" of the device would better serve its purpose.

2.1 Agricultural Engineering by 2020

Agricultural science and engineering has the potential to produce innovative approaches to problems that include:

- Knowledge-based competitive machinery and process technology
- Food production with documented quality
- Production processes that are fully compatible with environment
- Technology for production and utilization of renewable resources and efficient use of by-products
- Efficient machines to operate in optimized production systems, for example more automated tractors and harvesters, equipped with plug-and-play electronically controlled implements, networked or autonomous and guided via telematic links with a control station.

2.2 Technical feasibility

Computer simulation and modelling has now reduced the wastage of resources involved with trial and error. It is now possible to analyse various options before a working prototype is constructed. After testing the prototype some minor modifications may be effected to obtain the final working design.

Conventional farm products from the field are routinely mixed into a single sample before being sent to a laboratory for analysis. Typically, the seeding rate and chemical application rates are held constant over an entire field. These conventional practices have been used even though agronomists and farmers have known for years that soil productivity varies within fields. However, economic and environmental concerns are providing strong motivation for adopting SSCM (or precision farming) at the same time that technological advances are bringing it into the realm of technical feasibility. The recent satellite launch for Nigeria in conjunction with global positioning system (GPS) techniques of soil investigation will facilitate rapid agricultural engineering development. Electronics, automation and robotics are widely used. Wireless communication technologies offer access to broadly spread farming

facilities and link them to decentralized web-based processing and information sources. Sophisticated up-to-date software packages, expert systems and fixed, mobile farm technology are provided for the farmer

Erosion and pesticide use are environmental issues of increasing community concern that cannot be ignored. Although herbicides have assisted the economic viability of farming and helped reduce the risk of soil erosion, however, their use may be seen as a potential ecological hazard. Minimum tillage and no-tillage have been shown to reduce erosion, but farmers are reluctant to adopt these practices because costs may increase or profits reduce. Detect spray offers a solution to the above problems. It is both cost effective and environmentally friendly, and has the potential to increase adoption of minimum tillage practices. Detect spray is a reflectance-based system that automatically controls the nozzles on spray boom to apply pesticide only to green vegetation. Each nozzle is fitted with a solenoid valve that opens briefly to apply the spray when the nozzle passes over green plants. Each nozzle has a sensor located ahead of it that has a "field view" matching the spray pattern of that nozzle to the spectral characteristics of green vegetation.

Agricultural engineering and extension could be developed alongside the commercialization of the farm equipment manufacturing industry for greater food production. China has become the World number one market with India occupying the second place. The common factor of these two countries is large population. It is envisaged that Nigeria as the most populous country in Africa can aim for the third market position.

3. Agricultural extension in engineering

In this age of information technology (IT) and less than ten years to 2020 there is need for feed back from farmers about their experience with existing equipment to enable designers of such tools to keep on improving them. Database could be established whereby all major equipment can be monitored and their operational data made available to other professionals. This can be achieved through extension efforts. Extension and commercial agriculture are now seeking a relationship more appropriate to the changing social, environmental and technological context of agriculture (Bloome, 1992).

The issues are no longer just production efficiencies, rather there is an increasingly complex matrix often referred to as sustainability. This matrix includes expectations that agriculture will be environmentally sound, humanly safe, bureaucratically regulated, politically controlled (export quotas) and strongly influenced by world markets.

When farmers are conversant with a new technology they will find a local fabricator to reproduce it. Through this local artisans will challenged to improve their skills on modern fabrication techniques. Thus the extension exercise will close the loop in the chain between designers-farmers-fabricators. More engineers with interest in agriculture will thus evolve and the necessary market for farm equipment design/manufacturing established. This will record more enrolments into agricultural engineering courses to meet the ever-increasing food/fibre demand.

4. Conclusion

Equipment development is a continuous process whereby both designers and users must be in constant touch with one another. The need for extension methods for the adoption and diffusion of proven engineering technologies cannot be over-emphasized. While extension can assist the small-to medium-scale farmers achieve production efficiencies, sustainability is the main problem needing attention in large-scale organized enterprises. Through extension, operators can be trained to handle improved equipment with minimum time/energy wastage.

A lot of the equipment developed need to be extensively tried by farmers, thus assessing their relative merits and possibly demerits for further improvement. This is urgently needed for the continued application of latest knowledge on machines. Agricultural equipment manufacturing industry can develop through the establishment of sustainable large-scale agricultural production zones.

Nigeria needs agricultural engineers in order for the agricultural sector to meet up with the nation's food demand and industrialization.

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