

Review

Integrating indigenous knowledge system in extension education: The potential for sustainable agricultural development in Nigeria

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This paper looks at the integration of indigenous knowledge system in Extension education with the aim of promoting sustainable agricultural development. It explores the meaning of indigenous knowledge and extension education. Attempts made in the past to achieve agricultural development, provide rationale to valuing indigenous knowledge and integrating indigenous knowledge in extension education. Efforts have been made in the past in pursuit of agricultural development but few of those involved in these effort including those in extension services take the trouble to understand the farmers and their indigenous knowledge rather the farmers are often described in generalization as ultra – conservative, steeped in tradition, hemmed in by custom, lacking in motivation and inactive, captive to age-old methods, incapable of making wise decisions. There have however, been a growing consensus now that some of the solutions to the problems that currently plague agricultural development must proceed from the role of understanding the dynamics within the local context and local capacities. Such dynamics include the roles of indigenous knowledge and practice in sustainable agricultural development. This can be achieved by integrating indigenous knowledge into the extension education system to address some of the knowledge deficiencies for development that is currently formulated from the western perspective. There is therefore a need for paradigm shift towards harnessing indigenous knowledge for the development of extension service since sustainable agriculture in all nations will require greater scientific respect for and more effective collaboration with those who possess the wisdom of generations of non scientific farming. It is in the face of this that indigenous knowledge becomes handy especially in its ability to promote sustainable agricultural development.

Keywords: Indigenous knowledge system, extension education, agricultural development, integration.

INTRODUCTION

Concept of indigenous knowledge

Indigenous knowledge is a local knowledge that is unique to a given culture or society (Warren, 1987). It is the systematic body of knowledge acquired by local people through the accumulation of experience, informal experiments and ultimate understanding of the environment in a given culture (Rajasekaran, 1993). According to Haverkot (1991), indigenous knowledge is the actual knowledge of

a given population that reflects the experiences based on tradition and include more recent experience with modern technologies. It is knowledge generated, developed and used by certain people in a certain area and not limited to indigenous peoples. It can include knowledge originating from elsewhere but has been internalized by local people through local processes of learning, testing and adaptation (Jaya, 2005). It forms the basis for the art of identifying, combining, unfolding, and protecting local resources and is rooted in and stems from the local practices hence it is specific to local context. Indigenous knowledge is the information base for a society which facilitates communication and decision making. It is a

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body of knowledge built up by a group of people through generation of living in close contact with nature and such knowledge evolves in the local environment, so that it is specifically adapted to the requirements of local people and conditions. It is the basis for local level decision making in Agriculture, healthcare, food preparation, Education, Natural resources management, and a host of other activities in rural communities (Warren 1991, Anaeto et al .2005 and Asiabaka, 2009). Local people including farmers, landless labourers, women, rural artisans and cattle rearers are the custodians of indigenous knowledge systems. Moreover, these people are well informed about their own situations, their resources, what works and does not work and how one change impacts other parts of their system. It is the knowledge used by local people to make a living in a particular environment, evolves in situ and dynamic, creative, constantly growing and adapting to meet new conditions. The term “indigenous knowledge” sometimes refers to the knowledge possessed by the original inhabitants of an area while the term “local knowledge” is a broader term which refers to the knowledge of any people which have lived in an area for a long period of time. Indigenous knowledge is considered to be cultural knowledge in its broadest sense. It is embedded in a dynamic system in which spirituality, kinship, local politics, and other factors are tied together and influence one another. Indigenous knowledge systems may appear simple to outsiders but they represent mechanisms to ensure minimal livelihoods for local people. They are often tuned to the needs of local people and the quality and quantity of available resources. They also pertain to various cultural norms, social roles, or physical conditions.

Diversity of indigenous knowledge

Indigenous knowledge systems are:

- i. Adaptive skills of local people usually derived from many years of experience that have often been communicated through “oral traditions” and learned through family members over generations (Thrupp, 1989).
- ii. Time-tested agricultural and natural resources management practices, which pave the way for sustainable agriculture (Venkatratnam, 1990).
- iii. Strategies and techniques developed by local people to cope with the changes in the socio-cultural and environmental conditions.
- iv. Practices that are accumulated by farmers due to constant experimentation and innovation
- v. Trial-and-error problem-solving approaches by groups of people with an objective to meet the challenges they face in their local environments (Roling and Engel, 1988).
- vi. Decision-making skills of local people that draw upon the resources they have at hand.

The aforementioned statements clearly illustrate that indigenous knowledge systems are invaluable, diversified and comprehensive, although this is not always the perception among outsiders.

Utilization of indigenous knowledge

Indigenous knowledge has been utilized in various ways by the local people and it worked for them whether in areas of agriculture, health, storage, processing and preservation system, environmental management, erosion control, biodiversity conservation etc. Example, the indigenous knowledge of the people was very effective in meeting their food requirements, effective in areas of soil enrichment, land clearing, sowing, harvesting, weeding and mound/ridge making. Their mixed farming mixed cropping, crop rotation and shifting cultivation helped tremendously in their bumper harvest. Azoro et al. (2002) observed that different types of soap were made for bathing and washing using indigenous resources such as palm oil, palm kernel, palm fibers and the leaves ash. Taxonomy of crops and soils is the basic knowledge on which decisions are made in selecting crop varieties to plant or soils to cultivate (Anaeto et al., 2005). The local people have gained experience in soil management because they know that to address the adverse effect of soil acidity; they have to use compost manure. They also have biological, botanical and mechanical ways to control pests from attacking their crops/plants. It is common knowledge that local people in the process of trying to scare away birds in rice fields, build a mock human being dressed properly and allowed to stand at strategic areas in the rice field. The birds mistake these mock beings as real and stay away from the field. Empirical evidence available shows that food crops suffer from storage pests and other waste-inducing agents. The local resource poor farmers have developed indigenous storage systems that have reduced grain storage waste to the lowest ebb. To control soil erosion problem, the local people use tie mounds and ridges across the slope as well as cover crops/grasses such as vetier.

To maintain soil fertility, they conserve the soil nutrient by adopting fallow system as well as shifting cultivation and crop rotation. They equally use compost manure to maintain soil fertility. They also restore, maintain and advance the ecosystems and ecological processes by reserving some forest as no-go area for any activity. In most cases, our local people often dye their chicks for the purpose of protecting them against the attacks of the predators that then would not recognize them as chicks. *Heterobranchus* is species of fish that is known not to spawn in captivity but our people’s indigenous knowledge had shown that this fish has successfully been induced to spawn in some parts of South-Eastern States of Nigeria. This was achieved by planting grasses at base of bunds/dykes and under this favourable environment; the fish

lays her eggs, which later hatch out into fingerlings. Also, at the periphery of bunds, farmers submerge a log of wood with shallow holes where fish goes to lay eggs. Other indigenous knowledge often used by the people according to Okwuanga (1994) includes:

- i. Planting of lemon grass near the termitarium to control or expel termites
- ii. Use of wood ash solution on cut surface of yam sets to avoid decay/rotten and expel termites
- iii. Rubbing the bitter leave juice on the surface of affected tubers as soon as infestation of termite is noticed
- iv. Use of dogonyaro leaves (Neem) to control termites on cassava by squeezing the leaves and sprinkle on the sets with broom on growing cassava plants
- v. Keeping maize on the kitchen to dry moisture content low enough to keep them safe against weevils
- vi. Processing and preserving of cassava in dry form and grinded into flour for a traditional dish
- vii. Processing and preserving of yam, cocoyam and plantain in dry form and grinded into flour for a tradition dish
- viii. Using Neem (*Azadirachta Indica*) for its insecticide and repellent actions. It is effective against such pests as cowpea beetles, rice weevil, aphids and mites. Also aqueous extracts from Neem seeds help in control of vegetable pests, melon beetles, and grasshoppers. Neem powder is also used to treat rice weevils successfully.
- ix. Unripe fruits, seed, leaves and roots of sour sap (*Annona muricata*) have been found to be both contact and stomach poison, insecticidal, larvicidal and are used in control of Aphids, brown rice hopper, grasshopper, green bugs, potato Aphids.
- x. Chilli pepper (*Capsicum frutescens*) is stomach poison, insecticidal, anti-feedant and fumigant
- xi. Garlic (*Allium sativum*) has insecticidal repellent, anti-feedant, bactericidal, fungicidal and nematocidal action and used against Aphids, Army worm, wire worm etc.
- xii. Solution of tomato (*Lycopersicon esculentum*) leaves and stems are used against egg laying insects such as Aphids, moths, cockroaches and corn borers
- xiii. The ripe yam bean seeds are used as spray against Aphids, armyworms and caterpillars. It is a contact and stomach poison.
- xiv. The leaves and stalks of tobacco are both stomach and respiratory poison. It has insecticidal repellent, fungicidal as well as a acaricidal actions. It is positive for pest control.
- xv. Wood ash is effective against maggots and sucking insects
- xvi. Cow urine/cow dung had been effective in the control of mealy bug, aphids, caterpillar, mites and fungus.

Amalu (2002) summarized utilization of indigenous knowledge in agriculture as shown in Table 1. Indigenous knowledge no doubt has existed for so long a time but

unfortunately, there has been little or no documentation of the use and value of it to the people. More often our people including the highly educated ones have neglected this important aspect our lives. It is therefore not surprising that our local people are often described in generalizations as ultra conservative, steeped in tradition, hemmed in by custom, lacking in motivation and incentive, captive to age-old methods and incapable of making wise decision (Williams, 1978). Instead of indulging in a weeping generalization as this, we should try to understand and appreciate the indigenous knowledge of our people so as to know where they are, what they know, why they behave the way they do. Once this is known, it becomes easier to plan any programme for the people which will suit them.

AGRICULTURE AND SUSTAINABLE DEVELOPMENT

Agriculture is a basis of livelihood and development for all mankind, but in particular in developing countries like Nigeria where majority of the population still depends on agriculture as a main source of income and seen from a global perspective, agriculture has become a dynamic force (Amalu, 2002). Agriculture has often been described as the backbone of many nations economy including Nigeria. It is the source of food, fibre and other raw materials needed by the people. It provides employment for about 75 percent of the population who live in the rural areas and provides the initial capital for industrial development. It frees excess labour force industrial development and serves as a foreign exchange earner for the country. Agriculture has remained the world's primary industry. It is a leading non-oil sector in Nigeria supporting almost 60 percent of the population directly and providing about 20 percent of the country's gross domestic product (GDP). Agricultural development, although primarily concerned with increasing farm productivity, is essentially an interactive process which takes place within a social, economic and cultural system (Onu, 2005). According to Lionberger and Chang (1990), it require series of interrelated and communicatively linked systems to generate and diffuse information and technological innovations, ranging from abstract theories and assumptions of science through applied research, development of specific innovations and adaptive testing to diffusion of locally tested products to farmer adopter clientele. Sustainable Development in area of agriculture is a development that would be continuous, everlasting and non-stopping. It is a development geared towards reducing the incidence of food crises and assures food security thus reducing or alleviating rural poverty prevalent mostly in rural areas where the bulk of the farmers on whom the nation depends on for her food requirements reside. To overcome the pressures of food demands and deteriorating rural poverty, the various governments in Nigeria (Federal, State, and Local

Table 1. Indigenous agricultural technology in Nigeria.

Sector	Sub-sector	Local Knowledge	Technology Domain
Crop	Land Management	<ul style="list-style-type: none"> - Experience and history of soils, previous of crops and natural vegetation of the site. - Use of features of top soil colour to top layers, texture, consistency and "Humus" availability. - Use of knowledge of water-level table, water retention capability weed types, topography, nature of working tools. - Use of knowledge of "Akundu" 	<ul style="list-style-type: none"> (1) Soil Classification (2) Site Selection (3) Land measurement and conversion. (4) Site preparation (5) Seed selection and seed technology (6) Planting distance/planting density (7) Manuring and/or fertilization (8) Crop protection (yam minisett treatment).
Livestock	Livestock management	<ul style="list-style-type: none"> - Use of local information vigorous females, twinning females and females reputed for successful rearing of young ones. - Selection of well-tested and harmless forages and suspending forage material on short tree stand. 	<ul style="list-style-type: none"> (1) Pedigree manipulation (2) Selection of breeding stock (3) Adequate nutrition and proper sanitary and hygienic feeding environment.
Fisheries	Livestock Health	<ul style="list-style-type: none"> - Palm oil used in treatment of bloat and skin problem - Use of "Anwirinwa" leaves in treatment of retained placenta. - Farmers avoid the use of infected male animals to serve females or vice versa. 	<ul style="list-style-type: none"> (1) Utilization of medicinal properties of local plants and plant materials (2) Disease
	Fisheries pond/site identification	<ul style="list-style-type: none"> - Presence of burrow pits, food plains, waterlogged and grass-nested swamps for fishing - Presence of white sands (white flood) at river banks, Lunar cycle in tidal waters and echo-sounding using paddle or pole for croaker. 	<ul style="list-style-type: none"> (1) Fishing site selection (2) Fishing season
	Fishing Methods	<ul style="list-style-type: none"> Differential "Kotula" netting and "Atalla" lift netting gears - Dugout canoe crafts - Triggered books, basket-traps, leaf-traps, use of bamboo pipes - Use of date palm fruits as pumpkin roots, cactus and "Dawadawa" as fish tranquilizers 	<ul style="list-style-type: none"> (1) Fish capture and harvesting
	Fish processing and preservation	<ul style="list-style-type: none"> - Sustained smoke drying with fresh wood materials - Sun-drying on sands and raised platforms for prawns and fishes. 	<ul style="list-style-type: none"> (1) Processing and end-use preservation
Food Technology and processing	Formulation and fortification of foods	<ul style="list-style-type: none"> - Odourless "fofoo" from fermented cassava - Formulation of soy-milk, soy-balls - Use of palm bunch burnt refuse and oil in making of local soaps. 	<ul style="list-style-type: none"> (1) Cottage food processing and refining
Technology transfer	Extension	<ul style="list-style-type: none"> - Use of town-criers and local ombudsmen - Use of traditional rulers, Head clan man, or village head - Use of fresh spear leaves of oil palm tree 	<ul style="list-style-type: none"> (1) Delivery and communication system.

Governments) implemented various agricultural and rural development programmes aid at making development sustainable. Some of these programmes are still ongoing while many have gone moribund and thus abandoned. They include among others:

- i. National food production program (NAFPP, 1972)
- ii. Operation Feed the Nation (OFN, 1975)
- iii. Agricultural Development Programs (ADPs, 1975)
- iv. River Basin Development Authorities (RBDAs, 1978)
- v. Directorate of Food, Rood and Rural Infrastructural (DFRRI, 1986)
- vi. Better Life for Rural Women (Now Women Commission, 1987)
- vii. National Agricultural Land Development Authority (NALDA, 1991)
- viii. Farm Settlement etc.

In spite of all these attempts meant to develop agriculture in Nigeria, Nigerian agriculture is still in doldrums. The big issue that needs to be addressed as "what is the problem with Nigeria Agriculture"? It is often believed that systematic research is the base upon which modern agriculture is built. In attempting to solve the problems of the farmers, it is often assumed that the farmer must learn from the scientist, seldom does the scientist think he may learn from the farmer (Williams, 1978). It is in line with this that Asiabaka (2010) agrees that the farmer's knowledge counts more than that of the scientist.

Conventional transfers of technology and the constraints

Agricultural research connotes an organized quest for acquiring new knowledge, or refuting or modifying existing hypothesis about lands, plants and animals of agricultural value (Amalu, 2002). It is done with the aim to assist the farmer or policy maker in taking decisions for the exploitation of available researches in the plants and animals as sources of food, fibre and other products useful to man. The overall objective of agricultural research is the development of technologies for sustainable increase in agricultural production with increasing efficiency while enhancing the resource base as much as is possible (Okigbo, 1991). Agricultural research is expected to play a key role in dramatically increasing agricultural production, shaping the structure of agriculture and fundamentally altering the society as a whole. It is expected that the innovations so generated from research would aid the local farmers in the quest for development of agriculture. Dissemination of technologies to increases agricultural production using the conventional transfer of technology system has often failed to consider the natural environments, indigenous knowledge system and the resource endowments around which poor-farmers normally operate. One answer for the failure in our quest for agricultural development is the

tendency to ignore the preference and capabilities of our farmers. Often research on farmers needs are done in the cities where the researchers dwell assuming away the actual needs of the farmers. Too little is known about the economic behavior, motivations, values and attitudes of the local farmers. This has resulted greatly to the short falls in agricultural development agenda.

Agricultural research according to Richard (1989) has been highly reductionist, parochial, and discipline oriented. Normal science generates packages, whereas resource-poor families engage in farming as continuous performance. Lack of relevance to small farm conditions was found to be one of several constraints in agricultural development in Nigeria. Among the constraints in the conventional transfer of technology which affect agricultural development are:

- i. Neglecting local classification systems. Agricultural researchers and even extensionists usually are not aware of local classification systems of farmers regarding soils, crops, livestock's and other natural resources.
- ii. Under perceiving farmers' experiments: It is found that farmers' innovations are not considered while conducting on-farm research trials conducted by researchers i.e. farmers experiment on alternative coping strategies to avoid extreme conditions such as floods and droughts, diversified food production techniques such as intercropping and border cropping in order to broaden their food and fodder requirements, adjusting their sowing and harvesting periods to meet the local market demand.
- iii. Technical messages syndrome: Farmers are mainly seen as the recipients of technical messages but not the originators of either technical knowledge or improved practice.
- iv. Attitudes of outsiders: Attitudes generated by the top-down transfer of technology (TOT) paradigm have precluded learning indigenous knowledge of farmers.
- v. Feedback from farmers remains a missing link: After technology dissemination, feedbacks from farmers regarding the characteristics of the introduced technologies are rarely recorded. Development of technologies in research stations have become a continuous process without judging what is happening in the field, (Rajasekaran 1993).
- vi. Consequence of disregarding indigenous knowledge systems: Undermining farmers' confidence in their traditional knowledge can lead them to become increasingly dependent on outsiders expertise (Richard, 1989). One of the greatest consequences of the under-utilization of indigenous knowledge systems is the loss and on-utilization of indigenous knowledge which results in the inefficient allocation of resources and manpower to inappropriate planning strategies which have done little to alleviate rural poverty (Atteh, 1992). With little contact with rural people, planning experts have attempted to implement programmes which do not meet the goals of rural people or affect the structures and processes that

perpetuate rural poverty. Human and natural resources in the rural areas have remained inefficiently used or not used at all. There is little congruence between planning objectives and realities facing the rural people. Planners think they know what is good for the rural people who they see as poor, backward, ignorant, primitive, possess an attitude of fatalism, low level of aspirations, mutual distrust in interpersonal relations, limited time perspective, technological backwardness, limited view of the world, low empathy and the like (Williams, 1978, Rajasekaran, 1993).

EXTENSION EDUCATION, INDIGENOUS KNOWLEDGE SYSTEMS, SUSTAINABLE DEVELOPMENT AND SUSTAINABLE AGRICULTURAL DEVELOPMENT

Extension education is a system of education which involves behavioral change. It aims at helping people appreciate their circumstance and strive to change for better. The essence of extension education is that as an educational process, it involves working with the people along the lines of their immediate/felt needs and interest, discovering their real needs and this involves making a living, enhancing their level of living and improving their physical surrounding. It is a dynamic process which brings about change in what people know, change in how they react to situation and change in what they can do with their hands (Ani, 1999). It is more than just dissemination of information on innovations but has its foundations on the premise that human beings are naturally endowed with the power to change themselves mentally and their environment physically, and have the ability to learn new attitudes, new skills, new methods and ability to make decision, construct or alter their physical surrounding (Ani 1999). In spite of all the importance of agricultural extension to the nation building, the failure of the various extension delivery approaches to effectively engineer significant and sustainable agricultural growth has become a major concern to all stakeholders, thus the shift in recent years in the understanding of the practicalities for empowering farmers, through effective extension service. According to Madukwe (2006), with a rapidly expanding population, environmental degradation, political instability, economic failure and the declining budget, re-thinking the way agricultural technology is delivered to farmers has become necessary. If public extension systems are going to be effective in improving rural livelihoods, then they must change their focus, structure and approach (Swanson, 2008). The dominance of the Western knowledge system has largely led to a prevailing situation in which indigenous knowledge is ignored and neglected (Madukwe, 2006) and since indigenous knowledge is the information base of a society, which facilitates communication and decision-making, it then becomes important

when one critically looks at farmers as co-advocates of knowledge especially indigenous knowledge and extension the advocates of farmers. Posey (1985) observed that a strong relationship exist between indigenous knowledge and sustainable development and this offers new models for development that are both ecologically and socially sound. Development activities that work with and through indigenous knowledge and organizational structures have several important advantages over projects that operate outside them (Madukwe, 2006). Indigenous knowledge provides the basis for grassroots decision-making, much of which takes place at the community level through indigenous organizations and associations where problems are identified and solutions to them are determined (Warren, 1992). Much of the world's biological and agricultural diversity is in the custody of farmers who follow age old farming and land use practices (Old field and Alcorn 1991). Development agencies are beginning to review the role of indigenous knowledge in the development process (Madukwe, 2006). According to Titilola (1990), since indigenous knowledge is part of the lives of the rural poor, their livelihood depends almost entirely on specific skills and knowledge essential for their survival thus for the development process, indigenous knowledge is of particular relevance for the following sectors and strategies:

- i. Agriculture
- ii. Animal husbandry and ethno veterinary medicine
- iii. Use and management of natural resources
- iv. Primary health care (PHC), preventive medicine and psychosocial care
- v. Saving and lending
- vi. Community development
- vii. Poverty alleviation

These aforementioned features suggest therefore that indigenous knowledge is an integral part of the development process of local communities which is the reason for extension services. Essentially agricultural extension is the hub of any agricultural development programme and its ultimate goal is to improve the socio-economic well being of farmers, including all those who can benefit from its services.

Integrating indigenous knowledge systems in extension education as the potential for sustainable agricultural development: (Need for a new paradigm)

Recognizing indigenous knowledge and harnessing it for use in extension service could form new paradigm for meaningful agricultural development where special emphasis could be placed on developing and disseminating local content, improving the relevance of the information to local development, as well as capturing

and auditing all relevant local resources. Extension needs to go beyond technology transfer to developing skills and knowledge of farm families for sustainable agriculture and rural development (Madukwe, 2006). There should be a paradigm shift from the conventional method of technology transfer via training and visit, face to face contact as well as the top-down approach of generating technologies/innovations meant for farmers to the bottom-top approach which would see the farmer as the focal point, whose knowledge count more than that of the scientist (Asiabaka, 2010) and from whom the scientist can learn from (Williams, 1978). It is in the face of this that indigenous knowledge becomes handy especially in its ability to promote sustainable development. Therefore development activities, especially those that aim to benefit the poor directly, need to consider indigenous knowledge in the design and implementation stages of the process. A better understanding of the local conditions including indigenous knowledge system and practices could therefore help to better integrate global technologies to solve the problems facing extension in local communities and this would in turn help to improve the impact of development assistance as well as client satisfaction with the services of extension and other development partners (World Bank, 1998). The challenge that needs to be addressed today is how to find better ways to learn about indigenous institution and local practices and this could be achievable by integrating indigenous knowledge systems and practices into extension education. The key factor in the adaptation process of this new paradigm is the involvement of those who possess indigenous knowledge (local farmers' knowledge) in the development activities. In achieving this therefore, the approaches and methods of promoting indigenous knowledge via Extension Service become obvious in what recent extension participation approaches like farmer field school (FFS), farmer study circle (FSC), farmer meeting groups (FMG), Household approach or family approach system focus group discussion (FGD), and facilitation cycle (FC) are all about. (Madukwe, 2006; Rajasekaran, 1993; Asiabaka, 2010). These approaches and methods help to bring about fuller participation of farmers groups and strengthen their capacity to identify their needs, to set priorities and demand appropriate services. Virtually every grassroots organization plays a developmental function within the community and strengthening the capacity of this existing organization can greatly facilitate sustainable approaches to development (Warren, 1991; Atteh, 1992). Unfortunately, many indigenous knowledge systems are at risk of becoming extinct because of rapidly changing natural environment and fast pacing economic, political and cultural changes on a global scale. Practices vanish and disappear because of the intrusion of foreign technologies. The tragedy of the impending disappearance of indigenous knowledge is most obvious to those who have developed it and make a

living through it. Indigenous knowledge is not yet fully utilized in the development process including sustainable agricultural development. The implication of this therefore is the need for a new paradigm or shift which calls for integration of indigenous knowledge system into extension education so as to help protect, improve, and sustain the peoples local knowledge by involving them in programmes meant to develop them. This also calls for need for extension policy formulation that would strengthen the linkage between research, extension and farmer linkage. If this is properly harness by incorporating the indigenous knowledge systems of the people in the linkage, research would no more be sterile or impotent and extension would no more be weak while the local farmers become originators of ideas. All these will thus contribute to sustainable agricultural development. Fortifying this linkage is very important because despite continuous importance given to the linkage while developing, disseminating and utilizing sustainable agricultural technologies, several socio-political and institutional factors act as constraints for such an effective linkage (Ortiz et al., 1991). After a decade of rhetoric about feedback of farmers' problems to extension workers and scientists, a large gap still remains between the ideal and reality (Haugerud and Collinson, 1991). Kaimowitz (1992) put it more succinctly when he emphasized that researchers perceived extension agents and institutions to be ineffective and unclear about their mandate, making researchers reluctant to work with extension agents. When researchers did work with extension agents, they tended to look down on them and view them as little more than available menial labour, an attitude strongly resented by the extension workers yet it is clear that without research extension has nothing to extend and without extension research is as good as nothing.

Framework for incorporating indigenous knowledge systems into agricultural research extension and farmer linkage

In view of the constraints in conventional transfer of technology, a framework for incorporating indigenous knowledge systems into agricultural research, extension service and farmer linkage could be developed with the following salient features:

- i. Strengthening the capacities of research and extension organization
- ii. Building upon local people's knowledge that is acquired through various processes such as farmer-to-farmer communication and farmer experimentation
- iii. Identifying the need for extension scientist/social scientist and farmers in an inter-disciplinary research team
- iv. Formation of a sustainable technology development

consortium to bring farmers, researchers, NGOs and extension workers together well ahead of the process of technology development

v. Outlining the areas that research and extension organization need to concentrate on during the process of working with farmers.

Use of indigenous knowledge systems can be facilitated if the following are kept in place:

- i. Establishing indigenous knowledge resources centres
- ii. Bringing a desirable change in the attitudes of outsiders
- iii. Target audience for training programmes
- iv. Supplementing training programmes.
- v. Need for inter-disciplinary approach
- vi. Problem identification (i.e situation analysis and farmers viewed as co-researchers, developers and extremists who can provide crucial inputs to determine what problems to address and to proceed (Chambers et al., 1989)
- vii. Recording relevant indigenous knowledge systems
- viii. Using the indigenous communication channels

CONCLUSION

In conclusion, the farmer is the focus of any programme of agricultural development. Considerations must be given to his needs, benefits, attitudes and aspirations. Attention should also be directed to the nature and attributes of the innovation, its adaptability to local conditions, resources, time and skills it will require. We need to build or improve on what we have and this can only be done by intensively studying our traditional system of agriculture and the indigenous knowledge of the local people. Only then can we understand the farmers' problems and derive from them ideas as to how we can be of help to them. Indigenous knowledge is relevant on three levels for the development process viz.

- i. It is most important for the local community in which the bearers of such knowledge live and produce
- ii Development agents (CBOs, NGOs, government, donors, local leaders, private sector initiatives etc) need to recognize it, value it and appreciate it in their interaction with the local communities
- iii. Lastly, indigenous knowledge forms part of the global knowledge

Finally the following conclusions can therefore be made based on the framework of this paper

There is much to be learned from indigenous knowledge systems of local people

- i. Devaluing indigenous system as "low productive, primitive and old" is no longer a useful attitude.

ii. Establishing indigenous knowledge resource centre is inevitable for strengthening the capacities of agricultural research and extension systems.

iii. Bringing a desirable change in the attitude and behaviours of researchers and extensionists would stimulate the process of incorporating indigenous knowledge systems in agricultural research and extension.

iv. Using indigenous communication channels and farmer-to-farmer extension strategies would increase the rate of dissemination and utilization of technologies that are built on indigenous knowledge.

v. Keeping indigenous knowledge as a basis during the process of developing technology would result in sustainable technological options.

vi. Validating farmers' experiments would create an environment of respecting local people and village-level extension workers thus leading to their increased participation and empowerment.

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